Received: 16 September 2021 | Revised: 31 January 2022 | Accepted: 2 February 2022

DOI: 10.1111/csp2.12650

Conservation Science and Practice
A journal of the Society for Conservation Biology
Open Access
WILEY

CONTRIBUTED PAPER

# News coverage of ocean issues and its impacts on public perceptions and conservation information-seeking of sea turtles

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**Funding information**
Stanford University's Emmett Interdisciplinary Program in Environment and Resources; Stanford University's Precourt Institute for Energy

## Abstract

The news media can influence how the public learns about environmental issues, including endangered marine species such as sea turtles, which may prompt further information-seeking. However, what people learn through the media can be problematic for conservation efforts if it is misaligned with scientific priorities. Here, we seek to better understand how members of the public learn about sea turtles through the news, assess public perceptions and knowledge about these animals, and evaluate how these variables are associated with information-seeking behavior on their conservation. We surveyed a representative sample of 1162 adults living in the coastal United States and collected information on ocean news consumption, sea turtle interest, risk perceptions of sea turtle population status and individual threat types, self-reported knowledge, and information-seeking behavior. News consumption was associated with interest, risk perceptions of population status, and self-reported knowledge about sea turtles. Although news consumption was not associated with risk perception about individual hazards, individuals generally viewed pollution as a top hazard facing sea turtle populations, which may misalign with scientific understanding. Greater interest, risk perceptions of population status and overall threat, and knowledge was associated with more information-seeking behavior, with knowledge moderating the relationship between risk perceptions of population status and information-seeking behavior. These findings improve understanding of how the public learns about sea turtles through the news media, suggests coupling messaging about sea turtles with their risks may provide more effective conservation messaging, and highlights how educators and conservation stakeholders can use the news as a communication tool.

KEYWORDS

endangered species, environmental communication, interest, knowledge, marine megafauna, news media, risk perceptions

## 1 | INTRODUCTION

Public attitudes toward large marine megafauna have shifted over time; while once perceived as a valuable resource to exploit, community understanding of these animals and appreciation for their ecological roles in societies have grown, partly due to increases in public curiosity of wildlife, access to coastal environments, and environmental campaigns dedicated to marine wildlife (Mazzoldi et al., 2019). Today, these animals, such as whales, dolphins, and sea turtles, are considered flagship species that capture public imagination, encouraging wider biodiversity conservation support. A well-known example include polar bears, who have emerged as iconic ambassadors for climate change through powerful imagery portrayed in the media of these animals adrift in melting sea ice (Born, 2019; Dunaway, 2009). Similarly, sea turtles have been linked to the anti-plastics movement after a video of a sea turtle with a straw stuck up its nose went viral (Figgener, 2015), resulting in their popular use as a symbol to promote efforts about reducing single-use plastic straws. Further, many of these charismatic animals are threatened or endangered themselves, which may amplify the impact that increased public attention on these species may have toward long-term population survival.

How people think about environmental problems may influence whether they take action to address them (Fielding & Head, 2012), however it is not always clear how much people know, what they know, and how they learn about those issues. In a study on public attitudes and knowledge about whales and dolphins, Naylor and Parsons (2018) found that while marine mammal conservation was important for the majority of participants, knowledge about the conservation statuses of several, high-profile cetaceans remained low. They suggest that support for marine mammal conservation may not necessarily depend on detailed knowledge of the animals, but note that this discrepancy can nonetheless make conservation efforts more difficult (Naylor & Parsons, 2018). Misaligned understanding may unintentionally shift public attention and efforts toward initiatives that do not fully target the key hazards threatening endangered species, such as sea turtles, stalling population conservation.

There is already a demonstrated mismatch between public and expert knowledge of threats facing marine animals, as well as the marine environment more generally (Howard & Parsons, 2006; Lotze et al., 2018; Potts et al., 2016; Ressurreição et al., 2012), and such disparities may lie in part due to differences in sources of information between the two groups (Howard & Parsons, 2006; Lotze et al., 2018). Scientists are generally influenced by research and scientific data, while members of the public may rely on personal experiences and the media, as that is the information that are readily available to them (Lotze et al., 2018). The news media is a critical intermediary in propagating information about charismatic megafauna to the public. Documented to serve a prominent role in focusing public attention to important topics (Takahashi & Tandoc, 2016), media coverage can be particularly vital in the communication of issues that are not directly observable by the general public, such as remote environmental issues (Mikami et al., 1995) and wildlife (Corbett, 1995). Much of public knowledge about marine mammals has come from mass media, including films, television, magazine articles, and newspaper articles (Barney et al., 2005).

Given that many of the threats impacting marine megafauna are human-induced (Avila et al., 2018; Donlan et al., 2010), understanding public perceptions and knowledge about these enigmatic creatures and the hazards that harm them, as well as how these perceptions ultimately translate to pro-environmental behavior, can be critical for effective conservation education and outreach efforts. Here, we present data from a study of a coastally representative sample of Americans to investigate the relationship between ocean news consumption on interest, risk perceptions, and self-reported knowledge about sea turtles and their conservation. To assess the practical importance of this inquiry, we also assess whether these variables extend to information-seeking to learn more about conservation regarding these animals.

## 2 | CASE STUDY: SEA TURTLES

Sea turtles are marine animals that capture public attention (Liordos et al., 2017) and are often used as a conservation icon (Tisdell & Wilson, 2005b). However, populations have plummeted in recent years due to several environmental and human induced threats, including fishing activity (Lewison, Freeman, & Crowder, 2004), climate change (Fuentes & Cinner, 2010), and disease (Mashkour et al., 2020). The enigmatic nature of these animals provides a unique opportunity to leverage public support for their conservation. Thus, it is worth considering how individuals currently perceive information about these species to aid in environmental education and advocacy outreach. Further, given the highly migratory nature of sea turtles, it is likely that many individuals may not have an opportunity to interact with these species in the wild. Instead, they may rely on other information sources, such as the news, to form knowledge about these animals, including the hazards and threats that they face. Although knowledge alone is often not enough for an individual to adopt pro-environmental

behavior in their everyday lives, informal education through news media outlets can increase public concern and engagement (Östman, 2014).

Research has assessed public awareness of threats impacting the marine environment more generally (Gelcich et al., 2014; Lotze et al., 2018), as well as hazards facing cetacean (Howard & Parsons, 2006; Naylor & Parsons, 2018) and shark (Garla et al., 2015) populations. Public perception research on sea turtle topics have focused primarily on opinions regarding nesting site management (Jones et al., 2011) and ecotourism (Campbell & Smith, 2006; Smith et al., 2019; Tisdell & Wilson, 2005a), as well as on overall attitudes toward their conservation (Dimopoulos & Pantis, 2003; Senko et al., 2011). Dimopoulos and Pantis (2003) found positive environmental attitudes toward sea turtle conservation among children in Greece, including understanding and concern for local populations as well as verbal commitments to act for their benefit, but low levels of knowledge on sea turtle biology and existing protective measures. As part of a larger study on public attitudes toward rehabilitation centers, Feck and Hamann (2013) briefly assessed public knowledge of threats impacting turtle populations in Australia and reported that all participants indicated a willingness to make changes in their lives to support sea turtles after learning about the risks they face.

Six of the world's seven sea turtle species are found within U.S. waters (IUCN, 2020), and southeastern U.S. coastal areas provide critical nesting habitat for many of these animals (National Marine Fisheries Service and U.S. Fish and Wildlife Service, 2008). Loggerheads (*Caretta caretta*) and olive ridleys (*Lepidochelys olivacea*) are listed as vulnerable in the International Union for Conservation of Nature's Red List (IUCN, 2020), greens (*Chelonia mydas*) are classified as endangered, and both hawksbills (*Eretmochelys imbricata*) and kemp's ridleys (*Lepidochelys kempii*) are listed as critically endangered. Yet, a targeted systematic evaluation of public understanding of sea turtle threats by U.S. residents has yet to be undertaken. Assessing public perceptions in the U.S. region can help in understanding the state of knowledge, awareness, and concern that individuals have toward these threatened animals. Those who are more knowledgeable, aware, and concerned for these species may want to learn more to support them. Understanding these relationships can help target outreach and education efforts, which can ultimately help the conservation of numerous turtle populations.

Further, sea turtles are an interesting case study given that they have recently been linked to the global anti-plastics movement. In 2015, a video of researchers removing a plastic straw from a turtle's nose went viral (Figgener, 2015), gaining widespread media and public attention. Since then, much of the imagery and language around reducing single-use plastic straws has been connected to the oceans, and in particular to the impact they might have on sea turtles (Arkesteyn, 2020). Sea turtles were brought to the forefront of the anti-plastics movement (Chiu, 2019), which may have profoundly shaped the way the public perceives the impacts of pollution on these animals. A recent media analysis noted that news coverage on pollution as a sea turtle hazard has been relatively high over the past decade and has increased in recent years (Santos & Crowder, 2021), which may be problematic if it skews public opinion in a way that is misaligned with scientific consensus. Even though plastic can indeed pose a risk to sea turtles (Wilcox et al., 2018), it is critical to consider the relative impact of this threat among other hazards for sea turtles prioritized by conservation experts (Bolten et al., 2011; Hamann et al., 2010). While the media may have a potential role in shaping public knowledge, its relationship to perceptions about animals and their conservation are not well understood. This study aims to bridge this gap by assessing the relationship between news consumption and various sea turtle interest and perceptions variables, as well as their association with sea turtle and conservation information-seeking behavior.

## 3 | CONCEPTUAL MODEL AND HYPOTHESES

This study seeks to understand how ocean news media consumption by members of the public in coastal areas may be associated with seeking out additional information on sea turtles and their conservation. A further objective is to explore how news consumption and information-seeking are related to interest, risk perceptions, and knowledge. Here, news media consumption is conceptualized broadly as consumption of news about ocean-related issues, while the other variables in the conceptual model (interest, risk perceptions, and knowledge) were focused on sea turtles specifically. The following hypotheses are proposed in this study, based on a literature review (see Appendix S1 for more details) and conceptual model depicted in Figure 1 borrowing elements from Griffin et al. (1999)'s risk information seeking and processing (RISP) model. While we use the RISP model to identify potentially important variables related to news consumption and information-seeking behavior, we note that we do not directly test the model in this research.

Some posit that greater news consumption is likely associated with greater interest in news topics (Yuan, 2011), and as highly charismatic marine species, sea turtles in particular have been noted to capture public

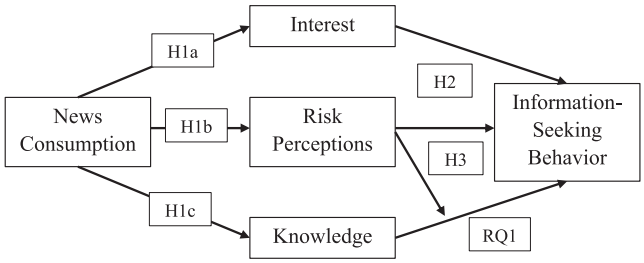


**FIGURE 1** Conceptual model used to guide the hypotheses tested in this study. This conceptual model borrows some elements of the risk information seeking and processing model from Griffin et al. (1999), for example, interest can be loosely mapped as part of "individual characteristics," risk perceptions as "perceptions of the characteristics of the hazard," and knowledge as "beliefs of information sufficiency."

attention (Liordos et al., 2017). Therefore, articles about sea turtles may capture the interest of casual ocean news consumers, and we hypothesize that greater consumption of ocean news will be associated with greater interest in sea turtle news specifically. The news media is also an important way that people form knowledge and learn about risks. As Joffe (2003) notes, a member of the public may first become exposed to a potential danger through the news media, which often presents a simpler and sometimes sensationalized version of expert knowledge about that topic in hopes of increasing audience attention. Studies have shown how media coverage can place emphasis on some hazards over others (Spencer & Triche, 1994; Woods, 2007), including in reporting about threats to marine wildlife (Santos & Crowder, 2021; Shiffman et al., 2020). Importantly, this framing by the media can influence how these issues are understood and interpreted by individuals, and play a role in shaping risk perceptions (Kapuściński & Richards, 2016). Greater news consumption has been linked to greater risk perceptions (Slater & Rasinski, 2005; Zhao et al., 2011) and self-reported knowledge (Weberling et al., 2011). Therefore, we hypothesize that (H1) *greater consumption of ocean news will be associated with* (*a*) *greater interest in sea turtle news*, (*b*) *greater risk perceptions of sea turtle conservation issues*, *and* (*c*) *greater self-reported knowledge of sea turtles*.

Extant research suggests individuals' interest in and risk perceptions regarding issues across domains from health (Baumann et al., 2017; Huurne & Gutteling, 2008; Rimal, 2001) to the environment (Mead et al., 2012; Yang et al., 2014) are associated with more information-seeking behavior, which refers to actions an individual may take to learn more about a specific topic or issue. Griffin et al. (1999) proposed the RISP model to explain why individuals seek and process information, highlighting seven influential factors: individual characteristics, perceptions of the characteristics of the hazard, one's affective response to the risk, social pressure, beliefs of information sufficiency, capacity to learn, and beliefs about the usefulness of the information (Griffin et al., 1999). People are more likely to engage in something that they are interested in, and as Yuan (2011) notes, it is likely that individuals who consume more news have greater interest in it. Interest has also been found to play a role in engagement with online news (Arapakis et al., 2014; O'Brien & McKay, 2016) and Yang et al. (2014) found that perceived issue salience of climate change was positively related to information processing and support for mitigation policies. Further, risk perceptions, which can be defined as one's assessment of the probability of an event occurring and concern about its consequences, has also been noted as a predictor of information-seeking behavior. Mead et al. (2012) noted that adolescents with higher climate change related risk perceptions were more likely to seek out information about it compared with those with lower risk beliefs (Mead et al., 2012). Therefore, we predict that (H2) *greater interest in sea turtles and greater risk perceptions about the hazards they face will both be associated with greater information-seeking behavior on their conservation*.

The literature is mixed as to whether subjective, self-perceived knowledge is associated with greater information-seeking behavior. One body of evidence suggests that the public is broadly interested in science, and adults frequently seek to increase their knowledge of science and technology (Falk et al., 2007). This has been found to be true among those who report high levels of subjective knowledge (Dodd et al., 2005; Mishra & Kumar, 2011). However, research has also found the opposite, where subjective knowledge reduces intention to seek information (Noh et al., 2016; Park et al., 2014). It is possible that that individuals with higher self-reported knowledge may not think they need to learn more about a particular topic, and thus are less interested in searching for additional information. Given the ambiguity in the literature, we ask (RQ1) *what is the relationship between self-reported knowledge of sea turtles and information-seeking behavior?*

While risk perceptions and knowledge have both been shown to be direct predictors of intention to seek information, risk perceptions have been noted to both mediate and moderate relationships between knowledge and behavior in the health and financial decision-making domains. Iorfa et al. (2020) found risk perceptions to mediate the association between COVID-19 knowledge and precautionary behavior, while financial decision making studies demonstrate a moderating relationship of

risk perceptions on investment knowledge and investment decisions (Ademola et al., 2019; Kaufmann et al., 2012). Risk perception is an important factor that can determine information-seeking behavior and may be influenced by the knowledge that an individual possess. Therefore, we hypothesize that (H3) *the positive relationship between knowledge and information-seeking behavior will be moderated by risk perceptions, where greater perceived risk will be associated with more information-seeking behavior*.

## 4 | METHODS

### 4.1 | Data collection

We surveyed a representative coastal sample of adults (>18 years of age) in the NORC AmeriSpeak Panel. Research has shown that proximity to coastal areas can shape awareness and concern about ocean issues (Fletcher & Potts, 2007), thus we focused our U.S. survey on a representative sample of residents living in continental states bordering the Pacific, Atlantic, or Gulf of Mexico coast, as well as Hawaii, to increase the likelihood of reaching individuals with a more active interest in sea turtles and greater possibility of engaging in efforts for their conservation (see Appendix S2 for geographic residency of survey respondents). We excluded Alaska and New England coastal states due to a relatively lower presence of sea turtles in these regions. Households were selected using area probability and address-based sampling methods, and surveys took place from February 22 to March 8, 2021. A total of 1162 interviews were collected for this study: 1111 online and 51 by phone. The sample size was chosen to maximize the number of respondents given resource constraints and the survey was preceded by a pilot study to adjust the questionnaire for clarity. All materials and procedures were approved by Stanford University's Institutional Review Board (Protocol #56486).

### 4.2 | Survey structure

The survey questionnaire explored themes on news consumption, interests, risk perceptions, knowledge, and information-seeking behavior. Demographics including age, sex, combined race/ethnicity, education level, household income, and political affiliation were provided by NORC. To identify potential participants with specialized, subject-level expertise, we asked whether individuals have a job that involves ocean or marine topics. If they answered affirmatively, they were asked a follow-up question on if that work involves sea turtles. For descriptive purposes, we also collected information on participants' main sources of news and information about ocean issues from a list of options that included newspapers/magazines, internet, social media, books, television, radio/podcasts, family and friends, scientific publications, or environmental organizations. Participants were asked to check all that apply and were able to indicate multiple options, as well were provided a write-in "other" option. The survey design was informed by a review of the literature and was developed to meet Stanford University Institutional Review Board guidelines. The full questionnaire can be found in Appendix S3.

### 4.3 | Variables

A variable of news consumption was created by having participants indicate how often they consume news about ocean issues (1 = never, 5 = very frequently). This was the only question about the ocean more generally, while subsequent questions focused specifically on sea turtles. In earlier, piloting stages of this study, asking participants about their consumption of sea turtle news in particular was found to be too narrow in scope and difficult to answer. Participants' interest in sea turtles was assessed by asking "In general, how interested would you be in news about issues related to sea turtles?" on a scale where 1 = not at all interested to 5 = extremely interested. Next, participants' self-reported knowledge about sea turtles (1 = nothing at all, 5 = a great deal) was assessed by asking "In general, how much do you know about sea turtles?"

Risk perceptions were measured in two categories, including, sea turtle population status and various threats. Participant risk perceptions about sea turtle population status was assessed by asking: "In general, how threatened do you think sea turtle populations are by human and environmental activities?" on a scale where 1 = not at all threatened and 5 = extremely threatened. Participants' risk perceptions about various sea turtle threats were also assessed by asking "In your opinion, how harmful are the following threats to sea turtles?" on a scale where 1 = not at all harmful and 5 = extremely harmful. Threat categories were chosen based on previous identification as sea turtle hazards within expert communities (Bolten et al., 2011). They included: accidentally getting tangled in fishing gear (fishing bycatch); interacting with humans, for example, getting hit by a boat, being harassed (non-fishing human interactions); coastal erosion and habitat alterations, for example, loss of sand on the beach, poor water quality (habitat alterations); pollution on beaches or in the oceans, for

example, pollution from trash, light, noise, oil (pollution); getting eaten by other animals or falling ill from disease (species interactions); changes in water temperatures or weather events, for example, climate change, hurricanes, typhoons (weather and climate); and coastal construction and development, for example, building hotels or homes (construction). Responses were averaged to create an overall threats score, with a Cronbach's alpha of 0.89. Due to an anticipated ceiling effect, participants were also asked to rank the seven threats, where 1 = threat ranked most harmful to sea turtles and 7 = threat ranked least harmful to sea turtles, to better assess differences in perceived threat.

Finally, information-seeking behavior was assessed by asking participants if they were interested in learning about supporting sea turtle conservation, "Are you interested in more information on things you can do to help protect sea turtles?" Online participants then had the option to click on a link "Go to sea turtle information" or proceed to the next question. Those taking the survey by phone indicated verbally that they would like to learn more. Clicking the link or verbally saying yes was coded as 1 and those who moved on were coded as 0.

### 4.4 | Weights

Multiple socioeconomic and demographic characteristics (age, race/ethnicity, sex, education level, income, household ownership, marital status, and geographic region) were used to create post-stratification weights (Appendix S2). The weights of the survey respondents were compared with U.S. Census benchmarks and adjusted to allow for population-based inferences. The final sample is similar to March 2020 Census Bureau Current Population Survey estimates for race/ethnicity, household ownership, income, education, number of children, marital status, gender, and geographic region. Unless noted otherwise, these study-specific post-stratification weights were used in inferential analyses but not descriptive statistics.

### 4.5 | Data analysis

We tested H1 by conducting three ordinary least square (OLS) regressions with news media consumption predicting interest (H1a), risk perceptions (H1b), and knowledge (H1c). For H1b, nine separate OLS regressions were run between news media consumption and risk perceptions in terms of population status, overall threat, and for the seven threats individually. We also performed paired two-sample *t*-tests to compare the mean ranking for each combination of threat type. H2 and RQ1 were tested by conducting binary logistic regressions with interest, risk perceptions, and knowledge separately predicting information-seeking behavior. H3 was evaluated by assessing the interaction between knowledge and risk perceptions on information-seeking behavior. For H2, RQ1, and H3, risk perceptions as measured by population status and the overall threat variable were used. The data analysis plan for H1 as well as the direct relationship between news consumption and information-seeking were pre-registered before analysis in Open Science Forum; see https://osf.io/9qg4d. H2, RQ1, and H3 were not pre-registered but were added to understand the conceptual model more fully.

Due to missing data, variables were imputed using the multivariate imputation by chained equations (MICE) package in R. The proportions of variables with imputed values ranged from 0.09% to 4.13%. Imputation methods used included predictive mean modeling for continuous variables and logistic regression for binary variables, and the imputation model was conducted based on all variables of interest for this study. The "survey" package was used in hypothesis testing to adjust for survey samples using inverse-probability weighting. All OLS regressions (H1) were conducted using a generalized linear model with a Gaussian distribution. For each OLS regression model, partial (Cohen's *d*) $f^2$ was calculated to quantify effect size for each predictor, which is considered small at 0.02, medium at 0.15, and large at 0.35 (Cohen, 1988). Demographic variables were controlled for in all statistical tests and all analyses were performed using R (version 4.0.4). Diagnostic plots of the data indicated no violations from normality or apparent influential outliers. All studied variables had a calculated variance of inflation factor below 1.47, indicating no multicollinearity (O'Brien, 2007).

## 5 | RESULTS

Characteristics of the sample population's reported main sources of news about ocean issues is summarized in Table 1, while descriptive statistics of the weighted and un-weighted population can be found in Appendix S2.

In support of H1, greater news consumption was found to be associated with greater interest in sea turtle news (H1a), greater risk perceptions of sea turtle population status (H1b), and greater self-reported knowledge of sea turtles (H1c; Table 2). Greater news consumption was not found to be associated with greater risk perceptions of overall threat, or individual sea turtle threat type across all seven hazard types (Table 2). In general, participants ranked pollution as one of the threat types most

hazardous to sea turtles ($M = 3.09$, *Median* = 3, $SD = 1.76$, range = 1 (high) to 7 (low); Figure 2), and also reported pollution as a greater threat than all other hazard types (Appendix S2).

Greater interest in sea turtle news and greater sea turtle risk perceptions, measured by risk perceptions of overall threat and sea turtle population status, were all found to be associated with greater information-seeking behavior, supporting H2 (Table 3). In addition, greater self-reported knowledge was also associated with greater information-seeking behavior (RQ3; Table 3), although in general, there were overall low levels of knowledge ($M = 2.15$, $SD = 0.03$, range = 1 [low] to 5 [high]) and information-seeking behavior (~10% of the participants clicked on the link for more information). While risk perceptions of population status moderated the relationship between knowledge and information-seeking behavior, risk perceptions of overall threat did not (H3; Table 3). At low levels of risk perceptions of sea turtle population status, those with low knowledge of sea turtles were less interested in learning more about their conservation, whereas those with higher levels of knowledge were more interested. Conversely, at high levels of risk perceptions, individuals with lower levels of knowledge were interested in learning more, while those with higher levels of knowledge were less interested (Figure 3).

**TABLE 1** Descriptive statistics on participants' reported main sources of news about ocean issues (n = number reported, % = percentage of survey group reported)

| Main sources of news about ocean issues | n | % |
|---|---|---|
| Newspaper/magazines | 323 | 32 |
| Internet | 662 | 65 |
| Social Media | 323 | 32 |
| Books | 102 | 10 |
| Television | 671 | 66 |
| Radio/podcasts | 147 | 14 |
| Family and friends | 202 | 20 |
| Scientific publications | 166 | 16 |
| Environmental organizations | 199 | 19 |
| Other | 14 | 1.4 |

*Note*: Participants were asked to check all that apply and were able to indicate multiple options. "Other" included responses related to travel, school, Netflix, documentaries, National Geographic, the professional Association of Diving Instructors, "conversations with Native people", and participation in beach clean-up events. One hundred and forty participants declined to answer this question (N = 1022).

## 6 | DISCUSSION

Ocean news consumption was associated with interest, risk perceptions, and knowledge about sea turtles and their conservation, which were ultimately associated with more information-seeking behavior. Although news consumption was not associated with risk perception regarding individual hazard types facing sea turtle populations, individuals generally ranked pollution as one of the top hazards facing sea turtle populations and found it more hazardous than all other threat types. Importantly, our results improve understanding of how members of the coastal public learn about sea turtle issues, as well as highlights how environmental educators and other

**TABLE 2** OLS regression results: Interest in sea turtle news, risk perceptions of population status, self-reported knowledge, risk perceptions of overall threat and individual sea turtle threat type predicted by frequency of ocean news consumption[a]

| | Variable: Frequency of ocean news consumption | | | | | |
|---|---|---|---|---|---|---|
| **Outcome** | ***β*** | **SE** | ***p*** | **95% CI** | | ***f*²** |
| Interest in sea turtle news | **0.44** | **0.06** | **.00** | **0.31** | **0.56** | **0.04** |
| Risk perceptions: Population status | **0.28** | **0.08** | **.00** | **0.13** | **0.43** | — |
| Self-reported knowledge | **0.28** | **0.05** | **.00** | **0.17** | **0.38** | **0.02** |
| Risk perceptions: Overall threat | 0.07 | 0.04 | .10 | −0.01 | 0.16 | — |
| Pollution | 0.03 | 0.07 | .69 | −0.11 | 0.16 | — |
| Fishing bycatch | 0.03 | 0.07 | .70 | −0.11 | 0.16 | — |
| Habitat alterations | 0.14 | 0.08 | .07 | −0.01 | 0.30 | — |
| Weather and climate | 0.06 | 0.06 | .32 | −0.06 | 0.18 | — |
| Non-fishing human interactions | 0.13 | 0.08 | .09 | −0.02 | 0.27 | — |
| Construction | 0.07 | 0.07 | .32 | −0.07 | 0.21 | — |
| Species interactions | 0.01 | 0.05 | .81 | −0.09 | 0.12 | — |

*Note*: Bolded values indicate a *p*-value of .05 or less.

[a]Abbreviations: β, standardized regression weight; $f^2$, partial (Cohen's) $f^2$ (only partial $f^2$ effect sizes of at least 0.02 are displayed). See Appendix S2 for full models with control variables.

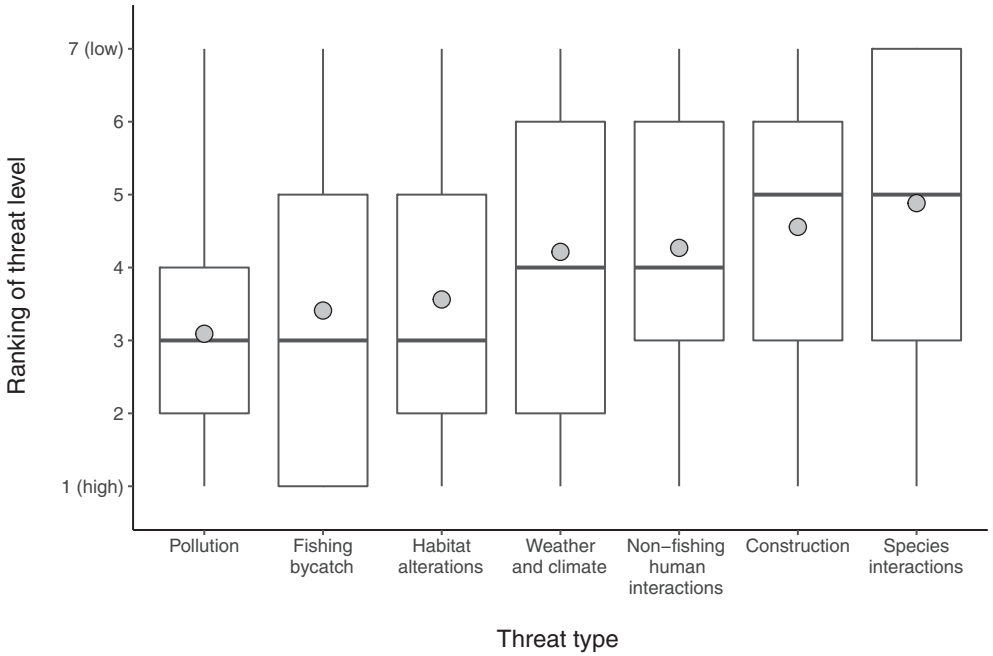


**FIGURE 2** Boxplot depicting ranking of threat types in terms of hazardous level to sea turtles (1 = most hazardous, 7 = least hazardous). Gray dot represents mean

**TABLE 3** Binary logistic regression results: Information-seeking behavior predicted by (1) interest in sea turtle news, risk perceptions (measured by overall threat and population status), and self-reported knowledge, as well as the interaction between knowledge and (2) risk perceptions of overall threat and (3) risk perceptions of population status[a]

| | **Information-seeking behavior** | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **1** | | | | **2** | | | | **3** | | | |
| Variables | OR | *p* | 95% CI | | OR | *p* | 95% CI | | OR | *p* | 95% CI | |
| Interest in sea turtle news | **2.83** | **.00** | **1.88** | **4.27** | | | | | | | | |
| Risk perceptions: Overall threat | **2.06** | **.02** | **1.10** | **3.85** | **8.17** | **.01** | **1.51** | **44.14** | **5.50** | **.00** | **1.78** | **16.99** |
| Risk perceptions: Population status | **1.61** | **.01** | **1.15** | **2.25** | | | | | | | | |
| Knowledge | **1.69** | **.03** | **1.04** | **2.76** | **22.39** | **.04** | **1.18** | **425.77** | **13.32** | **.02** | **1.50** | **117.98** |
| Knowledge × risk-perceptions of overall threat | | | | | 0.54 | .07 | 0.27 | 1.06 | | | | |
| Knowledge × risk-perceptions of population status | | | | | | | | | **0.57** | **.03** | **0.34** | **0.96** |

*Note*: Bolded values indicate a p-value of .05 or less.
[a]Abbreviations: OR, odd's ratio. See Appendix S2 for full models with control variables.

conservation stakeholders can use the news media as a public communication tool.

We found that ocean news consumption was associated with interest in, risk perceptions of population status, and knowledge about sea turtles and their conservation. The association between ocean news consumption and interest specifically in sea turtle news is unsurprising given the charismatic nature of these animals (Liordos et al., 2017) and public appeal toward wildlife. In a study of college-aged students in an introductory oceanography class, marine life was one of the most popular topics referenced in essays explaining why students were interested in the ocean (Cudaback, 2006). Over half of the students indicated that they wanted to learn more about marine life, and the majority were interested in the organism-level scale, rather than ecosystems (Cudaback, 2006). Similarly, public school students in Canada were also found to overwhelmingly show the most interest in ocean topics related to marine life (Guest et al., 2015). Thus, our results support the notion that sea turtle related articles may capture the specific interest of casual ocean news consumers. Importantly, educators can take advantage of this public interest to communicate in ways that encourage conservation and support of these endangered animals.

Ocean news consumption was also found to be associated with risk perceptions of population status and

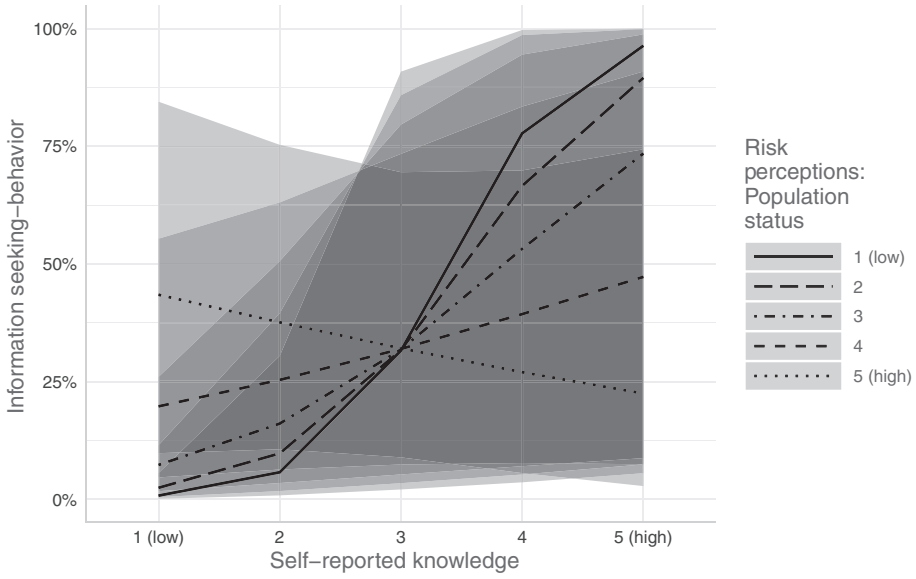


**FIGURE 3** Predictive probabilities of information-seeking behavior by self-reported knowledge and risk perceptions of population status. Predictive probabilities computed using ggPredict() and shaded areas represent 95% confidence intervals

knowledge of sea turtles and their conservation, which may have important implications for how individuals engage with environmental issues. Studies have shown that individuals with higher knowledge of marine animals, such as sharks and dolphins, are more likely to support their conservation and less likely to engage in potentially harmful behavior (Barney et al., 2005; O'Bryhim, 2009). This may have practical implications for conservation efforts, and our results suggest that individuals may be learning about sea turtles to some degree through news consumption. However, we found overall low self-reported knowledge of sea turtles, which further underscores the potential in using the media as an informal environmental education avenue where interested members of the public can learn more about these animals. The news was also found to be related to how threatened individuals thought sea turtles were. Courchamp et al. (2018) found that the public is often unaware that charismatic animals are threatened with extinction, with a few exceptions, including pandas, tigers, and polar bears. The authors note this may be due to the elevated communication efforts regaring these species, which may have impacted public conservation status awareness (Courchamp et al., 2018). This supports the association found between ocean news consumption and risk perception of sea turtle population status, and further underscores the potential of the news media as a conservation communication resource.

Although news consumption was not found to be associated with risk perceptions of threat types, pollution was ranked as the top sea turtle threat and perceived to be a greater hazard than the other six threat types. The non-association between risk perceptions of threat type and news consumption indicates that members of the public may be learning about a broad range of threats from other sources besides the news. While studies suggest that the way wildlife is portrayed through news media outlets is related to one's conservation awareness (Jacobson et al., 2012; Muter et al., 2013), people may also learn about animals through personal experiences (Soga et al., 2016) and informal education settings, such as aquariums (Adelman et al., 2010). The high perception of pollution as a top threat was expected due to the strong association of sea turtles as an anti-plastics icon (Chiu, 2019) as well as the elevated news coverage of pollution as a sea turtle threat (Santos & Crowder, 2021). Santos and Crowder (2021) conducted a media study analysis of online news articles about sea turtles from 2010 to 2020 and found that of sea turtle-related articles that discussed sea turtle threats, pollution and non-fishing resource use were the threats most often mentioned. In addition, they note that the disproportionately large number of articles about pollution as a sea turtle hazard has increased in recent years. Our results illustrate that people are also perceiving pollution as one of the top sea turtle threats, suggesting that they may be learning about sea turtle hazards from the news to some degree.

Hazards facing sea turtles can be complex and vary based on region, season, and species (Wallace et al., 2011). Although pollution can be indeed be hazardous to sea turtles, such as through the ingestion of marine plastics (Wilcox et al., 2018), fishing bycatch is well accepted within scientific communities as one of the top oceanic threats impacting sea turtle populations worldwide (Donlan et al., 2010; Wallace et al., 2011). In this study region in particular, experts have ranked bycatch as the top threat facing sea turtles in both the

Western Atlantic and Eastern Pacific oceanic areas, with coastal development tied as the leading threat in the Western Atlantic, followed second by pollution in both areas (Donlan et al., 2010). Thousands of sea turtles die globally through interactions with fishing gear (Lewison, Crowder, et al., 2004), which often targets later-aged individuals where mortality can have greater population-level impacts (Crowder et al., 1994). Research suggests that the public is highly concerned about ocean pollution, which may misalign with scientific priorities (Gelcich et al., 2014; Lotze et al., 2018; Ressurreição et al., 2012). Pollution has also been noted as a top public concern posing harm for other marine species, such as cetaceans (Howard & Parsons, 2006). Our results suggest that members of the public may face similar perceptions about pollution as a sea turtle hazard, given that participants ranked it as the highest threat facing sea turtle populations. Importantly, this may misalign with scientific priorities of hazards facing turtles in these regions (Donlan et al., 2010). A misinformed view of the types of hazards that are most pressing can be problematic if it misguides public attention and potential environmental actions away from those threats where increased awareness would be most worthwhile.

In addition, sea turtle interest, risk perception, and knowledge were found to be associated with ocean news consumption and actual information-seeking behavior. This suggests that the news media may indirectly be associated with whether an individual engages in learning more about species-specific conservation issues. Importantly, information-seeking behavior has also been linked to support for environmental policies about climate change (Yang et al., 2014). It has also been found to mediate the relationship between recycling intention and behavior (Rosenthal, 2018). Our results underscore the importance of these factors, including interest, risk perceptions, and knowledge, in terms of encouraging people to want to learn more, which may be an important precursor to pro-environmental behavior and support.

Our results also suggest that risk perceptions of population status moderate the relationship between knowledge and information-seeking behavior, which can have important implications for environmental communications. Individuals with higher risk perceptions of population status and higher self-reported knowledge of sea turtles are overall less likely to information-seek, possibly because they may already believe that they know a lot on this topic and thus do not need more information. Conversely, individuals with lower risk perceptions of population status and higher self-reported knowledge are more likely to seek information. It is possible that these individuals are seeking information for reasons other than learning more about how sea turtles are threatened and ways to support conservation; indeed, the bulk of individuals may not really be thinking about threats to sea turtles in particular, but are interested in knowing more about them more generally. Overall, this study suggests that individuals may not know as much about sea turtles as they think they do, and thus, creating coupled, targeted messages that appeal to the public curiosity and interest in sea turtles along with scientifically accurate information on their conservation may result in individuals seeking out additional information on these animals or learning more when they do.

## 6.1 | Limitations

One limitation of this study was that knowledge was assessed by subjective, self-reported knowledge, rather than objective knowledge. Although both indicators tend to be correlated (Carlson et al., 2009; Feick et al., 1992) and used in public perception research, it is possible that an individual's perception of how much they know (subjective knowledge) does not reflect their true knowledge, particularly about pro-environmental behaviors (Ellen, 1994). Therefore, it is possible that our results would differ with the use of objective knowledge as an indicator, although our findings still align with previous studies that found that members of the public generally have low levels of both subjective and objective knowledge about ocean issues (Steel et al., 2005). Future research could also investigate how casual members of the public may passively learn about these animals from other sources besides news media outlets, such as movies and documentaries, as well as look for regional or state-based differences in knowledge, risk perceptions, and interest. A second limitation is our measure of news consumption regarding "ocean issues" was vague. However, initial survey piloting suggested that asking participants about sea turtle news consumption was too narrow and difficult to answer, so we intentionally chose to survey participants about news media consumption on "ocean issues" more vaguely. Future studies could have participants self-define what they mean by ocean issues to better understand how this concept was individually conceptualized. A third limitation is that one measure of risk perception ("In general, how threatened do you think sea turtle populations are by human and environmental activities?") used in this study is double-barreled in construction, and may have elicited perceptions about responsibility ascription rather than risk perception. However, this question was found to be moderately associated with other risk perceptions questions, suggesting that it may still capture participants' risk perceptions.

Future research could look at these two activities—human and environmental—separately, as individuals may hold different perceptions about the impacts of anthropogenic versus natural threats. Additional research could also ask these questions in multiple different ways, as well as to further investigate ascription of responsibility for these hazards versus risk perception of their harm. Finally, a single-item dichotomous measure was used to assess information-seeking behavior, offering insight into actual rather than reported or intended behavior. Future studies could extend this approach by measuring behavior using multiple items and considering other dimensions of pro-environmental behavior beyond information-seeking (e.g., willingness to donate money, sign-up for conservation relevant listservs, volunteer).

## 7 | CONCLUSION

Although the public is generally interested in and concerned about the marine environment, they often lack robust understanding of the threats it faces and conservation actions that can be taken to preserve it (Gelcich et al., 2014). The results of our study suggest that media consumption is one important avenue that relates to interest, perceptions, and knowledge about sea turtle issues. Risk perceptions also moderate the relationship between news consumption and information seeking behavior on sea turtle conservation issues, suggesting that educators should consider coupling information about sea turtles with their risks for possibly more effective messaging. Although people may generally be aware of threats to sea turtles, only attending to certain types of information about these animals may not educate them on their conservation as effectively. These findings underscore the important use and potential of the news media as a public communication tool by environmental educators and other conservation stakeholders, highlighting how targeted, coupled messaging may motivate further information-seeking.

## ACKNOWLEDGMENTS

The authors would like to gratefully thank the Behavioral Decisions and the Environment Group at Stanford University for feedback throughout the project, as well as two anonymous reviewers for comments on earlier versions of the manuscript. Support was provided from Stanford University's Precourt Institute for Energy as well as the Emmett Interdisciplinary Program in Environment and Resources.

## CONFLICT OF INTEREST

The authors declare no conflicts of interest.

## AUTHOR CONTRIBUTION

Both authors were involved in research conceptualization and survey design. Bianca S. Santos led the data analysis and writing, to which Gabrielle Wong-Parodi contributed to extensively.

## DATA AVAILABILITY STATEMENT

Deidentified survey responses used in this study is available upon request.

## ETHICS STATEMENT

Survey instruments and data collection for this study were approved by Stanford University's Institutional Review Board (Protocol #56486) to protect the rights and welfare of human research subjects.

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## SUPPORTING INFORMATION

Additional supporting information may be found in the online version of the article at the publisher's website.

**How to cite this article:** Santos, B. S., & Wong-Parodi, G. (2022). News coverage of ocean issues and its impacts on public perceptions and conservation information-seeking of sea turtles. *Conservation Science and Practice*, *4*(4), e12650. https://doi.org/10.1111/csp2.12650