



OPEN ACCESS

EDITED BY

Lyne Morissette,
M – Expertise Marine, Canada

REVIEWED BY

Joshua Patterson,
University of Florida, United States
Vaughn Robison,
Oregon State University, United States

*CORRESPONDENCE

Pablo Pita
✉ p.pita@udc.es

RECEIVED 07 March 2025

ACCEPTED 28 April 2025

PUBLISHED 21 May 2025

CITATION

Pita P, Tracey S, Arlinghaus R, Bachiller E, Pinho-Duarte F, Ferter K, Henriques F, Hook S, Hyder K, Irigoyen A, Jiménez MP, Laporta M, Lejk AM, Leonard E, Olesen HJ, Palmer F, Pavičić M, Pontes J, Pujol-Baucells M, Radford Z, Rangel M, Roche W, Rudd H, Ryan D, Sbragaglia V, Selles J, Silva CNS, Skov C, Strehlow HV, Taylor S, Veiga P, Venerus LA, Venturelli P, Vertegaal D, Weltersbach MS, Wiech M and Winkler A (2025) Staying hooked: effective science engagement and communication in recreational fisheries.
Front. Mar. Sci. 12:1589544.
doi: 10.3389/fmars.2025.1589544

COPYRIGHT

© 2025 Pita, Tracey, Arlinghaus, Bachiller, Pinho-Duarte, Ferter, Henriques, Hook, Hyder, Irigoyen, Jiménez, Laporta, Lejk, Leonard, Olesen, Palmer, Pavičić, Pontes, Pujol-Baucells, Radford, Rangel, Roche, Rudd, Ryan, Sbragaglia, Selles, Silva, Skov, Strehlow, Taylor, Veiga, Venerus, Venturelli, Vertegaal, Weltersbach, Wiech and Winkler. This is an open-access article distributed under the terms of the [Creative Commons Attribution License \(CC BY\)](https://creativecommons.org/licenses/by/4.0/). The use, distribution or reproduction in other forums is permitted, provided the original author(s) and the copyright owner(s) are credited and that the original publication in this journal is cited, in accordance with accepted academic practice. No use, distribution or reproduction is permitted which does not comply with these terms.

Staying hooked: effective science engagement and communication in recreational fisheries

Pablo Pita^{1*}, Sean Tracey², Robert Arlinghaus^{3,4}, Eneko Bachiller⁵, Filipa Pinho-Duarte⁶, Keno Ferter⁷, Filipe Henriques^{6,8}, Samantha Hook⁹, Kieran Hyder¹⁰, Alejo Irigoyen¹¹, María P. Jiménez^{8,12}, Martín Laporta^{13,14}, Adam M. Lejk¹⁵, Eoin Leonard¹⁶, Hans Jakob Olesen¹⁷, Freya Palmer¹⁸, Mišo Pavičić¹⁹, João Pontes²⁰, Marta Pujol-Baucells^{21,22}, Zachary Radford¹⁰, Mafalda Rangel²⁰, William Roche¹⁶, Hannah Rudd²³, Diarmuid Ryan¹⁶, Valerio Sbragaglia²², Jules Selles²⁴, Catarina N. S. Silva²⁵, Christian Skov²⁶, Harry V. Strehlow²⁷, Stephen Taylor²⁸, Pedro Veiga²⁰, Leonardo A. Venerus¹¹, Paul Venturelli²⁹, David Vertegaal³⁰, Marc Simon Weltersbach²⁷, Martin Wiech⁷ and Alexander Winkler³¹

¹CICA - Centro Interdisciplinar de Química e Biología, Departamento de Biología, Universidade da Coruña, A Coruña, Spain, ²Institute for Marine and Antarctic Studies, University of Tasmania, Hobart, TAS, Australia, ³Department of Fish Biology, Fisheries and Aquaculture, Leibniz Institute of Freshwater Ecology and Inland Fisheries, Berlin, Germany, ⁴Division of Integrative Fisheries Management, Faculty of Life Sciences and Integrative Research Institute on Transformations of Human-Environment Systems, Humboldt-Universität zu Berlin, Berlin, Germany, ⁵AZTI, Marine Fisheries and Ecosystem Sampling and Data Collection (ItsasData), Basque Research and Technology Alliance (BRTA), Sukarrieta, Spain, ⁶Direção de Serviços de Monitorização, Estudos e Investigação do Mar, Direção Regional de Pescas, Funchal, Portugal, ⁷Institute of Marine Research, Bergen, Norway, ⁸MARE—Marine and Environmental Sciences Centre/ARNET—Aquatic Research Network, ARDITI Regional Agency for the Development of Research, Technology and Innovation, Funchal, Portugal, ⁹Substance Ltd, Manchester, United Kingdom, ¹⁰Centre for Environment, Fisheries and Aquaculture Science, Lowestoft, United Kingdom, ¹¹CESIMAR - Centro para el Estudio de Sistemas Marinos, CCT CONICET-CENPAT - Centro Científico Tecnológico, Consejo Nacional de Investigaciones Científicas y Técnicas, Centro Nacional Patagónico, Puerto Madryn, Argentina, ¹²Spanish Institute of Oceanography (IEO, CSIC), Centro Oceanográfico de Cádiz, Cádiz, Spain, ¹³Dirección Nacional de Recursos Acuáticos, Ministerio de Ganadería, Agricultura y Pesca, Rocha, Uruguay, ¹⁴Campus DoMar, International Campus of Excellence, Vigo, Spain, ¹⁵National Marine Fisheries Research Institute, Gdynia, Poland, ¹⁶Inland Fisheries Ireland, Dublin, Ireland, ¹⁷Section for Monitoring and Data, Technical University of Denmark, DTU Aqua, Lyngby, Denmark, ¹⁸International Centre for Ecohydraulics Research, Faculty of Engineering and the Physical Sciences, Southampton, United Kingdom, ¹⁹Institute of Oceanography and Fisheries, Split, Croatia, ²⁰Centro de Ciências do Mar do Algarve (CCMAR/CIMAR LA), Universidade do Algarve, Faro, Portugal, ²¹Institut Català de Recerca per a la Governança del Mar (ICATMAR), Barcelona, Spain, ²²Institute of Marine Sciences (ICM-CSIC), Barcelona, Spain, ²³Angling Trust, Leominster, United Kingdom, ²⁴Consultant, Marseille, France, ²⁵Centre for Functional Ecology - Science for People & the Planet (CFE), Associate Laboratory TERRA, Department of Life Sciences, University of Coimbra, Coimbra, Portugal, ²⁶Section of Freshwater Fisheries and Ecology, Technical University of Denmark, DTU Aqua, Silkeborg, Denmark, ²⁷Thünen Institute of Baltic Sea Fisheries, Rostock, Germany, ²⁸Department of Primary Industries and Regional Development, Government of Western Australia, Perth, WA, Australia, ²⁹Ball State University, Muncie, IN, United States, ³⁰Sportvisserij Nederland, Bilthoven, Netherlands, ³¹Department of Ichthyology and Fisheries Science, Rhodes University, Makhanda, South Africa

- This abstract summarizes the results of two expert consultations conducted to gather insights into effective communication and engagement strategies in recreational fisheries.

- Effective science communication fosters knowledge, understanding, and trust in both science and management decisions.
- Public involvement and stakeholder engagement are essential for effective management.
- Simplifying complex research findings and using diverse communication tools enhance awareness and understanding.
- Strong communication strategies are necessary to implement sustainable recreational fisheries management frameworks.
- Funding for communication efforts is often insufficient but remains crucial for success.
- Participatory workshops and data-sharing arrangements enhance collaboration and involvement.
- Multi-stakeholder consortiums and tailored communication strategies strengthen stakeholder engagement and promote adaptive governance. Interdisciplinary outreach and strategic social media use play vital roles in raising environmental awareness.

KEYWORDS

public involvement, communication strategies, stakeholder participation, expert opinion, effective scientific communication

1 Introduction

Recreational fishing is a globally significant activity with substantial social and economic impacts, occurring in both freshwater and marine environments. Estimates indicate that at least 220 million people participate in recreational fishing worldwide (Arlinghaus et al., 2019), with 120 million in Europe, North America, and Oceania alone (Arlinghaus et al., 2021). This activity plays a key role in promoting well-being and mental health (Pita et al., 2022) while supporting an industry valued at approximately US\$190 billion annually (Kelleher et al., 2012).

Developing sound communication strategies is essential to implementing recent legal frameworks aimed at ensuring sustainable recreational fisheries in Europe and globally (Potts et al., 2019; Radomski et al., 2001) because public involvement is critical to fostering effective management (Crona and Bodin, 2006; Keohane et al., 2014; Patel et al., 2012; Sterling et al., 2017). However, effective scientific communication within recreational fishing research and management is particularly challenging (Dedual et al., 2013) due to the need to simplify complex methods and findings for a diverse audience with different demographics and preferences (Adams et al., 2024). Another significant challenge arises from distrust among recreational fishers about sharing information, driven by concerns that their data might lead to restrictive measures (e.g., closed seasons and areas, reduced bag limits, etc.), further complicating efforts to build collaborative and transparent management practices (Brownscombe et al., 2019).

Effective communication, where a sender delivers a clear message to a receiver, fosters mutual understanding and is essential for building trust and respect in relationships (Lewicki and Bunker, 1996). In a time when unsubstantiated counter-science is rampant and amplified by social media, disseminating transparent research methodologies and results is even more crucial for maintaining trust in science and the management decisions that are underpinned by that science (Sidky, 2020). Moreover, communication should not be limited to one-way transmission of information, but should support dialogue, responsiveness, and collaborative learning among all actors involved—core elements of engagement, defined here as the active and mutual involvement of stakeholders in shaping, interpreting, and applying information, rather than passively receiving it (Morsing and Schultz, 2006; Tufte and Mefalopulos, 2009). Choosing appropriate communication channels is also key, as different media can either foster interaction or reinforce passive information flow (Calvó-Armengol et al., 2015).

Given the rapid evolution of communication platforms over the past decade, researchers need to adapt and effectively use new media, including popular social media platforms and marketing strategies, to engage with stakeholders. A strong communication strategy should clearly define the target audience (e.g., recreational fishers, researchers), establish key messages and objectives, determine appropriate tools and frequency of communication, secure funding, assign responsibilities, and include mechanisms for evaluation. This approach helps promote the use of effective methods across a broad audience, including those actively seeking

information and those who are harder to reach but still play important roles in recreational fisheries (Dedual et al., 2013). For example, trusted ambassadors within stakeholder groups can play a key role in addressing audience-specific communication needs (Farthing et al., 2022; Freberg, 2021; Tracey et al., 2023). By understanding the values, language, and concerns of their peers, these individuals can help ensure that scientific messages are not only well translated but also relevant and accessible to their communities (Uzunoğlu and Kip, 2014).

Adequate resourcing of research dissemination and public engagement components also needs to be secured to develop effective management-oriented, applied science (Holder et al., 2020; Sbragaglia et al., 2023). This aspect is often underfunded due to researchers' budgeting oversight and a potential lack of appreciation of its importance by funding agencies (Davies and Greenwood, 2004). Considering the substantial investment in marketing by private sector businesses, it is evident that scientists, policymakers, and fishery managers may significantly underestimate the need to properly resource and fund science communication efforts.

This article aims to enhance knowledge and provide resources to improve communication programs within recreational fishing research and management communities. To this end, it offers a guide for enhancing engagement among scientific researchers, managers, policymakers, recreational fishers, and various stakeholders—including NGOs and civil society—who are conceptualized as distinct audiences with specific roles, interests, and communication needs. By studying existing communication frameworks and initiatives—primarily, though not exclusively, related to recreational fisheries—our research supports the development of strategies for effectively disseminating research findings, attracting and retaining fishers in research and management efforts, and fostering positive attitudes and behaviors, e.g., toward science-informed decision-making, conservation goals, and responsible fishing practices.

1.1 Consultation process

In June 2021, an expert consultation was conducted to gather insights on enhancing communication and public involvement in recreational fisheries. International experts, predominantly researchers from different scientific disciplines, public managers, policymakers, and representatives from recreational fishers' associations, participated via a semi-structured online questionnaire. This consultation was organized within the International Council for the Exploration of the Sea (ICES) Working Group on Recreational Fisheries Surveys (WGRFS), which comprises ~130 members from 29 countries (ICES, 2024). This expert group is dedicated to standardizing recreational fisheries data collection, ensuring data quality, providing scientific advice to management agencies, and promoting stakeholder engagement. The questionnaire aimed to gather practical information for developing effective communication strategies and tools among 1) researchers, encompassing academics and scientists, 2) public managers and policymakers, 3) recreational fishers, and 4) other stakeholders, including NGOs and civil society

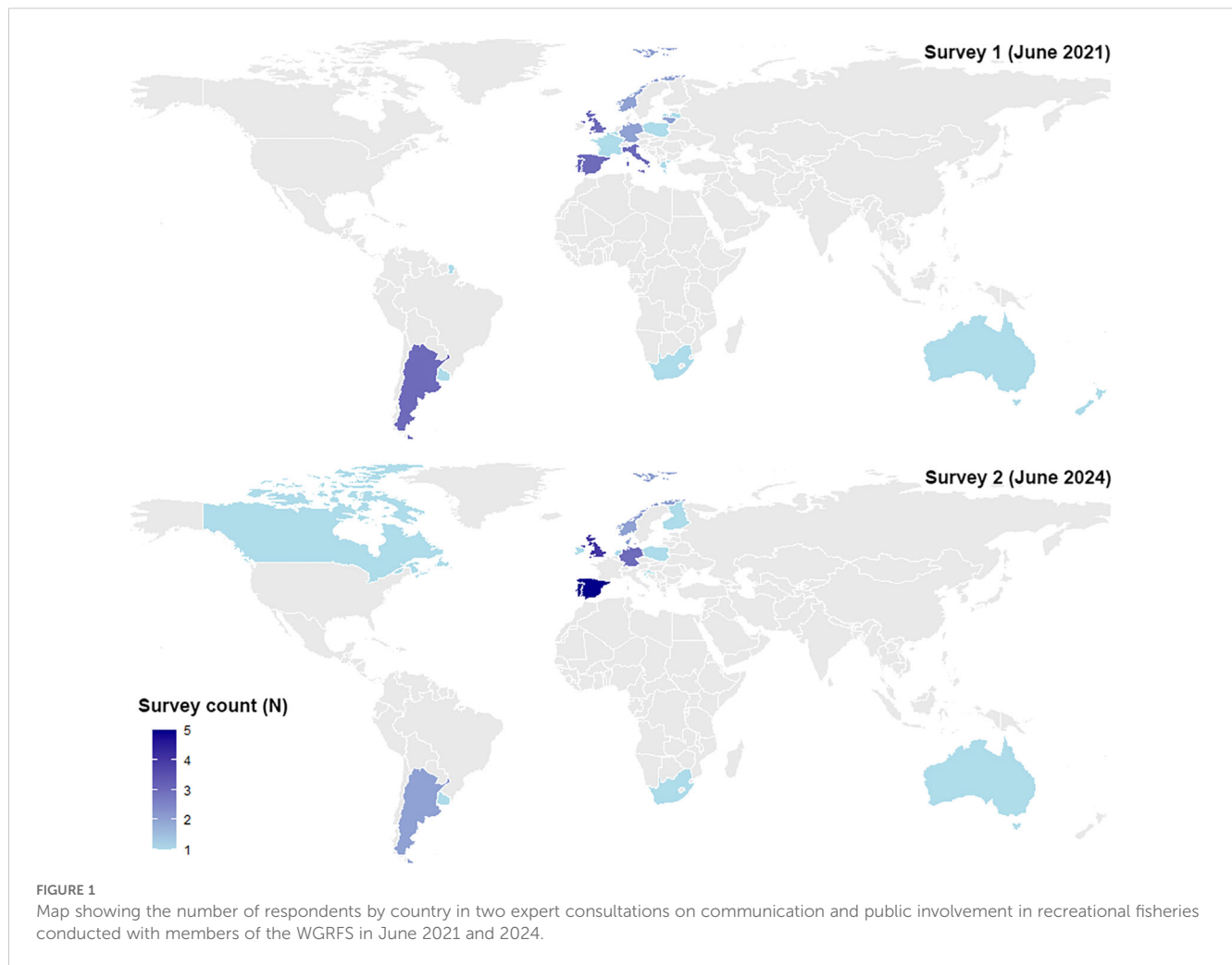
(see Appendix I in the Supplementary Material). Experts who participated in this consultation were invited to contribute as co-authors of this article.

The consultation with WGRFS members gathered insights from 30 recreational fisheries experts spanning 17 countries (Figure 1). Respondents had an average age of 43.2 years (± 10.5 SD, range 23 to 63 years). All participants held university degrees, with 73% identifying as male. Most respondents were researchers (90%), while public managers, policymakers, and representatives from recreational fishers' associations each represented 3% of the group. In terms of fishing experience, 3% had never engaged in recreational fishing, 67% fished occasionally, and the remaining 30% were nearly evenly split between those who fished frequently (13%) and avidly (17%) (Table 1).

In June 2024, a follow-up consultation was held with the same group of experts to explore effective communication strategies and practices. Another online semi-structured questionnaire examined how different communication approaches enhanced ten predefined outcomes: communication, collaboration, participation, co-creation, co-innovation, co-management, capacity building, conflict resolution, empowerment, and sustainability within recreational fisheries (see Appendix II in the Supplementary Material). Up to 33 responses were received from 17 countries (Figure 1). Respondents identified and described strategies aimed at fostering stakeholder participation (submitted as free text), referencing 29 examples or case studies (Supplementary Table S1 in Appendix III).

Respondent input on strategies and examples in marine recreational fisheries was reviewed to consistently emphasize key strategies, which were coded as single words or hyphenated terms across all case studies. Each respondent rated their certainty on a scale from 1 (very uncertain, based on personal perceptions) to 5 (very certain, based on direct participation in initiatives, studies, or publications on the topic). These ratings were used to weigh up to ten potential outcomes for each case study, converting a binary variable (0 for no effect, 1 for effect) into a discrete one. The average certainty reported was relatively high (4.06 ± 0.95). This indicates that the expertise that was provided stemmed from substantial field experience gained through various projects, including multiple surveys conducted in multi-stakeholder contexts (Supplementary Table S1).

The outcomes considered were: 1) Communication, establishing effective channels for transparent information sharing among stakeholders, 2) collaboration, fostering joint efforts, resource pooling, and shared responsibilities, 3) participation, involving stakeholders in decision-making, planning, and implementation to foster ownership, 4) co-creation, encouraging idea generation and solutions, 5) co-innovation, inspiring stakeholders to contribute innovations and technologies, 6) co-management, enabling collective governance of shared resources, 7) capacity building, investing in stakeholder development for better engagement, 8) conflict resolution, resolving disputes through dialogue and mediation, 9) empowerment, ensuring marginalized groups can voice concerns and participate, and 10) sustainability, emphasizing long-term resilience and equitable outcomes. Each case study was further categorized into one of four main goals:



Adaptive governance, data collection, engagement, and environmental awareness.

Free-text descriptions of strategies were analyzed using text mining tools from the R *tm* package (R Core Team, 2024) to generate a frequency matrix linking communication strategies to observed outcomes. The most significant connections, based on frequency and certainty level, were visualized using the R *circlize* package (Gu et al., 2014).

The expert consultation findings were based on participants' experiences in marine recreational fisheries. While the panel was predominantly composed of researchers, it also included public managers, policymakers, and representatives from recreational fisher's associations, offering a range of perspectives. This diversity helped to balance potential biases, although the predominance of academic viewpoints should be considered when interpreting the results (O'Hagan, 2019).

2 Policy options and implications

The European Union (EU) has recently revised its fisheries control regulations, ushering in significant changes for both

commercial and recreational fishing practices (European Parliament and Council of the European Union, 2023). The primary objective of these revisions was to modernize the oversight and management of fishing activities, promote sustainable utilization of marine resources, and establish a uniform control framework across EU member states. Key amendments pertaining to recreational fisheries included registration for recreational fishers to enhance data collection on fishing activities and mandatory reporting by adopting electronic catch recording for specific species to bolster data collection, accuracy, and traceability.

Although the EU's comprehensive overhaul sets a new benchmark to sustainably manage recreational fisheries (Pita et al., 2018), other countries have also instituted diverse regulations, including electronic reporting. For instance, in the United States, the Magnuson-Stevens Fishery Conservation and Management Act, the principal legislation governing marine recreational fisheries, mandates licenses for saltwater fishing, with certain species requiring mandatory reporting to ensure sustainable fishing (Department of Commerce of the United States of America, 1996). In some states of Australia, recreational fishers are obligated to obtain licenses (Ryan et al., 2016; Smallwood et al., 2024).

TABLE 1 Characteristics of the participants in the survey conducted with members of the WGRFS in June 2021 regarding communication and public involvement in recreational fisheries.

Item	N	Percent
Gender		
<i>Male</i>	22	73.3
<i>Female</i>	7	23.3
<i>I prefer not to say</i>	1	3.3
Occupation		
<i>Researcher</i>	27	90.0
<i>Members of recreational fishing associations</i>	1	3.3
<i>Policymaker</i>	1	3.3
<i>Public manager</i>	1	3.3
Fishing		
<i>A lot</i>	5	16.7
<i>Often</i>	4	13.3
<i>Sometimes</i>	20	66.7
<i>Never</i>	1	3.3

Additionally, electronic reporting systems are utilized in certain states to enhance data collection on recreational catches (Kearney, 2001). In Canada, regulations for recreational fishing encompass licensing, seasonal closures, and catch limits, with some provinces adopting electronic licensing and reporting systems to bolster monitoring and compliance (Brownscombe et al., 2014).

Global initiatives and the EU's updated regulations emphasize the critical need for sustainable management of recreational fisheries, highlighting their substantial role in total removals (Ihde et al., 2011; Radford et al., 2018) and the importance of effective governance to maximize societal benefits while ensuring long-term sustainability (Arlinghaus et al., 2019; Grati et al., 2024). These regulations introduce stricter reporting requirements and integrate advanced technologies, placing significant new responsibilities on recreational fishers. Successfully navigating these changes will depend on enhanced communication strategies to build legitimacy, promote understanding of the regulations' importance, and foster acceptance and trust among those involved in recreational fisheries (Cooke et al., 2013; Gray et al., 2012).

Without clear and consistent communication, recreational fishers may be hesitant to report critical data—particularly non-mandatory data—that is essential for effective fisheries management and may face challenges in complying with new regulations. Moreover, the implementation costs of these rules can be prohibitive without the active participation of recreational fishers, as formal institutions that rely on enforcement and sanctioning mechanisms are often costly to operate (Cooke et al., 2013). To address these challenges, fostering transparency and promoting stakeholder engagement through participatory procedures is essential. Such processes—where stakeholders are meaningfully involved in shaping management decisions—can help build

shared understanding, enhance legitimacy, foster cooperation, and support the successful implementation of new fisheries policies (Adams et al., 2024).

3 Actionable recommendations

Overall, results from the expert consultation on communication and public involvement in recreational fisheries indicated that the most common strategy for effective engagement across different stakeholder groups was to communicate scientific content either monthly or in response to key events—such as press releases, new research publications, or major meetings (Supplementary Figure S1 in Appendix IV).

Face-to-face meetings were deemed to be the most effective strategy for engaging with the four main audiences (Figure 2), particularly with other stakeholders (distinct from recreational fishers), including NGOs, and civil society (Supplementary Figure S1). Additionally, biannual face-to-face meetings were perceived as having optimal frequency for engaging with recreational fishers. Updated website content after relevant news was also highlighted as valuable, especially for engaging public managers and policymakers, who would benefit from monthly emails to stay informed. Organizing two webinars per year was identified as significant for disseminating information related to recreational fisheries to the public, while monthly newsletters were considered effective for targeting researchers (Supplementary Figure S1).

Social media is known to present challenges, such as difficulties in managing responses, and opportunities, like the enhanced connectivity they offer for communication in recreational fisheries (Lennox et al., 2022; Sbragaglia et al., 2023; Sbragaglia and Arlinghaus, 2020). Among social media platforms, Facebook, X (formerly Twitter), and blogs were the most favored by respondents, followed by YouTube, podcasts, and Instagram. Other platforms such as Snapchat, Pinterest, LinkedIn, ResearchGate, and WhatsApp were considered less important (Figure 2). However, with a deeper understanding of user demographics (e.g., age), some of these alternative options may serve a greater purpose. For example, Snapchat and TikTok tend to be preferred by younger demographics (Mittmann et al., 2022).

Monthly updates were generally considered the ideal frequency for social media engagement. Respondents identified recreational fishers as the group most likely to use social media tools, with Facebook, blogs, YouTube, Instagram, and WhatsApp being their primary platforms (Supplementary Figure S1). To optimize communication with recreational fishers via social media, it is essential to explore the motivations behind content sharing and engagement (Lennox et al., 2022; Sbragaglia et al., 2020; Vitale et al., 2021).

Public managers and policymakers, the second most frequent users of social media platforms, primarily engage with X. Podcasts were also considered effective for engaging the public, followed by less significant platforms such as Snapchat and Pinterest. Researchers were found to be the least likely to use social media, although they engage with specific platforms like LinkedIn and ResearchGate (Supplementary Figure S1).

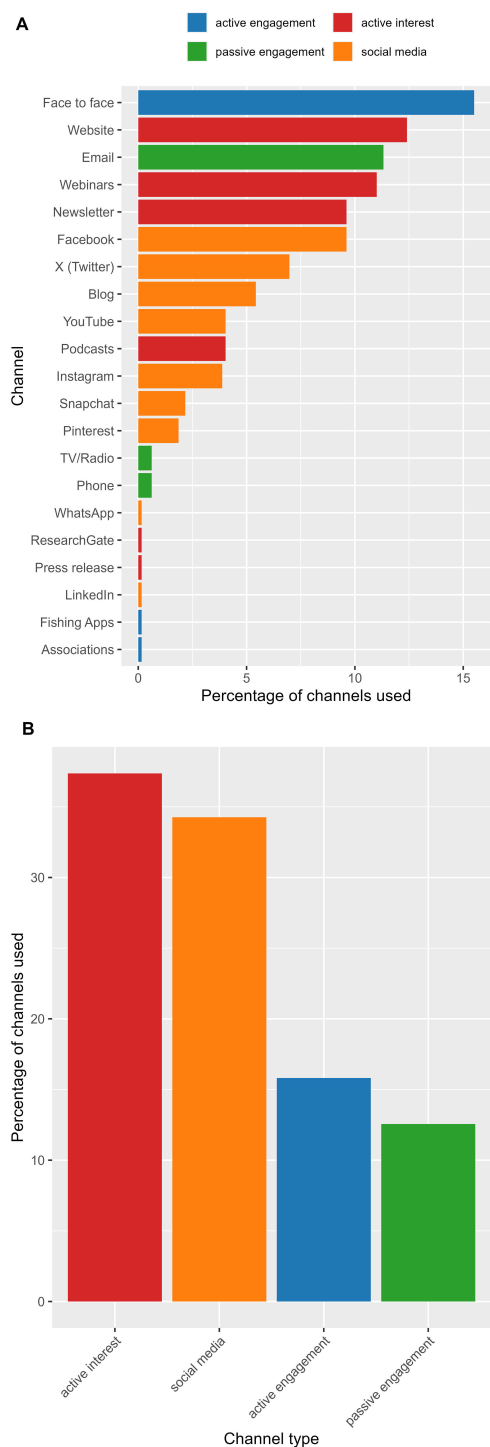


FIGURE 2
Percentage of communication channel use in recreational fisheries, based on survey responses from WGRFS members in June 2021. Panel (A) shows the percentage of use of each channel, grouped and color-coded by type: 'active engagement' (face-to-face, associations, fishing apps), 'passive engagement' (email, TV/radio, phone), 'active interest' (websites, webinars, newsletters, podcasts, press releases, ResearchGate), and 'social media' (Facebook, X (Twitter), blogs, YouTube, Instagram, Snapchat, Pinterest, LinkedIn, WhatsApp). Panel (B) illustrates the relative use of each channel type.

Traditional communication channels such as television, radio, and press releases were viewed by the respondents as less critical but still relevant for engaging public managers and policymakers. Moreover, liaison with recreational fishing associations and fishing apps was considered key for engaging recreational fishers, while phone calls were noted as relatively important for maintaining contact across other stakeholder groups (Supplementary Figure S1). It is important to recognize that fishing apps can experience a decline in user retention over time (Skov et al., 2021), highlighting the need to investigate the underlying causes for this retention decline before developing strategies to attract and engage existing users and new fishers in data collection initiatives.

Respondents were divided on who should create and disseminate communications. Nearly half (48%) believed that anyone generating the information should handle its dissemination, while 41% preferred a hired communication specialist. The remaining respondents preferred a combination of both (Figure 3A).

Respondents highlighted the significance of using plain language, avoiding jargon, and involving various stakeholders in research and management projects to develop effective communication strategies, each scoring 4.2 ± 1.0 on a 1 to 5 Likert scale where 1 indicates "not at all important" and 5 indicates "very important." Other effective strategies recommended in recreational fisheries communication included utilizing diverse channels to disseminate messages (4.0 ± 0.8) and obtaining feedback from the recipients of the information (4.0 ± 1.0). Respondents also regarded involving different stakeholders in the communication strategy (3.6 ± 1.2) and employing neutral facilitators in meetings (3.3 ± 1.2) as relatively important (Figure 3B).

In the follow-up consultation on effective communication strategies and practices in marine recreational fisheries, respondents identified participatory workshops as the most effective strategy for encouraging stakeholder participation, followed closely by data sharing. These workshops—bringing together stakeholders from the recreational fishing sector, public administrations, and scientists—were described as valuable platforms for knowledge exchange, voicing concerns, and fostering collaboration. According to respondents, such workshops, especially when facilitated by external moderators, played a key role in building a shared vision and supporting consensus-based decision-making (Figure 4).

Respondents emphasized that two-way data sharing—where recreational fishers provide information to researchers or managers and receive elaborated feedback in return—plays a key role in fostering engagement among all parties involved in research. This reciprocal exchange supports effective data use and strengthens the perceived credibility of initiatives, especially among those providing the original data. Formal data-sharing agreements, in which stakeholders provide their fishing activity data to researchers, were seen as fostering mutually beneficial relationships, enhancing engagement, and ensuring continued access to data (Figure 4). As a result, clearly defining ethical principles regarding

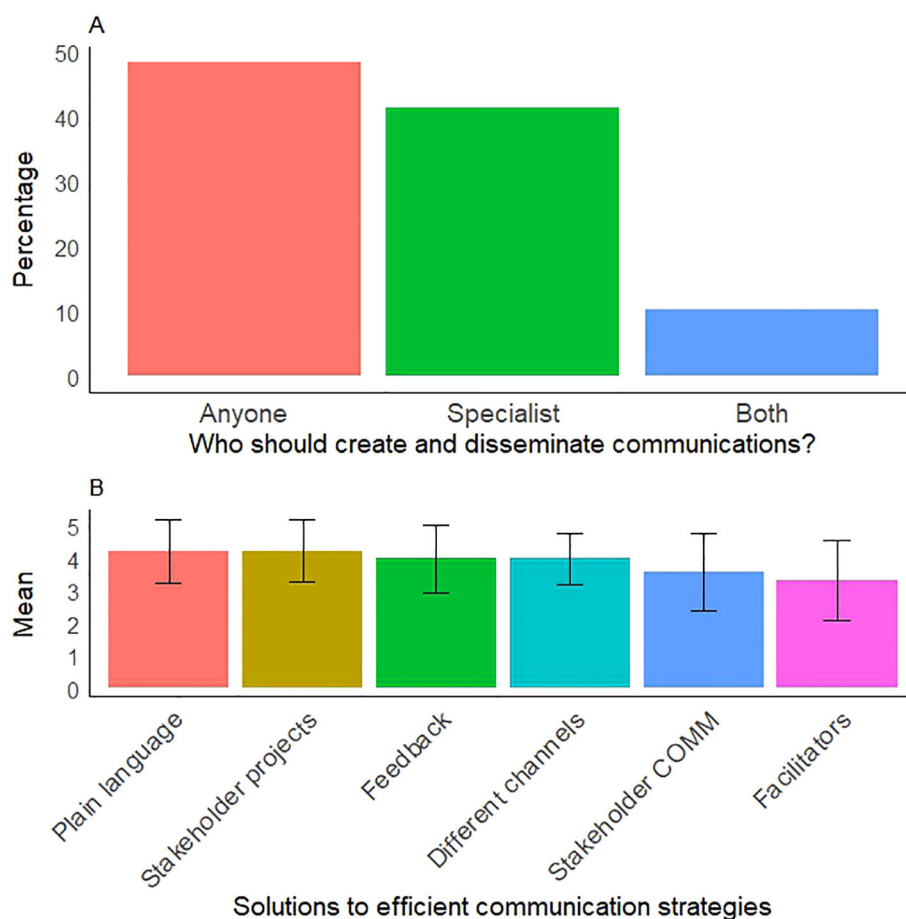


FIGURE 3

Preferences for information sources (A) and communication strategies (B) in recreational fisheries, derived from an expert consultation with WGRFS members in June 2021. Panel A illustrates respondents' preferences for information sources, including individuals, hired specialists, or a combination of both. Panel B displays mean scores (bars) and standard deviations (whiskers) for communication strategies, rated on a Likert scale from 1 ("not at all important") to 5 ("very important").

authorship and the use of generated information is vital for maintaining healthy, long-term relationships between all parties involved (Gourguet et al., 2018).

Participatory workshops were again highlighted by the respondents as the most effective strategy in cases aiming to foster adaptive governance. Other significant strategies included participatory processes, inclusive involvement, and co-creating management areas. These top strategies (accounting for 10% of the total score for this goal) were primarily linked to key outcomes such as collaboration, participation, co-management, capacity building, and conflict resolution (Supplementary Figure S2 in Appendix IV).

According to the respondents, participatory processes are crucial for effective management because they directly involve stakeholders in decision-making, leading to better management outcomes and greater acceptance and compliance in recreational fisheries (e.g., Cooke et al., 2013; Dimech et al., 2009). They highlighted the importance of inclusive engagement—ensuring that all stakeholders are involved from the start of management initiatives—to promote legitimacy and transparency (e.g., Guimarães et al., 2023; Horta e Costa et al., 2022). Respondents

also emphasized that stakeholder involvement in co-developing area-based management strategies, such as Marine Protected Areas (MPAs), is vital to ensure their interests are considered in the management process (e.g., Garcia et al., 2022; Villasante et al., 2023) (Supplementary Figure S2).

Respondents identified reciprocal data sharing as essential for sustaining engagement in data collection initiatives. They also emphasized the importance of direct communication and relationship building. Researchers were noted to benefit from participating in forums organized by recreational fishing associations and maintaining engagement through direct communication channels such as social media, phone calls, and, to a lesser extent, emails (e.g., Bachiller et al., 2022). Direct communication was deemed critical for building relationships and helping recreational fishers to feel connected to research and management, thereby reinforcing their role in collaborative initiatives. Additionally, respondents highlighted that engaging with recreational fishers in their own environment allows researchers to better understand and address challenges, fostering shared experiences and strengthening relationships (Supplementary Figure S3 in Appendix IV).

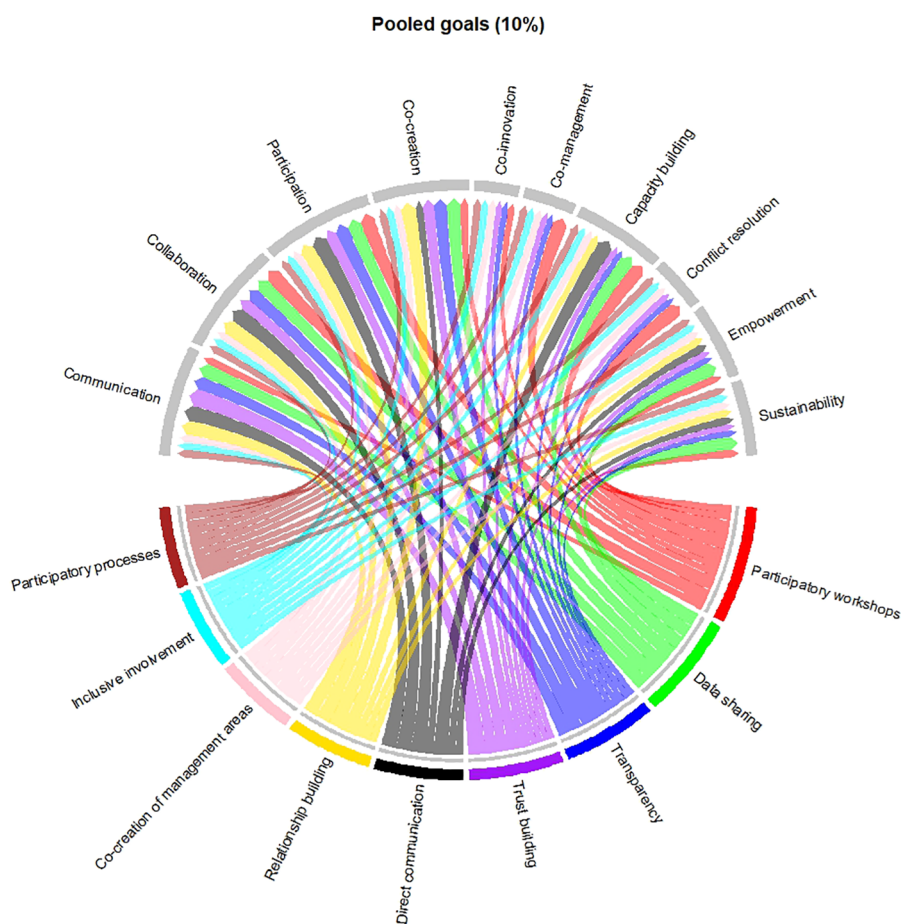


FIGURE 4

Relationships between communication strategies (shown at the bottom, highlighted in colors) employed in 29 case studies on marine recreational fisheries and their associated outcomes (displayed at the top). These strategies aimed to foster goals like adaptive governance, data collection, stakeholder engagement, and environmental awareness. The thickness of each connecting line reflects the strength of the relationship, determined by both frequency and certainty levels. The percentage in parentheses in the title denotes the proportion of the aggregated score for the displayed connections relative to the overall total. Only connections exceeding 10% of the total frequency are shown. This analysis was based on expert consultation with members of the WGRFS in June 2024.

Six additional strategies were highly valued for data collection: 1) obtaining detailed contributions from recreational fishers (e.g., tissue samples), 2) ensuring direct feedback through two-way communication, 3) involving stakeholders early in the research process, 4) engaging fishers in sampling campaigns to reduce costs, 5) minimizing the impact of sampling by guiding recreational fishers on techniques that preserve catch value (e.g., sampling fish tissues without reducing their edibility), and 6) building science-based trust by demonstrating that management decisions are grounded in scientific evidence. These nine key strategies collectively accounted for 23% of the total score, emphasizing outcomes such as communication, collaboration, and participation (Supplementary Figure S3).

Respondents highlighted three key strategies as vital for strengthening engagement: 1) clear leadership, 2) joint strategies, and 3) multi-stakeholder consortiums. These top strategies contributed 32% of the total score for this goal, supporting six key outcomes: communication, collaboration, participation, co-creation, conflict resolution, and sustainability. Establishing clear

leadership roles was regarded as crucial for aligning objectives. Joint communication strategies tailored to various groups involved in recreational fisheries were also deemed effective. Furthermore, multi-stakeholder consortiums were recognized for promoting knowledge exchange and fostering collaboration (Supplementary Figure S4 in Appendix IV).

Experts identified seven key strategies for raising environmental awareness, collectively accounting for 57% of the total score. These strategies, supporting outcomes such as communication, collaboration, participation, capacity building, conflict resolution, and empowerment, include: 1) tailoring communication to cultural contexts, 2) engaging through informal channels used by recreational fishers (e.g., social media groups), 3) promoting openness in information sharing, 4) involving interdisciplinary groups in outreach efforts, 5) organizing public awareness campaigns (e.g., exhibitions integrating art, science, and interactive elements), 6) leveraging specialized media to disseminate research, and 7) prioritizing participatory and transparent decision-making

(Supplementary Figure S5 in Appendix IV). Regarding the final strategy, Sbragaglia and Arlinghaus (2020) observed that recreational fishers engaged in bottom-up initiatives tend to develop more positive attitudes toward environmental conservation.

4 Conclusion

The expert consultations conducted in this study identified the creation of multi-stakeholder consortia as a key strategy for strengthening stakeholder engagement in recreational fisheries. Defining leadership roles and distributing responsibilities within these consortia were highlighted as essential for ensuring joint communication plans that facilitate effective collaboration among diverse stakeholders. This approach was noted to foster transparency, support content co-creation, and enhance long-term sustainability. Experts suggested organizing one to two webinars annually to share the consortium's progress with the public. Websites were identified as the most efficient tool for updating public managers and policymakers, while monthly emails provide timely updates, and monthly newsletters effectively engaged the researchers.

Targeting specific groups of recreational fishers and enlisting influential recreational fishers as social media ambassadors have proven successful in some initiatives reviewed by the experts, particularly in raising awareness, encouraging data reporting, and promoting participation in research and management activities. However, caution is recommended to avoid overexposing researchers in their role as disseminators and to account for potential biases related to the age or profile of recreational fishers active on social media, particularly when incorporating data from these platforms into research.

Experts highlighted two-way data sharing as the most effective strategy for improving data collection from recreational fishing activities. They noted that differing needs between researchers and recreational fishers—particularly around new policies limiting fishing opportunities—can undermine fishers' confidence in management processes. To address this, formal agreements between researchers and recreational fishers were seen as vital for reinforcing trust, involvement, and credibility, thereby promoting collaboration and participation. Regular, direct communication through biannual or monthly face-to-face meetings was also emphasized to strengthen relationships and ensure sustained data access over the long term.

Experts identified inclusive participatory activities as the most effective strategies for promoting adaptive governance, providing a platform for stakeholder dialogue. These initiatives were noted to foster key outcomes such as co-management and conflict resolution by enabling stakeholders to voice concerns, share knowledge, and enhance transparency in decision-making. Face-to-face meetings were considered particularly effective for organizing these events, outperforming online meetings, especially when engaging stakeholders like NGOs and civil society groups.

According to the expert consultations, raising environmental awareness is most effectively achieved through transparent,

interdisciplinary outreach activities tailored to cultural contexts. Public awareness campaigns that combine art, science, and interactive elements were highlighted as particularly impactful, as they not only inform but also actively involve stakeholders. This type of engagement fosters a deeper connection to environmental issues, empowering individuals to participate more meaningfully in management and stewardship efforts while building long-term capacity for sustainable practices.

Recreational fishers were found to be most engaged through informal social media channels such as Facebook, blogs, YouTube, Instagram, and WhatsApp, as well as through recreational fishing association channels and apps. Public managers and policymakers, identified by the experts as the second most active group on social media, primarily engage with X and podcasts. While traditional media channels like television, radio, and press releases are less crucial, they still play a role in reaching public managers and policymakers. Researchers, who use social media less frequently, prefer platforms like LinkedIn and ResearchGate, with podcasts also being effective for engaging the public.

Effective science engagement in recreational fisheries requires selecting suitable outreach methods and tailoring messages to the cultural and informational needs of target audiences. Experts emphasized that joint strategies and context-sensitive messaging are key to promoting participation, collaboration, and environmental awareness, especially when aligned with the specific concerns of different stakeholder groups. Since no single platform can effectively reach all stakeholders, a strategic mix of communication tools is necessary to maximize engagement and impact. Understanding how different audiences prefer to receive information helps deliver key messages in ways that resonate across the recreational fishing sector. In light of recent policy changes—such as the EU's revised fisheries control regulations—our findings offer guidance on how communication strategies can foster trust, promote understanding, and support compliance through the active involvement of recreational fishers. To achieve this, adequate resourcing for dissemination and public engagement is essential, yet often overlooked within research planning and funding structures. By outlining effective communication and engagement approaches, this work supports the cost-effective and socially accepted implementation of new management measures.

Author contributions

PP: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Resources, Supervision, Writing – original draft, Writing – review & editing. SeT: Conceptualization, Writing – original draft, Writing – review & editing, Resources. RA: Writing – original draft, Writing – review & editing. EB: Visualization, Writing – original draft, Writing – review & editing. F-PD: Writing – original draft, Writing – review & editing. KF: Writing – original draft, Writing – review & editing. FH: Writing – original draft, Writing – review & editing. SH: Writing – original draft, Writing – review & editing. KH: Writing – original draft, Writing – review & editing. AI: Writing – original draft, Writing – review & editing. MPJ:

Writing – original draft, Writing – review & editing. ML: Writing – original draft, Writing – review & editing. AL: Writing – original draft, Writing – review & editing. EL: Writing – original draft, Writing – review & editing. HO: Writing – original draft, Writing – review & editing. FP: Writing – original draft, Writing – review & editing. MP: Writing – original draft, Writing – review & editing. JP: Writing – original draft, Writing – review & editing. MP-B: Writing – original draft, Writing – review & editing. ZR: Writing – original draft, Writing – review & editing. MR: Writing – original draft, Writing – review & editing. WR: Writing – original draft, Writing – review & editing. HR: Writing – original draft, Writing – review & editing. DR: Writing – original draft, Writing – review & editing. VS: Writing – original draft, Writing – review & editing. JS: Writing – original draft, Writing – review & editing. CNS: Writing – original draft, Writing – review & editing. CS: Writing – original draft, Writing – review & editing. HS: Writing – original draft, Writing – review & editing. StT: Writing – original draft, Writing – review & editing. PeV: Writing – original draft, Writing – review & editing. LV: Writing – original draft, Writing – review & editing. PaV: Writing – original draft, Writing – review & editing. DV: Writing – original draft, Writing – review & editing. MSW: Writing – original draft, Writing – review & editing. MW: Writing – original draft, Writing – review & editing. AW: Writing – original draft, Writing – review & editing.

Funding

The author(s) declare that financial support was received for the research and/or publication of this article. PP and VS acknowledge the financial support of the Ministerio de Ciencia, Innovación y Universidades, Ramón y Cajal call, under Grants RYC2022-035937-I and RYC2021-033065-I. PP also acknowledges Xunta de Galicia, Grupos con Potencial de Crecimiento, under Grant ED431B 2024/23 and Proxectos de Excelencia, under Grant ED431F 2024/09. ML is supported by the Agencia Nacional de Investigación e Innovación (ANII, POS_EXT_2020_1_165362). This study received Portuguese national funds from FCT - Foundation for Science and Technology through projects UIDB/04326/2020 (DOI:10.54499/UIDB/04326/2020) and LA/P/0101/2020 (DOI:10.54499/UIDP/04326/2020), and LA/P/0101/2020 (DOI:10.54499/LA/P/0101/2020), and DOI:10.54499/2022.01002.CEECIND/CP171. MSW, AML and CS have been co-funded by the European Commission's Data Collection Framework (DCF). CS also acknowledges funding

from the Danish Rod and Net Fish License funds, project 39122. RA acknowledges funding by the Federal Ministry of Education and Research of Germany in the framework of marEEchange (project number 01LC1826D).

Acknowledgments

We appreciate the responses provided to the questionnaires developed by the ICES WGRFS.

Conflict of interest

Author SH was employed by the company Substance Ltd.

The remaining authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Author PP was an editorial board member of Frontiers at the time of submission. This had no impact on the peer review process and the final decision.

Generative AI statement

The author(s) declare that no Generative AI was used in the creation of this manuscript.

Publisher's note

All claims expressed in this article are solely those of the authors and do not necessarily represent those of their affiliated organizations, or those of the publisher, the editors and the reviewers. Any product that may be evaluated in this article, or claim that may be made by its manufacturer, is not guaranteed or endorsed by the publisher.

Supplementary material

The Supplementary Material for this article can be found online at: <https://www.frontiersin.org/articles/10.3389/fmars.2025.1589544/full#supplementary-material>

References

- Adams, A. J., Boucek, R. E., Lewis, J. P., Lombardo, S. M., Perez, A. U., Wilson, J. K., et al. (2024). Stakeholder engagement as a core component of recreational marine fisheries research, education, and conservation. *Fisheries* 49, 565–576. doi: 10.1002/fsh.11166
- Arlinghaus, R., Aas, Ø., Alós, J., Arismendi, I., Bower, S., Carle, S., et al. (2021). Global participation in and public attitudes toward recreational fishing: international perspectives and developments. *Rev. Fish. Sci. Aquac.* 29, 58–95. doi: 10.1080/23308249.2020.1782340
- Arlinghaus, R., Abbott, J. K., Fenichel, E. P., Carpenter, S. R., Hunt, L. M., Alós, J., et al. (2019). Opinion: Governing the recreational dimension of global fisheries. *Proc. Natl. Acad. Sci.* 116, 5209–5213. doi: 10.1073/pnas.1902796116
- Bachiller, E., Korta, M., Mateo, M., Mugerza, E., and Zarauz, L. (2022). Assessing the unassessed marine recreational fishery in the Eastern Cantabrian coast. *Front. Mar. Sci.* 9, 975089. doi: 10.3389/fmars.2022.975089
- Brownscombe, J. W., Bower, S. D., Bowden, W., Nowell, L., Midwood, J. D., Johnson, N., et al. (2014). Canadian recreational fisheries: 35 years of social, biological, and economic dynamics from a national survey. *Fisheries* 39, 251–260. doi: 10.1080/03632415.2014.915811
- Brownscombe, J. W., Hyder, K., Potts, W., Wilson, K. L., Pope, K. L., Danylchuk, A. J., et al. (2019). The future of recreational fisheries: Advances in science, monitoring, management, and practice. *Fish. Res.* 211, 247–255. doi: 10.1016/j.fishres.2018.10.019

- Calvó-Armengol, A., De Marti, J., and Prat, A. (2015). Communication and influence. *Theor. Econ.* 10, 649–690. doi: 10.3982/TE1468
- Cooke, S. J., Suski, C. D., Arlinghaus, R., and Danylchuk, A. J. (2013). Voluntary institutions and behaviours as alternatives to formal regulations in recreational fisheries management. *Fish. Fish.* 14, 439–457. doi: 10.1111/j.1467-2979.2012.00477.x
- Crona, B., and Bodin, Ö. (2006). What you know is who you know? Communication patterns among resource users as a prerequisite for co-management. *Ecol. Soc.* 11. doi: 10.5751/ES-01793-110207
- Davies, J. E., and Greenwood, H. (2004). Scholarly communication trends—Voices from the vortex: A summary of specialist opinion. *Learn. Publ.* 17, 157–167. doi: 10.1087/leap.2004.17.issue-2
- Dedual, M., Sague Pla, O., Arlinghaus, R., Clarke, A., Ferter, K., Geertz Hansen, P., et al. (2013). Communication between scientists, fishery managers and recreational fishers: lessons learned from a comparative analysis of international case studies. *Fish. Manage. Ecol.* 20, 234–246. doi: 10.1111/fme.12001
- Department of Commerce of the United States of America (1996). *Magnuson-Stevens Fishery Conservation and Management Act* (USA: National Oceanic and Atmospheric Administration).
- Dimech, M., Darmanin, M., Smith, I. P., Kaiser, M. J., and Schembri, P. J. (2009). Fishers' perception of a 35-year old exclusive Fisheries Management Zone. *Biol. Conserv.* 142, 2691–2702. doi: 10.1016/j.biocon.2009.06.019
- European Parliament and Council of the European Union (2023). REGULATION (EU) 2023/2842 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 22 November 2023 amending Council Regulation (EC) No 1224/2009, and amending Council Regulations (EC) No 1967/2006 and (EC) No 1005/2008 and Regulations (EU) 2016/1139, (EU) 2017/2. *Off. J. Eur. Union.* 105.
- Farthing, M. W., Childs, A. R., Mann-Lang, J. B., Bova, C. S., and Potts, W. M. (2022). Are recreational fishing guides role models for their clients? *Fish. Res.* 254, 106408. doi: 10.1016/j.fishres.2022.106408
- Freberg, K. (2021). *Social media for strategic communication: Creative strategies and research-based applications* (Sage Publications, Thousand Oaks, California).
- Garcia, S. M., Rice, J., Himes-Cornell, A., Friedman, K. J., Charles, A., Diz, D., et al. (2022). OECMs in marine capture fisheries: Key implementation issues of governance, management, and biodiversity. *Front. Mar. Sci.* 9, 920051. doi: 10.3389/fmars.2022.920051
- Gourguet, S., Briand, F., Marçalo, A., Ünal, V., Liu, Y., Kaiser, B., et al. (2018). “Engaging marine scientists and fishers to share knowledge and perceptions – An overview,” in *CIESM Monograph 50. Engaging Marine Scientists and Fishers to Share Knowledge and Perceptions-Early Lessons*. Ed. F. Briand (CIESM Publisher, Monaco and Paris), 5–27.
- Grati, F., Hyder, K., Mugerza, E., Arlinghaus, R., Baudrier, J., Bell, B., et al. (2024). Effective governance of marine recreational fisheries in Europe is needed to maximize the societal benefits of its fisheries. *ICES J. Mar. Sci.* 82 (2), fsae169. doi: 10.1093/icesjms/fsae169
- Gray, S., Shwom, R., and Jordan, R. (2012). Understanding factors that influence stakeholder trust of natural resource science and institutions. *Environ. Manage.* 49, 663–674. doi: 10.1007/s00267-011-9800-7
- Gu, Z., Gu, L., Eils, R., Schlesner, M., and Brors, B. (2014). Circlize” implements and enhances circular visualization in R. *Bioinformatics* 30, 2811–2812. doi: 10.1093/bioinformatics/btu393
- Guimarães, M. H., Rangel, M., e Costa, B. H., Ressurreição, A., Oliveira, F., and Gonçalves, J. M. S. (2023). Creating a common ground for the implementation of a community-based Marine Protected Area—a case study in Algarve, Portugal. *Ocean Coast. Manage.* 240, 106627. doi: 10.1016/j.ocecoaman.2023.106627
- Holder, P. E., Jeanson, A. L., Lennox, R. J., Brownscombe, J. W., Arlinghaus, R., Danylchuk, A. J., et al. (2020). Preparing for a changing future in recreational fisheries: 100 research questions for global consideration emerging from a horizon scan. *Rev. Fish. Biol. Fish.* 30, 137–151. doi: 10.1007/s11160-020-09595-y
- Horta e Costa, B., Guimarães, M. H., Rangel, M., Ressurreição, A., Monteiro, P., Oliveira, F., et al. (2022). Co-design of a marine protected area zoning and the lessons learned from it. *Front. Mar. Sci.* 9. doi: 10.3389/fmars.2022.969234
- ICES (2024). Working Group on Recreational Fisheries Surveys (WGRFS; outputs from 2023 meeting). *ICES Sci. Rep.* 6 (11). doi: 10.17895/ices.pub.25067702
- Ihde, T. F., Wilberg, M. J., Loewenstainer, D. A., Secor, D. H., and Miller, T. J. (2011). The increasing importance of marine recreational fishing in the US: challenges for management. *Fish. Res.* 108, 268–276. doi: 10.1016/j.fishres.2010.12.016
- Kearney, R. E. (2001). Fisheries property rights and recreational/commercial conflict: implications of policy developments in Australia and New Zealand. *Mar. Policy* 25, 49–59. doi: 10.1016/S0308-597X(00)00035-X
- Kelleher, K., Westlund, L., Hoshino, E., Mills, D., Willmann, R., de Graaf, G., et al. (2012). *Hidden harvest: The global contribution of capture fisheries* (Washington, DC: Food and Agriculture Organization of the United Nations (FAO), the WorldFish Center, and the World Bank's Global Program on Sustainable Fisheries (PROFISH)).
- Keohane, R. O., Lane, M., and Oppenheimer, M. (2014). The ethics of scientific communication under uncertainty. *Polit. Philos. Econ.* 13, 343–368. doi: 10.1177/1470594X14538570
- Lennox, R. J., Sbragaglia, V., Vollset, K. W., Sortland, L. K., McClenachan, L., Jarić, I., et al. (2022). Digital fisheries data in the Internet age: Emerging tools for research and monitoring using online data in recreational fisheries. *Fish. Fish.* 23, 926–940. doi: 10.1111/faf.12663
- Lewicki, R. J., and Bunker, B. B. (1996). Developing and maintaining trust in work relationships. *Trust Organ. Front. Theory Res.* 114, 30. doi: 10.4135/9781452243610.n7
- Mittmann, G., Woodcock, K., Dörfner, S., Krammer, I., Pollak, I., and Schrank, B. (2022). TikTok is my life and snapchat is my ventricle”: a mixed-methods study on the role of online communication tools for friendships in early adolescents. *J. Early Adolesc.* 42, 172–203. doi: 10.1177/02724316211020368
- Morsing, M., and Schultz, M. (2006). Corporate social responsibility communication: stakeholder information, response and involvement strategies. *Bus. Ethics A Eur. Rev.* 15, 323–338. doi: 10.1111/j.1467-8608.2006.00460.x
- O'Hagan, A. (2019). Expert knowledge elicitation: subjective but scientific. *Am. Stat.* 73, 69–81. doi: 10.1080/00031305.2018.1518265
- Patel, H., Pettitt, M., and Wilson, J. R. (2012). Factors of collaborative working: A framework for a collaboration model. *Appl. Ergon.* 43, 1–26. doi: 10.1016/j.apergo.2011.04.009
- Pita, P., Gribble, M. O., Antelo, M., Ainsworth, G., Hyder, K., van den Bosch, M., et al. (2022). Recreational fishing, health and well-being: findings from a cross-sectional survey. *Ecosyst. People* 18, 530–546. doi: 10.1080/26395916.2022.2112291
- Pita, P., Villasante, S., Arlinghaus, R., Gomes, P., Strehlow, H. V., Veiga, P., et al. (2018). A matter of scales: Does the management of marine recreational fisheries follow the ecosystem approach to fisheries in Europe? *Mar. Policy* 97, 61–71. doi: 10.1016/j.marpol.2018.08.039
- Potts, W. M., Downey-Breedt, N., Obregon, P., Hyder, K., Bealey, R., and Sauer, W. H. H. (2019). What constitutes effective governance of recreational fisheries?—A global review. *Fish. Fish.* 21, 91–103. doi: 10.1111/faf.12417
- Radford, Z., Hyder, K., Zarauz, L., Mugerza, E., Ferter, K., Prellezo, R., et al. (2018). The impact of marine recreational fishing on key fish stocks in European waters. *PLoS One* 13, e0201666. doi: 10.1371/journal.pone.0201666
- Radomski, P. J., Grant, G. C., Jacobson, P. C., and Cook, M. F. (2001). Visions for recreational fishing regulations. *Fisheries* 26, 7–18. doi: 10.1577/1548-8446(2001)026<0007:VFRFR>2.0.CO;2
- R Core Team (2024). R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria.
- Ryan, K. L., Trinnie, F. I., Jones, R., Hart, A. M., and Wise, B. S. (2016). Recreational fisheries data requirements for monitoring catch shares. *Fish. Manage. Ecol.* 23, 218–233. doi: 10.1111/fme.12151
- Sbragaglia, V., and Arlinghaus, R. (2020). Conservation bottom-up initiatives in marine recreational spearfishing suggest the emergence of positive attitudes towards conservation. *Sci. Mar.* 84, 441–444. doi: 10.3989/scimar.05139.05A
- Sbragaglia, V., Brownscombe, J. W., Cooke, S. J., Buijs, A. D., Arlinghaus, R., and Potts, W. M. (2023). Preparing recreational fisheries for the uncertain future: An update of progress towards answering the 100 most pressing research questions. *Fish. Res.* 263, 106662. doi: 10.1016/j.fishres.2023.106662
- Sbragaglia, V., Correia, R. A., Coco, S., and Arlinghaus, R. (2020). Data mining on YouTube reveals fisher group-specific harvesting patterns and social engagement in recreational anglers and spearfishers. *ICES J. Mar. Sci.* 77, 2234–2244. doi: 10.1093/icesjms/fsz100
- Sidky, H. (2020). *Science and anthropology in a post-truth world: A critique of unreason and academic nonsense* (Lexington Books, London, United Kingdom).
- Skov, C., Hyder, K., Gundelund, C., Ahvonen, A., Baudrier, J., Borch, T., et al. (2021). Expert opinion on using angler Smartphone apps to inform marine fisheries management: status, prospects, and needs. *ICES J. Mar. Sci.* 78, 967–978. doi: 10.1093/icesjms/fsaa243
- Smallwood, C. B., Ryan, K. L., Flanagan, E. A., Maggs, J. Q., Ochwada-Doyle, F. A., and Tracey, S. R. (2024). Spiny lobster recreational fisheries in Australia and New Zealand: An overview of regulations, monitoring, assessment and management. *Fish. Res.* 280, 107149. doi: 10.1016/j.fishres.2024.107149
- Sterling, E. J., Betley, E., Sigouin, A., Gomez, A., Toomey, A., Cullman, G., et al. (2017). Assessing the evidence for stakeholder engagement in biodiversity conservation. *Biol. Conserv.* 209, 159–171. doi: 10.1016/j.biocon.2017.02.008
- Tracey, S. R., Cleary, B., Creely, L., Graba-Landry, A., Gray, S., Moore, A., et al. (2023). *The role of the recreational fisher in the stewardship of the Southern Bluefin Tuna fishery* (University of Tasmania, Hobart, Tasmania, Australia).
- Tufte, T., and Mefalopoulos, P. (2009). *Participatory communication: A practical guide* (World Bank Publications, Washington, DC).
- Uzunoglu, E., and Kip, S. M. (2014). Brand communication through digital influencers: Leveraging blogger engagement. *Int. J. Inf. Manage.* 34, 592–602. doi: 10.1016/j.jinfomgt.2014.04.007
- Villasante, S., Ainsworth, G. B., Pita, P., Belgrano, A., Bennett, N., and Sumaila, R. (2023). “The role of marine protected areas (MPAs) in providing ecosystem services to improve ocean and human health,” in *Oceans and Human Health*. Eds. L. Fleming, L. A. Creencia, W. Gerwick, H. C. Goh, M. Gribble, B. Maycock and H. Solo-Gabriele (Elsevier, London, United Kingdom).
- Vitale, G., Dedeu, A. L., Pujol, M., and Sbragaglia, V. (2021). Characterizing the profile of recreational fishers who share their catches on social media. *Front. Mar. Sci.* 8, 768047. doi: 10.3389/fmars.2021.768047