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Perceived misinformation in offshore wind: Insights from participants in Northeastern U.S. offshore wind planning and permitting processes

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ABSTRACT

Offshore wind planning and development have emerged alongside misinformation about projects and their impacts. Misinformation poses challenges for renewable energy planning and permitting, creating confusion, increasing polarization, and reducing meaningful community input and participation in energy decision-making. In this mixed-methods study, we examine misinformation from the perspective of individuals involved in the planning and permitting of two U.S. offshore wind projects: Vineyard Wind 1 and South Fork Wind. Qualitative interviews and a quantitative survey were conducted to investigate the perceived examples, sources, drivers, and impacts of misinformation. Misinformation was perceived as pervasive and spreading from both supporters and opponents of offshore wind. We identified multiple perceived drivers of offshore wind misinformation, including biased information reception and processing, a lack of trusted communicators, and missing information and uncertainty. Misinformation was also found to hinder offshore wind planning processes by exhausting time and resources and undermining communication. We conclude with recommendations for energy communication professionals to mitigate the spread and impact of misinformation.

1. Introduction

Effective communication is essential in renewable energy planning and decision-making, shaping the governance and public awareness of the technologies. However, misinformation poses communication and planning challenges, decreasing trust and confidence in renewable energy and potentially delaying project implementation [1]. In the U.S, there is a long, well-documented history of misinformation about climate and energy issues [2]. Recent concerns have grown about misinformation related to wind energy technologies, including offshore wind projects [3]. As part of a broader study of communication in offshore wind energy deployment, this mixed-methods study contributes to understanding how misinformation influences renewable energy projects from the perspective of participants in planning and permitting for two U.S. offshore wind projects.

Offshore wind is a relatively new industry in the United States. The first U.S. project was installed in 2016 in Rhode Island state waters, the Block Island Wind Farm. However, globally, the offshore wind industry has expanded over the past three decades as countries pursue goals to reduce carbon dioxide emissions and increase generation from renewable energy sources, and a large offshore wind pipeline is under development. At the end of 2023, the total installed global capacity of offshore wind was 68,258 MW (MW), including 13,096 offshore wind turbines and 319 operating projects [4]. In the U.S., between 2021 and 2025, the Biden Administration issued permits for eleven offshore wind projects. However, in January 2025, the second Trump Administration temporarily withdrew areas on the Outer Continental Shelf (OCS) from offshore wind leasing. As of July 2025, seven projects were completely installed or under construction on the East Coast of the U.S., including the Block Island Wind Farm, Coastal Virginia Offshore Wind Pilot Project, Vineyard Wind 1, South Fork Wind, Revolution Wind, Empire Wind, and Sunrise Wind.

Alongside the growth of the industry, concerns about offshore wind misinformation have taken shape [3,5–7]. In this paper, we understand *misinformation* as false or misleading information spread potentially by accident [8]. We use the term misinformation broadly to refer to false information when it is spread accidentally or when intentionality is unclear. In the early stages of the operation of the Block Island Wind Farm, concerns about misinformation were prevalent, especially concerning the project's impact on whales [3,5–7]. These concerns have

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spread as projects have developed along the U.S. East Coast, with offshore wind being attributed to the unusual mortality events of whales [5]. In response to these concerns, the U.S. National Oceanic and Atmospheric Administration (NOAA), the lead U.S agency for managing marine species, including marine mammals, reported that there is no evidence to link offshore wind and whale mortality [9]. Other reported examples of misinformation about offshore wind have included distortions of turbine size and visibility [10], adverse health risks associated with the electromagnetic fields emitted from submarine cables [11], and claims that projects have not completed required environmental impact statements [6].

Another area of research has illuminated the role of vested interests that spread *disinformation* [12]. Disinformation is distinguished from misinformation based on intent; we use the term disinformation to refer to false or misleading information spread to deceive. Recent reports have highlighted connections between fossil fuel companies and grassroots organizations that spread disinformation about offshore wind [3,13]. In this article, we focus primarily on misinformation as broadly defined because intentions are not always clear; however, we also address perceptions of intentionality and use the term disinformation when false information was spread intentionally. We will examine both concepts in more detail in Section 2.1.

Misinformation can have wide-ranging effects. A precondition for meaningful engagement in decision making processes, such as energy planning, is access to accurate information [14]. However, after exposure to misinformation, individuals may continue to rely on inaccurate information when making judgments, which can foster distrust in science and institutions [15,16]. Further, misinformation has been found to shape public perceptions about renewable energy technologies [17], which can translate into legal challenges. Concerns have been raised about the prevalence of false or misleading information in lawsuits against offshore wind farms. For example, lawsuits challenging the Vineyard Wind 1 project have contested the government's permitting of the project, citing the adverse effects of offshore wind on North Atlantic Right Whales [18]. In another lawsuit against developers in the New York Bight, researchers found that groups falsely blamed whale strandings on geophysical surveys conducted by offshore wind developers [19].

More research is needed to understand misinformation about offshore wind. With the exception of a few studies [3,7], limited research has investigated offshore wind energy misinformation. To our knowledge, studies have not yet considered misinformation from the perspective of individuals participating in offshore wind energy planning and permitting processes, including those representing governments, wind energy developers, non-governmental organizations (NGOs), and maritime industries (hereafter "participants"). It is necessary to recognize the perceptions of actors involved in these processes as they can shape the form, content, and/or interpretation of offshore wind communication. Participants involved at the federal and state levels can also dictate availability and access to formal offshore wind information.

In this mixed-methods study, we used qualitative interviews and a quantitative survey to explore the perceptions of individuals involved in two offshore wind projects in the Northeast U.S.: South Fork Wind and Vineyard Wind 1. Here, we focus on participants' perceptions of offshore wind misinformation, its prevalence, its impacts on planning processes, and contributors to its spread. Our goal is not to discuss the veracity of any offshore wind claims but rather to illuminate the perceptions of individuals engaged in offshore wind processes. This exploratory study also aims to provide a foundation for further investigations of misinformation in renewable energy planning.

2. Literature review

This study contributes to extant energy social science research by highlighting how participants characterize misinformation and how it affects offshore wind planning. As such, in this literature review, we consider the extant literature defining misinformation and disinformation. We then review misinformation drivers and mechanisms, as well as the impacts of misinformation, particularly in the case of renewable energy technologies.

2.1. Misinformation and disinformation: Clarifying the concepts

Misinformation is generally defined as false or misleading information that is shared without intent to deceive [8]. By contrast, disinformation involves a deliberate intention to mislead. However, these definitions and understandings of "false" and "intentionality" have been contested. Krause et al. [20] critique misinformation for becoming a "near-meaningless catch-all" that is lacking precision (p. 113). Vraga and Bode [21] propose defining misinformation and falsity based on two dimensions: the level of expert consensus and best available evidence.

Building on the ideas from Vraga and Bode [21], Southwell et al. [22] suggest differentiating scientific misinformation and define it as "publicly available information that is misleading or deceptive relative to the best available scientific evidence or expertise at the time and that counters statements by actors or institutions who adhere to scientific principles" (p. 100). This underscores how definitions of scientific misinformation are not always clear-cut, as scientific consensus can change or emerge over time. Further adding to these ideas, Winter et al. [17] conceptualized misinformation as "contrarian claims," to capture how it can include "grains of truth" and represent how "objective truth is often unknowable" (p. 1).

Other scholars have recognized the complexities in determining what is "false" and have conceptualized misinformation on a continuum of accuracy [23–27]. For example, Hameleers et al. [24] suggest that information can fall on a "span of untruthfulness" that ranges from entirely accurate to entirely false. The concept of intentionality, used to distinguish misinformation from disinformation, is also debated. Some scholars have argued that deciphering intent is difficult in practice [23,28,29] and propose that intentionality exists along a spectrum or continuum [25,28].

2.2. Drivers of misinformation

Research across various disciplines has identified multiple, intersecting contributors to misinformation and disinformation. Scheufele and Krause [8] propose that the "roots" of misinformation can be understood across individual, community, and societal levels. At the individual level, research has identified psychological factors that increase susceptibility to misinformation, including motivated or directional reasoning [30–32], which broadly describes how an individual's motivations or goals affect reasoning and judgment [33,34]. This phenomenon has been argued to increase people's tendency for biased assimilation, the privileging of information consistent with prior views [8], or confirmation bias, the process where individuals seek out information that conforms with prior beliefs [35].

With regard to renewable energy, personal beliefs or values have been found to drive belief in misinformation. For instance, Benegal and Scruggs [36] found that political party identity shaped belief in corrections to misinformation about renewable energy. In a cross-national study of onshore wind, Winter et al. [17] reported that belief in conspiratorial claims predicted agreement with misinformation, including beliefs that secret arrangements have been made with energy companies and politicians. Rejecting a pro-ecological worldview was also associated with stronger belief in misinformation [17].

At the community level, social and information environments shape information exposure [8]. Sovacool [37] argued that there is a disconnect between how electricity is made and how it is socially perceived, producing public apathy and misinformation about it, such as why new electricity generation is needed. Information gaps have also been found to contribute to wind energy misinformation. In a study in Canada, Richards et al. [38] found that stakeholders, including energy group

representatives, corporations, and academic experts, spread misinformation when they had incomplete knowledge or limited experience with the technology. Smythe et al. [7] reported an "information gap" for tourists and recreationists who desired more information than provided by developers about the Block Island offshore wind project in Rhode Island, U.S. Further, researchers identified concerns that misinformation fueled tourists' misunderstandings about the project, such as its impact on marine mammals [7].

Misinformation cannot be attributed to technology alone, but social media platforms can amplify its speed and spread [30–32]. It can also expand the reach of misinformation by connecting individuals with larger networks not limited by geography [39]. Further, the curation of content through algorithms and individual preferences can create "filter bubbles" and "echo chambers" that reinforce exposure to content that aligns with an individual's ideology or interests [40,41]. In wind-related contexts, Facebook groups have been identified as a source of information and a medium for local mobilization [42]. For example, Fergen et al. [39] found that Facebook groups were used to promote misinformation, increasing false perceptions about human health and public safety risks related to wind energy.

At the societal level, broader structural conditions can drive misinformation [43]. A growing body of literature has focused on the spread of climate and energy mis- and disinformation from vested interests, such as corporations, think tanks, philanthropic foundations, and lobbyists [12,44,45]. That is, the intentional spread of false information through disinformation campaigns can contribute to the spread of misinformation. Research has documented the role of fossil fuel companies in promulgating scientific uncertainty to cast doubt on climate science [46]. With regard to onshore wind energy, fossil fuel companies, utilities, and labor unions were found to influence legislative processes and public opinion through tactics like political campaigns and legal challenges [47].

Nevertheless, limited research has examined the drivers of misinformation related to offshore wind. An important exception is Slevin et al. [3], who identified a network of actors involved in offshore wind disinformation in the U.S., including corporations, think tanks, local organizations, and media outlets. In their examination of local East Coast organizations involved in offshore wind opposition, the authors found that the issue could not be simply understood as groups being "astroturfed" (top-down initiatives disguised as grassroots campaigns). Instead, the situation was more nuanced, and local groups tied to offshore wind misinformation received "information subsidies" – shared messaging and information – from organizations with fossil fuel interests.

2.3. Consequences of misinformation and disinformation

A large body of research has investigated the consequences of exposure to misinformation in health and environmental contexts [48,49]. A distinct, yet related, body of literature on the "social acceptance" of renewable energy helps elucidate the potential impacts of misinformation in renewable energy contexts. Social acceptance research has long examined factors that shape acceptance of renewable energy technologies [50,51]. Early research focused on discourses of NIMBYism (Not-In-My-Backyard) but has since shifted to recognize that opposition can be rooted in legitimate concerns and conditional factors related to project planning and design [52,53]. Public attitudes are dynamic and have been found to shift over time [50,54]. These attitudes can be shaped by multiple factors, including relationships with developers or planners [55], perceptions of trust and fairness in the process [56], and power dynamics [50,52].

Recent studies have linked misinformation to social acceptance and public opinion research [57–59]. Caporale et al. [59] found that misinformation and lack of information increased critical attitudes toward wind energy. Likewise, Diógenes et al. [60] argued that adequate information is necessary for social acceptance, but wind energy is broadly unknown in multiple areas, and misinformation about its benefits was common.

Other work has attributed misinformation to delays in wind energy development. Eleftheriadis & Anagnostopoulou [57,58] posited that misinformation in local communities was a barrier to renewable energy diffusion in Greece. Winter et al. [17] found a significant level of agreement with misinformation in the U.S., U.K., and Australia, contending that the extent of misinformation may be sufficient to hinder the expansion of wind energy.

To our knowledge, few studies have examined how misinformation affects offshore wind planning and permitting. While Slevin et al. [3] helped elucidate the landscape of mis- and disinformation in offshore wind, more research is needed on the nature and impacts of it from the perception of those directly involved in the process.

3. Research context

States in the Northeast region of the U.S. have been leading the way in the planning and development of offshore wind projects nationally. Our research focuses on two U.S. offshore wind projects: South Fork Wind (SFW) and Vineyard Wind 1 (VW1) (Fig. 1). We selected SFW and VW1 as they are the first two large-scale U.S. offshore wind developments approved for federal waters.

SFW is in federal waters east of Long Island, New York (NY), and 19 miles southeast of Block Island, Rhode Island. The project has 12 turbines that generate 132 MW of electricity, contracted by the Long Island Power Administration. Electricity is transmitted to a cable landing in East Hampton, NY. The project is a 50/50 joint development between Ørsted and Eversource. Construction began in February 2022. This project began delivering electricity with its first two turbines by December 2023, and construction was completed in March 2024.

VW1 is in federal waters 35 miles off the mainland Massachusetts (MA) coast and 15 miles south of Martha's Vineyard, MA. It has 62 turbines that will provide 806 MW of electricity to mainland MA. The project developer is Vineyard Wind LLC, owned by Avangrid and Copenhagen Infrastructure Partners. The transmission cable makes landfall in Barnstable, MA. VW1 began construction in 2022 and first delivered power from installed turbines in January 2024; the project is expected to be fully installed in 2025.

4. Methods

This study explored offshore wind planning and permitting process participants' perceptions of misinformation and disinformation. This is a part of a multi-part, mixed-methods study examining communication and engagement regarding VW1 and SFW. We employed interviews and a survey for this project. Our study was exploratory and investigated three main research questions:

1. How do offshore wind planning participants ("participants") characterize offshore wind misinformation and disinformation? (RQ1)
2. What are the perceived drivers of misinformation? (RQ2)
3. What are the impacts of misinformation on offshore wind participants? (RQ3)

4.1. Sampling frame

Our sampling frame was the network of individuals who participated in the U.S. Bureau of Ocean Energy Management (BOEM)-led process for siting and permitting the VW1 and/or SFW projects. Participants included individuals from federal, state, and local governments, energy developers, non-governmental organizations (NGOs), scientists or researchers, and community and industry representatives.

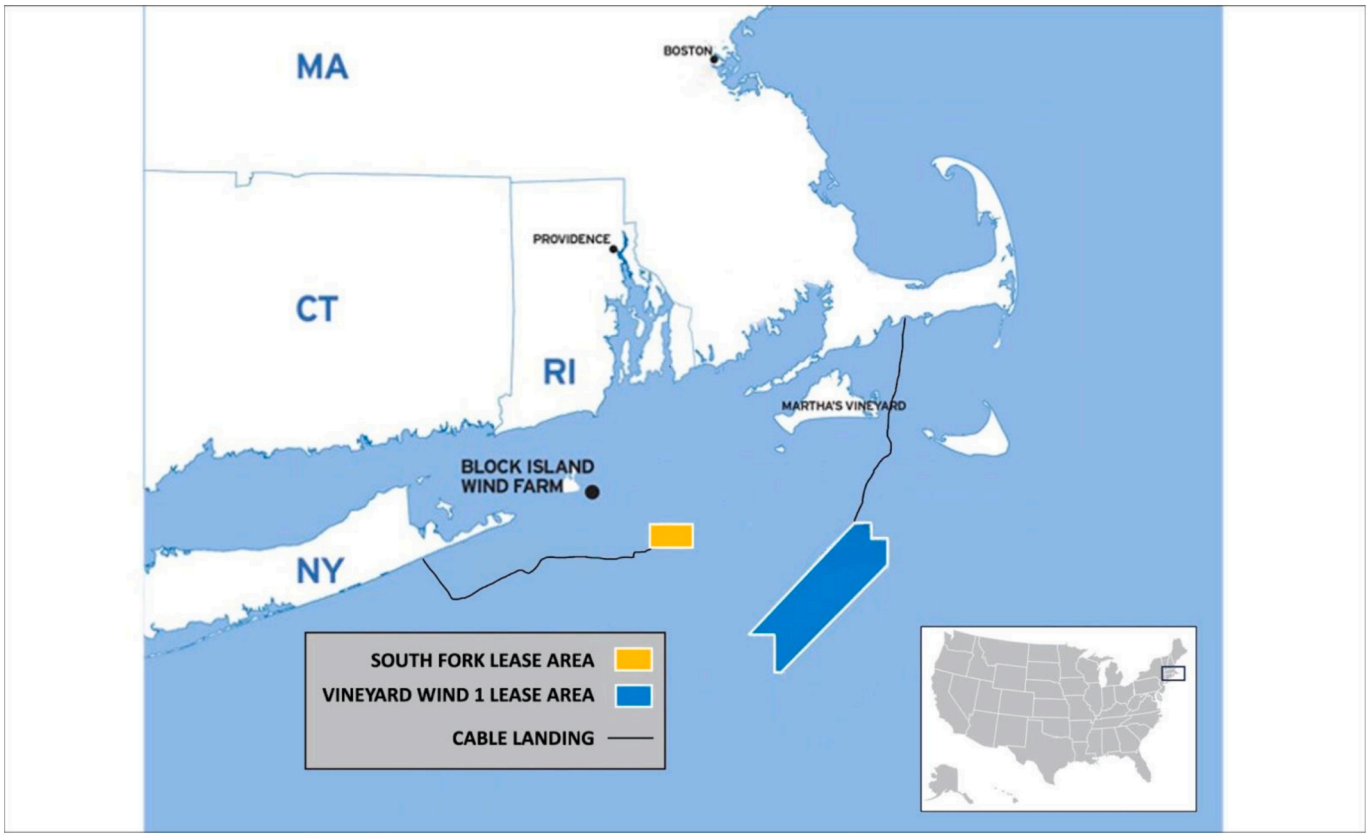

Fig. 1. Map of the study area. (Source: Authors).

4.2. Qualitative interviews

Two sampling methods were used for the interviews: purposive sampling, in which individuals were initially identified through their sector and role in the planning process with an effort to have participants from every relevant sector (federal government, state government, local government, NGOs, academia, and industry), and snowball sampling, in which participants suggested others in their network who were involved in the VW1 and/or SFW project. An advisory committee assembled for this project assisted in creating an initial sample for the interviews.[1]

Semi-structured interviews followed a list of prepared questions but retained flexibility, allowing follow-up questions and space for participants' responses [61]. Given that this research was part of a larger project investigating communication in offshore wind, each interview began with questions about the participant's involvement in offshore wind and their communication networks [62]. Questions were then asked about the prevalence of false information, examples, and its effects. Our questions were designed to characterize misinformation and disinformation in the offshore wind domain to support theory development and future investigation.

The term "false information" was used inclusively in interviews, as misinformation and disinformation are often conflated in literature and practice [48]. However, we did not define false information for interviewees as we were interested in their understanding of the term. To spur conversations about disinformation, interviewees were asked about the extent to which they believed false information was intentional.

Twenty-nine (29) interviews were conducted during the summer of 2023 (Table 1).

Interviews were conducted in person or virtually by one or two lead researchers, depending on participant interest and availability, and lasted between 34 and 104 min (average 58 min).

Coding was guided by a deductive codebook, informed by our interview guide. We used NVIVO qualitative data analysis software to code the data. Two researchers independently coded interviews; five were coded together to compare for coding consistency until an acceptable level of agreement on the codebook was reached. Intercoder reliability was calculated by randomly selecting samples from the five interviews and comparing results, providing 84 % agreement. Then, a thematic analysis was completed, enabling us to identify and analyze patterns within our data [63,64]. Two researchers generated themes interactively through six 90-min sessions. Researchers first used Lucid Spark mind mapping software to identify connections between codes and then synthesized these findings into a series of themes.

Table 1
Interview participants by sector.

Sector	ID Code for Thematic Analysis	Number of Participants
Federal government	GF	4
State government	GS	6
Local government	GL	2
Offshore wind industry	OI	5
Fishing industry	FI	4
Non-governmental organizations	NGO	7
Private citizen	C	1

[1] The mixed-part, mixed-methods project of which this study is a part included a project Advisory Committee to help researchers understand study context and ensure real-world relevance. The committee included representatives from federal and state agencies, the offshore wind industry, universities, and non-governmental organizations.

4.3. Survey

Results from the qualitative analysis informed the creation of a survey, which we subsequently distributed to a broader network of individuals involved in VW1 and SFW project planning and permitting. In fall 2024, survey invitations were mailed and emailed to a list of potential participants gleaned from: the purposive and snowball sampling conducted for interviews (which included interview participants), a list of individuals quoted or named in articles about the two projects (identified through a media content analysis completed in an earlier phase of this project) [65,66] and names suggested by our project advisory committee. Interviewees were included in our sampling frame, but as the survey was anonymous, there was no way to identify if individuals participated in both parts of the study.

All survey questions measured the individual's perceptions. The survey questions and items were informed by ideas presented in the interview, as well as the literature and researchers' experience on these topics. The survey began with questions about respondents' involvement in VW1 and SFW and attitudes toward communication and engagement practices. Then, the survey offered the following definition: "The next questions ask about misinformation and offshore wind energy development. Misinformation is incorrect or misleading information (but not necessarily with the intent to deceive)." Survey questions then asked about three main issues: (1) the magnitude of misinformation in communications about offshore wind, (2) sources of misinformation, and (3) drivers of misinformation. All survey items were measured on a 5-point Likert scale with higher values indicating greater frequency of exposure or stronger agreement, depending on the item.

Four hundred and forty-nine (449) individuals received the survey, and we received 84 valid responses (19 % response rate). Survey respondents' ages ranged from 33 to 82 (M = 58.3). More men participated in the study than women: 47 identified as men (65 %), and 18 identified as women (25 %). Six preferred not to indicate their gender identity (8.3 %), and one preferred to self-identify (1.4 %). Our sample had high levels of formal education, with 85.1 % holding a bachelor's degree and 63.5 % holding a graduate or professional degree. The majority of respondents identified their political orientation as moderate (31; 43.1 %), followed by liberal and very liberal (24; 33.3 %), and conservative (8; 11.1 %); no respondents indicated they were very conservative, and 9 preferred not to respond.

Nineteen respondents participated in only VW1, 27 participated in only South Fork, and 38 participated in both. Thus, 57 respondents engaged in VW1 and 65 in SFW. To better understand respondents' role in the process, we asked questions about which activities they engaged in for the VW1 and/or SFW projects, and common forms of engagement included attending meetings, speaking at meetings, submitting written comments, conducting outreach or engagement, and working on regulatory/permitting documents (See Appendix A for complete list and frequencies). Additionally, survey respondents were asked to identify which offshore wind events they participated in for the VW1 and/or SFW projects, and the most commonly attended events included BOEM-led meetings, state-led meetings, and developer or industry-led meetings (See Appendix A for complete list and frequencies).

5. Results

In this section, we present integrated findings from both the survey and interviews, organized into four topics aligned with our research questions: (1) how participants characterize offshore wind misinformation, (2) perceived sources of misinformation, (3) perceived drivers of misinformation, and (4) its perceived impacts. The interview offers in-depth insights into offshore wind misinformation, while the survey captures perspectives from a broader range of participants involved in the planning or permitting of the South Fork Wind and/or Vineyard Wind 1 projects.

5.1. Characterization of offshore wind misinformation

Across both the survey and interviews, misinformation was described as pervasive in offshore wind energy development. One interview participant described misinformation as "*one of the biggest challenges*" the industry is dealing with. [NGO-12] Another interviewee described one of the "*biggest obstacles*" to offshore wind communication as "*misinformation and fear*." [NGO-24] Our findings underscore how misinformation is perceived as a timely and major challenge within offshore wind planning and permitting.

In this section, we explore these perceptions in more depth, focusing on the perceived topics and examples of misinformation, how examples of misinformation were shared (in support or opposition to offshore wind), and how participants interpreted the falsity and intentionality of information.

5.1.1. Prevalence of topics

Both methods investigated perceived examples or topics of offshore wind misinformation. The survey explored how participants rated the frequency with which they encountered misinformation about different issues, measured on a scale from 1 (never) to 5 (very frequently) (Fig. 2).

The most frequently cited example of misinformation was the impact of offshore wind on marine mammals, particularly whales. Among survey respondents, this issue received the highest average rating for how frequently they encountered misinformation related to it, with a score of 5 indicating very frequently (M = 4.18, SD = 0.93). Interviewees corroborated this, often discussing concerns about the claim that offshore wind is responsible for unusual mortality and mass strandings of whales along the U.S. East Coast. This claim was described by a federal government representative as the *"biggest [misinformation] right now."* [GF-4] Another NGO representative noted that misinformation about offshore wind spreads "*every time a dead whale washes up on a beach.*" [NGO-7] Some interviewees emphasized that there are no data to link offshore wind activities and whale mortality, and some highlighted alternative causes of whale deaths, including vessel strikes, entanglement, and climate change.

This example aside, we found participants perceived misinformation across a broad range of topics, demonstrating the breadth of offshore wind misinformation. In the survey, we found high agreement among respondents that they frequently encountered misinformation across multiple topics including: ecosystem/habitat impacts (M = 4.04, SD = 0.99), wind farm costs/financing (M = 4.03, SD = 0.9), climate change (M = 3.88, SD = 1.06), and commercial fishing (M = 3.82, SD = 0.96) (Fig. 2).

Interviewees also cited examples of misinformation about topics not included in the closed-ended survey questions: electromagnetic cables causing cancer or fertility issues and distortions of turbine size and visibility. For instance, an offshore wind industry member shared how people will *"doctor visual impact analysis to make it look like offshore wind turbines are being constructed on the beach."* [OI-29]

5.1.2. "Both sides:" anti- and pro-wind examples of misinformation

In addition to elucidating perceived examples, both methods also explored the perceived stance of misinformation about offshore wind; that is, whether it was shared to support or oppose offshore wind projects. Many participants perceived offshore wind misinformation as oppositional, especially concerning whale strandings or adverse health effects from transmission cables.

However, several interviewees described a dual perception, in which misinformation was shared by "*both sides*" [NGO-15] [GF-2] - opponents and proponents of offshore wind. For instance, one federal government representative noted that misinformation was shared *"both for and against offshore wind."* [GF-10] Another interviewee similarly noted how there are "*factual misstatements on all sides,*" explaining how industries downplay risks and dangers. [NGO-27].

Perceived misinformation shared in support of offshore wind

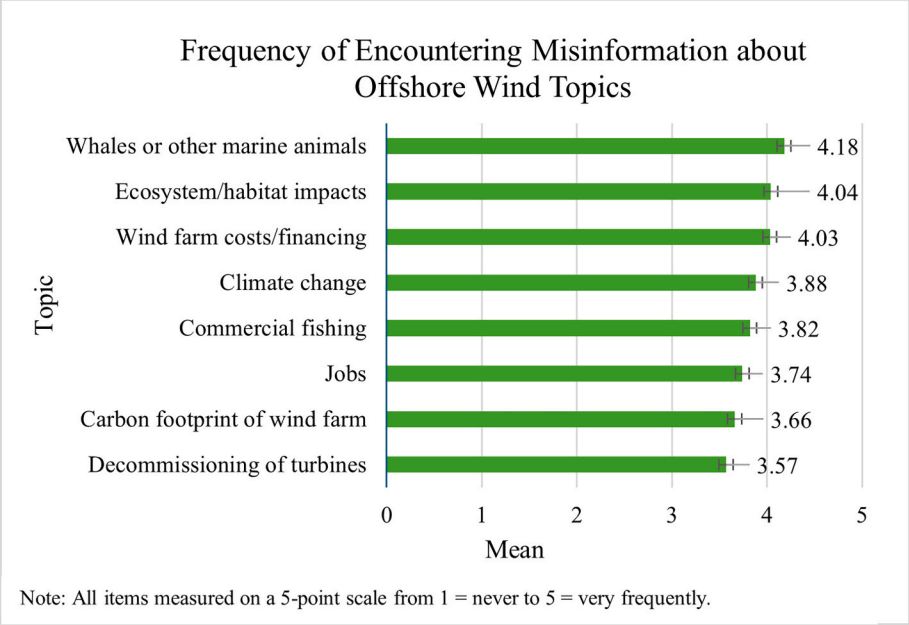

Fig. 2. Frequency of encountering misinformation about offshore wind topics.

included pro-wind narratives that interviewees believed overplayed economic benefits, such as job creation, and underplayed uncertainties or impacts, such as ecological impacts on fisheries. For example, one interviewee shared: *"I have seen some information from the wind sector [saying that] there is no interaction between fisheries and offshore wind; they have all been positive… But the actual studies just are not out there at the level that we would need to see where you could measure a potential population-level consequence.* [GF-2] Another stated, *"The truth would be…we really do not know. But instead, [developers] would say…It will be fine."* [NGO-15].

In line with interview findings, survey respondents were asked to rate the extent to which they agreed that misinformation about offshore wind was shared in support of and in opposition to offshore wind. Survey respondents rated misinformation shared in opposition to offshore wind as occurring more frequently (M = 3.95, SD = 1.26) than misinformation shared in support of offshore wind (M = 3.55, SD = 1.38), measured on a scale of 1 (strongly disagree) to 5 (strongly agree). Still, many survey respondents had a dual perception, agreeing that misinformation was shared both in support of and in opposition to offshore wind energy development (Fig. 3).

5.1.3. Perceptions of falsity and intentionality

While the survey captured a broad view of the examples and framing of offshore wind misinformation, interviews provided deeper insights into how participants made sense of misinformation and disinformation. We found that interviewees' understandings of falsity and intentionality (which, as discussed in Section 2, is used to distinguish between misinformation and disinformation) were nuanced and varied.

First, in many interviews, we found that the concept of "false" was dynamic – misinformation was not always perceived as wholly or

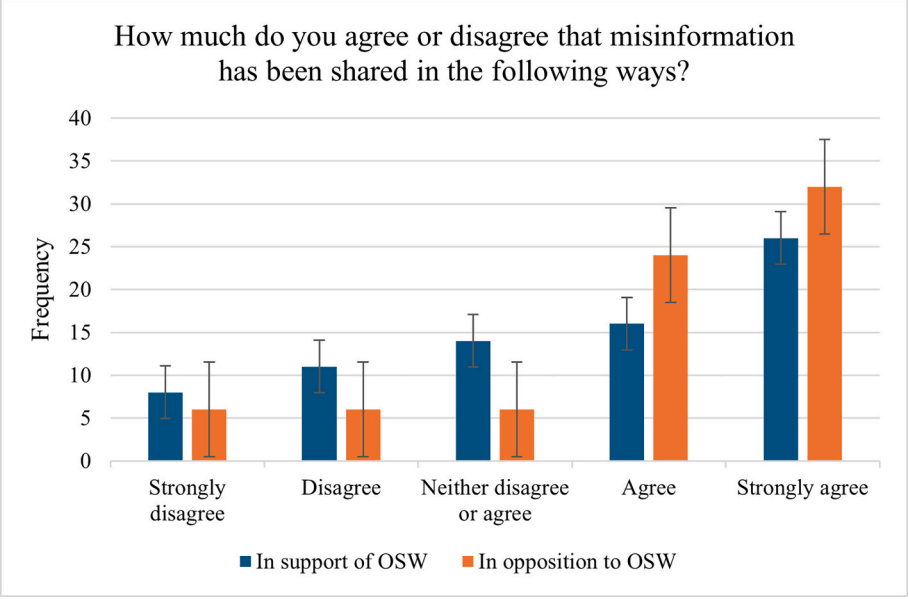

Fig. 3. Level of agreement with the extent to which misinformation has been shared in support of or in opposition to offshore wind.

unequivocally false. Instead of treating information as binary (either accurate or false), many interview participants described it as existing along a continuum ranging from accurate to false. They used terms like *"partial,"* [GL-22] *"misleading,"* [GF-4] *"bias"* or *"exaggeration,"* [NGO-27] and *"hyperbole."* [OI-29] to characterize misinformation. A local government interviewee explained how individuals will combine accurate and false information, describing it as *"partial"* information, and added that *"people [are] grabbing bits of information."* [GL-22] This may illustrate the challenges some participants face in determining what is false, as an interviewee noted, *"It is hard to say what is false."* [FI-3] It may also indicate a hesitation among participants to label offshore wind misinformation as unequivocally false.

Interview participants also expressed difficulty distinguishing intentionality (an indicator of disinformation). Some hesitated to attribute intent, reflecting broader difficulties in discerning whether false information results from confusion or intentional manipulation. Many factors were perceived to affect the intentionality of false information, for example:

"Who is lying? I have a very hard time [determining] that…. Is that lying? Or is that a bias…because of your interest? Are you exaggerating? Making unsubstantiated claims, but they are also not refutable? As but one example, a fisherman says, 'That OSW company lied to me. They did not tell me that…' Did the company representative fail to communicate clearly? Fail to communicate in a timely manner? Change their position but not explain it? Or just lie?" [NGO-27].

Interviewees also explained that false information could be misinformation, not disinformation, due to people's cognitive biases, lack of awareness or access to information. A state government official explained: *"People believe sometimes what they want to believe… and so relaying that [information]…is that an intentional lie? Maybe not."* [GS-26] In some instances, false information was described as unintentional due to confusion, misunderstanding, or lack of information: *"It is not … intentionally false, but…inaccurate based on a limited perspective or limited conveyance of information."* [GF-10].

That said, others explicitly identified cases of perceived disinformation. For instance, one state government official explained that misinformation about whales spread by grassroots organizations is "*100 % intentional.*" [GS-18] An NGO representative explained that they perceived offshore wind misinformation to be "*75% intentional and 25% people falling victim because they are not hearing anything different.*" [NGO-1] The issue of disinformation will be further examined in Section 5.3.3.

5.2. Sources of offshore wind misinformation

The survey and interview investigated participants' views on where misinformation originates and how it spreads. We understand "sources" as where participants heard or encountered misinformation, including actors (e.g., politicians or offshore wind developers) and information channels (e.g., social media and traditional media). In the survey, the sources of offshore wind misinformation were measured on a scale from 1 (never encountering misinformation from the source) to 5 (very frequently encountering misinformation from the source). A summary of average ratings for each perceived topic from the survey is provided in Fig. 4.

Information channels like social media and traditional media were identified as a medium through which people encounter misinformation. Among all items listed, social media received the highest average rating as a source of misinformation (M = 4.36, SD = 0.79). Interviewees reflected that social media is the "*channel through which [information] flows*" [GL −22] and where "*a lot of the falsities and negatives come from.*" [FI-3] Another information channel, traditional media (M = 3.74, SD = 1.01), was rated moderately as a source of offshore wind misinformation. Our interview data is limited regarding the role of traditional media. Still, survey responses suggest that many participants have encountered misinformation in these media channels, such as newspapers or broadcast news.

Regarding actors and organizations, politicians and elected officials were ranked very highly as a source of misinformation (M = 3.92, SD = 0.89). Additionally, anti-wind groups were also ranked highly as a source of misinformation (M = 3.78, SD = 1.34). This is in line with interview results, as many interviewees perceived anti-wind groups as a frequent source of misinformation. As previously noted, many falsehoods, especially whale mortality or concerns about transmission cables, were perceived to stem from opposition groups.

Other actors were rated moderately as sources of misinformation, with mean scores falling in the mid-range of the scale, including government agencies (M = 2.96, SD = 1.39), the fishing industry (M = 3.14, SD = 1.34), nonprofits/community groups (M = 3.16, SD = 1.07), and offshore wind developers (M = 3.36, SD = 1.45). The high agreement across items reflects how interviewees shared diverse examples of where

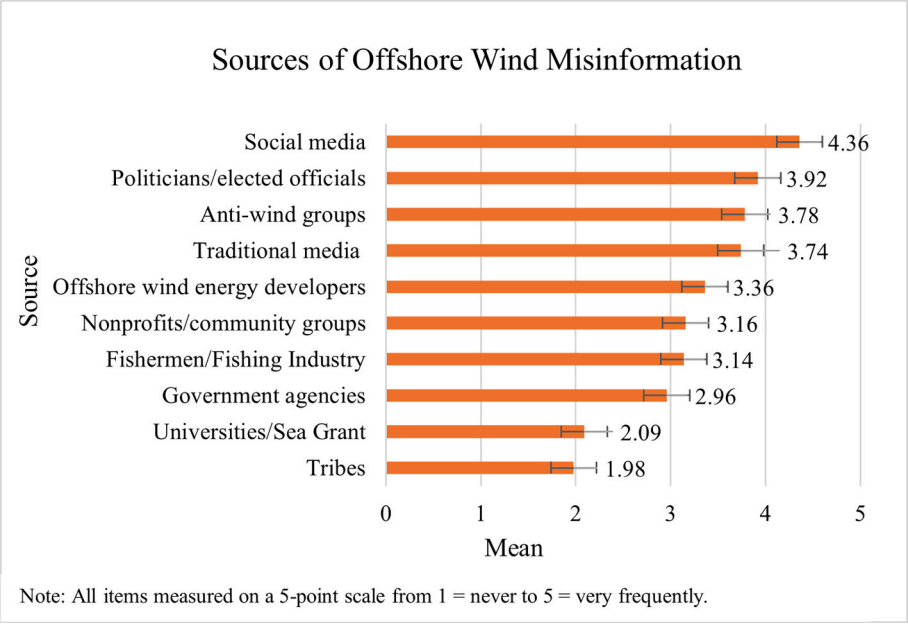

Fig. 4. Sources of offshore wind misinformation.

they encountered misinformation. For instance, concerning offshore wind developers, one participant stated that *"The developers are willing to lie"* [FI-23] Another participant explained how they encountered false and misleading information from pro-wind NGOs, specifically they encountered "*NGOs in New Jersey who would exaggerate the benefits of offshore wind*" and they reflected that sometimes NGOs are "*a little too excited*." [NGO-20].

Conversely, Tribes (M = 1.98, SD = 1.06) and universities/Sea Grant programs (M = 2.09, SD = 1.04) were ranked the lowest as sources that spread misinformation. In line with these survey results, interviewees did not discuss Tribal governments and Sea Grant programs frequently and did not identify either as sources of misinformation.

5.3. Perceived drivers of offshore wind misinformation

Both the survey and interview also revealed participants' perceptions of the underlying causes or contributors to the belief in and spread of misinformation, which we refer to as "drivers" of misinformation. While the interview did not explicitly ask about these causes, many interviewees reflected on them in their responses. In our survey, we asked respondents to rate the extent to which a list of factors contributed to the spread of misinformation, measured on a scale from 1 (strongly disagree) to 5 (strongly agree).

In this section, we organize the perceived drivers conceptually across three levels –individual, organizational, and societal – to reflect the layered nature of how misinformation was described to emerge and spread. A summary of average ratings of each perceived driver from the survey is provided in Fig. 5.

5.3.1. Individual-level drivers

At the individual level, participants perceived misunderstanding or confusion, cognitive biases, political partisanship, and distrust in institutions as drivers, shaping how people interpret and spread offshore wind information.

5.3.1.1. Misunderstanding and confusion. In many of our discussions of the intentionality of misinformation spread, interviewees reflected that they believe people were often confused or misinterpreted offshore wind policy and science. For example, a local government representative shared how there was confusion regarding decommissioning plans, which they described as "*more confusion than falsification.*" They explained how people perceived that the turbines and submarine cables would be "*pull[ed] out of the ocean in 25 years*," even though they clarified that the "*plan is not decommissioning, it is recommissioning.*" [GL-13] The survey further supports this; respondents rating "misunderstanding of information" above the scale's midpoint, indicating general agreement that it contributes to misinformation (M = 3.96, SD = 0.93; 5-point scale where 5 = strongly agree).

5.3.1.2. Cognitive biases. A common thread through interviews was the role of cognitive biases, and specifically, the perception that people select and process information that conforms to their preexisting opinions. This was described as people coming to the table with a *"lens"* filtering their information [GF-2], *"selective hearing"* [GS-18], and people seeking *"validation of their perspectives."* [GF-10] Preexisting beliefs were perceived as overriding an individual's ability to receive or accept new information, creating communication challenges:

"There is a challenge when…different groups just want to believe what they want to believe… It is a challenge to…come to some understanding of each other…. We end up… talking past each other because what one group is saying may not comport with the understanding that the other group has." [GF-4].

A fishing industry representative expressed how motivated reasoning and selective hearing constrained communication: *"They do not believe it. They do not want to see it. They do not want to hear it. They just want something to be wrong…that makes it go away."* [FI-3] Additionally, interviewees expressed that individuals selectively choose or cherry-pick information that conforms with their opinions [67].

5.3.1.3. Political polarization. While our interview participants did not specify the role of political polarization or partisanship as a driver, and interviewers did not prompt this topic, discussions suggested that the information-filtering "*lens*" described by one interviewee (above) may be influenced by political ideology. These ideas were more evident in the survey (which included a question about this topic). Our survey exemplified how political partisanship was widely viewed as a misinformation driver, as it was the item with the second highest level of agreement among respondents regarding drivers (M = 4.53, SD = 0.58).

5.3.1.4. Individual mistrust of offshore wind communicators. Participants

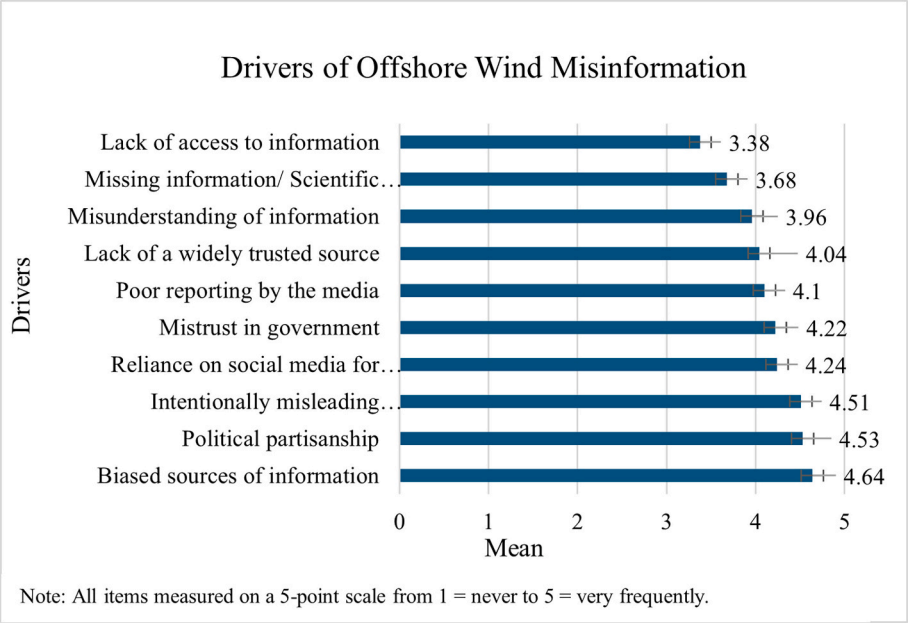

Fig. 5. Drivers of offshore wind misinformation.

also reflected that an individual's trust in offshore wind communicators could drive misinformation. More broadly, interviewees' responses reflected a perceived tendency of individuals to mistrust expert sources or institutions and instead trust interpersonal connections, such as their local social circles or neighbors. Interviewees expressed a concern that coastal communities form their own insular "*social networks*" as sources of information. [OI-16] An offshore wind representative explained that it became difficult to *"inject correct information"* because residents were *"more trusting of their peers…[than] of a developer or even of the Town."* [OI-16] Similarly, a state government representative noted how getting "*fact-based information out into the community*" and "*getting trusted partners or experts to speak their concerns…has been a major roadblock*" and further relayed the tendency of people often to rely on their own "*trusted partners, [which are] their neighbors*" for information. [GS - 25]. We found that trust can be categorized as both an individual-level and organizational-level driver of misinformation, see further discussion in Section 5.3.2. below.

5.3.2. Organizational-level drivers

At the organizational level, participants demonstrated how offshore wind communicators, including government and energy developers, influence the dissemination of misinformation. As one offshore wind developer reflected, "*the messengers are really important*" and are a "*huge part of [misinformation]*." [OI - 16] Participants from both the survey and interviews perceived misinformation to be caused by a lack of information and a lack of trust in offshore wind communicators.

5.3.2.1. Lack of information. Interviewees criticized many communicators, including federal agencies, state agencies, and developers, for providing either insufficient information about offshore wind or inadequate responses to misinformation. Some interviewees reflected on the lack of a "*central place*" for accurate information about offshore wind. [OI - 29] An NGO representative emphasized how timely rebuttals to misinformation from the government were needed: *"When [there is] false information…the federal government or the state should have done a press conference saying this is a myth…. But because they did not do that, the myth spreads…. In the absence of the truth, a myth will spread."* [NGO-1] Interviewees suggested that there is an information void or vacuum in offshore wind due to inadequate communication by the government and developers (for further discussion, see Smythe et al. [62]). In the survey, the "lack of access to information" scored above the midpoint, indicating that a moderate number of respondents rated this issue highly (M = 3.38, SD = 1.1; 5-point scale where 5 = strongly agree).

5.3.2.2. Lack of trusted organizations. Participants described how the lack of trusted organizations involved in offshore wind contributes to misinformation. As such, we categorized trust as both an individual and organizational-level driver, acknowledging how participants perceived it to be shaped by both personal beliefs and how effectively organizations communicate. Survey data support this finding; mistrust of the government was rated highly as a driver of misinformation (M = 4.22, SD = 0.821). More broadly, survey respondents also rated a lack of a trusted source of offshore wind highly as a driver of misinformation (M = 4.04, SD = 0.84). This aligns with interview findings, where interviewees identified a lack of a widely trusted source of communication. For instance, one interviewee stressed the need for an organization *"trusted by all stakeholders"* [NGO-28] and emphasized, "*If you're a member of a coastal community, it's hard to know where to find trusted information about offshore wind development.*" [NGO - 28] Interviewees underscored how organizations involved in offshore wind have not established a consistent or widely trusted source of information to dispel misinformation.

5.3.3. Societal-level drivers

Our data further revealed perceived drivers of misinformation at the societal or structural level, including information sources or communication platforms, scientific uncertainty, and disinformation campaigns.

5.3.3.1. Sources of information and communication channels. Survey respondents rated "biased sources of information" the highest out of all items as a driver of misinformation (M = 4.64, SD = 0.82). Respondents concerned with bias may reflect a tendency to associate biased sources with the spread of false or misleading content. It also suggests that respondents perceive people's sources of information as influential in the spread of misinformation.

To better understand information sources, the survey also included items assessing perceptions of specific communication channels, specifically social media sites and traditional media (e.g., newspapers or television). Survey respondents rated poor reporting from traditional media (e.g., newspapers) highly as a driver of misinformation (M = 4.26, SD = 0.79; 5-point scale where 5 = strongly agree). Although our survey provided limited context for why or how the media was a perceived driver, beyond that, reporting was poor, which suggests that many participants perceive journalistic errors related to offshore wind.

In addition, "reliance on social media for information" (M = 4.24, SD = 0.933) was rated highly as a driver. While interviewees discussed social media platforms infrequently, a few identified them as a medium that enables people to "*rapidly share*" false information. [GL-22] While our survey data cannot speak to which affordances of social media contribute to misinformation, it underlies a perception that social media enables information about offshore wind, which is sometimes false, to disseminate across communities rapidly. The reported reliance on social media may also undergird a perception that individuals are not seeking out other credible, factual sources of offshore wind information.

5.3.3.2. Scientific uncertainty. Another perceived driver was scientific uncertainty and how this uncertainty is communicated. Survey respondents rated "missing information/scientific uncertainty" moderately as a contributor to offshore wind misinformation (M = 3.38, SD = 1.1). This issue was identified in only a few interviews, but interview data provides important and novel insights about how offshore wind science can inadvertently contribute to misinformation. Here, we refer to uncertainties about facts and science due to limited knowledge [68] and known unknowns that frequently exist due to inadequate scientific research [69] For example, a federal government interviewee linked a lack of scientific information about offshore wind and whales to misinformation:

"One of the conspiracies is that NOAA and BOEM are covering up all these whale deaths…And the accurate statement is, we have no evidence to conclude that these whale deaths are associated with wind energy. But again, we do not have any evidence to suggest that they are not, either." [GF-10].

This reflects that limited scientific evidence, and inability of science to disprove a negative, was perceived to contribute to the spread of misinformation about offshore wind and whales. While this participant was reflecting upon perceived misinformation shared about the association between offshore wind and whales, this also suggests that misinformation can result from miscommunicating the state of certainty or level of scientific evidence.

Moreover, this issue was connected to the spread of local rumors or conspiracy theories. One interviewee noted that "*scientific uncertainty… makes it very easy for people to issue public comments, making wild claims.*" [GS - 18] Likewise, another federal government interviewee reflected how "*uncertainty creates pathways for…personal theories to…propagate.*" [GF-2]

5.3.3.3. Disinformation campaigns. Both methods revealed some participants' beliefs that disinformation campaigns can drive offshore wind misinformation. The survey revealed how "intentionally misleading communication" (M = 4.51, SD = 0.729) was rated highly as a driver of misinformation. Interviews further elucidated how disinformation was

perceived to foster misinformation. An interviewee described a case of perceived disinformation as a "*clear attempt*" to "*confuse people.*" [GS-18] Disinformation was also described as a "*basic opposition tactic*" [NGO - 7] and a *"political strategy."* [NGO-12].

The influence of money, specifically funding from the oil and gas industry or wealthy residents, in support of disinformation campaigns, was discussed in some interviews. For example, an offshore wind industry representative explained: *"There is just a tremendous amount of disinformation out there…very well organized, well-funded campaign partially funded by the fossil fuel industry to derail offshore wind and turn people against it."* [OI-5] A state government representative highlighted an example of a grassroots organization spreading disinformation that was "*funded by the oil and gas industry.*" [GS-18] Another interviewee mentioned how "*lobbying groups*" that are "*anti-wind*" are "*promoting a specific agenda"* and contribute to misinformation. [GF-4].

Survey respondents expressed high agreement across all provided drivers of misinformation (Fig. 4). Together, results suggest that the perceived complexity of offshore wind misinformation is attributed to a combination of factors that interact across scales, ranging from personal beliefs to social trust to disinformation campaigns.

5.4. Impacts of misinformation

Interview and survey findings both illustrated perceptions of the impacts of misinformation on offshore wind planning and development. In the survey, a majority of respondents identified misinformation as a very serious or extremely serious problem (60; 71 %), with only one indicating it was "not at all" an issue. Interviewees echoed similar concerns, as misinformation was described as consuming significant time and resources, with one offshore wind industry representative comparing their response to misinformation to a *"game of whack-a-mole."* [OI-16].

From the interviews, we identified two main impacts of misinformation: (1) straining resources and (2) harming communication. First, most interviewees expressed that misinformation demands staff bandwidth, including time for conversations, answering questions, or attending forums about misinformation topics. A local government official reflected that this is *"the most time in their career"* [GL-22] they have ever spent responding to false information. An offshore wind developer representative shared:

"If you are talking about things that are not really impactful…you are getting distracted from trying to mitigate and develop responsibly…. A lot of effort goes into…misinformation that could be spent…coming up with innovative solutions." [OI-5].

Second, misinformation was found to hinder effective communication by harming interpersonal relationships and efforts at conflict resolution. As one interview participant put it, misinformation is a *"major roadblock to effective communication right now."* [GS-25] A fishing industry representative added, *"When somebody is lying, then you cannot have a conversation with them anymore."* [FI-23] Interviewees also explained that communication was constrained because misinformation harmed trust; for example, one interviewee noted that it was difficult to have *"genuine discussions,"* and that *"[people] do not believe you either way because there is so much misinformation getting thrown around."* [GS-18].

Communication channels were described as essential for planning and conflict resolution: *"In order to better make plans for surveys, for mitigation, for science, I need to be able to talk to you. If you are going to spread misinformation, and then [if] you do not want to talk to me, [then] I can't make some things better."* [OI-9].

Interviewees also associated misinformation with difficulties in leading public meetings; for instance, a state government representative shared, "*[Misinformation] immediately puts fear into people's minds*," and they continued, "*Trying to get accurate information out to people who are legitimately concerned and asking legitimate questions is very difficult.*" [GS-25].

6. Discussion

Our study provides novel insights into the challenges of misinformation and disinformation in renewable energy planning and permitting. Through qualitative interviews and a quantitative survey of participants involved in the planning and permitting of two offshore wind projects in the U.S., we explored how misinformation and disinformation are understood, perceptions of why misinformation spreads, and its perceived impacts. These findings help us understand points of consistency and divergence between participants' perceptions and academic research and provide a foundation for future research investigating renewable energy misinformation.

6.1. Participant characterization of offshore wind misinformation

Our study contributes to the misinformation and disinformation literature by highlighting how participants involved in energy planning understand these concepts. We found that misinformation is perceived as multidimensional, including partial, biased, or exaggerated information that is not always wholly or immutably false. Participants' perceptions echo research that misinformation can include pieces of truth [17] and that it is multidimensional [25,70–74]. These perceptions also reflect research that misinformation can be classified on a continuum of accuracy ranging from completely accurate to completely false, rather than a clear binary distinction [23,24].

Interview participants described intentionality in complex ways, often emphasizing unintentional drivers of misinformation such as cognitive biases, misunderstanding or confusion. While some interviewees described what they perceived to be the intentional spreading of misinformation (e.g., disinformation), many hesitated to attribute intentionality to false information, reflecting broader difficulties in discerning between misinformation and disinformation [71]. These results suggest that communicators may have different interpretations of what constitutes falsity or intentionality, making the boundaries between misinformation and disinformation ambiguous.

Nevertheless, our results should be interpreted in light of the roles of our participants. The reluctance to label information as wholly false or ascribe intent may reflect a reluctance among some participants to label information as false or to identify it as intentional (disinformation). As our sample included professionals from the government, energy and maritime industries, and NGOs, findings reflect perceptions shaped by professional roles and involvement in offshore wind planning and permitting. For example, government officials may be constrained by the need to fulfill statutory obligations. Likewise, offshore wind developers can be influenced by their project goals and timelines. This raises valuable questions for future research: how offshore wind professionals interpret and define falsity and understand the intentionality of false information.

6.2. Examples of perceived offshore wind misinformation

Misinformation was perceived as pervasive and a serious challenge for offshore wind development. The frequency with which participants mentioned topics like marine mammal deaths and ecosystem impacts suggests that certain misinformation narratives have become pervasive. However, concerns about marine mammals are not novel, as they were reported during the early stages of the Block Island Wind Farm's operation [7]. But the dominance of narratives about marine mammals may reflect the importance of marine mammals in shaping perceptions offshore wind [75], the attachment coastal communities have to the marine environment [76], and/or the emotionally salient and persuasive power of marine mammals as "charismatic mega-fauna" [77] That said, our interviews and survey underscored other examples of perceived offshore wind misinformation, including its costs, viewshed impacts, adverse health effects from transmission cables, and the reality of climate change. These topics reflect many of the key priorities of the

public when faced with offshore wind energy development [78,79].

Many participants reported a dual perception of how misinformation was shared, describing it as being shared both in support of and in opposition to offshore wind. Concerns were raised that advocates exaggerate economic benefits, such as job creation, and underplay the ecological risks, including threats to fisheries. Previous offshore wind research has reported similar concerns, including distrust in developers and a perception that they share inaccurate or misleading information [38,80]. This perception could be the result of poor communication and engagement from offshore wind developers, as Haggett [80] argued that a lack of communication fueled mistrust and opposition, fomenting perceptions that developers spread inaccurate information.

Our finding that misinformation originates from "both sides" supplements previous research, which has primarily focused on the role of anti-wind groups [3,17]. This also raises critical areas for future research. One such need is an examination of offshore wind developers' communications, which could investigate whether and how claims are misleading, and whether they reflect genuine concerns about advocates' communication practices or a "discourse of delay" designed to slow development [3,81].

6.3. Perceived drivers of misinformation

Our study extends the literature on the drivers of misinformation by exploring how participants involved in offshore wind planning and permitting perceive its origins and spread. We analyzed these drivers across scales – individual, organizational, and societal. We found no clear consensus across interviews and surveys about which factors had the most impact. Instead, we found that participants perceived the issue as influenced by a myriad of interrelated variables.

Participants frequently highlighted how information deficits or confusion cause misinformation. Many interviewees expressed a need for improved information provision and education related to offshore wind, echoing research that calls for improved communication from government agencies and project developers [7,82]. While some participants' responses primarily reflected the "information-deficit" approach to science communication [83,84] by emphasizing the need for more information as the solution to public understanding, others acknowledged more complex dynamics of why and how misinformation takes root.

Participants further identified a lack of a centrally trusted source of offshore wind information. The survey and interviews revealed a perceived distrust in government agencies and developers, suggesting that the absence of a trusted organization leaves room for speculation and local rumors. These concerns reflect a broader societal trend of institutional distrust [85] and a lack of public trust in renewable energy developers [82]. Specifically, they could reflect a lack of trust in federal agencies or planning processes for offshore wind [86]. Rather than relying on scientific organizations for information, participants perceived the public to depend on local, trusted social circles. This aligns with research that insular or homogenous social networks are prime for misinformation spread, for acceptance of false information appears socially normal [8,87]. It also underscores the importance of empowering local, trusted liaisons for offshore wind communications [56,88].

Another common thread through the interviews was that "*people believe what they want to believe,*" [GS-26], illustrating the perceived role of motivated reasoning and underscoring a skepticism among planning participants that information is effective in altering people's opinions on offshore wind. Other biases, such as selective attention, were discussed, aligning with research that psychological biases can shape how individuals receive and process information [16,89]. However, the extent to which cognitive biases like motivated reasoning or confirmation bias influence misinformation belief is contested in academic literature [90,91]. It also further demonstrates that participants recognize the limitations of the information deficit approach [83].

Moreover, our survey results revealed that many respondents perceived partisanship as a significant driver of misinformation, but interviewees did not explicitly mention political identity. Although survey results echo findings from academic research that political ideology influences attitudes toward renewable energy [92] and impacts beliefs in misinformation corrections [36]. These findings identify areas for future research to understand how partisanship influences opinions on offshore wind misinformation.

Participants also highlighted broader societal drivers of misinformation, including the role of social media and disinformation campaigns. Survey respondents widely agreed that reliance on social media contributed to misinformation about offshore wind. This perception aligns with research on misinformation and social media, including the ways it amplifies misinformation through rapid sharing and spreading of content [93], bots and algorithm curation [94,95], and creation of filter bubbles or ideological echo chambers [40,96].

Additionally, some participants identified how intentionally misleading information (disinformation) originating from vested interests, such as fossil fuel companies or wealthy homeowners, can drive misinformation. This is in line with disinformation research identifying how disinformation campaigns contribute to the organic and unwitting spread of misinformation [97,98]. These perceptions also underlie the problem of climate obstruction; research in this field documents the role of special interests in disseminating disinformation about climate and energy topics [12]. Participants' perceptions may reflect a phenomenon that Slevin et al. [3] called "solutions-denialism" or "solutions-skepticism," where climate change obstructionist groups denounce policies used to mitigate climate change (p. 8). Nevertheless, organized networks or disinformation campaigns were featured less prominently in our findings than reflections on misinformation, suggesting a gap between extant academic research [3] and the perceptions of those directly involved in offshore wind planning processes. This could also be the result of our data collection instruments having a greater focus on misinformation, rather than disinformation.

Finally, scientific uncertainty was perceived as a contributor to misinformation by a sub-section of our participants. Participants noted that the evolving state of offshore wind science, particularly concerning topics such as marine mammals and ecological impacts, created space for misinterpretation and confusion. Specifically, they conveyed the challenge of communicating NOAA's reports that there was no evidence of harm to whales. These findings highlight challenges in science communication, including the difficulty scientists face in proving a negative, i.e., that there is no known association between offshore wind and whale mortality. It also underlies how inherent features of science, including uncertainty resulting from emergent and iterative research, as well as data limitations, equivocate science communication [68,69]. Nevertheless, we must recognize that it could also reflect the history of science research, which has documented how "scientific uncertainty" was used as a delay tactic to limit action on climate change [46]. Offshore wind presents an interesting area for future research in this regard, given that it is relatively novel in the U.S, information gaps exist, and it is rife with misinformation.

6.4. Perceived impacts of offshore wind misinformation

Our study exemplifies the serious challenge that misinformation poses in offshore wind planning and permitting. Prior research has argued that misinformation can undermine the uptake of renewable energy projects by contributing to public or stakeholder knowledge gaps [60], affecting acceptance [17,57], or by enabling organized opposition [47]. Our findings expand upon this literature by illuminating the internal impacts of misinformation on the planning process.

Interviewees described how misinformation demanded significant time and strained their staff capacity. It was also perceived to hinder communication, erode trust, and subsequently disrupt efforts to build consensus, conduct outreach, or resolve conflicts. These effects were related to both personal and policy-related communication, as they were

described as affecting components of planning, such as survey efforts or mitigation strategies. In this way, our work suggests that misinformation affects not only public perceptions but also the effectiveness of actors involved in planning and permitting decisions, which could have broader implications for the development of offshore wind.

6.5. Study limitations and future research

Our research has some limitations. We focus on only two offshore wind projects, which could limit the generalizability to other energy projects or geographic contexts. The study is also limited by its number of interview participants (29) and survey respondents (84). Local government officials and labor groups were underrepresented. The selection of individuals involved in the planning and permitting phases may have excluded those with less access to formal processes, such as citizen activists. Further, we were unable to draw sector-level or engagement-level conclusions from the survey or interviews. Another limitation is demographic representation. Though we did not seek a representative sample, our survey had a greater representation of men and those with higher levels of education; thus, our sample may not capture diverse perspectives and lived experiences. These demographics provide a boundary for what we can understand about perceptions of misinformation and disinformation related to offshore wind.

Our study was exploratory and does not provide a comprehensive overview of offshore wind misinformation. However, as highlighted in our discussion above, it offers novel insights for future research. It also presents interesting research questions: How do energy planners understand misinformation and disinformation across different energy or national contexts? How does the framing of energy developers' official communication influence perceptions of its facticity? Research should investigate the finding that offshore wind advocates are perceived as sources of misinformation and examine the origins of these claims and their accuracy; this research could consider whether the issue is used disproportionately by opponents or proponents. This research could also expand upon the work of Stokes [47] and Slevin et al. [3] to further examine the role of vested interests and astroturfing.

Further, our study did not focus on the interventions needed to combat misinformation or disinformation. However, future research could build upon existing work that explores the scalability of pre-bunking or inoculation strategies in wind energy contexts, which can provide preemptive exposure to false information followed by a correction to prepare individuals for misinformation and deception strategies [99,100].

7. Conclusion

A successful transition to more sustainable sources of electricity requires effective communication in the planning and development of new energy infrastructure. Early and continuous communication and engagement are also vital; however, misinformation risks distorting public understanding and hindering engagement in energy transitions. This research focused on the first two federal offshore wind energy developments in the U.S. to elucidate participants' perceptions on how misinformation and disinformation create obstacles to effective communication, which is necessary for planning. Our findings demonstrate that misinformation has tangible consequences for offshore wind participants, limiting time and capacity. Interventions to address misinformation can help reduce the burnout of individuals in the energy planning process.

This research has broad policy implications and could help inform contexts in the U.S. and in other locations around the world where misinformation and disinformation about wind energy have emerged [1,60]. We have four recommendations. First, it is essential to recognize the traditional "information deficit approach" and simple provision of information as insufficient to mitigate the spread of false information. While the lack of information about offshore wind is a concern, our findings highlight that information alone may not be sufficient to change people's opinions. Instead, communicators should couple information provision with additional strategies, such as building relationships and trust through informal and one-on-one interactions [56,101]. Second, offshore wind communicators should understand their audiences and acknowledge diverse historical contexts, values, and ideologies that drive beliefs. Communicators could tailor their messages, and co-partisan corrections could be one avenue to design messages [36]. Third, we recommend that the offshore wind industry representatives acknowledge uncertainties, missing information, or knowledge gaps. Our recommendations also align with those of Skjølsvold et al. [102], who suggest that proponents and developers should avoid over-promising or exaggerating and acknowledge potential harms.

Finally, given that lack of trust and perceptions of bias were reported as drivers of misinformation, the choice of a messenger is critical in correcting misinformation. Thus, we also recommend identifying trusted communicators [62]. Ultimately, our study reflects participants' multidimensional perceptions of false information and highlights the need to design interventions to address misinformation that improves offshore wind communication and prevents stakeholder burnout.

CRediT authorship contribution statement

Shannon Howley: Writing – review & editing, Writing – original draft, Visualization, Validation, Methodology, Investigation, Data curation, Conceptualization. **Tiffany Smythe:** Writing – review & editing, Writing – original draft, Validation, Project administration, Methodology, Investigation, Funding acquisition, Formal analysis, Data curation, Conceptualization. **Emily Diamond:** Writing – review & editing, Visualization, Validation, Project administration, Methodology, Investigation, Funding acquisition, Data curation, Conceptualization. **David Bidwell:** Writing – review & editing, Validation, Project administration, Methodology, Investigation, Funding acquisition, Data curation, Conceptualization.

Declaration of competing interest

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests: Shannon Howley, Tiffany Smythe, Emily Diamond, David Bidwell reports financial support was provided by Northeast Sea Grant Consortium. If there are other authors, they declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix A

Participants' engagement in offshore wind processes

Table 1
Number of participants engaged in planning and permitting activities for VW1 and/or SFW

Type of Engagement	Vineyard Wind 1	South Fork Wind
Attended meetings	48	51
Spoke at meetings	31	43
Submitted written comments	37	39
Posted/commented on social media	12	15
Media contact (gave an interview/wrote an op-ed)	23	25
Attended protests/demonstrations	5	11
Conducted outreach or engagement	31	34
Worked on regulatory/permitting documents	24	21
Conducted scientific research	15	16

Table 2
Number of participants engaged in offshore wind events for VW1 and/or SFW

Offshore Wind Events	Vineyard Wind 1	South Fork Wind
BOEM-led meetings	42	42
Other federal government-led meetings or information sessions (e.g., NOAA, USCG)	29	35
State-led events or meetings	36	35
Local government-led meetings or information sessions	29	38
Developer or industry-led public meetings or information sessions	43	44
Nonprofit or community group-led meetings or information sessions	22	30
Sea Grant or other university-led meetings	21	14
Informal interactions (phone/video calls, small meetings)	38	35

Data availability

The data that has been used is confidential.

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