UNIVERSIDADE FEDERAL DO PARANÁ

ISABELI CRISTINA GOMES MESQUITA

INTEGRANDO ABORDAGENS DE PESQUISA E EXTENSÃO PESQUEIRA PARA ENVOLVER PESCADORES ARTESANAIS NA AVALIAÇÃO E NO USO VOLUNTÁRIO DE DISPOSITIVOS DE REDUÇÃO DA FAUNA ACOMPANHANTE

PONTAL DO PARANÁ

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Orientador: Prof. Dr. Rodrigo Pereira Medeiros

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Os membros da Banca Examinadora designada pelo Colegiado do Programa de Pós-Graduação SISTEMAS COSTEIROS E OCEÂNICOS da Universidade Federal do Paraná foram convocados para realizar a arguição da dissertação de Mestrado de **ISABELI CRISTINA GOMES MESQUITA** intitulada: **INTEGRANDO ABORDAGENS DE PESQUISA E EXTENSÃO PESQUEIRA PARA**
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A prática do diálogo é um dos meios mais simples com que nós, como professores, acadêmicos e pensadores críticos, podemos começar a cruzar as fronteiras, as barreiras que podem ou não ser erguidas pela raça, pelo gênero, pela classe social, pela reputação profissional e por um sem-número de outras diferenças.

(Bell Hooks – Ensinando a transgredir, 2017, p. 174)

RESUMO

A principal estratégia para reduzir o descarte na pesca de arrasto de camarão tem sido o desenvolvimento e utilização de dispositivos de redução da fauna acompanhante (BRDs). Pesquisas têm-se concentrado no desempenho dos BRD em termos biológicos e tecnológicos, não reconhecendo a importância das dimensões humanas, tais como as percepções dos pescadores. Por outro lado, é necessária uma melhor compreensão da abordagem metodológica que permite aos pescadores a adoção voluntária dos BRDs. Este documento analisou o desempenho dos BRD através de uma combinação de atividades de interação e experiências científicas convencionais. Foram realizadas quatro atividades de interação com pescadores de arrasto de camarão de 12 localidades pesqueiras no litoral do Paraná, sul do Brasil. Adaptado de pesquisas anteriores e após sugestão dos pescadores nas atividades de extensão, foi testada uma grelha Nordmored para avaliar as diferenças de uma rede comum no peso do camarão (*Xiphopenaeus kroyeri*) e das capturas acessórias, e o comprimento total de *X. kroyeri*. As atividades de interação enfatizaram a importância do diálogo e da participação e mostraram que a percepção dos pescadores envolvia uma diversidade de parâmetros, expandindo a compreensão do desempenho do BRD. Além disso, a abordagem metodológica proporcionou espaço para a aprendizagem coletiva e o envolvimento dos pescadores, com registros de iniciativas voluntárias para reduzir os descartes. Os resultados mostraram que o diálogo é melhorado com a diversificação e integração dos métodos de comunicação, bem como o tempo é crucial para os pescadores processarem informação e construírem conhecimentos. Uma análise da abordagem metodológica utilizada no presente documento fornece informações sobre a forma de aumentar a adoção voluntária de BRD, bem como de envolver os pescadores de forma mais consistente como protagonistas da gestão para uma pesca responsável.

Palavras-chave: pesca responsável; extensão pesqueira; abordagem participativa; dimensões humanas; percepção dos pescadores; capturas indesejadas

ABSTRACT

The main strategy for reducing discards in shrimp trawl fisheries has been the development and use of bycatch reduction devices (BRDs). Research has focused on the performance of BRD in biological and technological terms, undermining the importance of the human dimensions, such as fishers' perceptions. On the other hand, a better comprehension of which methodological approach enables fishers volunteer adoption of BRDs is required. This paper analyzed the performance of BRD through a combination of interaction activities and conventional scientific experiments. Four interaction activities were conducted with shrimp trawlers from 12 fishing sites at the coast of Paraná, South Brazil. Adapted from previous research and after fishers' suggestion in the interaction activities, a Nordmored grid was tested against a control net to evaluate differences in shrimp (*Xiphopenaeus kroyeri*) and bycatch weight, and total length of X. Kroyeri. Interaction activities stressed the importance of dialogue and participation and showed that fishers perceived a high diversity of parameters, expanding the understanding of BRD performance. Also, the methodological approach provided room for collective learning and fishers' engagement, with reports of voluntary initiatives to reduce bycatch. The results showed that the dialog is improved with diversification and integration of communication methods, as well as timing is crucial for fishers to process information and to build knowledge. An analysis of the methodological approach used in this paper provide insights on how to increase voluntary BRD adoption as well as to engage fishers more consistently in being stewards for the responsible fishing.

Keywords: responsible fishing; outreach; participatory research; human dimensions; fishers perceptions; unwanted catch

SUMÁRIO

INTRODUÇÃO GERAL

A diversidade dos sistemas pesqueiros artesanais ou de pequena escala a nível mundial não permite uma definição conceitual única e varia de acordo com cada contexto (JENTOFT *et al*., 2017). Ao longo da costa brasileira é caracterizada por uma diversidade de modos de vida, sendo voltada ao comércio ou subsistência, com dedicação exclusiva ou parcial, de mão-de-obra familiar ou comunitária, sendo os recursos destinados ao mercado local ou apenas consumo (VASCONCELLOS *et al*., 2011; SERAFINI, 2018). A contribuição desta atividade para a subsistência, nutrição e segurança alimentar, redução da pobreza, além da importância identitária e patrimônio cultural é amplamente reconhecida (BENÉ, 2016; JENTOFT *et al*., 2017; BENNET *et al*., 2018).

Apesar desse reconhecimento as pescarias de pequena escala sofrem com a ausência de políticas públicas específicas a atividade. No Brasil, os incentivos econômicos a partir da década de 60 acabaram por impulsionar o setor industrial, em detrimento da crise nos recursos pesqueiros e marginalização dos pescadores artesanais (VASCONCELLOS *et al*., 2011; AZEVEDO e PIERRI, 2014). Ainda, o contexto político-histórico brasileiro favoreceu as instituições de gestão com modelos centralizadores de poder, de certa maneira alimentados por uma ciência convencional reducionista, que reconhecia o conhecimento científico como verdade absoluta (KALIKOSKI e VASCONCELLOS, 2007; KALIKOSKI *et al*., 2009; MEDEIROS *et al*., 2013; FERNANDEZ e THÉ, 2013).

Neste cenário, o conhecimento dos pescadores foi muitas vezes invalidado e negligenciado, tornando-os descartados dos processos de gestão ou vistos apenas como informantes (KALIKOSKI e VASCONCELLOS, 2007; SILVA *et al*., 2013 STEENBOOCK *et al*., 2015; DIGUES, 2019). Para além do valor intrínseco do conhecimento tradicional de assegurar a diversidade cultural (BERKES, 1993) autores chamam atenção para a importância da inclusão da percepção dos pescadores, bem como de integrar os conhecimentos tradicionais e científicos para melhores estratégias na gestão de recursos (BERKES, 2008; GASPARE *et al*., 2015; BENNET, 2016; SCHULZ *et al*., 2019). Ainda, a ausência da participação impossibilita a visualização da diversidade dos grupos sociais além de fragilizar a relação entre pescadores e instituições, o que dificulta a legitimidade das medidas (BEGOSSI, 2010; MACEDO *et al*., 2019).

A gestão diante da diversidade sócio-política-cultural dos sistemas pesqueiros requer modelos mais flexíveis, participativos, representativos e em conformidade com a realidade (MACEDO *et al.*, 2019). Neste cenário, abordagens alternativas como a gestão compartilhada e co-gestão adaptativa tem sido uma aposta para melhorar a participação e os resultados perante a gestão. Destaca-se o Enfoque Ecossistêmico Aplicado à Pesca (*Ecosystem Approach to Fisheries* - EAF) que considera a necessidade de investimento em estratégias que englobam de maneira integrada as questões ecológicas, econômicas, sociais e culturais (FAO, 2003; GARCIA e COCHRANE, 2005; YOUNG e CHARLES, 2008; RICE, 2011). Uma das questões chave desta abordagem tem sido a gestão da fauna acompanhante. O termo fauna acompanhante (*bycatch)* é utilizado para designar os indivíduos que são capturados mas que não são alvo da pescaria, que podem ser descartados ou aproveitados pelos pescadores. Quando há o aproveitamento dessa captura - seja para consumo ou comercialização - é utilizado o termo *byproduct* (EAYRS, 2007).

Uma das estratégias principais para a gestão da fauna acompanhante tem sido o desenvolvimento de dispositivos de redução da fauna acompanhante (*Bycatch Reduction Device* - BRD) (FAO, 2003; BELLIDO *et al.*, 2011). Os BRDs são modificações estruturais nas redes como forma de permitir a exclusão mecânica ou comportamental de espécies não aproveitadas pelos pescadores. O desenvolvimento destes dispositivos foi impulsionado por incentivos internacionais ligados à preocupação global com as altas taxas de descarte, especialmente para as pescarias de arrasto (EAYRS, 2007; PÉREZ RODA *et al.*, 2019). A implementação do uso destes dispositivos ocorreu em diversos países (BROADHURST, 2000). Já no Brasil, a única medida associada foi a determinação, para embarcações de arrasto de camarões acima de 11 metros, do uso de dispositivos de exclusão de tartarugas (*Turtle Excluder Devices* – TED). Esta norma repetiu a lógica já mencionada, ocorrendo de maneira arbitrária e sem diálogo com o setor pesqueiro e científico, influenciando no descumprimento da norma e desconforto ainda persistente referente aos BRDs (DUARTE *et al.*, 2019).

No litoral paranaense, a pesca de arrasto de camarão sete-barbas (*Xiphopenaeus kroyeri*) é predominantemente de pequena escala. A frota é caracterizada por canoas, bateiras e botes de 6-12 metros de comprimento, com exceção de uma frota mais especializada no município de Guaratuba (ANDRIGUETTO-FILHO *et al.*, 2006). Essa pescaria está entre as principais atividades e devido a característica de distribuição do recurso é realizada em profundidades rasas da costa, entre 6 a 15 metros (ANDRIGUETTO *et al*., 2009; VASCONCELLOS *et al*., 2011; MENDONÇA *et al*., 2017; ANDRIGUETTO-FILHO et al., 2022). Além disso, trata-se de uma região relevante para a produção dos estados de Santa Catarina e São Paulo e apresentou um crescimento dos desembarques de *X. kroyeri* nos últimos 50 anos, o que diverge do observado para a região Sul (GUANAIS *et al*., 2015; ANDRIGUETTO-FILHO *et al*., 2022).

Apesar importância significativa da pesca de arrasto de sete-barbas na região, pouco se sabia dos impactos a nível local até a realização de testes científicos mais robustos a partir de 2008. Alguns trabalhos focaram em mensurar a ictiofauna acompanhante (CATTANI *et al*, 2011; SOUZA *et al*., 2016), uma proporção média da razão camarão/peixe de 1:0,57, com predominância de indivíduos pequenos, mas com presença de espécies com média a alta relevância econômica (SILVA *et al*., 2011; CATTANI *et al*., 2011). Já a menor ocorrência de elasmobrânquios comparada a outras regiões foi atribuída a baixa potência das embarcações de arrasto na região (COSTA; CHAVES, 2006).

Ao mesmo tempo ocorreram iniciativas visando diminuir os impactos desta pescaria, algumas voltadas à avaliação do desempenho de BRDs na atividade (SILVA *et al*., 2012; CATTANI *et al*., 2012), outras também envolveram aspectos econômicos e de manejo (SILVA *et al*., 2013; MEDEIROS *et al*., 2013; GUANAIS *et al*., 2015). No entanto, mesmo diante de resultados científicos satisfatórios, não houve boa visibilidade e interesse sobre os BRDs por parte dos pescadores. Entende-se que os conflitos na relação entre pescadores, pesquisadores e agências reguladoras estão entre os motivos principais (JENNINGS e REVILL, 2007; CAMPBELL e CORNWELL, 2008; SILVA *et al*., 2013). Outro motivo pode estar atrelado a centralização dos esforços neste primeiro momento na experimentação científica, com a participação dos pescadores deixada em segundo plano.

No presente estudo a condução das atividades priorizou a participação dos pescadores no processo, de modo que posicionou a experimentação científica como um desdobramento das ações de extensão. Nesse sentido o esforço foi direcionado nas ações de comunicação favorecendo os espaços informais de diálogo que amplia a diversidade de grupos. Esse formato possibilita uma discussão que envolva interesses e saberes diversos, fator importante particularmente em comunidades pesqueiras, reconhecidas por serem plurais sócio-culturalmente que reúnem uma diversidade de interesses (KEARNEY e BERKES, 2007).

Esses espaços que permitem o intercâmbio de aprendizagem revelam ser instrumentos para o desenvolvimento de melhores práticas no manejo dos recursos pesqueiros, inclusive na gestão da fauna acompanhante (JENKINS *et al*., 2017). Porém, esses formatos exigem um investimento de tempo e recurso de longo prazo que muitas vezes não são contemplados por métodos de pesquisa convencionais (BALVANERA *et al*., 2017). Ainda, o tempo também é essencial para o engajamento dos pescadores para retomar seu papel de protagonista no manejo de recursos, visto que o formato atual de gestão pesqueira desmobilizou ou excluiu desse lugar (BORRINI-FEYERABEND *et al*., 2004; FREITAS et al., 2022).

Neste contexto, o presente documento descreve o envolvimento de pescadores de arrasto de camarões durante iniciativas de extensão e comunicação no litoral do Paraná, como parte do projeto Manejo Sustentável da Fauna Acompanhante da Pesca de Arrasto de Camarões na América Latina e Caribe (REBYC II-LAC). Em síntese, o artigo descreve o caminho metodológico escolhido para a promoção do debate sobre a redução dos descartes, com descrição e avaliação das abordagens utilizadas com base na análise da percepção dos pescadores. Ainda, descreve o experimento com um modelo de BRD adaptado pelos pescadores e avaliado por meio da integração de parâmetros científicos convencionais e de percepção dos pescadores.

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MANUSCRITO

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Integrando abordagens de pesquisa e extensão pesqueira para envolver pescadores artesanais na avaliação participativa e no uso voluntário de dispositivos de redução da fauna acompanhante

Integrating research and fishing extension approaches to engage small-scale fishers in the participatory evaluation and voluntary use of bycatch reduction devices

Submissão: Marine Policy (IF=4.315)

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HIGHLIGHTS

- Iniciativas de extensão e comunicação pesqueira contribuíram para o engajamento dos pescadores para a redução da fauna acompanhante

- Combinar indicadores convencionais e percepção dos pescadores amplia o entendimento do desempenho dos BRDs

- O engajamento e aprendizado dos pescadores é melhorado com a diversificação das abordagens de extensão

- O dispositivo de redução da fauna acompanhante adaptados pelos pescadores reduziu 60% dos descartes sem perda significativa de camarão

1 Introduction

Fisheries are among the main drivers of change in the structure and dynamics of marine ecosystems (CROWDER et al., 2008). One important impact is bycatch, some of which is used as a byproduct but most of which is discarded between catch and landing (EAYRS, 2007). Trawl fishing contributes to a high proportion of discards despite its socioeconomic importance for fishing households (BÉNÉ, 2003; EAYRS, 2007; FARACO et al., 2016). One of the main strategies to reduce the impacts of trawl fisheries comprise the development of bycatch reduction devices (BRD) (BROADHURST, 2000; EAYRS, 2007; PÉREZ RODA et al., 2019).

In recent decades, international fisheries agreements, policies, and incentives have focused on the use BRDs, and several of such initiative include Latin American as one of the core regions for FAO since 2002 (EAYRS, 2007; EAYRS, 2012; PÉREZ RODA et al., 2019; EAYRS; FUENTEVILLA, 2021). Research on BRD in trawl fisheries contributed to a variety of net modifications resulting in reduction in the capture of unwanted fishes and invertebrates without significant loss of the targeted shrimps. However, a better balance between conservation and socioeconomic goals is challenging and require the development of consistent incentives to fishers collaborate (ABE et al., 2022).

Such incentives are embedded in proposals within a broader framework such as sustainable development (SD) to address the global environmental crisis. SD emphasizes the need to balance economic growth, environmental protection, and social inclusion (UN, 2012). However, the criticism of overemphasizing economic indicators instead of other relevant human dimensions (BARRETO et al, 2020) makes SD merely a new rhetoric for the conventional paradigm of economic development (KHOTARI et al, 2014; WANNER, 2014). Consequently, the importation of such global models undermines local realities and contexts, such as social diversity, inequalities among social classes, and different human-nature relations and resource use (DIEGUES, 2000; DIEGUES, 2019). A conservation model coherent with Southern Hemisphere countries' realities should consider the importance of traditional knowledge and community-based conservation practices (DIEGUES, 2000).

Traditional knowledge is referred as "a cumulative body of knowledge, practice, and beliefs, evolving by adaptive processes and handed down through generations by cultural transmission, about the relationship of living beings (including humans) with one another and with their environment" (p. 07 - BERKES, 2008). Scientists have also called attention to the importance of combining traditional and scientific knowledge in resource management (BERKES, 2008; GASPARE et al., 2015; SCHULZ et al., 2019). Nevertheless, traditional knowledge continues to be attributed secondary importance in biodiversity conservation (ALLUT, 2000; DIEGUES, 2019).

That pattern is also found in BRD studies and projects. Fishers' participation is important but limited to promoting their voluntary adoption of BRD (CAMPBELL; CORNWELL, 2008). As a result, the scope of methods is limited to supporting the exchange or dissemination of information, the so-called domestication of subjects (FREIRE, 1983). Such a strategy dehumanizes fishers and leads to failures in fisheries management. Even when scientific results show benefits for fishers (BREWER et al., 1998; GARCÍA- CAUDILLO et al., 2000; SILVA et al., 2012; NOELL et al., 2018; THIAM et al., 2018), the voluntary use of BRD is still uncharted territory for researchers and fisheries alike (EAYRS; POL, 2019).

In southern Brazil, after ten years of research (SILVA et al., 2011; SILVA et al., 2012; CATTANI et al., 2012; MEDEIROS et al., 2013), BRDs are still largely unknown among fishers. Reasons for that include the fact that interventions are focused on conducting scientific experiments using only biological indicators, and that relationships between fishers and scientists have historically been very poor (JENNINGS; REVILL, 2007; CAMPBELL; CORNWELL, 2008). However, recent initiatives of fishing extension and communication with fishers have contributed to fishers' engagement in the region. These initiatives have emphasized dialogue and effective participation by fishers and have improved understanding of BRD performance from the construction of a BRD adapted to local context.

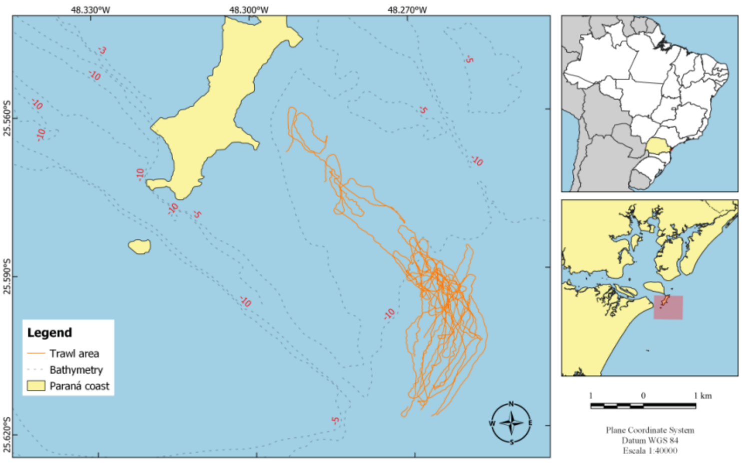
This paper describes and evaluates how such innovation in methods has contributed to a better understanding of the BRD performance and to fishers' engagement in voluntary use of BRD. From that perspective, we also explore how innovative methods can contribute to responsible fisheries and foster resilience in small-scale fisheries.

To contribute to the discussion on responsible fishing, this paper sets out to present the way in which the dialogue on BRD was established in the coastal region of Paraná and describes and evaluates how the methodological strategy contributed to the results achieved.

2 Material and Methods

2.1 Study area

Figure 1. Study area and tracks of the hauls.



Fishing off the coast of Paraná is mostly small-scale; boats range from 6-12 m in length, except for one site where a fishing industry has been established (ANDRIGUETTO-FILHO *et al.*, 2006; ANDRIGUETTO-FILHO et al., 2009; CALDEIRA; PIERRI, 2014; MENDONÇA *et al.*, 2017). Of the estimated 5,752 fishers, more than 70% rely on fishing as their main source of income (MENDONÇA *et al.*, 2017). Shrimp is the main target, using trawl nets and driftnets. (ANDRIGUETTO-FILHO, 2002; ANDRIGUETTO-FILHO et al., 2009; CALDEIRA; PIERRI, 2014.

The study included perception analysis in the fishing villages, using different methodological approaches, as well as demonstration and scientific hauls in their main fishing grounds. The study conducted the experiments in the inner shelf region of the Paraná coast, which agglutinates most of the small-scale fisheries in the region. The region's high biodiversity reflects the nutrient rich waters from the continental drainage system (SPIER et al., 2018), especially in the vicinity of the Paraná Estuarine Complex (*Complexo Estuarino de Paraná* - CEP), where the experiments were conducted (Figure 1). Oceanographical conditions, such as sediments, organic matter, water temperature and salinity (BORZONE et al., 1999; CATTANI; LAMOUR, 2015; POSSATO et al., 2017) also contribute to the existence of a high shrimp biomass. Therefore, besides local fleets, the region concentrates several small-scale to large-scale fleets and fisheries from the Southern-Southeastern region, mainly from São Paulo, Santa Catarina and Paraná States (GUANAIS et al., 2015; ANDRIGUETTO-FILHO et al., 2022).

2.2 Data gathering

2.2.1 – Fishers' perceptions of BRD performance and bycatch reduction

The data presented in this paper derive from a long-term national project aimed at providing information for building a national program to implement an ecosystem-based approach to trawl fisheries. The data was gathered from a series of fishing extension activities conducted from May through December 2019. These included 33 interaction activities in 12 fishing sites along the coast of Paraná State. The interaction activities included four main groups (Table 1): OD – Demonstration workshops, with and without audiovisuals, showing how BRD works (Table 2); OD2 – Demonstration workshops with the presentation of the scientific results obtained in other regions (MEDEIROS *et al.*, 2013; GUANAIS *et al.*, 2015; STEENBOCK *et al.*, 2015; PORTELA; MEDEIROS, 2016); DR – Devolution workshops, with the presentation of the results obtained with the fishers themselves; and PP – Demonstration hauls; fishing using modified trawl nets with local fishers (Table 3), to show how BRD perform in their own routine and context.

Table 1. Interaction activities, with the description of the number of sites and total number of participants.

Interaction Activities	**Number of activities**	**Number of sites**	**Number of participants**
OD	21	12	100
OD2	3	3	34
PP	6	3	7
DR	3	3	17

In all the workshops, eight configurations of BRD were presented and used to ’trigger’ the conversation and the evaluation with fishers, four from previous research and the others adapted from the contributions of a local netmaker (Table 2). Raw data of fishers’ perceptions included transcripts and personal notes from workshop reports, and audio and video recordings, when available. Dialogue and respect for fishers’ knowledge were the main foundations of the workshops. From that perspective, negative and positive perceptions of BRD performance were equally recorded and evaluated with the fishers, including those perceptions not congruent with scientific information on BRD.

Table 2. Description of BRDs used in the interaction activities.

BRD	Basic Configurations	*Reference*
Nordmore grid	30mm space bar distance	Medeiros *et al*., 2013
	30mm space bar distance with *flap* on the opening escape	Adapted from the local netmaker
	17mm space bar distance with *flap* on the escape opening	SILVA *et al*., 2012 - Adapted from the local netmaker
	24mm space bar distance with guiding panel	Medeiros *et al*., 2013
Escape panel	56 mm square mesh top panel (5B x 10B) at the codend entrance	Medeiros *et al*., 2013
	45 mm square mesh top panel (6Bx12B) at the codend entrance	local netmaker
	60 mm square mesh top panel (5Bx12B) at the codend entrance	local netmaker
Painted webbing + balloon	Painted webbing with 2x the number of meshes of the tradicional codend (between the codend and the net body)	Medeiros *et al*., 2013

We also conducted 26 demonstration hauls (PP) on six fishing days in four campaigns (Table 3). To focus on the conversation with fishers and the demonstrative nature of these types of hauls, we did not follow standard protocols of scientific experiments with BRD in PP, such as changing boat sides, number of hauls/days, and others. However, to share results with the fishers in the workshops (DR), we collected data on bycatch and shrimp biomass, total length of the Atlantic seabob shrimp *Xiphopenaeus kroyeri* and the white shrimp *Litopenaeus schmitti* (mm), and presence/absence of byproduct. We only considered specimens retained by the fishers onboard as byproduct. In the demonstration fishery using a single rigged trawl (Vessel type 3), we did not collect catch data, only perceptions, as there was no control net for comparison (Table 3). Bycatch composition information, net modifications and/or fishing behavior, and problems during the hauls were also collected. All information was shared in devolution workshops. (DR). After the landing, fishers' perceptions were recorded as a new workshop group (PP, Table 1) for participatory assessment in future workshops and as a means of adjusting the modified nets.

Table 3. Main features of the vessels used in the demonstration fishing.

	Vessel type			
Vessel Features	1	2	3	4
Type	Boat	Canoe	Canoe	Boat
Construction	Fiberglass	Fiberglass	Fiberglass	Wood
Superstructure	Yes	No	No	No
Power (Kw)	33.5	16.4	13.4	13.4
Gear type*	Double riggled otter trawl	Double riggled otter trawl	Single boat otter trawl	Double riggled otter trawl
Hauls (n)	3	18	2	3
head rope (m)	13.7	9.6	13.7	9.6
BRD	G17	G17	JE	G30

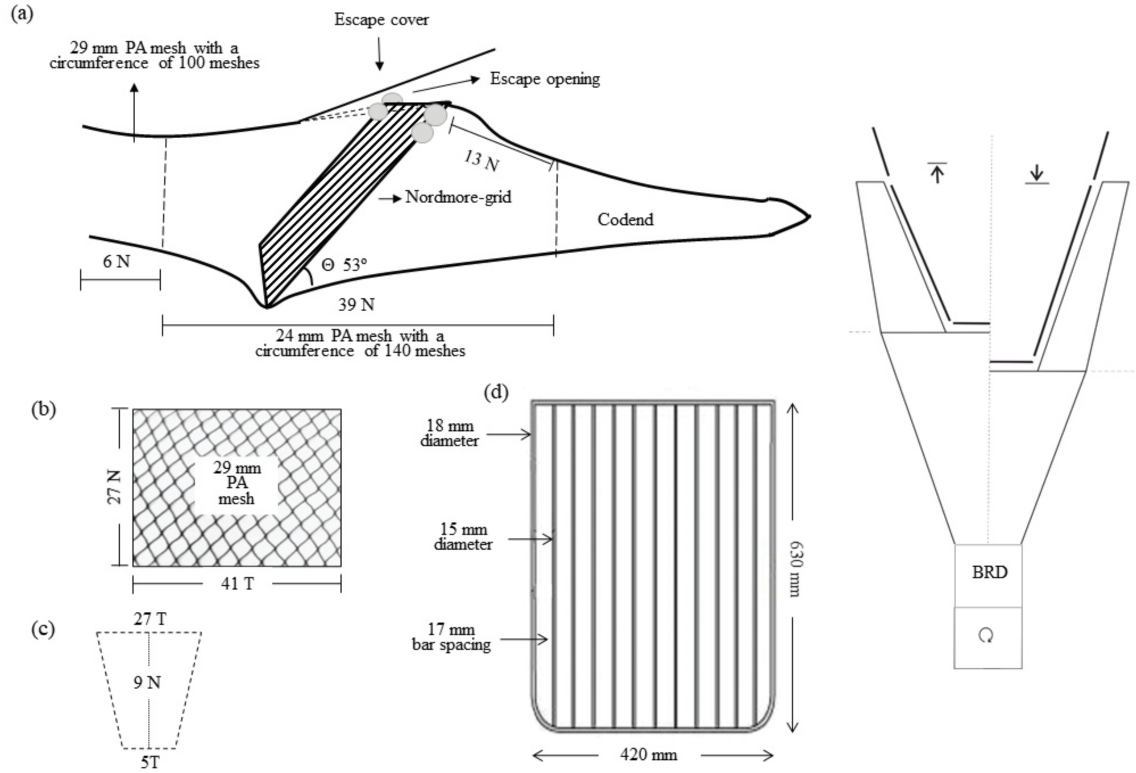
* Gear type names based on He et al. (2021).

2.2.2 Scientific experiments for testing BRD performance

At the end of this cycle of workshops, which lasted approximately eight months, a pair of nets were handcrafted by a local netmaker (Apêndice 1) to include the necessary adjustments suggested by the fishers in the course of the workshops. The control (Ctrl) and treatment (G17) nets had the same dimensions and webbing. G17 was then modified with the installation of a BRD adapted by the same netmaker. We tested an aluminum Nordmore grid

(Figure 2) with dimensions and design adapted from previous work in the region (MEDEIROS et al., 2013; SILVA et al., 2012).

Figure 2. (a) schematic description of the tested Nordmore Grid. (b) dimensions of flap used to cover the escape opening (c) escape opening dimensions. (d) Nordmore-grid dimensions. PA = polyamide.



The scientific experiment was conducted on a type 4 boat (Table 3). We performed thirty 60-min deployments, equally distributed along six days of experiments (January 27-30 and February 16-17, 2020). To obtain a paired number of hauls for control and treatment nets we switched sides of the nets after each day of research.

The catches in each deployment were weighed for total biomass (kg) and then sorted into three groups: shrimps (*X. kroyeri*), discards and byproduct, when available. We collected data on the biomass of each group; body length of all specimens of byproduct, including fish and the white shrimp (*L. schmitti*). We also randomly selected 30 specimens of *X. kroyeri* for total length measurement in each deployment for each net. Measurements of *X. kroyeri* may be biased because we used a non-standardized sampling. The main observations of the fishers were also recorded, to be analyzed and integrated with those of previous approaches for collecting data on perceptions. These perceptions belong to a new category of approach (PE).

2.3 Data analysis

Fishers' perceptions were transcribed and analyzed using the ATLAS.ti software for qualitative analysis. 50 documents were transcribed and used for the analysis of fishers' perceptions (OD:20; OD2: 3; PP: 7; DR:3; PE: 17). After reading all documents, quotes from perceptions were organized and categorized based on Discursive Textual Analysis (MORAES; GALIAZZI, 2006). A comprehensive understanding of the documents and the memory of the context of the speeches was crucial to the development of the categories. The categories were created through the process of reading the documents, and, when necessary, categories were revised and regrouped and/or merged. The final composition included 14 categories of perceptions arranged in three typologies (Table 4).

Table 4. Description of elements composing each perception category.

Typology	Category	Description
Effects on targets	shrimp loss	Factors that may negatively affect the catch
	technological mistrust	distrust or “it won't work” discourse
	quality	quality of the catch
	conditional approval	approval conditioned to improvement in BRD design
	satisfactory outcome	results are approved even with loss of shrimp
Bycatch exclusion	exclusion	Fishers show interest in excluding specimens or in an overall increase in fishing selectivity
	good performance	Approval of results of the compared exclusion of control and BRD trawl nets
	bad performance	Problems in BRD performance
	byproduct	emphasized perception on the use of bycatch
Labor conditions	working onboard	working conditions with the net and BRD on-board

	hauling time	Effects on bycatch of different hauling times
	ergonomy	on-board labor
	Work on-landing work	Concern with mounting and maintenance of BRD on land
	Shrimp sorting	Challenges and improvements in sorting shrimp on-board

To assess the performance of BRD, we used the permutational mutivariate variance analysis (PERMANOVA) to determine whether the capture of shrimp, bycatch and total lengths of *X. kroyeri* differ significantly between Ctrl and G17. We use the "adonis" function in the R Vegan Package (permutations = 999). The performance of exclusion was calculated using the formula %Exclusion = (Biomass C – Biomass BRD)/ Biomass C *100).

3 Results

3.1 Perceptions of BRD

We grouped 136 quotes in the three perception typologies related to BRD use (Table 5). The typologies show how fishers evaluate BRD and how such perceptions relate to conventional scientific parameters. *Bycatch exclusion* and *labor conditions* accounted for 84.6% (n=39) e 76.47% (n=17) of the total quoted OD and PP, respectively. On other hand*, effects on target species* and *bycatch exclusion*, accounted for 80% (n=10) e 85.3 % (n=34), of OD2 and PE, respectively. DR provided similar numbers of quotes in all typologies.

Table 5: Distribution of frequencies of the perception types according to the interaction activities.

Perception types	**OD**	**OD2**	**PP**	**DR**	**PE**
Effects on targets	6	4	4	11	14
Bycatch exclusion	18	4	7	13	15
Labor conditions	15	2	6	12	5

Perceptions about *effects on targets* (Table 6) showed fishers to be concerned about reducing the shrimp catches but indicating a certain level of ‘acceptable loss’. That flexibility stems from a perception of benefits from the exclusion of bycatch, with improved on-board work and shrimp quality. At first, fishers found it hard to identify the rationale behind the BRD performance, except for jellyfish. Fishers also expected grid clogging. After the presentation of results, fishers perceived positive outcomes and made comparisons between the nets. Fishers who used the devices highlighted the exclusion of teleosts, crustaceans, and jellyfish. The statements referring to labor conditions mainly illustrated the difficulties of the activity, emphasizing on how high bycatch rates affect their health and quality of life.

Table 6. Fishers’ perceptions of BRD performance. Original quotes were in Brazilian Portuguese.

Typology	Category	Examples of related quotes
Effects on targets	shrimp loss	*…the grid clogs the mouth and shrimp escapes...* *...from one boat side to another, sometimes there is a difference in catches...* *...when the bycatch comes out (especially bryozoan), it takes a little bit of shrimp* [with it]...
	techological distrust	...it *doesn't work, the grid tangles the net and loses a lot of shrimp...* *...must try to check if there is shrimp loss...* *...you could reduce the hole [escape opening] a little bit...*
	quality	*... amazing, only pure shrimp...* *...it’s different, and whole shrimp comes, alive and kicking...* *...look, the shrimp is bigger there [modified net] ...*
	conditional approval	*...it is worth losing a little bit of shrimp, as long as you eliminate a lot of bycatch...* *...approved already, you just have to adjust it carefully, to perform well...*
	satisfactory outcome	*...sometimes this is normal (about shrimp loss)* *...otherwise, this result is 100%...* *...I can’t see the difference in shrimp catch, that’s good ...*
Bycatch exclusion	interest in exclusion	*...the lower the fish catch the better...* *... it would be helpful for us to eliminate jellyfish, ...* *..., that “brown hair” (briozoan)*

	good performance	*...the difference in bycatch is extraordinary...* *...no sand dollars, no blue crabs there (G17), have you noticed? Much less catfish, no crabs ...*
	bad performance	*... What doesn't exit is here (referring to the material stuck to the base of the grid - sand dollar, starfish, and bryozoan) ...* *...Look what clogs the grill, it's the starfish that covers the mouth...* *...when the bycatch is high the flap can handle it...*
	byproduct	*...there is no fish for food...* *...we use only the fish above 150 mm (total length) ...*
Labor conditions	sorting	*...squatting in the sun hurts...* *...it even helps the sorting...* *...I took the dirt off the shrimp; it is taking the shrimp off the dirt. Difference of about 20 minutes in sorting time...*
	ergonomy	*sometimes you can't even pull the codend...* *...the one that even cracks the back...* *...I thought it would be lighter.../ ...the lighter the better... - ...related to the weight of the BRD* *... Very good to work with...*
	hauling time	*... hauling for 10-20 min at most (estimated time with high jellyfish concentration.* *...it is possible to haul 4 hours as if it were 1 hour, if those fishnets work...*
	onboard working	*... you waste around 30 min per haul to exclude the jellyfish before pulling the codend on board* *...it didn't bother me, it didn't curl, it didn't break, it performed equally on both sides...*
	on-land working	Suggestion of using a PVC pipe to reduce net damage from dragging *...I imagined a grid in the front, not in the codend, and then, yes, you just adjust between the codend and the tunnel.*

The comparative analysis between workshop approaches indicates a higher number of citations of OD, DR and PE, with 28.7%, 26.5% and 25% (n=136), respectively. It is also worth noting the diversity of the information, in terms of the number of perception categories (Table 7). In this case the approaches that provided a greater variety of information were the PP, DR and PE, with more categories mentioned. Therefore, although OD provided a greater number of citations, they were centered on few categories. DR, on the other hand, even with only three activities, was the second in number of citations with diversified categories. Also, technological distrust and ergonomy were present in all workshop approaches. Quality of shrimp was only present in PE.

There is also a difference in the evolution of perceptions. For the first approaches (OD) there is a predominance of questioning and distrust of BRD performance in both shrimp catch and in bycatch exclusion. As for the PP, DR, and PE, even when the shrimp catch is not satisfactory, the loss is understood or becomes less relevant when faced with high rates of bycatch exclusion.

Table 7: Distribution of categories of perceptions with the interaction activities.

Typology	Categories of perceptions	OD	OD2	PP	DR	PE
Effects on targets	shrimp loss	0	0	0	1	1
	technological distrust	1	1	1	1	1
	quality	0	0	0	0	1
	conditional approval	0	1	1	0	0
	satisfactory outcome	0	1	1	1	0
Bycatch exclusion	interest in exclusion	1	1	1	1	0
	good performance	0	0	1	1	1
	bad performance	0	0	1	0	1
	byproduct	1	1	0	1	1
Labor conditions	sorting	0	0	0	1	1
	ergonomy	1	0	1	1	0
	hauling time	1	1	1	1	1
	onboard working	1	0	0	1	0
	on-land working	0	1	1	1	1

3.2 Scientific BRD performance

In a total of 0.9 km^2 swept area, the catch was 294.84 kg for *X. kroyeri* and 516.32 kg for bycatch, with the shrimp/bycatch ratio of 1:1.57 and 1:3.76, in G17 and Ctrl, respectively. Byproduct was selected by fishers in 30% of the deployments, including 20 teleosts caught only on Ctrl. The total length of the byproduct was between 150mm and 250mm, except for three larger individuals. Also, captures of *L. Shmitti* (Ctrl = 16; G17 = 20) occurred in 30% of the hauls. The number of individuals of the byproduct and *L. Shmitti* did not allow for a more refined analysis of these data to be made and, in the same way, the influence of this variable on the fishers' perception was not observed since there was an understanding that this device is adjusted to capture *X. Kroyeri* and exclusive to fishers who do not take advantage of the byproduct.

The comparative analysis indicates bycatch exclusion efficiency by G17, with an average reduction of 60.86% (F=87.548; $p < 0.001$). On the other hand, the average reduction of 9.53% for *X. kroyeri* biomass resulted no statistically significant difference (F=0.5769; p=0.585). We also found significant differences in length of *X. kroyeri* (F=5.6898 p = 0.025). The loss of *X. kroyeri* varied per day of work, an issue that drew the attention of one fisher, who questioned the research in days of low shrimp catch.

4 Discussion

4.1 Dialogue as a reference: a look at perception

The analysis of the perceptions demonstrated that fishers evaluated the performance of BRD through a series of categories that involve biological, economic, operational, and physical health parameters in an integrated manner. It also allowed for the continuous improvement of a BRD that is more adequate as well as efficient for the local fishing context when compared to standardized metrics. Some work on BRDs has performed perception analysis (GUANAIS et al., 2015; PORTELLA; MEDEIROS, 2016), but it is much more recent than the conventional scientific parameter-based works, centered on exclusion rates, which are usual the basis for approval of a BRD (BROADHURST, 2000; NOAA, 2016). That difference may be a result of the unequal power relationship between these fields of knowledge, so that local knowledge has often been neglected by scientists in marine ecosystem analysis and management processes (ALLUT, 2000; DIEGUES, 2019).

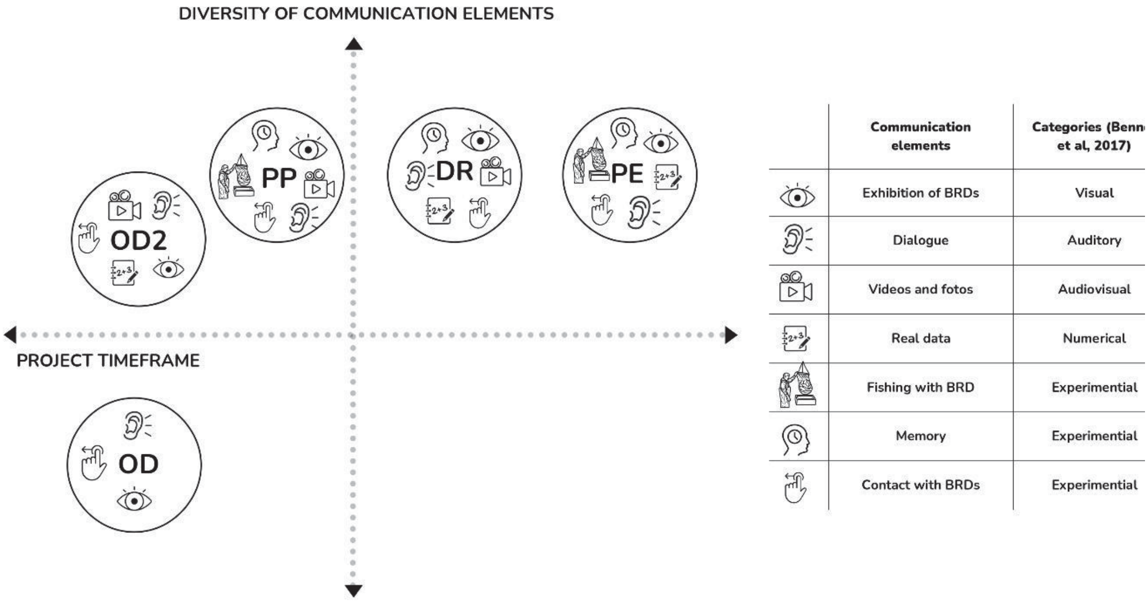
By breaking with conventional science, the methodological choice aligns with innovative approaches to managing social-ecological systems that recognize the need for learning processes in constantly changing systems, such as adaptive management, adaptive co-management, and adaptive governance (CUNDILL et al., 2015). The recognition of local perception as a key tool for conservation strategies is recent, but its use in co-management processes has been recommended to enhance and seek more coherent and legitimate management for actors (BENNET, 2016).

In the scope of bycatch reduction, fishers' participation was seen for a long time merely as a strategy to ensure voluntary adoption (CAMPBELL; CORNWELL, 2008), and not as a way to improve planning and evaluation actions, nor even as a way to produce new knowledge. Thus, efforts were devoted to procedures of dissemination and convincing, that is, approaches of 'domestication' and environmental training (FREIRE, 1983). That invasive and anti-dialogical logic hinders a broader and more adequate vision of possible paths for responsible fishing since participatory construction and learning are not seen as a result to achieve.

The unfolding and results of this study give clues as to which outreach/communication strategies are most effective. This is an important contribution of the work, as it has been a challenge in the sector (EAYRS; POL, 2019). Some more methodologically relevant observations are noted below, but first it is necessary to emphasize that establishing a horizontal relationship between communicator/extensionist and fishers is a key factor. The effort focused on mutual learning, favored the fishers' engagement with the theme and enabled a broadening of the understanding of BRDs' performance beyond conventional parameters. Freire (1970) points out that a dialogical approach is only possible when the discourse is based on horizontal relations and the relationship of trust becomes a consequence.

Adopting such an approach enabled refinement and diversification in communication methods. Overall, we used five social communication elements (Figure 3), according to the classification proposed by Bennet *et al*. (2017). The more diversification and integration the communication methods adopted the more dialogue increased. While some fishers preferred visual elements, others preferred auditive and experimental communication. Diversified perceptions occurred through approaches that used more diversified communication elements. Despite their lower frequency (number of activities), DR registered more perception categories.

Figure 3: Schematic flow of communication strategies through diversification of methods along a time frame of BRD development and implementation in a given fishery (Adapted from Bennet el al., 2017).



Using results from the demonstrative hauls (PP) in the devolution workshops (DR), fishers that have not experienced the BRD recovered fishing days where they were fishing side by side with fishers using BRD and mentioned its effects. Bringing back the memory of such days in the workshops helped them to build and share knowledge based on their own day-to-day context. In that situation high values of shrimp loss were understood or less relevant than the benefits from the high bycatch exclusion rates. That was different from the perceptions found by Portella and Medeiros (2016) using less diverse approaches, where even minimal shrimp losses were considered problematic. Shrimp loss is no longer a key factor, which was observed in the nature of the perception of the first approaches. This distances us from the predominant view of profit maximization and risk minimization attributed to fishers (CAMPBELL; CORNWELL, 2008). The evolution of perceptions is in consonance with transformative learning theory, which indicates a change in perceptions as individuals are challenged to critically reflect (ARMITAGE et al., 2008).

Timing is also relevant in the learning process and influenced the evolutions of the perceptions in this study. For example, engagement in resource management is a long-term process Freitas et al (2022). With constant and continued fishing extension activities, fishers and other actors develop bonding, nurturing a healthy environment for raising questions and will to learn. Timing also gives opportunities for fishers to process information and build a more comprehensive knowledge. Timing and the diversity of interaction approaches generated maturity of perception and deeper knowledge, empowering fishers in the conversation arenas. Going further, maturation in fishers' perception enable their interest and ability to participate in decision-making arenas.

One can look at the interaction activities as spaces for learning exchanges, where a diversity of interests, perceptions, understanding, and experience with the use of BRDs comes together. Learning exchanges have been an important tool for incorporating best practices in resource management, including examples of satisfactory results with respect to bycatch mitigation (JENKINS et al., 2017). In this format, a favorable scenario is created for fishers to recognize their role as stewards (LEE et al, 2019; BENNET et al., 2019). With this, it is hoped that the exchanges will go beyond the spaces of workshops and tests and be capable of expanding the discussion to fishers who were not interested in participating in these spaces initially.

The initiative of one of the fishers who shared his perception about the use of the BRD via a social network is an example of this and it has motivated the construction and voluntary use of BRDs by fishers from different locations (EAYRS; FUENTEVILLA, 2021). What led those fishers to fashion their own BRD? Certainly, a clear communication of benefits by someone they identify with is one reason. However, to be aware of the benefits will not necessarily result in change (EAYRS et al., 2015; EAYRS; POL, 2019). Nevertheless, some studies in behavioral science for conservation demonstrate an effort to improve the understanding of the context and factors that influence certain behaviors, this area being an important tool for management, but still little explored (REDDY et al., 2016; BATTISTA et al., 2018; BALMFORD et al., 2021).

There is a methodological path that enables fishers to encompass the complexity of perceptions observed in this study. Are we open to use methods that fit and embrace the diversity of fishers' knowledge and, as a consequence, to limit the pursue of the outcomes in conventional research? Otherwise, expanding the perspective of knowledge diversification require more integrative and truly participative approaches which embed concepts and theories usually poorly addressed in fisheries management, such as the human dimensions. (YOUNG et al., 2008; MEDEIROS et al, 2015; BARRETO et al., 2020). Such perspective provides a more comprehensive understanding on BRD performance, as well as creates opportunities to foster resilient fisheries, congruent to different contexts.

4.2 Integrated analysis: BRDs performance vis-a-vis conventional and perceived parameters

For each kilogram of shrimp, an average of 3.76 kg of other organisms were discarded by the control net. In the state of Santa Catarina, authors found ratios ranging from 1:2.0 to 1:5.05 (BRANCO; VERANI, 2006; PORTELLA; MEDEIROS, 2016). Cattani et al. (2011) presented an average shrimp-fish ratio of 1:0.57 in the region. There is no detailed analysis of the bycatch from our results, but previous works indicate the presence of mostly teleosts < 200 mm CT predominantly of the family Sciaenidae (BERNARDO et al., 2011; CATTANI et al., 2011; SILVA et al. 2011; SANTOS et al., 2020) and species of the genus *Brachirus* (SILVA et al., 2011). That pattern is also observed in Santa Catarina, as well as the presence of species of cnidarians, echinoderms and mollusks (BRANCO et al., 2015).

Use of byproduct is uncommon among fishers participating in the workshops. Except for the *L. Shmitti*, the byproduct was exclusive to the control net, being destined only for consumption, which confirms that the G17 can only be used by fishers who do not take advantage of the bycatch. The bycatch is characterized by small-sized individuals, with low or no commercial value. Authors have observed a variation in the utilization rate related to different fleets, with lower utilization by smaller fleets (< 33 kW), intended mainly for consumption or donation (BAIL; BRANCO, 2007; PORTELLA; MEDEIROS, 2016). In larger fleets, the main destination is sale, and the utilization rate is variable, being also influenced by other factors such as travel time, storage capacity and availability of the target resource (BELLIDO et al., 2011). In addition, conditions on land, such as adequate structure for processing and marketing and the presence of women in the fishing household are also important variables (GUANAIS et al., 2015; PORTELLA; MEDEIROS, 2016).

We found higher exclusion efficiency of total bycatch compared to previous experiments on the coast of Paraná (ranging from 20% to 50% - MEDEIROS et al., 2013). The exclusion rates differed from those of Silva et al. (2012), who obtained lower bycatch exclusion (43%) but with better shrimp capture results using a grid with the same dimensions. That may be a result of factors such as the absence of a guiding panel (SILVA et al., 2011; BROADHURST et al., 2012), different BRD configuration (such as angle, webbing length), or composition of the bycatch. The fishers attributed the highest shrimp losses to grid obstruction, especially related to high presence of bryozoans. Blockage by plants and debris can cause shrimp loss (BROADHURST et al., 2012, p.73). A better understanding is needed not only in terms of BRD use, but also because fishers perceive significant increase of bryozoans in bycatch. Impacts on bryozoans are little known in Brazil (MIRANDA et al., 2018) although their expansive behavior points to ecological impacts (FARRAPEIRA, 2011).

The reduced shrimp loss in our results proved to be an important factor for the positive evaluation of BRDs, being among the reasons often mentioned by fishers, especially in the first approaches. Shrimp loss strongly affects the willingness to adopt of the BRD (TUCKER et al., 1997; EAYRS et al., 2007; CRAWFORD et al., 2011; MEDEIROS et al., 2013; GUANAIS et al., 2015; PORTELLA; MEDEIROS, 2016). Brown et al. (2019) reported a rate of up to 5% loss as being acceptable to the fishing industry, but it is flexible and dependent on bycatch exclusion. Studies have evaluated economic impacts with the use of BRDs (GARCÍA-CAUDILLO et al., 2000), but few perform a more integrated cost-benefit analysis. On the other hand, the fishers' evaluation is presented in an integrated manner. Besides catch performance, factors such as selectivity, shrimp quality, and working conditions are also evaluated.

Fishers perceived the capture of larger individuals of *X. kroyeri* less damaged in modified nets, although no statistically significant differences have been observed. Several authors suggest there is improvement in product quality, brought about either by reduced damage due to less crushing, or the effective exclusion of brachiurs or the shorter exposure time on deck (BREWER et al., 1998; GARCÍA-CAUDILLO et al., 2000; SILVA et al., 2012; NOELL et al., 2018). In Australia, Gorman and Dixon (2015) obtained shrimp 88% less damaged with the Nordmore Grid, while Brewer et al., (2006) found a reduction of around 40-60%. Besides size and quality having effects on shrimp prices (GARCÍA-CAUDILLO et al., 2000; NOELL et al., 2018), larger individuals and bycatch exclusion facilitates the sorting on board.

Fishers identified the reduced sorting time with, consequently, better working conditions, as a positive outcome of BRD use. However, we didn’t calculate the sorting time in this study.

Other studies have already found significant differences in sorting time (GARCÍA-CAUDILLO et al., 2000; THIAM et al., 2018). Spending less time in an uncomfortable posture as well as lifting less weight when pulling the catch can reduce risks to fishers' health. The latter is especially compounded for fishers who pull the net by hand. Assuming most of trawlers in the region do not use engine to pull the net, such improvements in working on board were very valued by fishers. Likewise, disadvantages in working with the use of the grid have also been pointed out (SILVA et al., 2012; PORTELLA; MEDEIROS, 2016; GUANAIS et al., 2015). Among those mentioned were the added weight, the complexity of the net modification, difficulties in on-board handling and maintenance of the equipment.

5 Conclusion

Fishers' perceptions allow for a more comprehensive understanding of BRD performance. Moving beyond the conventional biophysical and economic parameters provides integration with aspects related to labor and health. Following up on fishers' perceptions, designed a different BRD, locally approved and with satisfactory scientific results. Inclusion of fishers' perceptions should play a more consistent role in BRD design and evaluation.

The comprehension of BRD design and performance, as well as their acceptance among fishers, depends on the methodological approach, as diversified approaches nourish more consistent perceptions. Results show that investing in strategies that prioritize learning and participation can lead to new knowledge. That perspective leads to fishers' engagement and responsible fishing.

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CONCLUSÃO GERAL

Em síntese, espera-se que o artigo possa contribuir de modo a reforçar as discussões em torno da necessidade de modelos alternativos à ciência e gestão convencionais, que reconheçam a necessidade de incorporação dos conhecimentos locais e as dimensões humanas da pesca. Também de modo associado que nos permita avançar para um novo olhar sobre a extensão pesqueira e que esta venha a estar presente de forma mais consistente nos planos de gestão. Ainda, que a descrição e avaliação das metodologias utilizadas possa servir de suporte para ações não somente da gestão da fauna acompanhante mas da discussão sobre pesca responsável.

Entende-se que as ações de extensão realizadas no litoral do paraná construíram um espaço de diálogo diferenciado na região. O que favoreceu o engajamento dos pescadores na temática com indícios de uso voluntário dos dispositivos por pescadores fora da área de atuação do projeto. Como fator chave dessa expansão dos resultados está a atuação do pescador Salmo Manuel de Borba como protagonista local. A divulgação de um vídeo em rede social contendo sua percepção sobre o dispositivo adaptado a partir do conhecimento dos pescadores, despertou o interesse e abriu espaço para o diálogo e troca de saberes entre pescadores de diferentes localidades, mas também entre pescadores e pesquisadores de modo remoto.

Esta iniciativa se desdobrou na criação do Youtube, intitulado Saberes Marinhos, que serviu como um meio de "extensão pesqueira" online (entre aspas porque o diálogo é limitado) em um momento de restrições de atividades presenciais devido à pandemia do coronavírus. Como forma de responder aos questionamentos que surgiram após a divulgação do vídeo, os vídeos continham informações sobre a redução da fauna acompanhante e tutorial de dicas de adaptação do dispositivo nas redes comuns. A perspectiva futura do canal é de discutir vários temas, sobre a voz dos diferentes atores envolvidos nos sistemas pesqueiros.

Compreende-se que as atividades online serviram para suprir a impossibilidade de atividades presenciais e também como forma de ampliar o alcance das informações. No entanto não tinham a função de substituir as atividades presenciais. Como demanda dos pescadores oficinas presenciais para apoio na montagem dos dispositivos foram realizadas em um período posterior ao analisado neste artigo. Importante também destacar que com a interrupção das atividades de extensão presenciais ao término do projeto acabamos por reproduzir mais uma vez a descontinuidade das abordagens que é tão criticada pelos pescadores. E novamente, se almejamos a sustentabilidade dos sistemas pesqueiros é preciso o investimento em ações continuadas e articuladas com os processos de gestão pesqueira. Ações que promovam a construção coletiva e empoderamento das comunidades.

APÊNDICE 1