2025

Perceptions & Audiences of the Marine Reserves

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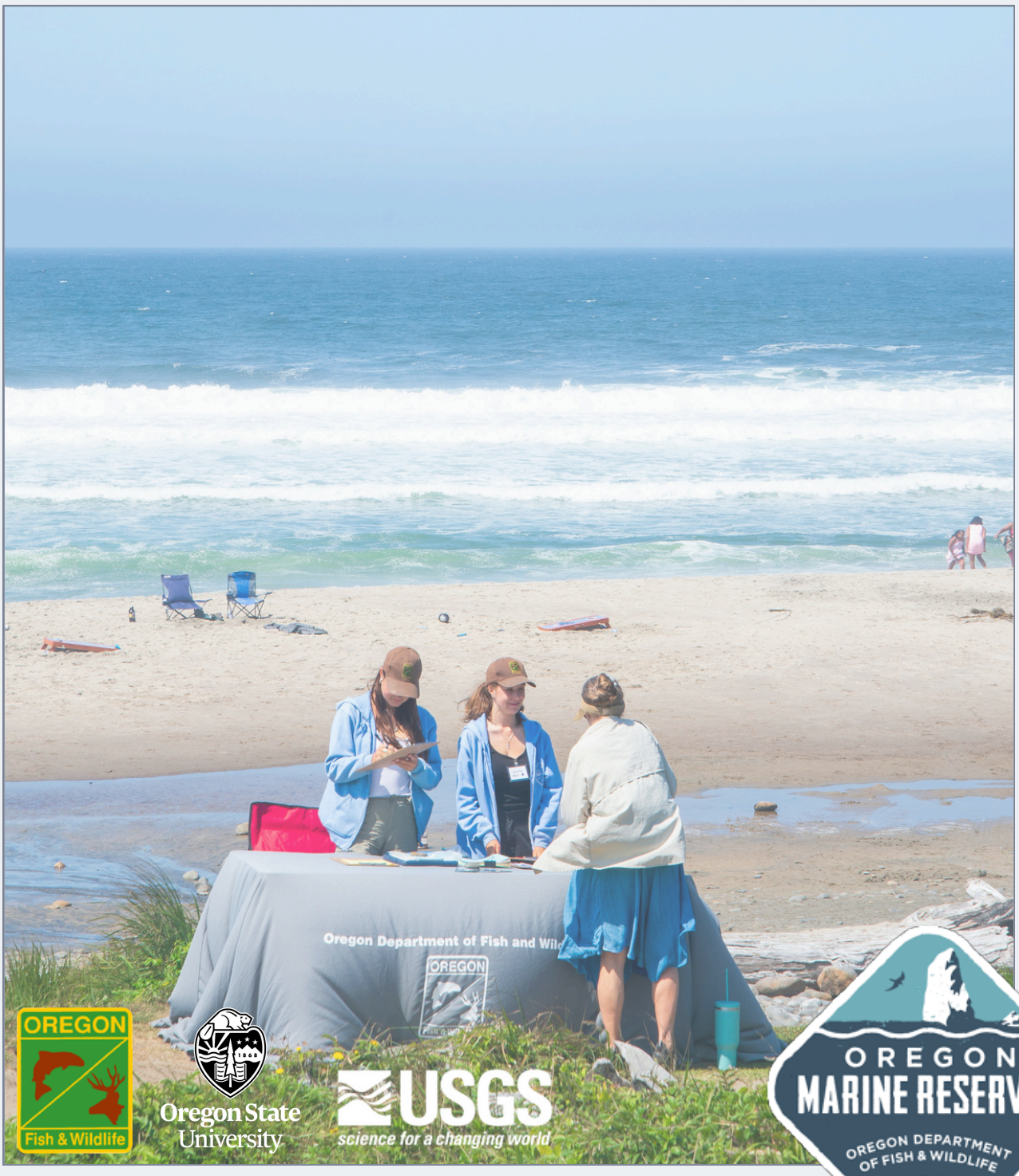
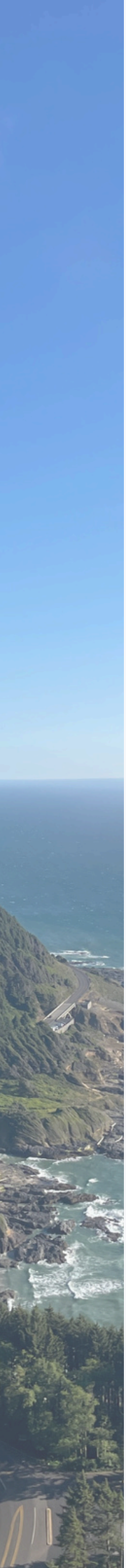
Final report conducted for and in cooperation with
Oregon Department of Fish and Wildlife





Contents

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Executive Summary

This report presents the findings of a collaborative project between the Oregon Department of Fish and Wildlife (ODFW), Oregon State University (OSU), and the U.S. Geological Survey (USGS) to evaluate public perceptions in Oregon of ocean acidification, engagement in climate action, and how these may be related to perceptions of the marine reserves.

Through a two-pronged survey approach administered in 2023, we found:

Online Survey

n = 1,414 Oregon residents

58% SUPPORT THE MARINE RESERVES

34% FEEL AT LEAST 'SLIGHTLY' KNOWLEDGEABLE ABOUT THE MARINE RESERVES

27% KNOWLEDGEABLE OF THE AGENCY RESPONSIBLE FOR THE MARINE RESERVES

Intercept Survey

n = 2,451 Oregon coast visitors

62% SUPPORT THE MARINE RESERVES

58% FEEL AT LEAST 'SLIGHTLY' KNOWLEDGEABLE ABOUT THE MARINE RESERVES

26% KNOWLEDGEABLE OF THE CLOSEST MARINE RESERVE TO THEIR LOCATION

Based on coastal visitors' perceptions of the marine reserves and their level of personal connection with the coast, we characterized visitors into four groups with similar responses:

35.7%

INDIFFERENT ROCKFISH

Least engaged with marine reserves & lowest coastal connection

28.6%

AGREEABLE ANEMONES

Strongest coastal connection & strongest support for marine reserves but low knowledge

11.8%

INTERESTED OYSTERCATCHERS

High self-assessed knowledge of marine reserves but short of regional knowledge

23.8%

ENGAGED SEA STARS

Most engaged with the marine reserves & strong coastal connection

Each of the four groups represents a distinct combination of perceptions regarding the marine reserves, thereby revealing four "audiences" with whom the ODFW Marine Reserves team interacts. The audiences also differed in their perceptions about ocean acidification and their engagement in climate actions. These distinctions and differences imply that **the communication goals and strategies of the ODFW Marine Reserves team should recognize and plan for these different target audiences**. Furthermore, the spatial distribution of each audience varied across specific sites along the Oregon coast, suggesting that **communication efforts could be tailored to the predominant audience at each location**.

Background

Since its establishment in 2009, the ODFW Marine Reserves team has conducted extensive human dimensions research to gauge public knowledge and attitudes about the marine reserves. This research has informed management of and communication surrounding the reserves by revealing trends in public attitudes and perceptions. More recently, the ODFW Marine Reserves team worked with OSU and USGS researchers to understand awareness of and actions applied to reduce ocean acidification—a considerable threat in Oregon. These efforts were in line with the Ocean Acidification and Hypoxia Plan established by the State of Oregon in 2019, which included "the expansion of public awareness" as one of its five areas for action (Walker, 2019). The results of the ocean acidification components of this project are available separately in two open access peer-reviewed journals (see "Additional Resources" on page 16).

Oregon, and specifically its coast, is a compelling place for public outreach efforts regarding climate change issues, such as ocean acidification, and associated marine conservation opportunities. National survey research estimates indicate 67% of Oregon residents are worried about climate change (Marlon et al., 2022) and statewide survey research indicates that a majority of residents are concerned about ocean issues in Oregon (ODFW, 2020). Additionally, the Oregon coast is a hotspot for ocean-related tourism, where an estimated 17.5 million people visited overnight in 2022 (Dean Runyan Associates, 2023). Resident concerns about climate change and ocean health coupled with large numbers of coastal visitors make the Oregon coast an opportunistic location for action-oriented communication around ocean issues.

The ODFW Marine Reserves team and its affiliated "community teams"—non-profit organizations of engaged members of the community who support and assist with their local marine reserve—frequently perform outreach efforts up and down the Oregon coast to boost public understanding of ocean ecosystems, ocean change, and marine reserve management. Through these efforts, staff and volunteers interact with people who have different relationships with the marine reserves—from community members whose long-standing connection with the Oregon coast predates the establishment of the marine reserves to out-of-state visitors exploring the Oregon coast for the first time. Regular monitoring is needed to determine how members of the public think and feel about the marine reserves and how the ODFW Marine Reserves team can best respond in the public interest to ocean and climate change threats.

This report describes the results of a collaborative effort between the ODFW Marine Reserves team, OSU, and USGS to understand current perceptions (awareness, knowledge, and opinions) of the marine reserves and how these relate to ocean acidification perceptions and climate action engagement. We present data from surveys conducted in 2023 on Oregon residents' and coastal visitors' perceptions of the marine reserves system, and describe four "audiences" (i.e., clusters of people) from those perceptions.

Methods

Data were collected online and in-person via a two-pronged survey approach administered in 2023.

Online Survey

The first survey was distributed via the online survey platform Qualtrics to a panel of Oregon residents from May to June, 2023. The 1,414 respondents were geographically representative of residents in the state based on Census population data for four broad regions: Respondents resided in coastal Oregon (n = 110), Willamette Valley (n = 899), southern Oregon (n = 163), and eastern Oregon (n = 242). Survey respondents were asked questions regarding their perceptions of the marine reserves, ocean change and ocean acidification, as well as their engagement in climate actions.

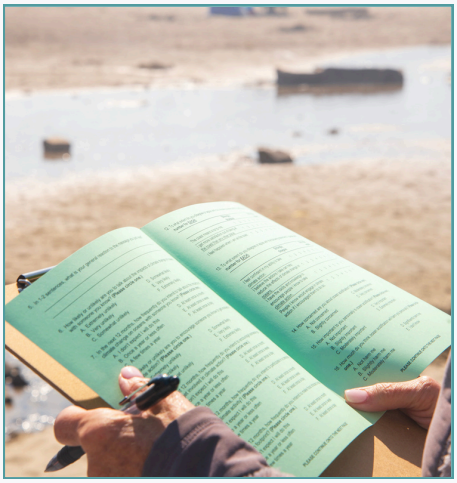
Intercept Survey

The second survey was administered in-person to visitors at 23 sample sites along a 283-mile stretch of the Oregon coast from June to August, 2023. The survey team approached an estimated 4,327 total visitors on the Oregon coast and received 2,451 responses from eligible respondents (i.e., over 18 years old and consented to participate), yielding a 56.8% response rate after accounting for 12 ineligible respondents. A systematic rotation of the sample sites by time of day, day of the week, and location was used to control visitor characteristics relative to visiting day, time, and location (ODFW, 2017). This sample was intended to represent a population the ODFW Marine Reserves team regularly interacts with. The survey was an experiment testing the association between different messages about ocean change (three experimental and one control) and respondents' post-message climate action intentions. In addition to their climate actions, respondents were asked questions regarding their knowledge and opinion of the marine reserves and their perceptions of ocean acidification.

Variables Measured

Questions pertaining to the marine reserves were drawn from previous ODFW intercept surveys. Both our online survey and intercept survey asked about participants' self-assessed knowledge, regional knowledge, and opinion about the marine reserves. The online survey included additional questions on participants' awareness of the marine reserves in Oregon and their factual knowledge about the marine reserves.

Both surveys measured participants' "connection with the coast" through a composite of questions assessing place attachment, place identity, and place dependence. The two surveys also measured concern, personal importance, perceived personal risk, and perceived risk to future generations regarding ocean acidification. Finally, participants reported their past and intended future engagement in four climate actions. The climate actions ranged in their level of social influence, from individual to interpersonal to community-based actions. The Appendix at the end of this report contains specific wording of questions and response options.



Perceptions of the Marine Reserves

1 | Opinion

Respondents' support for the marine reserves was similar in the intercept survey and online survey (Figure 1). Less than 1% of respondents on both surveys opposed the marine reserves. Most respondents supported the marine reserves, with a slightly higher proportion of the intercept survey sample expressing support compared to the online survey sample.

In turn, slightly more of the online sample has a neutral opinion than the intercept sample. These slight differences between survey results may be a consequence of the different sampling environments. ODFW Marine Reserves staff conducted the intercept survey. Those surveyed in-person may have felt inclined to express favorable opinions due to wanting to please the people surveying them.

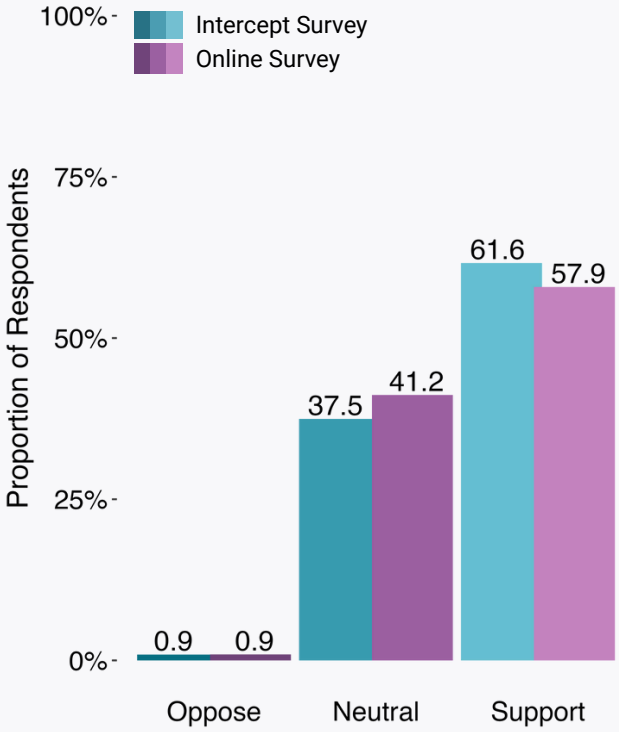


Figure 1. Proportion of responses to the question "What is your opinion of Oregon's marine reserves?

2 | Self-Assessed Knowledge

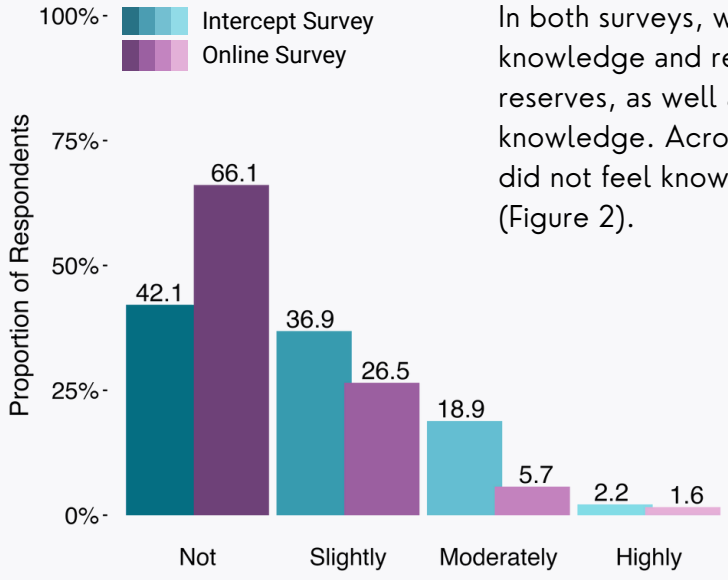


Figure 2. Proportion of survey responses to the question "How knowledgeable do you feel about Oregon's marine reserves?"

In both surveys, we assessed respondents' self-assessed knowledge and regional knowledge about the marine reserves, as well as the online survey respondents' factual knowledge. Across both surveys, respondents generally did not feel knowledgeable about the marine reserves (Figure 2).

A larger proportion of respondents in the online survey – which sampled only Oregon residents – felt that they were not knowledgeable about the topic of marine reserves (Online Survey: 66.1%; Intercept Survey: 42.1%). In turn, smaller proportions of respondents felt they were slightly, moderately, or highly knowledgeable compared to the intercept survey.

3 | Regional Knowledge

We used different questions to assess regional knowledge of marine reserves.

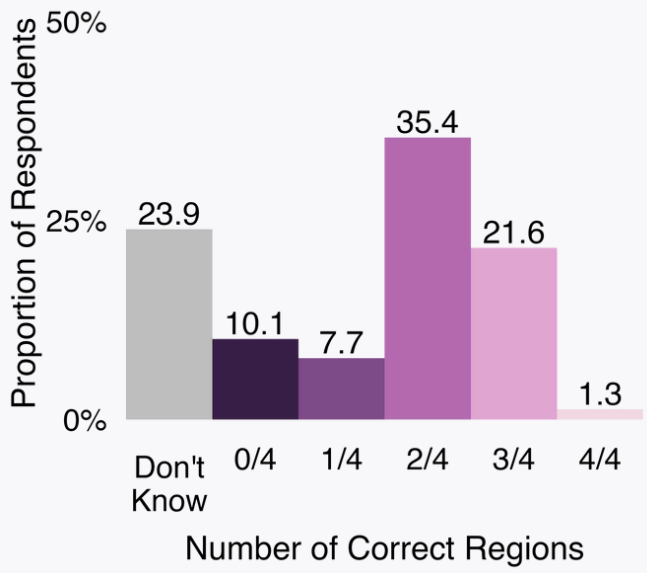


Figure 3. Online survey scores on the question: "*Referring to the map, select which region(s) in Oregon you think contain at least one marine reserve.*"

In the online survey, we provided a map of the Oregon coast with four boxed regions and asked participants to select the regions containing one or more marine reserves (see the map in the Online Survey Questionnaire Items section of the Appendix). Respondents were scored by the total number of regions they got correct out of four (i.e., correctly selecting the three regions that contained a marine reserve, and not selecting the one region that did not contain a marine reserve).

Most respondents got two or three of the four regions correct, or selected "Don't Know" (Figure 3). Only 1% identified all four correct regions.

In the intercept survey, coastal visitors were asked to select the marine reserve that was closest to their current location.

Most respondents said they did not know which marine reserve was closest. Aside from those who selected "Don't Know," over twice as many respondents correctly selected the closest marine reserve than those who incorrectly selected a different marine reserve (Figure 4).

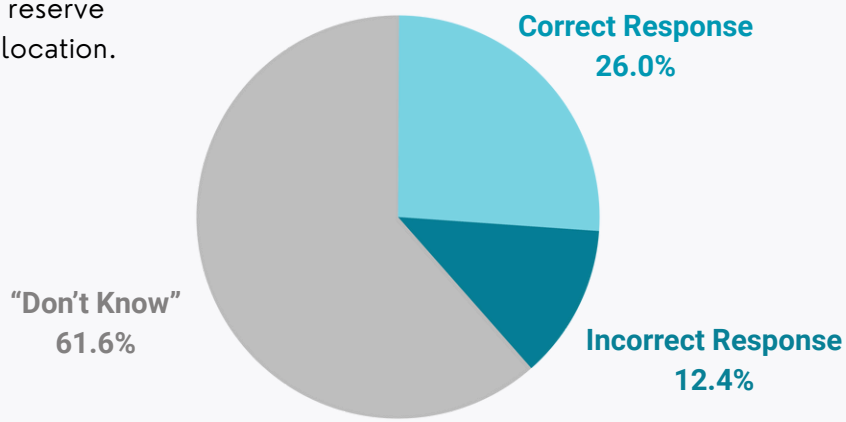


Figure 4. Regional knowledge of the marine reserves among the intercept survey sample. The question asked, "*Which marine reserve in Oregon are you closest to right now?*" and included response options for each marine reserve, "*don't know*," and "*other*." "*Other*" was coded as an incorrect response.

Results on this page reflect only the online survey, which included two variables not assessed in the intercept survey.

4 | Awareness

We first assessed the online survey respondents' awareness of the marine reserves. This question was asked prior to all other questions about the marine reserves to avoid bias from exposure to later marine reserve questions. Half of respondents were aware of the marine reserves, while just under 50% said they "Don't Know," and only 1.2% incorrectly said that Oregon does not have marine reserves (Figure 5).

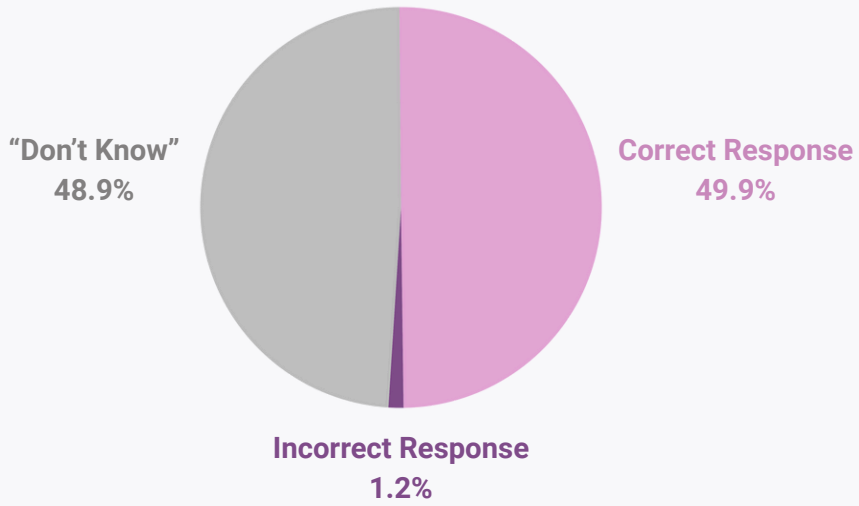


Figure 5. Online survey responses to the question, "*Does Oregon have marine reserves?*"

5 | Factual Knowledge

Finally, we assessed respondents' factual knowledge by asking them to select the agency responsible for the marine reserves. Only 27% correctly selected the Oregon Department of Fish and Wildlife as the agency responsible (Figure 6). Nearly three-quarters of respondents did not answer correctly, with 46% incorrectly selecting a different agency or organization and 26% selecting "Don't Know."

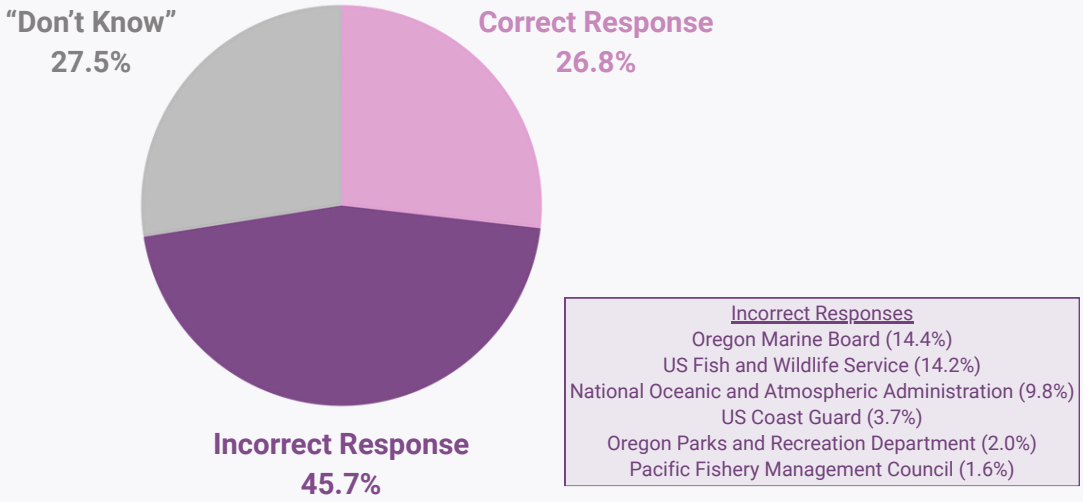
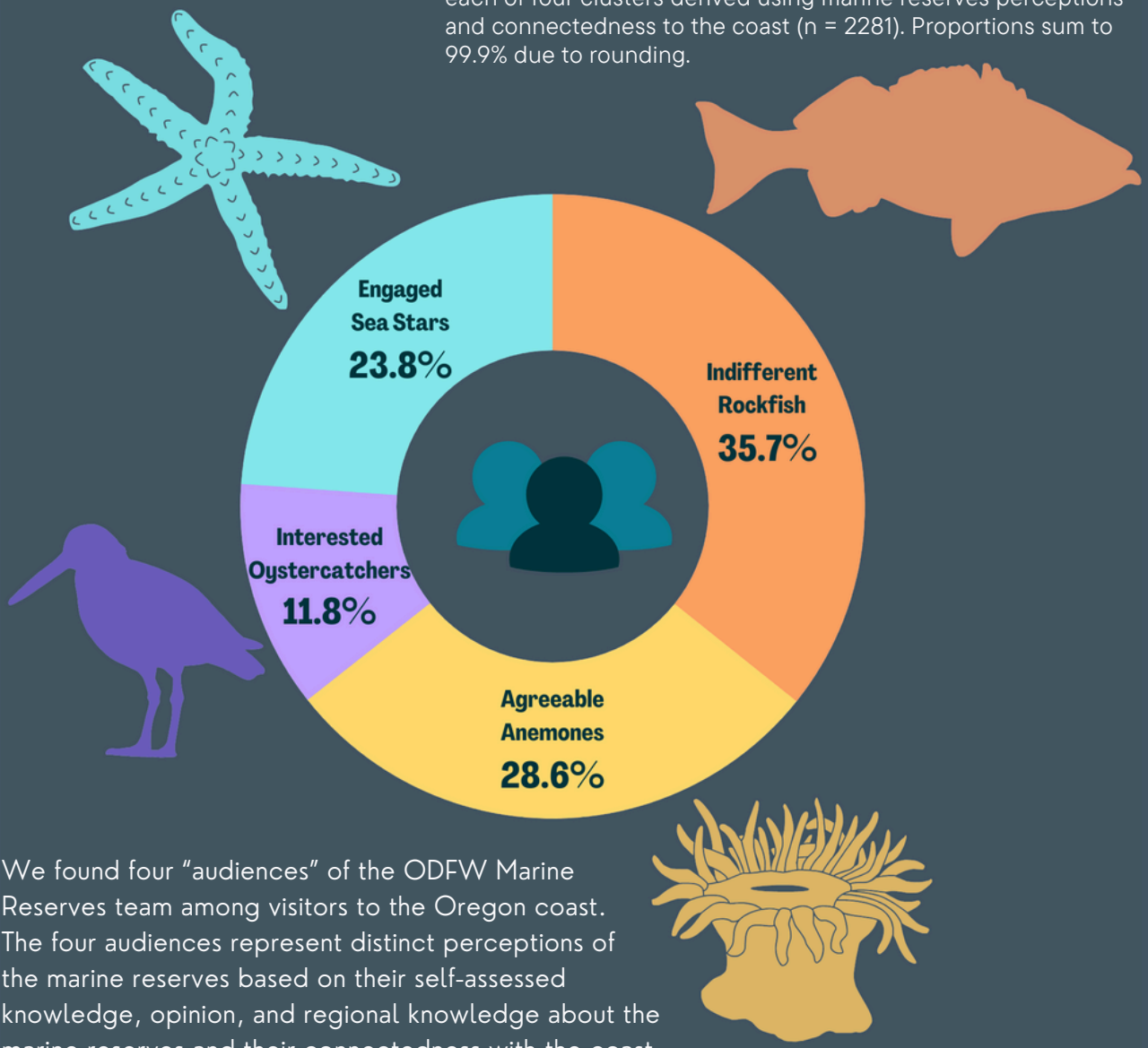


Figure 6. Online survey responses to the question, "*What one agency or organization do you think is currently responsible for marine reserves in Oregon?*"

Four Audiences of Coastal Visitors

Figure 7. Proportion of the intercept survey sample belonging to each of four clusters derived using marine reserves perceptions and connectedness to the coast (n = 2281). Proportions sum to 99.9% due to rounding.



We found four "audiences" of the ODFW Marine Reserves team among visitors to the Oregon coast. The four audiences represent distinct perceptions of the marine reserves based on their self-assessed knowledge, opinion, and regional knowledge about the marine reserves and their connectedness with the coast (Table 1). Further analyses revealed which specific audiences differed on each variable (Appendix Table A1), providing information on the characteristics that make one audience distinct from another. Auxiliary details of our questionnaire items and measures, cluster analyses, and results are described in the Appendix.

The emergence of the four audiences within a previously indiscernible population of coastal visitors provides insights to guide more effective communication efforts tailored to each audience's specific needs. We named each audience after an organism in the marine reserves to serve as a memorable reference and to help communicators more easily conceptualize and differentiate the audiences. The **Indifferent Rockfish** constituted the largest proportion of our sample of visitors to the Oregon coast (35.7%; Figure 7), followed by **Agreeable Anemones** (28.6%), **Engaged Sea Stars** (23.8%), and **Interested Oystercatchers** composing the smallest proportion (11.8%).

Table 1. Defining characteristics of the four audiences of coastal visitors. The values displayed for numerical variables (i.e., marine reserves self-assessed knowledge, marine reserves support, and connectedness to the coast) are each audience's average (i.e., mean) response on that survey question. Likewise, values for categorical variables (i.e., marine reserves regional knowledge) are each audience's most common response (i.e., mode).

	Indifferent Rockfish	**Agreeable Anemones**	**Interested Oystercatchers**	**Engaged Sea Stars**	Highest Possible Score
Marine Reserves Support	3.23 *"No opinion"* to *"Slightly"*	4.66 *"Slightly"* to *"Strongly"*	4.52 *"Slightly"* to *"Strongly"*	4.61 *"Slightly"* to *"Strongly"*	5 *"Strongly"*
Marine Reserves Self-Assessed Knowledge	1.14 *"Not"*	2.07 *"Slightly"*	2.23 *"Slightly"* to *"Moderately"*	2.23 *"Slightly"* to *"Moderately"*	4 *"Highly"*
Marine Reserves Regional Knowledge	2 *"Don't know"*	2 *"Don't know"*	0 *Incorrect Response*	1 *Correct Response*	
Coastal Connectedness	5.27	6.14	6.00	6.10	7 *"Strongly"*
n	815	653	269	544	
Within cluster error *	370.19	324.94	154.70	299.79	

***** The within cluster error is a measure for how well individuals within an audience resemble one another. Smaller values indicate closer resemblance within the audience. See the appendix for more information.

Audience 1 | Indifferent Rockfish (35.7%)

The Indifferent Rockfish had the lowest scores on the numerical variables informing the cluster analysis (Table 1). They reported to not be knowledgeable about the marine reserves (Mean = 1.1), mostly had no opinion about the marine reserves (Mean = 3.2), and did not know which marine reserve was closest (Mode = 2). The Indifferent Rockfish had the lowest connectedness with the coast relative to the other audiences (Mean = 5.3), although all four audiences scored highly on this variable. The Indifferent Rockfish were the largest audience overall (35.7%) and comprised the most out-of-state visitors (Table A2). **The Indifferent Rockfish responded as the least engaged with the marine reserves.**

Audience 2 | Agreeable Anemones (28.6%)

The Agreeable Anemones also did not know which marine reserve was closest (Mode = 2) but still felt slightly knowledgeable about the marine reserves (Mean = 2.1; Table 1). Despite their shortage of marine reserves knowledge, the Agreeable Anemones had the highest support for the marine reserves (Mean = 4.7) and highest connectedness to the coast (Mean = 6.1) across all four audiences. **At the surface, the Agreeable Anemones appear equivocal about the marine reserves; however even with their low knowledge, their high support may indicate a potential interest and opportunity for engagement.**

Audience 3 | Interested Oystercatchers (11.8%)

The Interested Oystercatchers had high support for the marine reserves (Mean = 4.5) and high connectedness to the coast (Mean = 6.0) but averaged lower on these variables compared to the Agreeable Anemones (Table 1). Still leaning toward only slightly knowledgeable, this audience reported higher self-assessed knowledge about the marine reserves (Mean = 2.2) than the previous audiences. Contrary to the Interested Oystercatchers' relatively high perceived knowledge, the entirety of this audience responded incorrectly to the regional knowledge question (Mode = 0). The Interested Oystercatchers had the highest ratio of Oregon residents compared to non-residents within the audience (Table A2). **The Interested Oystercatchers present moderate engagement with the marine reserves yet may not be as regionally knowledgeable as they perceive themselves to be.**

Audience 4 | Engaged Sea Stars (23.8%)

The Engaged Sea Stars scored highly or correctly on all four variables informing the audience analysis (Table 1). Their support for the marine reserves (Mean = 4.6) and connectedness to the coast (Mean = 6.1) sat between those of the Agreeable Anemones and the Interested Oystercatchers. The Engaged Sea Stars reported the same level of self-assessed knowledge about the marine reserves as the Interested Oystercatchers (Mean = 2.2). However, unlike the Interested Oystercatchers, all the Engaged Sea Stars correctly identified the closest marine reserve on the regional knowledge question (Mode = 1). **The Engaged Sea Stars emerge as the overall most involved with the marine reserves but might not recognize their own level of knowledge.**

The proportions of each audience varied by the site at which respondents were sampled (Figure 8). Specifically, sites that were located next to a marine reserve were more likely to have a higher proportion of Engaged Sea Stars and less likely to have Indifferent Rockfish. These differences were statistically significant ($X^2 = 149.6$, $p < .001$).

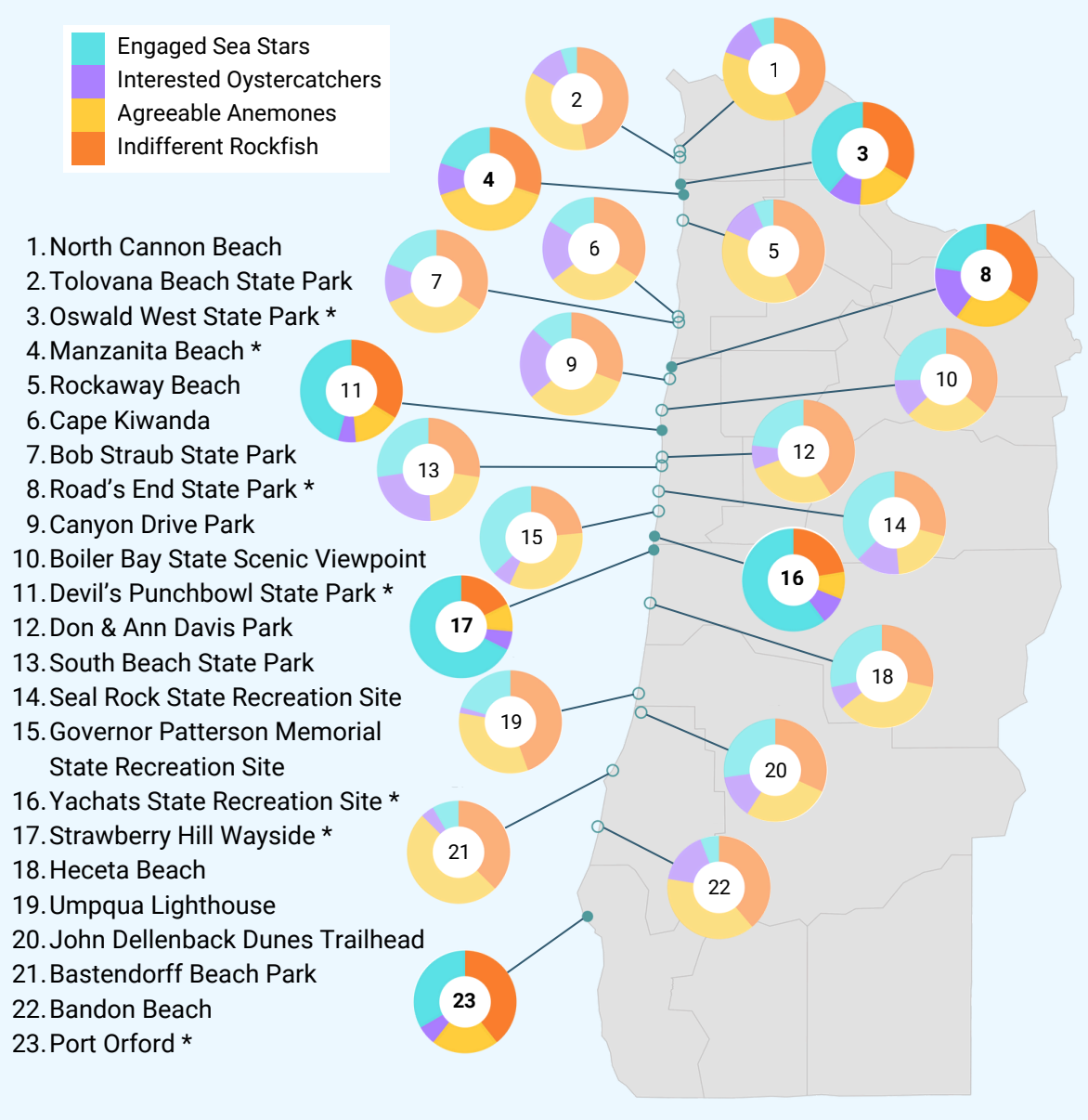


Figure 8. Proportion of audiences by sample site. Filled-in circles on the map and an asterisk by the site name indicate the site is located next to a marine reserve.

The different proportions of each audience across sites provides useful information for on-the-ground communicators affiliated with the marine reserves. For example, the marine reserves "community teams" – non-profit organizations of engaged members of the community who support and assist with their local marine reserve – frequently conduct public outreach along the Oregon coast. Depending on their outreach and engagement goals, these and similar groups who are interested in communication related to marine conservation could tailor their efforts to a specific audience of interest or to the most prevalent audience at a location of interest.

Climate Change Perceptions & Actions

Perceptions of Ocean Acidification

The marine reserve audiences differed in their levels of concern (Figure 9A), personal importance (Figure 9B), perceived personal risk (Figure 9C), and perceived future risk of ocean acidification (Figure 9D).

Across the four measures, the Indifferent Rockfish had the lowest perceptions of ocean acidification. A majority of those who were unconcerned about ocean acidification and did not find it important belonged to the Indifferent Rockfish. Further, most of the respondents who did not think or did not know how ocean acidification would harm them or future generations of people also belonged to the Indifferent Rockfish.

As concern, personal importance, and risk perceptions increased, so did the proportions of Engaged Sea Stars and Agreeable Anemones. Notably, the proportion of Interested Oystercatchers rose with each increasing response level but dipped slightly at the highest level on each item.

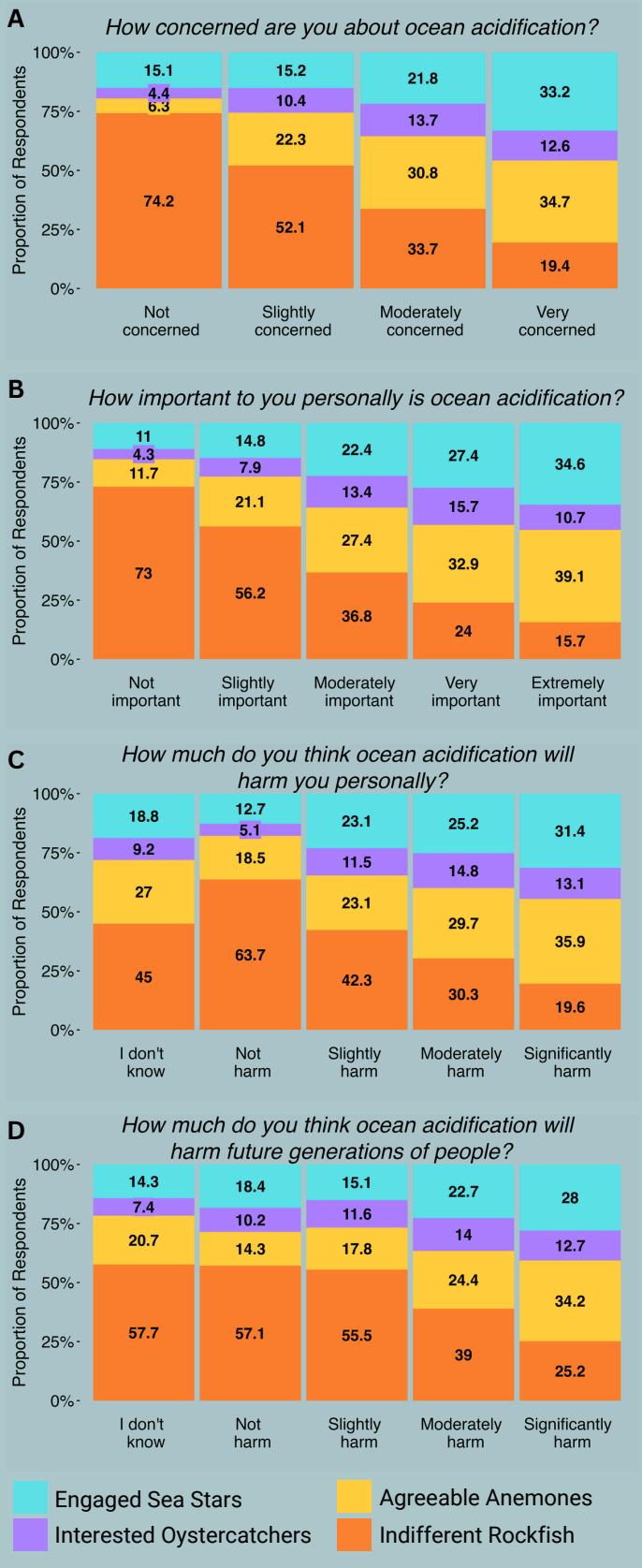


Figure 9. Responses to the ocean acidifications perceptions items, grouped by marine reserve audience.

Climate Actions

Averages of past and intended future engagement in climate actions exhibit patterns between and within marine reserve audiences (Figure 10). Between audiences, Indifferent Rockfish had markedly lower levels of past engagement and intended future engagement on all four climate actions compared to the other audiences, who were relatively close in their averages. Within each audience, both past engagement and intended future engagement decreased as the action became more public-sphere (i.e., socially-influential actions that are often taken with other people).

When comparing each audiences' reported previous climate actions to their intentions of taking the same actions in the future, all four audiences exhibit a drop in their intended frequency of interpersonal communication about ocean change (i.e., talking to others about ocean change). At the same time, all four audiences exhibit a slight increase in their intentions to relationally organize (i.e., encourage others to take action) and to engage in a community-organized climate activity compared to their past frequency of those actions. These patterns may indicate a shift in people's desires from talking about ocean change within their small social circles to instead engaging in more socially-impactful actions (e.g., participating in a climate rally or a sustainability club).

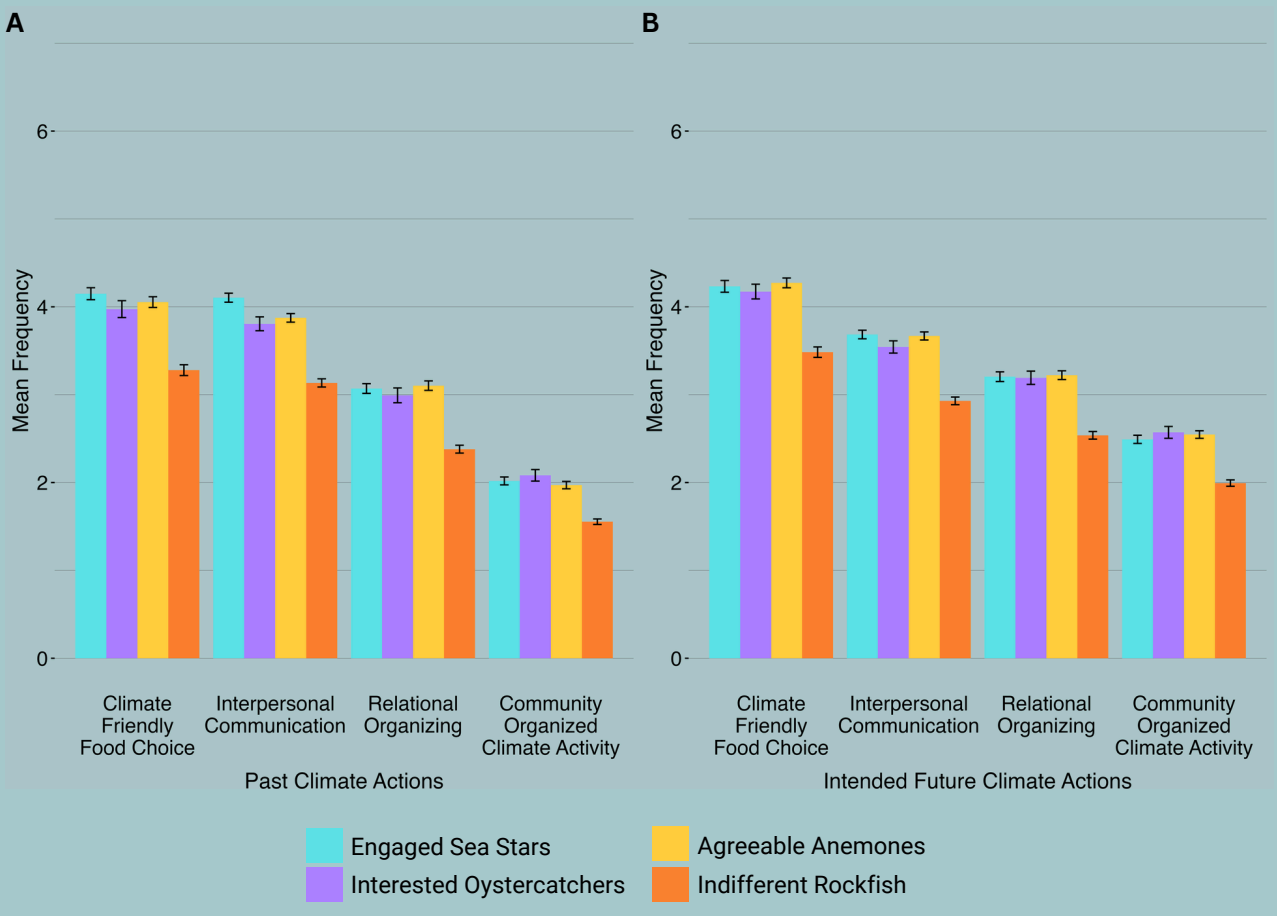


Figure 10. Mean levels of (A) past and (B) intended future engagement in climate actions among each marine reserve audience. Climate actions are ordered on the x-axis from the most private-sphere action on the left to the most public-sphere action on the right. Means are based on a 7-point scale from 1 = 'Never' to 7 = 'At least once a day.' Error bars represent standard errors.

Discussion

The ODFW Marine Reserves team's 2020 Strategic Communication Overview (ODFW 2020) set a goal to:

"Improve understanding of the marine reserve system and the objectives of the Marine Reserves program through 2023, while increasing awareness and support for ODFW's impartial scientific and management roles."

As such, in 2023, the ODFW Marine Reserves team and OSU implemented two surveys exploring perceptions of the marine reserves, ocean acidification, and climate actions among coastal visitors and Oregon residents. The results of our two surveys can help inform future evaluations of the Strategic Communication goal, particularly as some of the first data collected on marine reserve perceptions after the 2009-2021 program evaluation (ODFW 2022).

Most Oregon residents and visitors who participated in our surveys did not feel knowledgeable about the marine reserves. Despite having low self-assessed knowledge, support for the marine reserves system was high – at least among those who reported an opinion. Notably, however, many respondents from both surveys either had no opinion (Online survey: 28%; Intercept survey: 25%) or said they "neither support nor oppose" the marine reserves (Online survey: 17%; Intercept survey: 9%). **The low knowledge and lack of opinion about the marine reserves might indicate that a considerable proportion of Oregon residents and coastal visitors are disengaged with the subject.**

Our intercept survey sample intended to illustrate a population that the ODFW Marine Reserves team and associated community groups commonly target in their outreach efforts. An increase in disengagement with marine reserves among this population—who are otherwise already interacting with the Oregon coast—may signal opportunities to shift the communication focus. Rather than simply increasing awareness and understanding of the marine reserves, communication efforts could prioritize fostering and strengthening people's relationships with them to promote deeper engagement. To better understand the discrepancies in engagement among our sample, we took a deeper dive into their perceptions of the marine reserves. **Our analysis revealed four broad "audiences" of the marine reserves, encompassing those who appear indifferent about the marine reserves to those who exhibit relatively high engagement.** The proportions of each audience varied by the site at which respondents were surveyed, with higher proportions of highly engaged respondents occurring at sampling sites located next to one of the five marine reserves. Finally, the four audiences revealed additional trends in their perceptions of ocean acidification and engagement in climate actions. For instance, the audience who was least engaged with the marine reserves also had the lowest perceptions of ocean acidification, whereas the most engaged audience had the highest perceptions.

The trends displayed by each audience from our analysis provide the ODFW Marine Reserves team with insights for their outreach and engagement regarding the marine reserves and climate change issues experienced on the Oregon coast, such as ocean acidification. Overall, these results could contribute to improved ocean-related communication efforts not only within the ODFW Marine Reserves team but also among Oregon's coastal agencies and organizations more broadly. Moving forward, the ODFW Marine Reserves team could lead by example on the Oregon coast by further integrating audience-informed outreach into its communication strategies.

References

Dean Runyan Associates. (2023). The Economic Impact of Travel in Oregon, 2022p. Travel Oregon.

Marlon, J. R., Wang, X., Bergquist, P., Howe, P. D., Leiserowitz, A., Maibach, E., Mildenberger, M., & Rosenthal, S. (2022). Change in US state-level public opinion about climate change: 2008–2020. Environmental Research Letters, 17(12), 124046. https://doi.org/10.1088/1748-9326/aca702.

ODFW. (2020). Deeper Understanding: Strategic Communications Overview. Oregon Marine Reserves, Oregon Department of Fish and Wildlife.

ODFW. (2020). Human Dimensions: Information, Perceptions and Communication—What do people worry about in the ocean? Oregon Marine Reserves, Oregon Department of Fish and Wildlife. https://oregonmarinereserves.com/content/uploads/2020/04/info-and-perceptions_infographic.pdf.

ODFW. (2022). Marine Reserves Program Synthesis Report: 2009-2021. Oregon Department of Fish and Wildlife.

ODFW, Epperly, H., Swearingen, T., & Dalaba, J. (2017). 2016 Visitor Intercept Survey: Coastal Visitor Ocean Awareness. Oregon Department of Fish and Wildlife. https://drive.google.com/file/u/2/d/15BElez4nSS2Uxuib3hROl8zYiy1pn4Ye/view?usp=sharing&usp=embed_facebook.

ODFW, Fox, H., Swearingen, T., & French, J. (2022). 2021 Marine Reserves Visitor Intercept Survey: A comparative analysis to baseline 2012 to 2015 data. Oregon Department of Fish and Wildlife. https://drive.google.com/file/u/2/d/1pAEzhthJyv4rXTLIwGP6wLA6-LyzO1CY/view?usp=sharing&usp=embed_facebook.

Walker, D. S. (2019). Ocean Acidification and Hypoxia Action Plan. Presentation to Oregon Sustainability Board.

Additional Resources

Affiliated Publications

Waldo, J.L., Swearingen, T.C., Jones, M.S. (2025). A psychologically wise intervention to inform relational organizing in the face of climate and ocean change. npj Ocean Sustainability 4, 17. https://doi.org/10.1038/s44183-025-00115-8

Waldo, J.L., Needham, M.D., Jones, M.S. (2025). How can we sea change? Audience subgroups and psychological cognitions to target in action-oriented ocean change communication. Marine Policy. 173:106585. https://doi.org/10.1016/j.marpol.2024.106585

Data Repository

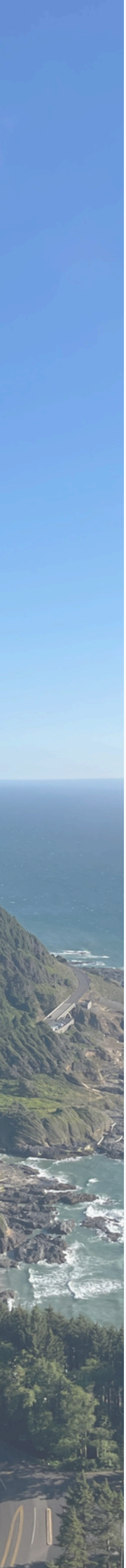
Online Survey: https://osf.io/dyhj6/?view_only=4e5ba1e0b50e4d5dbbbce932cc09112c

Intercept Survey: https://osf.io/5g4k9/?view_only=4e5ba1e0b50e4d5dbbbce932cc09112c

Websites & Applications

Oregon Marine Reserves Website: OregonMarineReserves.com

Oregon Ocean Change Opinions Interactive Map: OceanScientist.shinyapps.io/OregonOceanChange/



Appendix

Additional Methodological Details

Our 2023 coast-wide intercept survey mimicked the on-the-ground outreach efforts of the ODFW Marine Reserves team and community groups, providing a sample of 2,451 coastal visitors with which to investigate audience clusters. As such, we used the intercept survey data to conduct a k-prototype cluster analysis for two- to five-cluster solutions. K-prototype clustering divides a dataset into separate clusters, with each participant belonging to one cluster and each cluster containing participants with similar survey responses. Similarity is depicted through data resemblance patterns, which are measured by counting matches and mismatches for categorical variables and calculating the range-normalized absolute distances from the cluster median for numerical variables (Gower, 1971).

The optimal number of clusters in a k-prototype analysis is chosen using the within-cluster sum-of-squares errors (WSS) and validated with the silhouette metric (i.e., how similar a point is to its own cluster compared to other clusters). Smaller values of WSS (i.e., the sum of all squared errors for data points within a cluster) indicate that points within a cluster are close to the cluster center (i.e., close resemblance). In our analysis, WSS decreased as the number of clusters increased. However, high cluster solutions are not necessarily more optimal because they could comprise several similar clusters that are impractical to distinguish in targeted communication. Therefore, the number at which the WSS value begins diminishing is considered optimal. Figure A1 exhibits the four-cluster solution as optimal. The silhouette metric confirms the four-cluster solution as optimal, as higher silhouette values indicate better within-cluster cohesion and between-cluster separation (Figure A2).

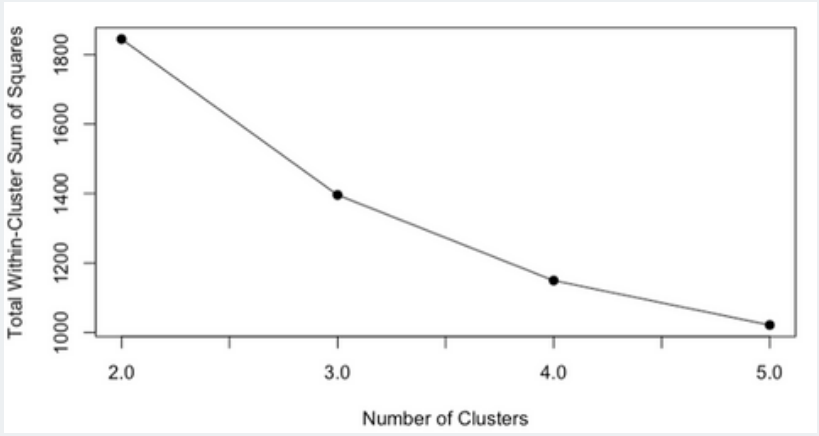


Figure A1. Within-cluster sum-of-squares values for two- to five-cluster solutions. The values “elbow” at four clusters.

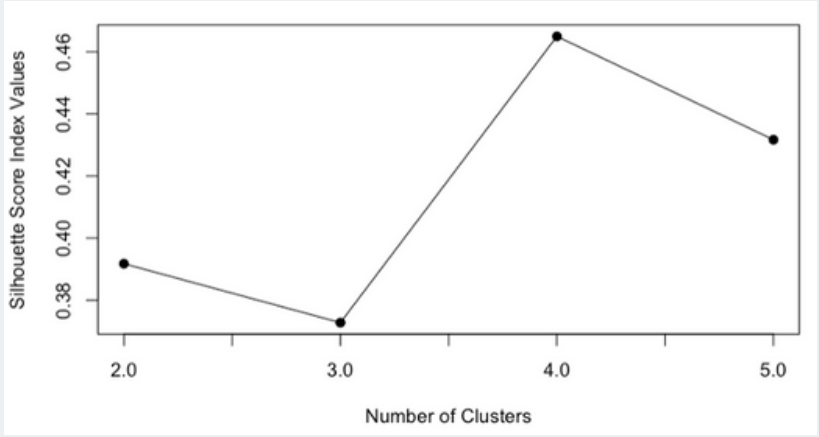


Figure A2. Silhouette scores for two- to five-cluster solutions. The scores peak at four clusters.

Supplementary Tables

Table A1. Kruskal-Wallis and Pearson's Chi-Square tests between audiences on the four variables that informed the cluster analysis. Post hoc analyses using Dunn's and Fisher's Exact tests revealed which specific audiences differed on each variable.

	Kruskal-Wallis (All audiences)		Dunn's Test [1] (Between audiences)		
	X^2	p-value	Audience comparison	Mean rank difference	p-value
Marine Reserves Support	1093.2	<.001*	*Anemones* vs *Rockfish* *Oystercatchers* vs *Rockfish* *Sea Stars* vs *Rockfish* *Oystercatchers* vs *Anemones* *Sea Stars* vs *Anemones* *Sea Stars* vs *Oystercatchers*	28.2 19.1 26.1 -1.9 -0.6 1.4	< .001* < .001* < .001* .169 1.000 .486
Marine Reserves Self-Assessed Knowledge	957.4	<.001*	*Anemones* vs *Rockfish* *Oystercatchers* vs *Rockfish* *Sea Stars* vs *Rockfish* *Oystercatchers* vs *Anemones* *Sea Stars* vs *Anemones* *Sea Stars* vs *Oystercatchers*	24.0 20.4 25.4 2.5 2.5 -0.4	< .001* < .001* <.001* .043* .036* 1.000
Coastal Connectedness	271.3	<.001*	*Anemones* vs *Rockfish* *Oystercatchers* vs *Rockfish* *Sea Stars* vs *Rockfish* *Oystercatchers* vs *Anemones* *Sea Stars* vs *Anemones* *Sea Stars* vs *Oystercatchers*	14.2 9.6 13.0 -1.4 -0.5 1.0	< .001* < .001* < .001* .476 1.000 .947
	Pearson's Chi-Square (All audiences)		**Fisher's Exact Test** [2] (Between audiences)		
	X^2	p-value	Audience comparison	Pairwise X^2	p-value
Marine Reserves Regional Knowledge	4175.1	<.001*	*Anemones* vs *Rockfish* *Oystercatchers* vs *Rockfish* *Sea Stars* vs *Rockfish* *Oystercatchers* vs *Anemones* *Sea Stars* vs *Anemones* *Sea Stars* vs *Oystercatchers*	NA 1010.0 NA 53.6 NA 1170.0	NA < .001* NA < .001* NA < .001*

***** Comparison is statistically significant.

[1] Difference in the average ranks for observations within each cluster. Higher cluster average ranks indicate higher observed values. P-values are adjusted for multiple comparisons using the Bonferroni adjustment.

[2] Pairwise chi-square comparisons between clusters. P-values calculated using Fisher exact test and adjusted for multiple comparisons using the Bonferroni adjustment. "NA" values indicate one or both clusters had zero members for a particular response on the questionnaire item.

Table A2. Oregon residency of the marine reserves audiences.

	Indifferent Rockfish	Agreeable Anemones	Interested Oystercatchers	Engaged Sea Stars	Total
Oregon resident	301	316	176	321	1114
Out-of-state visitor	504	329	88	217	1138
Total	805	645	264	538	2252

Table A3. Online survey socio-demographics.

	Count (n = 1414)	Percent	Valid Percent
Age			
18 – 19 years old	39	2.8	2.8
20 – 24 years old	119	8.4	8.4
25 – 29 years old	124	8.8	8.8
30 – 34 years old	140	9.9	9.9
35 – 39 years old	133	9.4	9.4
40 – 44 years old	141	10.0	10
45 – 49 years old	101	7.1	7.2
50 – 54 years old	115	8.1	8.1
55 – 59 years old	100	7.1	7.1
60 – 64 years old	101	7.1	7.2
65 – 69 years old	132	9.3	9.3
70 – 74 years old	88	6.2	6.2
75 – 79 years old	51	3.6	3.6
80 – 84 years old	25	1.8	1.8
85+ years old	3	2.1	0.2
Missing	2	0.1	
Region			
Willamette Valley	899	63.6	63.6
Coastal Oregon	110	7.8	7.8
Southern Oregon	163	11.5	11.5
Eastern Oregon	242	17.1	17.1
Level of education			
Less than high school	37	2.6	2.6
High school graduate or equivalent	339	24.0	24

Associate's degree or equivalent	604	42.7	42.7
Bachelor's degree	244	17.3	17.3
Some post-graduate education	62	4.4	4.4
Post-graduate degree	128	9.1	9.1
Gender			
Man	357	25.2	25.3
Woman	1002	70.9	71
Non-binary	36	2.5	2.5
Genderqueer	1	0.1	0.1
Agender	1	0.1	0.1
Transgender man	3	0.2	0.2
Transgender woman	1	0.1	0.1
Pan gender trans sexual	1	0.1	0.1
Omni pronouns	1	0.1	0.1
Demiboy	2	0.1	0.1
Missing	9	0.6	
Race and ethnicity*			
Native American, American Indian, or Alaska Native	0	0.0	0
Asian/Asian American	61	4.3	4.3
Black/African American	42	3.0	3
Middle Eastern	9	6.4	6.4
Native Hawaiian or Pacific Islander	19	1.3	1.3
White/Caucasian	1230	8.7	8.7
Hispanic or Latinx	104	7.4	7.4
Self-identified	29	2.1	2.1

Income			
< $20,000	254	18.0	18
$20,000 - $39,999	354	25.0	25
$40,000 - $59,999	264	18.7	18.7
$60,000 - $79,999	186	13.2	13.2
$80,000 - $99,999	124	8.8	8.8
$100,000 - $119,999	76	5.4	5.4
$120,000 - $139,999	44	3.1	3.1
$140,000 - $159,999	45	3.2	3.2
$160,000 - $179,999	25	1.8	1.8
$180,000 - $199,999	13	9.2	9.2
> $200,000	29	2.1	2.1
Other			
Fishing employment**	93	6.6	6.6

Political orientation: On a scale from 1 = Very Conservative to 10 = Very Liberal, participants placed themselves as 5.7 on average (Mdn = 5, where 5 = Moderate).

* Percentages of each do not total 100 because respondents could select multiple responses.

** Reflects the number and percentage of participants answering “yes” to this question.

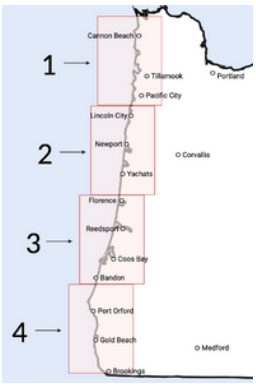
Table A4. Intercept survey socio-demographics.

	Count (n = 2451)	Percent
Age		
18 – 19 years old	50	2.09
20 – 24 years old	160	6.69
25 – 29 years old	173	7.24
30 – 34 years old	195	8.16
35 – 39 years old	254	10.62
40 – 44 years old	298	12.46
45 – 49 years old	249	10.41
50 – 54 years old	224	9.37
55 – 59 years old	162	6.78
60 – 64 years old	188	7.86
65 – 69 years old	188	7.86
70 – 74 years old	150	6.27
75 – 79 years old	66	2.76
80 – 84 years old	24	1.00
85+ years old	10	0.42
Gender		
Man	1075	44.53
Woman	1307	54.14
Non-binary	27	1.12
Other (Write-in):		
Demiboy/trans	1	0.05
X	1	0.05
Other (Not specified)	3	0.14

Level of education		
Less than high school	19	0.79
High school diploma	204	8.49
Some college, no degree	367	15.27
Associate degree	230	9.57
Bachelor’s degree	756	31.46
Graduate or professional degree	827	34.42

Online Survey Questionnaire Items

Measure	Item	Scale
Climate actions (11 items)		
Self-reported past frequency*	In the past 12 months, how frequently have you engaged in each of the following behaviors?	6-point
Future likelihood*	How likely or unlikely are you to perform the following behaviors in the next 12 months?	6-point
Future intended frequency*	In the next 12 months, how frequently do you intend to engage in each of the following behaviors?	6-point
**The following behaviors were measured:*		
Individual-level	Make a food choice to reduce your carbon footprint	
Interpersonal-level (Interpersonal communication)	Talk about the impacts of climate change on oceans with someone you know (for example, a friend, family member, coworker, etc.).	
Interpersonal-level (Relational organizing)	Encourage someone you know to get involved in climate action.	
Community-level	Participate in a community-organized climate activity (for example, a climate rally, a community gardening event, an environmental club meeting, etc.).	

Climate actions continued (3 items)		
Community-level action	If an Oregon Climate Stewards course was offered near you, how interested would you be in participating?	5-point
Motivation	In one or two sentences, please list the main reasons why you would or would not talk about climate change's impacts on oceans with someone you know (for example, a friend, family member, coworker, etc.) in the future.	Open-ended
Motivation	In one or two sentences, please list the main reasons why you would or would not participate in a community-organized climate activity (for example, a climate rally, community gardening event, environmental club meeting, etc.) in the future.	Open-ended
Marine reserves (5 items)		
Awareness	Does Oregon have a marine reserve system?	Binary
Self-assessed knowledge	How knowledgeable do you feel about the topic of marine reserves in Oregon?	4-point
Factual knowledge	What one agency or organization do you think is currently responsible for marine reserves in Oregon?	Multiple-choice (binary coded)
Regional knowledge	Referring to the map, please select which region(s) in Oregon you think contain at least one marine reserve. (Select all that apply).	Multiple choice: 
Opinion	What is your opinion of Oregon's marine reserves?	5-point

Efficacy beliefs (6 items)		
Personal efficacy	I feel confident in my ability to take climate action.	7-point
Personal response efficacy	I believe the actions I take can help reduce the effects of climate change on oceans.	7-point
Collective efficacy	I feel confident in my community's ability to take climate action together.	7-point
Collective response efficacy	I believe actions my community takes together can help in reducing the effects of climate change on oceans.	7-point
Relational organizing efficacy	I have the skills and knowledge to encourage people I know to engage in climate action.	7-point
Relational organizing response efficacy	People I know would engage in climate action if I encouraged them to do so.	7-point
Social norms (6 items)		
Injunctive norm	People I know would approve of me taking climate action.	7-point
Injunctive norm	People I know would approve of me encouraging others to	7-point
Descriptive norm	Many people I know regularly engage in climate action.	7-point
Descriptive norm	Many people I know encourage me and others to	7-point
Dynamic norm	Recently I have noticed more of the people I know engaging	7-point
Dynamic norm	Recently I have noticed more of the people I know encouraging each other to engage in climate actions.	7-point

Ocean acidification cognitions (8 items)		
Perceived knowledge	How knowledgeable would you say you are about ocean acidification?	5-point
Factual knowledge	Which of the following, if any, is the main cause of ocean acidification?	Multiple choice; binary coded
Concern	How concerned are you about ocean acidification?	4-point
Risk perception	How much do you think ocean acidification will harm you personally?	4-point
Risk perception	How much do you think ocean acidification will harm future generations of people?	4-point
Personal importance	How important to you personally is ocean acidification?	5-point
Psychological distance (Hypothetical distance)	In your opinion, how likely is it that ocean acidification will affect your life?	5-point
Psychological distance (Temporal distance)	When, if at all, do you think you could experience the effects of ocean acidification?	6-point
Ocean change cognitions (7 items)		
Concern	How concerned are you about climate change's impacts on oceans?	4-point
Risk perception	How much do you think climate change's impacts on oceans will harm you personally?	4-point
Risk perception	How much do you think climate change's impacts on oceans will harm future generations of people?	4-point

Ocean change cognitions continued (7 items)		
Personal importance	How important to you personally is the impact of climate change on oceans?	5-point
Psychological distance (Hypothetical distance)	In your opinion, how likely is it that climate change's impacts on oceans will affect your life?	5-point
Psychological distance (Temporal distance)	When, if at all, do you think you could experience the effects of climate change's impacts on oceans?	6-point
Perceived knowledge	How knowledgeable would you say you are about how climate change is affecting oceans?	5-point
Connectedness to the coast (13 items)		
Place identity	The coast is very special to me.	7-point
Place identity	I am very attached to the coast.	7-point
Place identity	The coast means a lot to me.	7-point
Place identity	Being at the coast says a lot about who I am.	7-point
Place identity (Negative)	Spending time at the coast says very little about who I am.	7-point
Place identity	I feel I can really be myself at the coast.	7-point
Place dependence	The coast is the best place for the activities I like to do.	7-point
Place dependence	No other place can compare to the coast for the things I like to do.	7-point
Place dependence	I get more satisfaction out of being at the coast than any other place.	7-point

Place attachment	I feel relaxed when I am at the coast.	7-point
Place attachment	I feel happiest when I am at the coast.	7-point
Place attachment	The coast is my favorite place to be.	7-point
Place attachment	I really miss the coast when I am away from it for too long.	7-point
Socio-demographics		
Age	What is your age (in years)?	Open-ended
Gender	What is your gender (e.g., woman, man, non-binary)?	Open-ended
Education	What is your highest level of education?	Multiple-choice
Income	What is your annual household income before taxes?	Multiple-choice
Political orientation	Where would you place your self on this scale from 0 (“Very conservative”) to 10 (“Very liberal”)?	Multiple-choice
Race/ethnicity	What is your race and ethnicity? (Select all that apply)	Multiple-choice
Region of residence	What is your zip code?	Open-ended
Fishing employment	Do you, or does one of your immediate family members, currently or previously work in fishing-related employment? (e.g., commercial fishing, charter fishing, harvest industry, etc.)	Binary
Other		
Additional thoughts	Is there anything else you would like to say regarding the topics discussed in this survey?	Open-ended

Intercept Survey Questionnaire Items

Measure	Item	Scale
Self-reported past climate actions (4 items)		
Frequency (Interpersonal communication; Interpersonal-level)	In the past 12 months, how frequently have you talked about the impacts of climate change on oceans with someone you know?	6-point
Frequency (Relational organizing; Interpersonal-level)	In the past 12 months, how frequently have you encouraged someone you know to get involved in climate action?	6-point
Frequency (Community-level)	In the past 12 months, how frequently have you participated in a community-organized climate activity?	6-point
Frequency (Individual-level)	In the past 12 months, how frequently have you made a food choice to reduce your carbon footprint?	6-point
Intended future climate actions (6 items)		
Likelihood (Interpersonal communication; Interpersonal-level)	How likely or unlikely are you to talk about the impacts of climate change on oceans with someone you know?	6-point
Frequency (Interpersonal communication; Interpersonal-level)	In the next 12 months, how frequently do you intend to talk about the impacts of climate change on oceans with someone you know?	6-point
Likelihood (Relational organizing; Interpersonal-level)	How likely or unlikely are you to encourage someone you know to get involved in climate action?	6-point
Frequency (Relational organizing; Interpersonal-level)	In the next 12 months, how frequently do you intend to encourage someone you know to get involved in climate action?	6-point

Frequency (Community-level)	In the next 12 months, how frequently do you intend to participate in a community-organized climate activity?	6-point
Frequency (Individual-level)	In the next 12 months, how frequently do you intend to make food choices to reduce your carbon footprint?	6-point
Connectedness to the coast (3 items)		
Place identity	The coast means a lot to me.	7-point semantic differential (agree/disagree)
Place dependence	I get more satisfaction out of being at the coast than any other place.	7-point semantic differential (agree/disagree)
Place attachment	I feel happiest when I am at the coast.	7-point semantic differential (agree/disagree)
Efficacy beliefs (4 items)		
Personal efficacy	I feel confident in my ability to take climate action.	7-point semantic differential (agree/disagree)
Personal response efficacy	I believe the actions I take can help reduce the effects of climate change on oceans.	7-point semantic differential (agree/disagree)
Relational organizing efficacy	I have the skills and knowledge to encourage people I know to take climate action.	7-point semantic differential (agree/disagree)
Relational organizing response efficacy (Social response efficacy)	People I know would engage in climate action if I encouraged them to do so.	7-point semantic differential (agree/disagree)
Ocean acidification perceptions (4 items)		
Concern	How concerned are you about ocean acidification?	4-point
Personal Importance	How important to you personally is ocean acidification?	5-point

Personal risk perception	How much do you think ocean acidification will harm you personally?	4-point + “I don’t know” option
Future risk perception	How much do you think ocean acidification will harm future generations of people?	4-point + “I don’t know” option
Marine reserves perceptions (3 items)		
Self-assessed knowledge	How knowledgeable do you feel about Oregon’s marine reserves?	4-point
Opinion	What is your opinion of Oregon’s marine reserves?	6-point
Regional knowledge	Which marine reserve in Oregon are you closest to right now?	Binary
Demographics		
Residence	Please list the state or country you live in and the zip code below:	Open-ended
Age	What is your age?	Open-ended
Gender	What is your gender?	Multiple choice + open-ended option
Education	What is the highest level of formal education you have completed?	Multiple choice