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Articles

Coastal ties, identity, and climate change adaptation preferences

Vínculos costeiros, identidade e preferencias de adaptación ao cambio climático

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Abstract

This study investigates public preferences for implementing Climate Change (CC) adaptation measures along the Galician coast, with a focus on key cultural and provisioning Ecosystem Services (ES). The environmental threats considered include impacts on seawater quality, jellyfish presence on beaches, and overall impacts on marine ecosystem productivity. This study explores differences in preferences between individuals living in coastal versus inland areas. Data were collected through an online survey, featuring a Discrete Choice Experiment (DCE) and additional CC-related perception scales. Findings indicate that a higher sense of local identity and identification with the coast leads to a greater willingness to support environmental initiatives, suggesting that a sense of identity may influence pro-environmental attitudes.

Keywords: Discrete choice experiment; Willingness to pay; Climate change; Valuation; Ecosystem services.

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Resumo

Este estudo investiga as preferencias da cidadanía respecto á implementación de medidas de adaptación ao cambio climático (CC) ao longo da costa galega, centrándose nos servizos ecosistémicos (SE) culturais e de aprovisionamento crave. As ameazas medioambientais consideradas inclúen os impactos na calidade da auga de mar, a presenza de medusas nas praias e os impactos xerais na produtividade do ecosistema mariño. Este estudo explora as diferenzas nas preferencias entre as persoas que viven en zonas costeiras e as que viven en zonas do interior. Os datos recompiláronse mediante unha enquisa en liña, que incluía un experimento de elección discreta (DCE) e escalas de percepción adicionais relacionadas co CC. Os resultados indican que un maior sentido de identidade local e de identificación coa costa conduce a unha maior disposición a apoiar iniciativas medioambientais, o que suxire que o sentido de identidade pode influír nas actitudes favorables ao medio ambiente.

Palabras chave: Experimento de elección discreta; Disposición a pagar; Cambio climático; Valoración; Servizos ecosistémicos.

JEL Classification: Q51; Q54; Q57.

1. INTRODUCTION

Coastal habitats are vital, offering a wide range of ecosystem services (ES) essential to human well-being (Haines-Young & Potschin, 2018) and biodiversity conservation (Barbier et al., 2011; Costanza et al., 1997). According to the Common International Classification of Ecosystem Services (CICES), coastal areas generate provisioning services (e.g., fisheries), regulating services (e.g., protection from erosion and natural hazards), and cultural or recreational services (e.g., tourism) (Haines-Young & Potschin, 2018).

The economic valuation of coastal environments is a dynamic interdisciplinary field (Bateman et al., 2011) aimed at quantifying coastal areas' market and non-market contributions, including fisheries, tourism, coastal protection, and carbon sequestration. While the economic relevance of these ecosystems is well-established, the challenges posed by Climate Change (CC)—driven by both natural and anthropogenic factors—necessitate a re-evaluation of their value and resilience (UN, 2022; WHO, 2016). Recent research calls for the integration of CC dimensions into coastal ecosystem valuation frameworks (Anthoff et al., 2009).

There is a growing body of literature focusing on preferences for implementing adaptation strategies in coastal regions to counteract climate change impacts (Mallette et al., 2021). This study focuses on the Galician coast —a region with a high dependency on the fishing industry, where CC is bringing significant disruptions. Unlike terrestrial systems, where climate impacts are more direct, marine ecosystems are influenced by a complex interplay of oceanographic dynamics (e.g., currents, salinity) and broader climate variability (e.g., warming trends, atmospheric shifts) (Bode et al., 2020).

We offer a novel contribution by comparing adaptation preferences among coastal and inland residents in Galicia—an aspect rarely addressed in the context of CC adaptation. While previous studies have examined preferences among tourists and residents (Loomis & Larson, 1994), few have explored this topic specifically for climate adaptation measures. We add to the literature following Hoyos et al. (2009) who explored the role of identity on preferences for forests in the Bask Country.

Hence, the primary objectives of this study are threefold: (1) to assess public preferences and willingness-to-pay (WTP) for various climate adaptation strategies aimed at protecting key coastal ES, such as seawater quality, ecosystem productivity, and beach conditions related to jellyfish; (2) to compare preferences between coastal residents and inland populations; and (3) to explore how identification with the local identity influences preferences for adaptation to CC.

Understanding public preferences and WTP for coastal adaptation options has considerable implications for policymaking, sustainable tourism, and environmental conservation. As emphasized by the Spanish Ministry of Environment (MITECO, 2020), public knowledge and perception of climate adaptation are crucial for guiding educational campaigns, enhancing civic engagement, and supporting cost-benefit analyses for policy development.

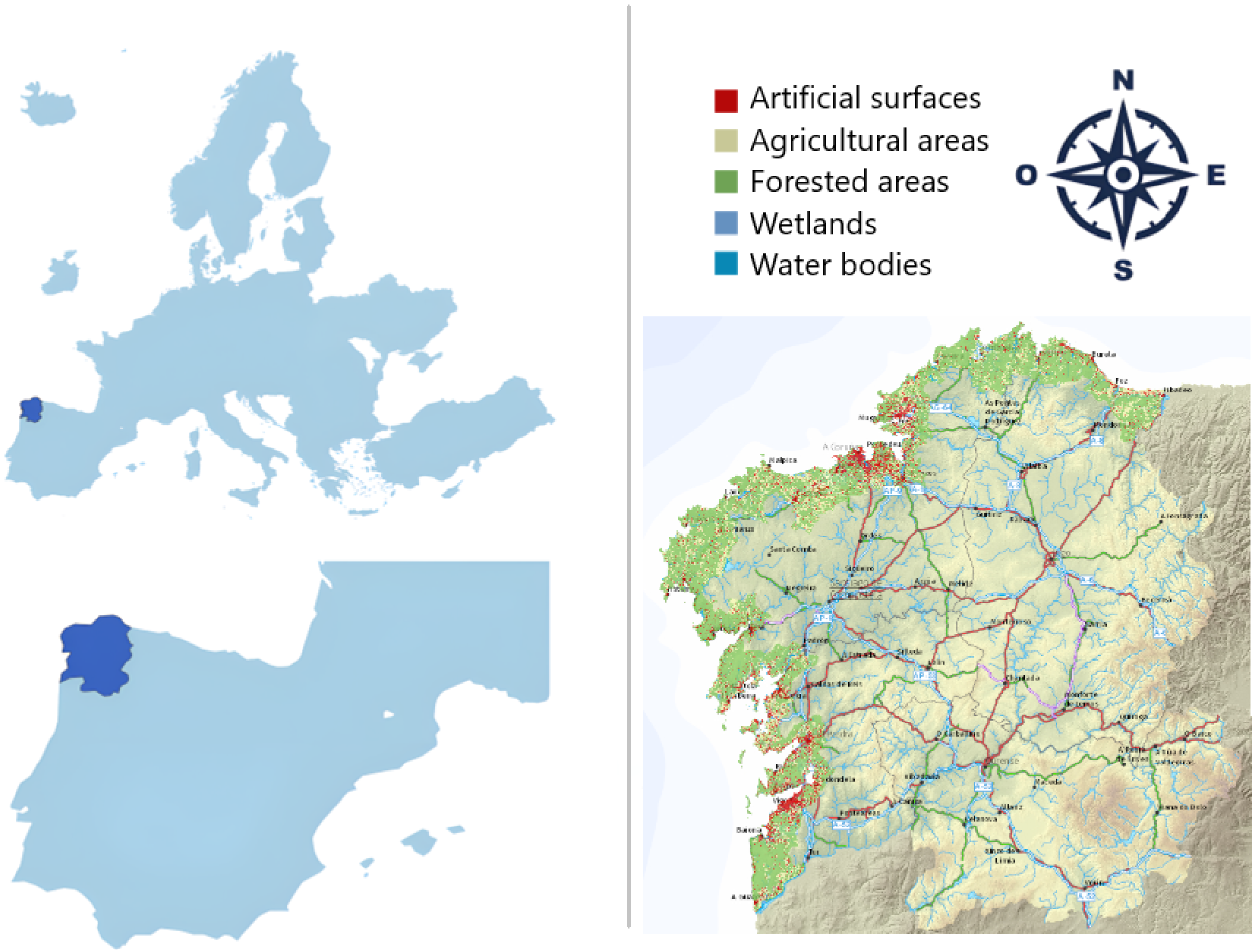
This article is structured as follows: after the introduction, the second section outlines the characteristics of the study area. Next, the methodology section specifies the aspects related to the research methods used. The fourth section presents the results obtained after the relevant empirical analyses, while the fifth section is dedicated to the discussion of the findings. Finally, the study concludes with the main results, limitations, and prospects.

2. STUDY AREA

Spain is highly vulnerable to climate alterations due to both its geographic location and socioeconomic characteristics (MAUC & MITECO, 2019; Ulargui, 2018). Galicia, the Spanish autonomous community with the longest coastline —1,885 km excluding islands and up to 2,555 km when including all coastal features (Pousa, 2023; BOE, 2023)— is characterized by unique estuarine systems known as 'rías' and a globally significant concentration of phytoplankton (Spyrakos et al., 2011). This mesotidal region supports substantial aquaculture, particularly shellfish production (Blanco et al., 2021).

To operationalize the concept of 'coast,' this study includes all Galician municipalities with direct access to the waterfront (Figure 1), totaling 5,009 km^2 (16.9% of Galicia), distributed across 82 municipalities (26.2%) and home to over 1.4 million people (53.34%). The region features diverse land covers, predominantly forested areas, with variation between the north (grasslands and croplands) and south (shrubland and agriculture).

Figure 1. Coast lands found in the Galician municipalities (NW Spain) according to Instituto de Estudos do Territorio (2019)



Climate change (CC) translates into various impacts in this study area, which entail profound implications at the ecosystem level. One of the most evident effects is the rise in temperature; in Galicia, air temperatures in the oceanic zone have increased by approximately +0.1 ºC per decade since 1900, while sea temperatures have risen at a similar rate since 1960

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(Fernández, 2006). These changes affect both native species —such as the disappearance of traditional populations like the plaice, highly sensitive to warm waters— and the spread of invasive species (Pereira et al., 2021; Bañón et al., 2024; Capdevila-Argüelles et al., 2011; Fernández, 2006). Alongside the expansion of maritime trade, rising sea temperatures have facilitated biological invasions along the Galician coast and increased the presence of toxins (Blanco et al., 2021) and parasites, particularly in clam and oyster farming (García & Remiro, 2013). Furthermore, warming intensifies ocean stratification (Pörtner et al., 2019), promoting eutrophication (UN, 2017) —an especially concerning process in the sensitive estuarine ecosystems of Galicia (Villares et al., 1999).

Eutrophication has two key ecological consequences: the proliferation of jellyfish and the overgrowth of algae (Dorgham, 2014). Jellyfish thrive in nutrient-rich, low-competition environments, often becoming apex predators and disrupting marine trophic chains (Marambio et al., 2021; Tiller et al., 2015). Their reproductive dynamics are strongly influenced by rising temperatures, which accelerate their proliferation (MITECO, 2011). Additionally, extreme precipitation events are altering salinity levels in estuarine systems such as the Rías Baixas (Des et al., 2021), reducing upwelling, daily water renewal, and overall productivity (Fernández, 2006), further encouraging jellyfish outbreaks (Ferrer et al., 2024). Historically rare along the Galician coast, jellyfish have become an occasional threat to tourism and coastal activities, sometimes even forcing temporary beach closures. On the other hand, eutrophication promotes the proliferation of both micro and macroalgae (Cox et al., 2021; Smetacek & Zingone, 2013; Liu et al., 2021), with implications for human health (FAO, 2023), tourism (The Ocean Foundation, 2019), and native biodiversity (FAO, 2023; The Ocean Foundation, 2019). In Galicia, the invasion of Sargassum muticum (Japanese seaweed) has notably altered coastal ecosystems, displacing native species and reducing biodiversity (García-Oliveira et al., 2020; Vaz-Pinto et al., 2019).

Another major impact is the acidification of ocean waters. Since 1975, the pH of the first 700 meters of the Atlantic off the northwest Iberian Peninsula has decreased by 0.0164 units per decade (Castro et al., 2009; Lavín et al., 2012), affecting organisms' ability to build shells and interfering with key biological processes (Marambio et al., 2021). In Galicia, this phenomenon threatens provisioning ecosystem services by jeopardizing shellfish species such as mussels —vital to the regional economy— and other particularly vulnerable marine resources (García & Remiro, 2013). Coupled with these changes, recent studies indicate a decline in the productivity of local marine species (Rossi et al., 2019; Veiga-Malta et al., 2019) and a decrease in catches of traditional species like sole (Fernández, 2006). Furthermore, the geographical range of some species has shifted, as seen with the gradual expansion of the Japanese oyster's cultivation range (Des et al., 2022), reflecting broader ecological transformations.

Lastly, the region faces increasing risks linked to sea-level rise and coastal erosion. Water levels have been steadily rising, contributing to more frequent episodes of erosion and flooding (Nieto et al., 2023). This trend is compounded by a rise in wave energy impacting the Cantabrian coast and a lengthening of storm durations (Medina, 2008). Consequently, erosion —already considered moderate along the Galician coast (Ibarra & Belmonte, 2017)— is expected to worsen. Between the 20th century and 1990, sea levels along the Atlantic Galician coast rose by 1 to 2 mm per year, accelerating to 4 to 8 mm annually thereafter (García & Remiro, 2013). The rate varies by location; for example, near Vigo, sea level has increased by over 2 cm per decade since 1940 (Bode, 2011).

Additionally, there are other anthropogenic issues, such as the growth of global maritime trade carrying significant risks related to oil spills (Loureiro et al., 2009; Monaco et al., 2017;

Vidal-Abad et al., 2024), as well as the impacts of higher tourism and population pressure (Barca-Bravo et al., 2008; Villacampa et al., 2017).

All these factors affect the ES provided by altering species composition and the abundance of individuals, which are essential for activities like coastal fishing and shellfish harvesting. Similarly, they impact regulation and maintenance services by reducing the genetic diversity of certain species while simultaneously increasing the prevalence of parasites and toxins. Lastly, recreational or cultural ES are affected, with a decline in the aesthetic value of coastal areas and a reduction in leisure activities such as swimming or boating (Kennerley et al., 2022; Wolf et al., 2017). In sum, these processes collectively lead to declines in regulation, provisioning, and cultural ES, resulting in reduced productivity and recreational activities in a region highly dependent on the sea.

3. MATERIALS & METHODS

To examine population preferences regarding climate adaptation on the Galician coast, we employed a Discrete Choice Experiment (DCE), a method widely used in economics for its flexibility and close resemblance to real-life decision-making scenarios (Louviere et al., 2000). It presents respondents with sets of potential alternatives that vary across several attributes.

These alternatives represent characteristics or attributes of a good, each measured at different levels. According to these authors, the sets of choices presented to respondents include at least two other alternatives that represent potential improvement plans and a constant alternative, known as the "status quo" (Hoyos, 2010), which represents the current situation.

Participants are asked to select their preferred option. By analyzing the participants' preferences on these choice cards, it is possible to estimate the monetary value that they assign to each displayed attribute.

For the experimental analysis, we performed a mixed logit regression analysis, based on the premises of random utility models. The Mixed Logit Model (MXL) allows for preference heterogeneity across individuals by incorporating random coefficients. Thus, although utility remains unobservable, we expect individuals to choose the alternative that provides them with the highest utility while accounting for variation in preferences:

$$U(\text{Cost}, x_2, \ldots, x_k) = \beta_1 \text{Cost} + \beta_2 x_2 \ldots + \beta_k x_k + \varepsilon \qquad (1)$$

In the formula, U represents the associated utility generated by each selection made, which contains a vector x representing the various attributes associated with each election, including the explicit cost. The parameters β follow a normal distribution and may vary across individuals, capturing preference heterogeneity. The term ε accounts for unobserved factors affecting utility.

To estimate the willingness to pay (WTP) for each attribute level based on the expressed preferences, we consider the specification of the coefficients in the model. It is obtained using the following equation:

$$\text{WTP}\left(k\right) = -\frac{\beta_k}{\beta_1}$$

This represents the amount of money that makes respondents indifferent between having a particular type of coastal adaptation program or not having it, while preserving a larger budget.

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To establish the different attributes of the DCE and their respective levels, a face-to-face focus group was conducted, consisting of workers from maritime and fisheries sectors, such as shellfish harvesters, coastal fishermen, and representatives of local tourist-sport facilities; in addition, we were assisted as well by biologists with expertise in the marine environment. Based on these consultations, attributes and corresponding levels were determined, as detailed in Table 1; these attributes are estimated for 30 years, given that climate projections for the area have shown to be more severe than expected and attempt to capture this environmental decline the most realistically and understandably possible.

Table 1. Attributes and levels of the DCE

Attributes	Levels	
Marine water quality	*Status Quo*: In the absence of additional protective and adaptative measures, 30 years from now, the state of marine water hinders primary and secondary recreation due to excessive eutrophication, presence of micro and macroalgae, microorganisms, unpleasant odor, etc. *Low*: In a scenario of limited protection and measures, 30 years from now, marine water is not suitable for bathing as it poses a risk to bathers. *Average*: Under a scenario of certain measures, 30 years from now, the state of marine water is acceptable for bathing but does not meet the minimum criteria for obtaining a Blue Flag *High*: With effective and holistic conservation and adaptation measures, 30 years from now, the state of marine water is equivalent to that of a beach with a Blue Flag.	
Jellyfish Proliferation	*Status Quo*: In the absence of additional adaptation and control measures, *beaches remain closed for a total of 15 days per year*, 30 years from now, due to the presence of these organisms. In a scenario with limited adaptation and control measures, *beaches remain closed for a total of 12 days per year*, 30 years from now, due to the presence of these organisms. In a scenario with certain adaptation and control measures, *beaches remain closed for a total of 6 days per year*, 30 years from now, due to the presence of these organisms. In a scenario with sufficient adaptation and control measures, *beaches remain closed for a total of 2 days per year*, 30 years from now, due to the presence of these organisms.	
Ecosystem Productivity	*Status Quo*: In the absence of any additional protection, biodiversity suffers a significant impact; 30 years from now, coastal fishing catches decrease by 20%. *Low*: Biodiversity suffers a high impact in a scenario of limited protection; coastal fishing catches decrease by 10% over a 30- year period. *Average*: Marine biodiversity suffers a moderate impact; 30 years from now, coastal fishing catches remain stable at current levels. *High*: With protective measures, biodiversity is protected; coastal fishing catches increase by 10% over a 30-year period.	
Additional Annual Cost (through a new tax)	*0* euros	*105* euros
	35 euros	*140* euros
	70 euros	

The choice cards were developed using the JMP program (JMP Pro 17, 2023). The final model exhibited very good levels of efficiency (D-Efficiency = 99.34; G-Efficiency = 95.24; A-Efficiency = 98.76), as well as an acceptable prediction variance ($\sigma 2$ = .37). Each participant completed a total of nine choice cards, with each card containing three alternatives plus a status quo option.

In addition to the mere presentation of alternatives, the decision was made to incorporate images for two fundamental purposes: enhancing intuitive understanding and making the questionnaire more engaging. In the case of the status quo option, it is important to clarify that choosing "none of the alternatives" has implications. In other words, by not taking action, participants are effectively deciding that these ecosystem resources may be potentially lost.

The first choice is presented below (Figure 2), and the valuation question can be found in the Appendix (A.1).

Figure 2. Example of a Choice Experiment card from our survey

Card 1	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Marine water quality	High	Average	Average	No additional protective measures: In 30 years, the water will be unfit for bathing, and its condition (algae, odor) will not allow for secondary recreation (walking on the beach, kayaking, etc.)
Jellyfish proliferation	12	6	2	No additional protective measures: Within 30 years, the beaches will be closed for a total of 15 days per year.
Ecosystem productivity	Average (+0%)	High (+10%)	Average (+0%)	No additional protective measures: 20% decrease in catches within 30 years.
Additional annual cost	35 €	35 €	105 €	0 €
	Alternative 1 ☐	Alternative 2 ☐	Alternative 3 ☐	Alternative 4 ☐

3.1. Fieldwork

The target population comprised individuals above 18 years old, either residents on the coast or inlands, but with real estate properties or family in the coastal area, or regular visitors. When determining the sample size, the specialized software G*Power version 3.1.9.7 (Faul et al., 2007; Faul et al., 2009) was utilized with the following key specifications: the odds ratio was set at 1.6, the confidence interval at 95%, and lastly, the statistical power at 95% as well. The minimum sample size calculated was 212 individuals, well below our sample of 1,009 initial participants.

As a previous step to administering the final questionnaire, a pilot test was conducted face-to-face with a total of 25 participants chosen through non-probabilistic snowball sampling. The results of this pilot study demonstrated the appropriateness of using the survey instrument, as well as minor changes to be addressed. In general terms, the individuals had no difficulty understanding the attributes or the status quo, agreeing that the images and explanatory texts helped in clearly expressing their preferences. The definitive survey was carried out online by a reputable marketing firm in September 2023, a company specializing in market research, marketing, and opinion studies. Stata version 14 (StataCorp, 2015) was the software employed for conducting the analyses.

3.2. Data quality check

Before conducting the pertinent analyses, scrutiny of all participants who completed the questionnaire was undertaken to exclude those who, despite completion, exhibited indications of poor attention. This exclusion aimed to prevent the introduction of noise into the data. We eliminate the participants who rushed through the survey. In our case, the participants who finished in under 4 minutes and 28 seconds were eliminated, as the time below this limit was clearly insufficient for reading and carefully completing the survey. Besides, and based as well on the pilot test, those who completed the entire DCE in less than 45 seconds ("DCE Speeders") or exceeded 5 minutes on a single DCE task ("DCE Super Slow") were also excluded: the first ones didn't have enough time to properly understand and answer the DCE, whereas the second group took so much time that it is reasonable to assume that they lost the common conductor thread of the task (Castro-Atanes & Loureiro, 2023). Finally, participants who reported that the instrument had a level of difficulty of 9 or 10 on a scale from 0 to 10 were omitted as well. It is worth noting that these groups are not mutually exclusive, and the same participant can belong to both, the DCE speeders and general speeders groups simultaneously.

Hence, the final sample comprised a total of 703 individuals, well above the threshold of 212 individuals set by the statistical power calculation software G*Power. In Appendix A.4, more information is provided regarding the participants who comprise the initial sample of the study.

4. RESULTS

Approximately 60% of respondents reside along the Galician coast, while 85.20% of them maintain direct ties to the region —through primary or secondary homes or family connections. The remaining 14.80% are recurrent visitors, averaging 36.91 days of coastal visits annually (SD = 22.82), primarily during holiday periods.

Provincial distribution aligns with population patterns, with most participants residing in A Coruña (44.85%) and Pontevedra (35.27%), which mirrors the regional demographics according to IGE (2024a).

Educational attainment reveals two primary groups: 44% of participants have not completed university studies, while the remainder either possess or are pursuing a degree. Regarding employment, 56.02% are in full-time paid positions, and 28.59% report monthly incomes above €2,000. Income distribution shows representation across economic strata, although education and income levels may be slightly overrepresented due to the online survey format.

Responses to the Climate Change Perception Scale (Appendix A.2) show broad agreement that CC is real and anthropogenic. The highest-rated items include: 'Climate change is real'

(M = 5.99, SD = 1.58), 'It causes biodiversity loss' (M = 5.98, SD = 1.48), and 'It may intensify extreme weather events' (M = 5.96, SD = 1.54). Lowest agreement was found for reverse-coded items downplaying its effects.

The Local Climate Change Threat Scale (Appendix A.3) reveals that participants view CC as a major threat to their area of residence or visitation. Highest concern was expressed for: 'Increase in extreme climatic events' (M = 5.64, SD = 1.58), 'Marine water pollution' (M = 5.49, SD = 1.69), 'Disturbance from invasive species' (M = 5.49, SD = 1.60), and 'Impacts on fisheries' (M = 5.48, SD = 1.61).

In the Multigroup Ethnic Identity Scale (see Appendix A.4) we observe that there is a relatively high degree of similarity across the different mean scores obtained from the different items. "I am happy to be a member of my ethnic group" (*M* = 5.58; *SD* = 1.49) and "I feel good about my ethnic or cultural tradition" (*M* = 5.54; *SD* = 1.45) stand out slightly, with the highest mean scores.

At the opposite end of the spectrum, we find the item "I feel strongly committed to my ethnic group" (*M* = 5.13; *SD* = 1.54) with the lowest mean score. As observable in Table 2, these three overall scales provide means which are not different across the various groups.

Table 2. Descriptive statistics by respondent group (n = 703)

Variable	Categories	Total	Coastal residents(*n* = 415)	Inland residents(*n* = 288)
Gender	Male	46.15	45.72	46.79
	Female	53.83	54.28	53.21
Age	18-29	14.95	15.65	13.93
	30-44	34.25	34.96	33.21
	45-64	42.53	42.54	42.50
	65+	8.27	6.85	10.36
Ties with the Galician coast	Yes	85.20	100	66.43
	No	14.80		33.57
(*If no ties*) When do you visit the Galician littoral	For most of the year	9.18	-	8.89
	During the summer period and other vacation times (Christmas, Easter, etc.)	29.59	-	30.00
	Only during the summer period	22.45	-	20.00
	A few days, at any time of the year that coincides with their vacation.	34.69	-	36.67
	Doesn't Know/Answer	4.08	-	4.44
Province	A Coruña	44.85	50.43	36.79
	Lugo	9.43	3.42	18.21
	Ourense	10.45	-	25.71
	Pontevedra	35.27	46.21	19.29
Ideological orientation	(Left) 0	5.52	6.11	4.64
	1	4.93	5.38	4.29
	2	10.16	9.05	11.79
	3	11.47	12.22	10.36
	4	9.87	10.51	8.93
	5	20.61	18.83	23.21
	6	7.11	6.11	8.57
	7	9.29	9.54	8.93
		7.40	7.33	7.50

Variable	Categories	Total	Coastal residents(n = 415)	Inland residents(n = 288)
	8 9 (Right) 10 Doesn't Know/Answer	3.19 3.77 6.68	4.16 3.91 6.85	1.79 3.57 6.43
Formal education	Up to Primary Education Secondary Education High School/Vocational Training University Studies	1.89 5.52 43.83 48.77	1.71 4.40 44.50 49.39	2.14 7.14 42.86 47.86
Current occupation	Student Full-time paid employment Part-time paid employment Unpaid work (e.g., household tasks) None of the above	6.10 56.02 14.37 8.42 15.09	6.85 57.70 13.69 6.60 15.16	5.00 53.57 15.36 11.07 15.36
Monthly income	No income Less than 500 euros From 500 to less than 1,000 euros From 1,000 to less than 1,500 euros From 1,500 to less than 2,000 euros More than 2,000 euros	7.69 4.64 12.19 27.00 19.88 28.59	7.09 4.65 12.71 26.65 20.05 28.85	8.57 4.64 11.43 27.50 19.64 28.21
Ethnical Identity Scale		5.40 (1.26)	5.44 (1.23)	5.34 (1.29)
Climate Change Perception		5.31 (1.11)	5.34 (1.10)	5.26 (1.12)
Local Climate Change Threat		5.24 (1.21)	5.22 (1.28)	5.22 (1.28)

4.1. Estimation results

4.1.1. Utility coefficients

To test whether coastal and inland residents exhibit significantly different preferences, we performed a likelihood ratio (LR) test comparing a pooled mixed logit model —including all respondents— with two separately estimated subgroup models for coastal and inland residents. All models share the same specification, and no interaction terms were included in the pooled version.

The LR test compares the goodness-of-fit of the pooled model to the combined log-likelihoods of the two subgroup models. The test statistic is calculated as:

$$LR = -2 \cdot \left(LL_{pooled} - (LL_{coast} + LL_{inland})\right)$$

The resulting test statistic was LR = 106.06 with 5 degrees of freedom, yielding a p-value < 0.001 (See Appendix A.5). This indicates a highly statistically significant difference in coefficients between the two groups at the 1% level, supporting the use of separate mixed logit models for coastal and inland populations.

Table 3. Mixed Logit Model Results: utility coefficients for inland and coastal populations

	Inland population (*n = 288*)		Coastal population (*n = 450*)	
Attributes level	Mean Coef. (SE)	SD (SE)	Mean Coef. (SE)	SD (SE)
Medium seawater quality	1.0112 (0.1163)***	-0.9469 (0.1398)***	1.4235 (0.0998)***	1.1832 (0.1111)***
High seawater quality	1.2510 (0.1324)***	1.6492 (0.1393)***	1.7159 (0.0975)***	1.5131 (0.1002)***
Presence of jellyfish at the beach	-0.0878 (0.0131)***	0.1413 (0.0129)***	-0.0817 (0.0098)***	0.1390 (0.0097)***
Medium ecosystem productivity	0.2858 (0.0857)***	-0.3973 (0.1561)**	0.2387 (0.0670)***	0.5168 (0.1183)***
High ecosystem productivity	0.8148 (0.0980)***	1.0101 (0.1041)***	0.8687 (0.0762)***	1.0692 (0.0816)***
Annual cost through taxes	-0.0066 (0.0011)***		-0.0080 (0.0008)***	
NoChoice (no improvement)	-0.8190 (0.5455)		-1.23203 (.41188)***	
NoChoice: ethnic identity	0.0288 (0.0070)***		-0.0199 (0.0101)**	
NoChoice: age	-0.4959 (0.2216)**		0.0157 (0.0061)**	
NoChoice: seawork	0.0095 (0.1988)		0.4142 (0.1931)**	
NoChoice: gender	0.00005 (0.00013)		0.1752 (0.1607)	
NoChoice: income	-0.0439 (0.0127)***		-0.0003 (0.0001)***	
LR $\chi^2(5)$	459.91		673.49	
Prob > χ^2	0		0	
Log Likelihood	-2499.99		-4226.9733	
AIC	5046.68		8533.29	
BIC	5064.35		8625.6	

Note. *** p < .01; ** p < .05; * p < .1.

Both inland and coastal populations show strong and significant preferences for improvements in seawater quality and ecosystem productivity, as well as a clear dislike for the presence of jellyfish on beaches. The model with the coastal residents generally shows higher mean coefficients for seawater quality improvements, indicating a stronger willingness to pay for these measures compared to inland residents. However, inland respondents exhibit a slightly stronger negative preference toward jellyfish presence.

Coastal individuals strongly reject the no-improvement (status quo) option. This suggests that coastal respondents have a clearer desire for environmental improvements, while inland respondents don't show a significant tendency towards this.

A stronger ethnic identity increases the likelihood of choosing the status quo (0.0288 [0.0070]) for inland population, while for coastal respondents, the opposite occurs: ethnic identity decreases the likelihood of choosing the no-improvement scenario (-0.0199 [0.0101]). This contrast indicates the higher cultural ties of residents in coastal areas and a sense of belonging and responsibility toward their local environment, motivating them to favour actions that protect or enhance coastal ecosystems. This is in line with the findings by Hoyos et al. (2009). However, working in the marine sectors significantly increases the likelihood of sticking with the status quo in coastal populations, suggesting professional

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interests may moderate WTP for change, as proposed actions may be associated with additional requirements to the sector. This effect is absent in the inland population.

In both samples, higher income significantly reduces the probability of choosing the status quo, though the effect is stronger in the inland group. This suggests that higher-income individuals are more open to supporting environmental improvements. Among inland respondents, older individuals are more likely to reject the status quo (-0.4959 [0.2216]), whereas for coastal respondents the opposite occurs (0.0157 [0.0061]). Gender has no significant effect in either group.

Overall, while both groups prioritize similar environmental attributes, coastal residents tend to have stronger and more consistent preferences, reflecting their closer connection to coastal conditions, although individuals working on the fisheries and related sectors prefer not to select any policy adaptation measure. This may be due to the concern of potential limitations of their extracting activities to make them more environmentally sound.

4.1.2. Willingness To Pay (WTP) Estimation

The results of the current study reveal that seawater quality is the most valued attribute across both population groups. Coastal residents show a higher valuation, with a WTP of 215.15 €/year (CI [167.04, 263.26]) for high and 178.49 €/year (CI [136.07, 220.90]) for medium seawater quality, while inland residents are willing to pay 188.79 €/year (CI [119.88, 257.71]) and 152.60 €/year (CI [95.11, 210.09]) respectively.

Ecosystem productivity is also a key attribute, with inland residents showing the strongest preference for high (122.96 €/year) and medium (43.13 €/year) ecosystem productivity, compared to coastal residents (108.92 €/year and 29.94 €/year).

In contrast, the presence of jellyfish at the beach is associated with a negative WTP across all groups, indicating a clear disutility: –13.26 €/year (CI [–18.53, –7.99]) for inland residents, with coastal residents again showing a slightly lower disutility (–10.24 €/year).

These findings emphasize the critical importance of improving and preserving seawater quality and ecosystem productivity in coastal areas, while the presence of jellyfish —although undesirable— is a relatively less influential factor in shaping preferences. All WTP estimates are statistically significant at the 95% confidence level.

Table 4. WTP (€/year) per attribute with 95% confidence intervals

	Inland Population		Coastal Population	
Variable	WTP	95% CI	WTP	95% CI
Medium seawater quality (€/year)	152.6	[95.11, 210.09]	178.49	[136.07, 220.90]
High seawater quality (€/year)	188.79	[119.88, 257.71]	215.15	[167.04, 263.26]
Presence of jellyfish at the beach (€/year)	-13.26	[-18.53, -7.99]	-10.24	[-13.16, -7.33]
Medium ecosystem productivity (€/year)	43.13	[16.63, 69.63]	29.94	[13.59, 46.28]
High ecosystem productivity (€/year)	122.96	[75.54, 170.37]	108.92	[80.43, 137.41]

Note. *** $p < .01$. All WTP estimates are statistically significant at the 95% CI.

5. DISCUSSION

This study highlights the strong societal support for climate adaptation strategies along the Galician coast. Using a DCE, we find that both coastal and inland populations show a clear willingness to support environmental improvement plans, placing the highest value on seawater quality, followed by ecosystem productivity. These results are consistent with Meyerhoff et al. (2021), who noted that recreational and safety aspects often outweigh purely ecological concerns in public preferences for coastal management.

Coastal residents display the highest WTP for seawater quality —215.15 €/year for high and 178.49 €/year for medium quality— reflecting their closer ties to coastal conditions. Inland residents also highly value seawater quality, with WTPs of 188.79 €/year for high and 152.60 €/year for medium quality but show a slightly stronger WTP for ecosystem productivity (122.96 €/year) compared to coastal residents (108.92 €/year). Although generally disliked, the presence of jellyfish plays a secondary role in shaping preferences, consistently generating negative WTPs—more pronounced among inland respondents (–13.26 €/year) than coastal ones (–10.24 €/year).

The role of identity emerges as a key factor differentiating preferences between groups. For inland residents, a stronger identity increases the likelihood of sticking with the status quo, suggesting a cautious attitude toward change or a weaker perceived connection to coastal environmental issues. In contrast, among coastal residents, a stronger ethnic identity decreases the probability of accepting the status quo, reinforcing the idea that cultural ties drive greater support for adaptation measures. These differential effects underscore how local identity shapes environmental attitudes differently depending on place-based experiences.

Other sociodemographic factors reveal additional nuances. Marine sector employment increases the likelihood of maintaining the status quo among coastal respondents, possibly reflecting concerns about the impacts of change on professional interests. Higher income consistently reduces status quo preference across both groups, indicating a greater openness to environmental investment among wealthier individuals. Age shows divergent effects: inland and older individuals are less likely to accept the status quo, while coastal older respondents tend to prefer it. Gender has no significant effect.

Overall, while both groups value similar attributes, coastal residents exhibit stronger, more consistent preferences for adaptation measures, likely reflecting their deeper cultural and emotional ties to the coastal environment.

Future research should aim for broader representation of inland residents without coastal ties and mitigate potential online survey biases. Additionally, in-person data collection in coastal zones —especially among tourists— and surveys across different seasons could provide a more nuanced, spatially detailed understanding of public preferences for coastal adaptation strategies.

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Authors contribution

Conceptualization, G.I.C, M.L.G; Methodology, A.C.A. and G.I.C; Data Curation, A.C.A. and G.I.C; Formal Analysis, A.C.A, G.I.C; Investigation, M.L.G; Validation, A.C.A, G.I.C; Funding Acquisition, M.L.G;

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APPENDIXES

Appendix A.1. Prior to the administration of the discrete choice experiment, this brief text was presented to address the topic

"To minimize the effects of climate change, various adaptation measures can be implemented. These measures aim to reduce the impacts of climate change but are costly. Below, we define the fields of action that characterize the different measures on which adapting policies would be based.

Climate change, along with direct human action, promotes a deterioration in the quality of marine water. If this trend continues, recreational opportunities related to marine water will be seriously compromised.

Measures related to water quality, for example, can focus on preventing the reduction of marine pH, something that is currently achieved only by reducing CO2 emissions into the atmosphere. One way to promote such reduction may be by reducing the use of fossil fuels and promoting the development of renewable energy sources, such as solar or wind power.

These changes in usual marine conditions favor the appearance of non-native species such as jellyfish. In a non-interventionist scenario, these episodes will potentially become a common occurrence on the Galician coast.

Adaptation measures for this issue may include the creation of a real-time surveillance network of the movements of these organisms or the installation of nets to prevent their passage.

In the last 15 years, records indicate a decrease of around 10% in catches from inshore fishing (including bivalves, octopuses, various fish species, and crustaceans). Therefore, in a scenario where no measures are taken, it can be expected that, in the next 30 years, the total catches from inshore fishing will decrease by 20%.

In order to prevent the decline of biodiversity, useful strategies may include implementing controls and improvements to reduce bycatch, increasing coastal protection, or reducing sediment loads present".

Appendix A.2. Mean score and standard deviation of Climate Change Perception Scale

Items	**Coastal residents (*n* = 415)**	**Inland residents (*n* = 288)**	**Participants with coastal affiliation (*n* = 602)**	**Total (*n* = 703)**
1. Climate change is real, that is, it is taking place	6.07 (1.51)	5.89 (1.68)	6.02 (1.54)	**6.00 (1.58)**
2. Climate change causes biodiversity loss	6.00 (1.46)	5.93 (1.50)	5.98 (1.47)	**5.98 (1.48)**
3. Climate change is not a threat to sustainable development (I).	3.18 (2.27)	3.39 (2.32)	3.29 (2.30)	**3.27 (2.30)**
4. Climate change is caused by human activity, not solely by natural environmental changes.	5.58 (1.58)	5.38 (1.77)	5.51 (1.65)	**5.49 (1.66)**
5. Climate change promotes increases in ocean fertility (I).	3.86 (2.03)	3.91 (2.02)	3.85 (2.03)	**3.89 (2.03)**
6. Climate change causes economic crises.	5.62 (1.54)	5.59 (1.64)	5.63 (1.55)	**5.61 (1.58)**
7. Climate change leads to decrease in incidence of contagious and infectious plant, animal, and human diseases (I).	3.44 (2.16)	3.39 (2.17)	3.42 (2.15)	**3.42 (2.16)**
8. Climate change does not cause coastal erosion (I).	2.89 (2.09)	2.99 (2.12)	2.90 (2.10)	**2.93 (2.10)**
9. Shortage of water that is suitable for domestic use and for irrigation of plants and animals may result from climate change.	5.61 (1.67)	5.57 (1.67)	5.58 (1.67)	**5.59 (1.67)**
10. Climate change may cause an increase in the frequency and intensity of extreme weather conditions such as heat waves, drought, hurricanes, and heavy rains in some areas in the world	5.96 (1.52)	5.95 (1.58)	5.95 (1.53)	**5.96 (1.54)**
Overall Scale	**5.46 (1.78)**	**5.26 (1.84)**	**5.31 (1.80)**	**5.31 (1.81)**

Note. These items belong to a modified version of the Climate Change Knowledge Test (CCKT; Gazzaz & Aldeseet, 2021). Items 1, 2, 7, 9, and 10 were unchanged from the original scale; Item 4 was modified; Items 3, 5, 6, and 8 were added.

(I) The items are phrased in reverse; when calculating the mean of the total scale, they were recoded.

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Appendix A.3. Mean score and standard deviation of the Climate Change Threat Awareness Scale

Items	**Coastal residents (*n* = 415)**	**Inland residents (*n* = 288)**	**Participants with coastal affiliation (*n* = 602)**	**Total (*n* = 703)**
1. Recreational activities from beaches	4.82 (1.63)	4.79 (1.79)	4.84 (1.65)	**4.80 (1.67)**
2. Marine water pollution	5.52 (1.69)	5.46 (1.68)	5.50 (1.69)	**5.49 (1.69)**
3. Biodiversity in the coastal and marine ecosystem	5.37 (1.67)	5.26 (1.71)	5.38 (1.65)	**5.33 (1.68)**
4. Tourism sector (number of visits, length of stay)	4.85 (1.62)	5.21 (1.65)	4.97 (1.63)	**5.00 (1.64)**
5. Local infrastructures	4.91 (1.52)	5.06 (1.58)	5.00 (1.52)	**4.98 (1.55)**
6. Ecosystem disturbance due to the emergence of invasive species	5.58 (1.51)	5.38 (1.70)	5.55 (1.54)	**5.49 (1.60)**
7. Human health	5.32 (1.56)	5.23 (1.69)	5.34 (1.56)	**5.28 (1.61)**
8. Long-term scenic attractiveness	5.23 (1.60)	5.25 (1.67)	5.26 (1.59)	**5.24 (1.63)**
9. Fishing sector (availability of specimens, number of captures)	5.57 (1.54)	5.35 (1.69)	5.53 (1.57)	**5.48 (1.61)**
10. Purchasing power (income, savings capacity)	4.84 (1.63)	4.88 (1.65)	4.88 (1.61)	**4.86 (1.64)**
11. Increase in the frequency and extent of extreme climatic events (e.g., floods, storms, erosion, etc.) in the next 30 years.	5.69 (1.53)	5.57 (1.64)	5.67 (1.55)	**5.64 (1.58)**
Overall Scale	**5.24 (1.59)**	**5.22 (1.68)**	**5.26 (1.60)**	**5.23 (1.63)**

Note. These items belong to a modified version of the residents' perception of risks instrument used by Remoundou et al. (2015). Items 1, 3, and 7 were unchanged from the original scale; items 4, 5, and 11 were modified; items 2, 6, 8, 9, and 10 were added.

Appendix A.4. Mean score and standard deviation of the scale used to assess the ethnic identity of the sample

Items	**Coastal residents (*n* = 415)**	**Inland residents (*n* = 288)**	**Participants with coastal affiliation (*n* = 602)**	**Total (*n* = 703)**
1. I am aware of my "ethnic roots" and what they mean to me	5.50 (1.46)	5.30 (1.65)	5.42 (1.65)	**5.42 (1.54)**

Items	Coastal residents (*n* = 415)	Inland residents (*n* = 288)	Participants with coastal affiliation (*n* = 602)	Total (*n* = 703)
2. I am happy to be a member of my ethnic group	5.63 (1.47)	5.51 (1.52)	5.62 (1.69)	**5.58 (1.49)**
3. I prefer to eat local gastronomic products, even if there are cheaper ones available	5.28 (1.53)	5.16 (1.54)	5.22 (1.65)	**5.23 (1.54)**
4. I feel strongly committed to my ethnic group	5.13 (1.54)	5.14 (1.54)	5.16 (1.63)	**5.13 (1.54)**
5. I feel good about my ethnic or cultural tradition	5.59 (1.39)	5.47 (1.52)	5.56 (1.52)	**5.54 (1.45)**
6. I am proud of my ethnic group	5.50 (1.48)	5.48 (1.50)	5.55 (1.54)	**5.49 (1.49)**
Overall scale	5.44 (1.23)	5.34 (1.29)	5.41 (1.29)	**5.40 (1.26)**

Note. These items belong to a modified factor of the Multigroup Ethnic Identity Scale in Spanish (MEIM; Esteban-Guitart (2010), developed from Phinney (1992), Roberts et al. (1999), and Smith (2002)). Items 1, 2, 4, 5, and 6 were unchanged from the original scale; item 3 was added; lastly, the original items "I feel connected to my ethnic group" and "I understand what it means to belong to the ethnic group" were eliminated.

Appendix A.4. Classification of the sample according to response times. Initial sample (n = 1009).

Variable	Coastal residents (*n* = 594)	Inland residents (*n* = 415)	People with ties with the coast (*n* = 857)	Total (*n* = 1,009)
Non completionists	-	-	-	**-**
Speeders (total) (in-group)	4.56% 7.74%	3.07% 7.47%	6.54% 7.70%	**7.63% (*n* = 77)**
DCE Speeders (total) (in-group)	15.66% 26.60%	11.40% 27.71%	22.79% 26.84%	**27.06% (*n* = 273)**
DCE Super Slow (total) (in-group)	2.18% 3.70%	1.68% 4.10%	3.47% 4.08%	**3.86% (*n* = 39)**

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Variable	Coastal residents (*n* = 594)	Inland residents (*n* = 415)	People with ties with the coast (*n* = 857)	Total (*n* = 1,009)
Difficulty > 8 (total) (in-group)	.50% .84%	.19% .48%	.50% .58%	**.69% (*n* = 7)**

Appendix A.5. Classification of the sample according to response times. Initial sample (n = 1009)

Model	Log-L	N Parameters
Pooled model	–6779.99	5
Coastal model	–4226.97	5
Inland model	–2499.99	5
Combined (coast + inland)	–6726.96	10
LR statistic	106.06	df = 5
p-value	< 0.001	