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Point-of-View

Consequences of a new species and different stocks of Spiny Red Lobster in Brazil

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Abstract: The Spiny Red Lobster has an important commercial role in Brazil. However, a downward trend in the production of lobsters due to overfishing has been observed and there is also a devaluation of the product in the international market due to the instability in the size pattern of lobsters commercialized. Here in Brazil we detected two issues regarding the Spiny Red Lobster: (1) According to recent studies, there are genetic and morphological differences between Caribbean and Brazilian populations, which may be considered different species and; (2) Current legislation, such as seasonal closures, does not consider the multiple probable stocks of the species, which have direct implications in management and conservation. Thus, the recognition of the Spiny Red Lobster from Brazil as *Panulirus meripurpuratus* and investments on population and biological research are essential to improve its management considering regional stock differences.
Keywords: *Spiny lobster; genetic variability; fishing stocks; conservation measures.*

Consequências de uma nova espécie e diferentes estoques de Lagosta Vermelha no Brasil

Resumo: A lagosta vermelha tem um importante papel comercial no Brasil, porém, uma tendência de queda na produção de lagostas devido a sobrepesca tem sido observada e há também uma desvalorização do produto no mercado internacional devido à instabilidade no comprimento das lagostas comercializadas. Aqui no Brasil, detectamos dois problemas em relação à lagosta vermelha: (1) De acordo com estudos recentes, existem diferenças genéticas e morfológicas entre as populações caribenha e brasileira e; (2) Atualmente a legislação não considera os múltiplos estoques prováveis da espécie. Desta forma, os períodos de defeso sazonais não consideram os diferentes estoques, o que tem implicações diretas no manejo e na conservação. Logo, o reconhecimento da lagosta vermelha do Brasil como *Panulirus meripurpuratus* e investimentos em pesquisas biológicas e populacionais são fundamentais pra facilitar seu manejo considerando diferenças regionais nos seus estoques.
Palavras-chave: *Lagosta espinhosa; variabilidade genética; estoques pesqueiros; medidas de conservação.*

Introduction

The Palinuridae Family comprises 49 species, which have very distinct characteristics such as: coloring patterns, long antennas and the presence of numerous thorns on the carapace (Spanier & Lavalli 2006). In Brazil, the most commercially important lobsters are spiny lobsters, popularly known as "Red Lobster" and "Green Lobster", recognized respectively as *Panulirus argus* (Latreille 1804) and *Panulirus laevicauda* (Latreille 1817), with the former being more abundant (Dias Neto 2008).

In Brazil, lobster fishing has an important commercial role in a large part of the coastline and the product of this activity is predominantly intended for the foreign market (Aragão 2013). This commercialization is commonly carried out in three ways: frozen lobster tail, frozen whole lobster and live lobster, with frozen lobster tail as the most exported product (Silva & Fonteneles-Filho 2011). Lobster exports from Brazil in 2020 were approximately 2,668 tonnes (Brasil 2021). However, despite the absence of updated fisheries statistics data in Brazil, there is a downward tendency in production between 1990 and 2014 of the order of 38% caused by overfishing, making the production levels of this fishery unstable (CeDePesca 2014, Cavalcante et al. 2018). This instability in production, as well as in the size of the lobsters, may have caused a devaluation of the product between 2007 and 2018 of approximately 25% (Dias Neto 2010, Aragão 2013, FAO 2021).

In Brazil, the maturity size of the Spiny Red Lobster is 13 cm in tail length (Ivo & Pereira 1996), which led to the determination of the minimum

catch size for the species (IBAMA 2006). The periods of reproductive occurrence (spawning season) occurs from January to April and September to October (Soares & Cavalcante 1985). Until 2019 the closed season for Spiny Red Lobster was from December 1 to May 31 (IBAMA 2008). Currently, the closed season goes from November 1 to April 30 (MAPA 2019). It has not yet been possible to assess the impacts caused by this change, as the last closed season is temporarily suspended due to the Covid-19 pandemic (MAPA 2020). The present work aims to discuss the implications caused by the use of inappropriate nomenclature of the Brazilian red lobster species and the possible multiple stocks along the Brazilian coast concerning management measures of this resource in the country.

Which is the Spiny Red Lobster Species in Brazil?

In the late 1990s, a study using mitochondrial DNA sequencing of lobsters from the Caribbean and Brazil identified high rates of divergences among specimens from the two areas (Sarver et al. 1998). The study also suggested provisional recognition of two subspecies of spiny lobster, *P. argus westonii* representing populations of Brazil and *P. argus argus* representing populations of the Caribbean. Later, a study using sequences from the mitochondrial DNA control region of *P. argus* observed high divergence between Southwest Atlantic and Caribbean populations. (Diniz et al. 2004). However, no taxonomic conclusion was performed. According to the Management Plan for the sustainable use of lobsters in Brazil (Dias-Neto 2008), based on several studies (Ogawa et al. 1991, Silberman & Walsh 1994, Diniz et al. 2005), the lobster *P. argus* from the Brazilian coast and the Caribbean Sea should be considered as distinct ecological and genetic units.

Giraldes & Smyth (2016), describe *Panulirus argus* occurring in Brazil, as being *Panulirus meripurpuratus* sp. nov. Due to the biogeographical barrier of the western Atlantic, created by the mouth of the Amazon River channel, there was genetic separation of *P. argus* and *P. meripurpuratus* in different populations, with *P.argus* to the north of the Amazon River plume and *P. meripurpuratus* to the south. After the new taxonomic definition of *P. meripurpuratus*, several studies disregarded the new nomenclature (Bevilacqua 2017, Cintra et al. 2018, Cavalcante et al. 2018, Oliveira 2018, Aragão & Cintra 2019), including the "Evaluation of the Management Plan for a Sustainable Use of Lobsters in Brazil" (Dias-Neto 2017) and the recent seasonal closure legislation (MAPA 2019). This may be due to the lack of knowledge of the published work by Giraldes & Smyth (2016). However, some authors have already identified the species with the new taxonomic category (Lima & Andrade 2018, D'oliveira 2017, Ribeiro 2017, Santana et al. 2016). Based on the new taxonomic definition, from now on we will consider the Brazilian species *P. argus* as *P. meripurpuratus.*

Spiny Red Lobster Stock Units in Brazil

In Brazil, a study using PCR markers (RAPDs) suggested the existence of two populations of *P. meripurpuratus*, one distributed between Ceará and Pará and the other from Pernambuco to Bahia (Carreiro 2001). Also, due to the Brazilian coast extension and the influence of different marine currents, it is probable to have different stocks of spiny red lobsters in Brazil (Diniz et al. 2010). These analyses that suggested different stock units only considered lobsters from the North and Northeast, preventing a comparison with lobsters from the Southeast region. Reinforcing the hypothesis of multiple stocks, a study considered two different stocks in Brazil, the first from Pará to Bahia and the second from Southern Bahia to São Paulo (Tourinho 2013).

In order to manage an economically important fishery resource throughout its entire distribution, such as *P. meripurpuratus,* including all environmental and ecological particularities, it is necessary to investigate how stocks are structured. In addition, conducting biological studies in each stock, such as recruitment, reproduction, age and growth, and mortality is essential to characterize the necessary aspects for the assessment of these stocks (Pollock 1993, Fonteles-Filho 1994, Dias-Neto 2010).

Ecological Consequences

The non-recognition of *P. meripurpuratus* prevents the correct determination of the area of occurrence of both (*P. argus* and *P. meripurpuratus*), since this area is more restricted than previously established (see Giraldes & Smyth 2016), generating direct consequences in the stock assessments.

The existence of different stocks of spiny red lobster in Brazil and the absence of detailed studies on different stock units have led to the establishment of a minimum catch size and seasonal closure extrapolation to a large part of the cost, with a single rule being applied to places where biological and ecological parameters of the species may be different. The possible direct consequence for that is the inadequate management of *P. meripurpuratus*, since the management of this resource does not consider the specific biological characteristics of each fishing stock.

According to fishermen from southern Bahia and Espírito Santo, the closed season implemented in the region (which is based on estimated population parameters from Ceará stocks) does not match the actual spiny red lobster spawning season (Almeida 2019). The modification of the closed season ordinance between 2008 and 2019 (IBAMA 2008, MAPA 2019) changing this closing period is an indication that the closed period was not adequate for the whole area of occurrence, considering that there are no studies about spawning season for the different regions or stocks. In this way, it is difficult to state that the period of closure determined is suitable for all regions of the country. This possibly wrong closed season in some locations throughout the spiny red lobster distribution in Brazil has resulted in the capture of breeding females in a fundamental period to maintain stock balance.

Recommendations

To solve this issue of one of the most profitable fishing resources in Brazil, this brief review recommends:

- The adoption of the new nomenclature *P. meripurpuratus* for spiny red lobster populations found from south of Amazon River plume in Brazil, including the adoption of this name in future fisheries regulations, and recognizing that previous regulations that cite *P. argus* are, in fact, referring to *P. meripurpuratus*, an endemic species.

- The dissemination of the new nomenclature to all stakeholders involved in the economic use of the Brazilian spiny red lobster, thus facilitating its commercialization and appreciation in the foreign market.

- Investments on population and biological research for lobster species in Brazil, in order to support the development of improved

regulations on minimum catch sizes and seasonal closures that take into account regional stock differences.

- The assessment of the conservation status and extinction risk of *P. meripurpuratus* as a way to support, with better information, the development of strategies to promote the recovery and sustainable use of this species.

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Author Contributions

Luciano Pinto de Almeida: Concepted and designed the study. Contributed with data collection. Contributed with interpretation and manuscript preparation.

Jones Santander-Neto: Concepted and designed the study. Contributed with data collection. Contributed with interpretation and manuscript preparation. Contributed with critical revision.

Ana Claudia França Silva: Contributed with data collection. Contributed with interpretation and manuscript preparation.

Mauricio Hostim-Silva: Contributed with interpretation and manuscript preparation. Contributed with critical revision.

Conflicts of Interest

The authors declare that have no conflicts of interest

References

ALMEIDA, L. P. 2019. Aspectos da pesca e comercialização de lagosta no espírito santo. TCC- Monografia apresentada à Coordenadoria do Curso de Engenharia de Pesca do Instituto Federal do Espírito Santo, Campus Piúma. https://repositorio.ifes.edu.br/handle/123456789/585 (Accessed 16 October 2021)

ARAGÃO, J. A. N., & CINTRA, I. H. A. 2019. Avaliação do estoque de lagosta vermelha *panulirus argus* na costa brasileira. *Arq. Ciênc. Mar*, *51*(2), 7-26. http://www.repositorio.ufc.br/handle/riufc/42020 (Accessed 16 October 2021)

ARAGÃO, J. A. N. 2013. Pesca de lagostas no brasil: monitorar para ordenar; Bol. Téc. Cient. CEPENE, Tamandaré - PE - v. 19, n. 1, p. 103-106. https://www.icmbio.gov.br/cepene/images/stories/publicacoes/btc/vol19/art08-v19.pdf (Accessed 16 October 2021)

BEVILACQUA, A. H. V. 2017. Entendendo a pesca de pequena escala: uma abordagem ecológica, social e econômica. 164f. Thesis (PhD in Ecology) - Center for Biosciences, Federal University of Rio Grande do Norte, Natal. https://repositorio.ufrn.br/jspui/handle/123456789/23663 (Accessed 16 October 2021)

BRASIL. MDIC. Comex Stat. Portal do Comércio Exterior do Brasil.. http://comexstat.mdic.gov.br/pt/geral/29474 (Accessed 11 march 2021)

CARREIRO, C. R. P. 2001. Identificação de populações da lagosta vermelha Panulirus argus do Norte e Nordeste do Brasil, usando marcadores moleculares (Master's Dissertation, Department of Fisheries Engineering, Federal University of Ceará, Fortaleza. 65p).

CAVALCANTE, M. F., CARVALHO, R. M., DE ARAÚJO, R. C. P., & CAMPOS, K. C. 2018. Fontes de variação no valor das exportações brasileiras de lagosta: uma aplicação do método shift-share. *Rev.Cienc.Soc. Perspect.18*(34), 32-55. http://www.repositorio.ufc.br/handle/riufc/41935 (Accessed 16 october 2021)

CEDEPESCA – Brasil. (Centro Desenvolvimento e Pesca Sustentável Filial Fortaleza-Brasil); Análises dos dados de exportação fornecidos pelo Sindifrio. Conclusões preliminares para contribuir com a gestão sustentável da pescaria de lagosta. CeDePesca – Brasil, Filial Fortaleza, 11 de novembro. 2014. 12 p. http://cedepesca.net/wp-content/uploads/2015/08/Situacao_dos_estoques_de_lagosta_no_Brasil.pdf (Accessed 02 march 2017).

CINTRA, I. H. A., DE SÁ PAIVA, K., HERRMANN, M., BARBOSA, J. M., DE MACEDO KLAUTAU, A. G., & DE ARAÚJO SILVA, K. C. 2018. Carcinofauna acompanhante do camarão-rosa em pescarias industriais na plataforma continental amazônica. Acta of Fish. Aqua. Resourc., *5*(2), 69-77. https://doi.org/10.2312/Actafish.2017.5.2.83-91 (Accessed 16 October 2021)

DIAS NETO, J. 2008. Plano de gestão para o uso sustentável de Lagostas no Brasil: Panulirus argus (Latreille, 1804) e Panulirus laevicauda (Latreille, 1817). Brasília: Ibama. http://www.sica.int/busqueda/busqueda_archivo.aspx?Archivo=odoc_65439_1_19012012.pdf (Accessed 16 October 2021)

DIAS-NETO, J. 2010. Gestão do uso dos recursos pesqueiros marinhos no Brasil. 242p. IBAMA, Brasília, DF, Brazil.

DIAS-NETO. J. 2017; Avaliação da execução do Plano de Gestão para o Uso Sustentável de Lagostas no Brasil; IBAMA Instituto Brasileiro do Meio Ambiente e dos Recursos Naturais Renováveis; Brasília.

DINIZ, F. M., MACLEAN, N., PATERSON, I. G., & BENTZEN, P. 2004. Polymorphic tetranucleotide microsatellite markers in the Caribbean spiny lobster, Panulirus argus. Mol. Ecol. Notes, *4*(3), 327-329. https://doi.org/10.1111/j.1471-8286.2004.00683.x (Accessed 16 October 2021)

DINIZ, F. M., MACLEAN, N., OGAWA, M., CINTRA, I. H., & BENTZEN, P. 2005. The hypervariable domain of the mitochondrial control region in Atlantic spiny lobsters and its potential as a marker for investigating phylogeographic structuring. *Mar. Biotechnol.*, *7*(5), 462-473. (Accessed 12 June 2017). https://link.springer.com/article/10.1007/s10126-004-4062-5 (Accessed 16 October 2021)

DINIZ, F. M., OGAWA, M., CINTRA, I. H. A., MACLEAN, N., & BENTZEN, P. 2010. Genetic identification of fishing stocks: new tools for population studies of the spiny lobster *Panulirus argus* (Latreille, 1804). *Bol. Téc. Cient. Cepnor*, *10*(1), 95-111.

D'OLIVEIRA, R. G. 2017. A pesca e o pescador de lagosta em setor do litoral oriental do Nordeste do Brasil. https://repositorio.ufrn.br/jspui/handle/123456789/23365 (Accessed 16 October 2021)

FAO, 2021. Fishstat Database Plus. Fisheries and Aquaculture Department, Food and Agriculture Organization of the United Nations. (Accessed 03 April 2020).

FONTELES-FILHO, A. A. 1994. The state of the lobster fishery in north-east Brazil. ln: BF Phillips, JS Cobb y J. Kittaka (eds), Spiny lobster management, Chapter 7.

GIRALDES, B. W., & SMYTH, D. 2016. Recognizing *Panulirus meripurpuratus* sp. nov.(Decapoda: Palinuridae) in Brazil—Systematic and biogeographic overview of Panulirus species in the Atlantic Ocean. *Zootaxa*, 4107(3), 353-366. https://doi.org/10.11646/zootaxa.4107.3.4 (Accessed 16 October 2021)

IBAMA. Instrução Normativa nº 138, de 06 de dezembro de 2006. Instituto Brasileiro do Meio Ambiente e dos Recursos Naturais Renováveis. Diário Oficial da República Federativa do Brasil, Poder Executivo, Brasília, DF, DOU de 07/12/2006 (nº 234, Seção 1, p. 121),

https://www.gov.br/agricultura/pt-br/assuntos/aquicultura-e-pesca/legislacao/lagosta/instrucao-normativa-ibama-no-138-de-06-12-2006.pdf/view (Accessed 16 October 2021)

IBAMA. Instrução Normativa nº 206, de 14 de novembro de 2008. Instituto Brasileiro do Meio Ambiente e dos Recursos Naturais Renováveis. https://www.icmbio.gov.br/cepsul/images/stories/legislacao/Instrucao_normativa/2008/in_ibama_206_2008_defesolagostavermelhaverde_revoga_in_137_1994.pdf

IVO, C. T. C.,. & PEREIRA, J. A. Crescimento e idade das lagostas Panulirus argus (Latreille) e Panulirus laevicauda (Latreille), do Norte e Nordeste do Brasil. Arq. Ciênc. Mar, v. 30, n.1/2, p.33-39, 1996. http://www.repositorio.ufc.br/handle/riufc/1302 (Accessed 16 October 2021)

LIMA, S. A. O., & ANDRADE, H. A. 2018. Variações nas capturas das lagostas vermelha (Panulirus meripurpuratus), verde (Panulirus laevicauda Latreille, 1817) e sapata (Scyllarides brasiliensis Rathbun, 1906) na costa de Pernambuco. *Fisheries Institute Bulletin, 43 (2)*, 194-206.

MAPA. Brasil. Instrução Normativa nº 54, de 29 de outubro de 2019. Ministério da agricultura pesca e abastecimento.Official Gazette of the Federative Republic of Brazil, Executive Branch, Brasília, DF, nº 211, section 1, page 2.http://www.in.gov.br/web/dou/-/instrucao-normativa-n-54-de-29-de-outubro-de-2019-224741744 (Accessed 16 October 2021)

MAPA. Instrução Normativa nº 11, de 16 de abril de 2020. Ministério da Agricultura, Pecuária e Abastecimento/Secretaria de Aquicultura e Pesca. Official Gazette of the Federative Republic of Brazil, Executive Branch, Brasília, DF, nº 74, section 1, page 4. https://www.in.gov.br/web/dou/-/instrucao-normativa-n-11-de-16-de-abril-de-2020-252934902 (Accessed 16 October 2021)

OLIVEIRA, P. A. D. 2018. Gestão da pesca de lagostas do gênero Panulirus no Litoral da Paraíba, Brasil. Tese de Doutorado em Desenvolvimento e meio ambiente. Universidade Federal da Paraíba. 156p. https://repositorio.ufpb.br/jspui/handle/123456789/14194 (Accessed 16 October 2021)

OGAWA, M.; OLIVEIRA, G. M.; SEZAKI, K.; WATABE, S., & HASHIMOTO, K. 1991. Genetic variations in three species of genus of spiny lobster, *Panulirus laevicauda, Panulirus argus* and *P. japonicus*. Rev. Invés. Pesq., v. 12, n. 1/3, p. 39-44.

POLLOCK, D. E. 1993. Recruitment overfishing and resilience in spiny lobster populations. *ICES* J.Mar. Sci., *50*(1), 9-14. https://doi.org/10.1006/jmsc.1993.1002 (Accessed 16 October 2021)

RIBEIRO, S. S. 2017. Conectividade ecológica no oceano Atlântico tropical por meio de modelagem numérica. Nível: Mestrado. http://www.repositorio.ufc.br/handle/riufc/23910 (Accessed 16 October 2021)

SANTANA, W., IVO, C. T., NETO, J. D., DUARTE, L. F. A., PINHEIRO, M. A., BOOS, H., & COELHO, P. A. 2016. Avaliação das lagostas-de-espinho (Decapoda: Palinuridae). Livro vermelho dos crustáceos do Brasil: Avaliação 2010-2014, 268-283.

SARVER, S. K., SILBERMAN, J. D., & WALSH, P. J. 1998. Mitochondrial DNA sequence evidence supporting the recognition of two subspecies or species of the Florida spiny lobster Panulirus argus. J.Crust.Biol.18(1), 177-186.

SILBERMAN, J. D., & WALSH, P. J. 1994. Population genetics of the spiny lobster, *Panulirus argus*. *BULLETIN OF MARINE SCIENCE-MIAMI-*, *54*, 1084-1084.

SILVA, A. C. D., & FONTELES-FILHO, A. A. 2011. Avaliação do defeso aplicado à pesca da lagosta no nordeste do Brasil. *publisher Expressão Gráfica,* Fortaleza.

SOARES, C. N. C., & CAVALCANTE, P. L. 1985. Caribbean spiny lobster (Panulirus argus) and smoothtail spiny lobster (Panulirus laevicauda) reproductive dynamics on the Brazilian northeastern coast. *FAO Fisheries Report (FAO)*.

SPANIER, E., & LAVALLI, K. 2006. *Scyllarides* species In: PHILLIPS, BF (eds.) Lobsters: Biology, Manag. Aquac. Fish. Part 2: Lobsters of Commercial Importance.

TOURINHO, J. L. 2013. Estrutura populacional e filogeografia de *Panulirus argus* (Latrelle, 1804). PhD Thesis in Biosciences. State University of Rio de Janeiro. 177p.

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