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Recreation in coastal environments: Estimating the non-market value of fishing harbors

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A B S T R A C T

The importance of the fishing sector goes beyond food provisioning, by generating both positive and negative externalities. The benefits on tourism and the recreational appeal of coastal areas are often invoked among the positive externalities, even if their measurement may be hampered by the lack of market information. Non-market valuation methods can thus be useful to quantify the societal importance of fisheries. Here we focus on the recreational value of harbors by applying the travel cost method and analyzing whether small-scale vessels represent an attractive amenity for individuals engaging in outdoor recreation. We use an existing dataset with wide EU coverage, and match information on individuals' number of visits to coastal environments with fishing capacity indicators at the chosen recreational destination. The results suggest that the presence of small-scale capacity (e.g. vessels) increases the attractiveness of coastal locations, as we estimate the loss in recreational value due to a reduction in only one artisanal vessel to be 0.05€ per visit. By monetizing the welfare effects of changes in fishing capacity, these findings can justify the allocation of financial support to the small-scale fishery sector.

1. Introduction

The fishing sector may serve the realization of multiple objectives, as appropriately described by the concept of multifunctionality, which is commonly used to indicate the joint production of both material and immaterial goods from farming activities (OECD, 2001; Renting et al., 2009). While the term was originally applied to agriculture, it has been recognized that fisheries can also be interpreted as providers of services that go beyond food production (Ropars-Collet et al., 2017). Mulazzani et al. (2019) have identified six categories of non-commodity outputs from fisheries: *i*) healthy ecosystems and biodiversity, *ii*) other environmental public goods/bads, *iii*) cultural heritage and coastal viability, *iv*) coastal employment, *v*) food security and *vi*) strategic benefits. Most of these non-commodity outputs show the characteristics of externalities or public goods, thus justifying the adoption of fisheries management that secures the provision of these services at the socially optimal level (Shortle and Uetake, 2015).

Strictly linked to multifunctionality, the concept of total economic value allows for a comprehensive assessment of environmental goods through the incorporation of both their use and non-use values, which can be estimated through non-market valuation techniques (Pearce et al., 2006). The literature focusing on the determination of the total economic value of ecosystems and biodiversity is extremely rich: in the case of marine resources typical examples include coral reefs (Cruz-Trinidad et al., 2011; Madani et al., 2012), mangroves (Gunawardena and Rowan, 2005; Rizal et al., 2018), vertebrate animals (Clua et al., 2011; Teh et al., 2018) or coastal areas in general (Aanesen et al., 2010; Fu et al., 2018) (see Remoundou et al. (2009) for an economic classification of coastal and marine values). In the case of fisheries, Barnes-Mauthe et al. (2013) used the concept of total economic value to describe the multiple contributions made by the small-scale fishing sector to the livelihood of coastal communities in Madagascar, but their analysis is limited to observable and quantifiable indicators of landings and profitability.

Recognition of the different functions fulfilled by the fishing sector has also influenced the allocation of structural funds supporting the EU Common Fisheries Policy. One significant example of such a broad interpretation of the role of fisheries has been the establishment of Fisheries Local Action Groups (FLAGs), which are area-based partnerships bringing together the private sector, local authorities and civil

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society organizations, whose aim is to increase employment and territorial cohesion in coastal and inland communities which depend on fishing and aquaculture (European Parliament, 2014). The connection between small-scale fisheries (SSFs) and the attractiveness of coastal environments is explicitly stated in the recent Regulation establishing the European Maritime, Fisheries and Aquaculture Fund (EMFAF), which claims that SSFs "are vital to the livelihood and cultural heritage of many coastal communities in the Union", thus justifying the adoption of ad hoc measures supporting the sector (European Parliament, 2021). In addition, various studies have argued that the total value of SSFs should incorporate their wider contribution to non-monetary measures of social wellbeing (Johnson, 2018), for instance through the maintenance of community cohesion and cultural identity (Lowitt et al., 2020; Tzanatos et al., 2020). Taking into account the major weight of the European Union (EU) with respect to the global allocation of subsidies to fisheries (Sumaila et al., 2019), quantification of the non-commodity outputs produced by the fishing sector is needed to justify its financial support by the EU.

One notable non-commodity output is recreation. It has long been recognized that fisheries generate many cultural ecosystem services for the benefit of the general population, including recreational opportunities (Ghermandi et al., 2010). In the literature it is common to find claims that fishing activities and harbors represent recreational amenities for tourists and visitors. More specifically, the presence of fishing vessels and related activities, such as direct selling of freshly caught food, equipment unloading by the docks and festivals celebrating fishing culture, constitutes a valuable asset promoting tourism (Arthur and Mensah, 2006; Gilden, 1999; Jung et al., 2014; Khakzad and Griffith, 2016; Lacher et al., 2013). Indeed, similar strategies can be found in various examples of touristic initiatives capitalizing on the tangible and intangible cultural heritage of fisheries (FARNET, 2014; Konior, 2018; Rogelja, 2004; Yüksel and Akgül, 2007). Fisheries are also deemed to maintain social cohesion and cultural identity in many coastal communities, both in developed and developing countries (O'Garra, 2009; Oleson et al., 2015), thus suggesting that the enjoyment of fishing operations in the local harbor constitutes an important recreational experience for the local population (Lange and Ounanian, 2020). It is important to stress that the attraction provided by fishing harbors has been frequently associated with SSFs rather than industrial fisheries (Malorgio et al., 2017; McCoy, 2015; Mulazzani et al., 2019; Stobberup et al., 2017).

Non-market valuation methods can be applied to estimate these recreational values. We focus on the recreational value of the fishing fleet to the general population rather than the value of recreational fishing, which has already been the object of a large number of studies (Ezzy et al., 2012; Pokki et al., 2018; Terashima et al., 2020; Toivonen et al., 2004). Attributing a recreational function to fishing fleets is based on the premise that the total economic value of fisheries should include both the direct benefits associated with the provision of fish products as well as some other forms of cultural services. This reflects the idea that cultural ecosystem services can be seen both as a product of the ecosystem (the fish stock) and the human activities interacting with it (the fishing fleet). Indeed, cultural ecosystem services are best described as a product of a relational process between people and the ecosystem (Fish et al., 2016).

The number of empirical studies assessing these values is limited. While empirical analysis has provided evidence in favor of the existence of a non-use value of fisheries (Durán et al., 2015; Ropars-Collet et al., 2017), other studies have produced mixed results with regard to their use component (Andersson et al., 2021; Pascoe et al., 2023; Waldo et al., 2023). Moreover, despite the intuition that SSFs may incorporate a higher non-market value than their large-scale (LSFs) counterpart (e.g. through the preservation of cultural heritage and the attraction of tourists (Bull, 2007; Mulazzani et al., 2019)), the only article that has accounted for this distinction has not found conclusive proof supporting this claim (Andersson et al., 2021).

The present paper addresses this line of research by deepening our understanding of the use value of fisheries by using the travel cost method (TCM). In particular, we estimate the recreational services generated by fishing fleets. The analysis takes into consideration various characteristics of the fishing fleets registered in the harbors of ten European countries to test whether fisheries-related variables motivate recreational behavior in marine environments. In particular, we are especially interested in *i*) understanding whether the fishing capacity[1] of the fleet registered at the harbor affects recreational behavior, or whether fishing presence suffices regardless of capacity; and *ii*) differentiating between SSF and LSF vessels. The latter point is motivated by the lack of empirical evidence supporting the belief of the higher level of attractiveness of SSF vessels versus LSF ones. Even if we do acknowledge that economic valuation may not be able to capture the entire value that coastal communities place on fisheries (Acott and Urquhart, 2014; Khakzad and Griffith, 2016), our concern regarding the relationship between SSFs and recreation addresses the need for empirical valuation of cultural heritage (Cellini, 2011). In order to answer the two research questions, the analysis controls for some specific fisheries-related variables describing the fishing capacity near the visited location, namely the presence of a fishing harbor and the number, tonnage and power of fishing vessels, discriminating between small-scale or large-scale (industrial) fisheries.

To investigate the role of fishing capacity on visitation, we employ a large European dataset used by Börger et al. (2021) and expand their analysis to explain the relationship between fisheries and recreation. The use of a large dataset characterized by broad multicountry coverage is unique in the Travel Cost method literature, and allows us to test for the generalization of the local and regional level results from previous studies (Le Gallic et al., 2015; Pascoe et al., 2023; Ropars-Collet et al., 2017; Waldo et al., 2023). Considering the reduction in fishing capacity that has taken place in the EU since the early 2000s (Bell et al., 2017; Raicevich et al., 2020; Sánchez Lizaso et al., 2020), measuring the demand for recreational trips as a function of fishing fleets can guide policymakers in assessing whether there is a risk of under provision of small-scale fishing capacity and the recreational services they provide due to their nature as a public good.

2. Methods

Non-market values can be estimated with two distinct methods: Revealed and Stated Preference methods. The former are based on the observation or reporting of individual behavior in relation to environmental goods and attributes to reveal people's implicit preferences towards changes in their quality or quantity, while the latter use hypothetical questions designed to elicit the value that the respondents place on the environment in terms of their willingness to tradeoff money for environmental goods (Champ et al., 2003; Freeman III et al., 2014). Stated preference methods are tailored to estimate value changes when non-use values are substantial. Revealed preference methods are adequate when the goal is to infer on changes in use values alone.

2.1. Non-market valuation of fisheries

Two studies have applied stated preference methods to estimate use and non-use values related to fisheries. The earliest example of a stated preference study is given by Durán et al. (2015), who estimated the values associated with the conservation of maritime and fishing cultural heritage in Galicia using discrete choice experiments. The results

[1] Fishing capacity indicates the potential output of a fleet in terms of landings when the factors of production are optimally employed. In order to support fisheries management plans, this is usually translated into an equivalent physical measure describing the structure of the fleet in terms of number of vessels, engine power or gross tonnage (Pascoe et al., 2001).

indicated a positive willingness to pay for the protection of both intangible (fishermen's knowledge, folklore) and tangible (fishing architecture, traditional boats) heritage. A stated preference approach to the non-market valuation of fisheries can also be found in Ropars-Collet et al. (2017), whose focus was the influence of amenities linked to the existence of commercial fishing activities in determining the recreational demand at seaside locations in France, Belgium and the United Kingdom. Evidence from the discrete choice experiments showed that both the presence of fishing vessels and the direct sale of seafood positively contributed to the utility of the respondents, especially with regard to the former attribute.

Other studies have applied revealed preference methods to explore the positive externalities that fisheries can bring to coastal communities by increasing their level of attractiveness. Andersson et al. (2021) investigated the relationship between fishing variables (i.e., landings and number of vessels, differentiated between large and small-scale) and tourism demand using a panel dataset covering 58 coastal municipalities in Sweden over the period 1998–2015. Although they found a statistically significant positive relationship between fishing activity and overnight stays when applying ordinary least squares, the results did not hold with fixed effects estimation, which controlled for the unobserved heterogeneity among the municipalities under consideration. On the other hand, in their contingent behavior travel cost analysis of touristic visits to the coastal town of *Mooloolaba* in Australia, Pascoe et al. (2023) demonstrated that a reduction in the number of visitors would take place if there were no fishing industry or the opportunity to eat local seafood. Moreover, the qualitative information gathered during the survey suggested that the view of the local fishing fleet would increase the interest in eating locally caught fish, which implies the existence of a positive externality from the fishery to other sectors of *Mooloolaba* economy. Similar conclusions were also reached by Le Gallic et al. (2015), who demonstrated that 34% of the visits to the French municipality of *Le Guilvinec* were specifically motivated by the presence of a fishery, as indicated by the fact that the activities linked to the fishing character of the town (walking in the harbor, looking at vessels, buying/eating seafood) were among the most frequently reported by tourists. Lastly, the study by Waldo et al. (2023) combined in-depth interviews with local tourism representatives and a questionnaire survey of 647 tourists who visited the *Träslövsläge* harbor to investigate the impact that the decline of Swedish SSFs may have on the marine tourism industry. Through the use of the TCM and stated preferences, the paper shows that the number of one-day visits would decrease without fishing-related attributes. In particular, the findings reveal that tourists value the presence of fishing vessels at approximately 9% of the total value of their visit. In contrast, fishing architecture and a harbor with active commercial fisheries are rated lower in importance. Interviews suggest that the fishing industry plays a crucial role in defining the village's character, but the overall touristic experience also relies on additional activities such as restaurants and water sports, to the extent that the significance of fishing-related attributes varies considerably among tourists.

2.2. *The travel cost method*

In this paper we apply the TCM to estimate the recreational value associated with fishing presence and capacity. The use of a revealed preference method like the TCM is appropriate if the researcher aims at estimating recreational use values, rather than other use or non-use values (Perman et al., 2003). First suggested by Hotelling in his famous letter to the US Park Service in 1947 (Hotelling, 1947) and later developed by Clawson (1959) and Clawson and Knetsch (1966), the TCM has been widely used to value the recreational use values of a variety of environments, such as wetlands (Gürlük and Rehber, 2008), mountain forests (Hesseln et al., 2003), lakes (Fleming and Cook, 2008), coastal beaches (Bin et al., 2005), marine protected areas (Chae et al., 2012) but also historical and cultural sites (Bedate et al., 2004; Tourkolias et al., 2015). The TCM considers the expenditures that the user incurs to enjoy the outdoors as their implicit price, for example including fuel costs and the opportunity cost of time (Phaneuf and Kerry Smith, 2005). If recreation trips are ordinary goods, then the frequency of visits to a recreation site should diminish if the travel cost increases (Bockstael and McConnell, 2007).

Outdoor recreation involves the participation in any leisure activity in the natural environment, such as ocean swimming or boating, and is a benefit derived from cultural ecosystem services (Haines-Young and Potschin, 2017). In certain scenarios, outdoor recreational areas like alpine skiing resorts are managed through market-based systems. However, recreational use of the environment is more commonly characterized as a public good, with both free entry and no consumption restrictions (Phaneuf and Requate, 2016). Having the characteristics of non-excludability and non-rivalry in consumption, recreational experiences are not traded in markets and therefore, despite generating substantial benefits to visitors of these sites (White et al., 2020), they share with other environmental goods and services the risk of undersupply relative to the social optimum (Champ et al., 2003). Using the choices revealed in markets or responses to questionnaires as proxies for visitors' preferences, non-market valuation methods are able to capture the changes in welfare associated with modifications in the provision of recreational opportunities, thus providing crucial information for resource management decisions (Bishop and Boyle, 2019; Freeman III et al., 2014).

The TCM typically uses survey data from samples of recreational visitors. To operationalize the TCM, the researcher can opt for the zonal TCM, the individual TCM or the random utility TCM (Phaneuf and Kerry Smith, 2005). In this work, we apply the individual TCM (which analyzes the number of visits chosen) rather than the random utility TCM (which analyzes which sites were chosen), given the lack of detailed individual level information and on potential substitute sites. We apply the so-called "typical site approach" of TCM studies, meaning that we do not consider only one specific location but we rather treat similar sites (coastal environments) taken together as one "typical" site (various examples of this technique can be found in Ezebilo (2016)).

We then estimate a trip demand equation to extract consumer surplus per visit conditional on its price, income and other variables of interest. The individual's problem when facing recreational decisions can be summarized by the following utility maximization problem (Phaneuf and Requate, 2016):

$$\max_{x,z,l} U(x,z,l,q) \; s.t. \; wT = z + (c + wt)x + wl \tag{1}$$

where the individual maximizes his or her utility by choosing the number of visits to the site (x) and the consumption of both non-recreational market goods (z) and leisure time (l) subject to time and budget constraints (w is the wage rate, t is the time needed for the visit, c is the cost to reach the site, T is the total time available).

The model can be further developed by relaxing some of the assumptions that are implicit in its basic formulation, namely the single purpose nature of the visit, an exogenously determined onsite time, the impossibility to adjust the trip decision, an opportunity cost of time based on the wage rate, and the absence of utility/disutility from travelling to the site (Phaneuf and Requate, 2016).

3. Data

3.1. *Recreation data*

This work uses an existing dataset from the BlueHealth International Survey, an international online study conducted in four waves between

June 2017 and April 2018 in 18 countries around the world, whose aim was to investigate people's recreational habits and the effects of blue spaces on physical and psychological health (Grellier et al., 2017).[2] The study resulted in a final number of 18,838 respondents, reached by the market research company YouGov through their registered panels of participants. Data collection was performed by means of stratified sampling of geographical regions by different combinations of age and sex with the aim of recruiting approximately 250 responses per country per wave. The publicly available version of the dataset includes information for 11 European countries on the following topics: subjective well-being, frequency and perception of visits to natural environments, features of recently visited blue spaces, the effect of bathing water signage on recreational habits, the participant's health status and demographics (Elliott and White, 2022).[3] A full description of the methodology applied to run the survey can be found in Elliott and White (2020).

This data was subsequently used by Börger et al. (2021), who applied the TCM to examine recreational visits to blue spaces in 14 EU Member States through a combined TCM and contingent behavior approach. The aim of Börger et al. (2021) was to understand recreationists' habits and how these would be impacted by changes in perceived water quality, as well as to provide an economic assessment of the value attributed to a visit. In their analysis, the recreational good is a blue space, namely urban inland (e.g. urban canals), rural inland (e.g. waterfalls), urban coastal (e.g. piers) and rural coastal sites (e.g. cliffs) (Elliott and White, 2020, p. 15). Since our interest lies on the influence of marine fishing activities on recreation, we filter the dataset keeping only observations pertaining to coastal environments.

Given the advantages of a dataset with such wide coverage and unusually high number of observations, we use the public version of this dataset to investigate how the presence of a fishing fleet affects individuals' choice of participation in coastal recreation. As in Börger et al. (2021), our dependent variable is the number of trips to the last visited coastal environment in the four weeks preceding the administration of the survey. The explanatory variables are the demographic and socioeconomic characteristics of the respondent (country, sex, age, education, marital status, income, swimming competence and dog ownership), the period in which the questionnaire was compiled, the type of environment visited, the purpose of the trip and the travel cost. We expand Börger et al. (2021)'s analysis by including both the opportunity cost of travelling time, and fisheries-specific variables among the regressors.

With regard to the dataset construction, we follow the same inclusion criteria described in Börger et al. (2021) to get what they call the final "TCM sample" (a thorough description of each step is provided in the Supplementary Material section A.3 of their article). This implies the exclusion of visits *i*) which were entirely for other purposes than visiting the site, *ii*) not starting from home, *iii*) with a one-way road distance of more than 1000 km and *iv*) with unrealistic combinations of travel mode and distance travelled/visit frequency. Respondents who declared on average more than two visits per day over a four- week period and those who provided unreliable home and visit locations are also excluded. Due to the exclusion criteria, the large majority of trips under analysis is likely to be day visits (i.e., with a duration of less than a day, beginning and ending at the same location) rather than overnight trips (i.e., with a duration of more than one day). Concerning the construction of the travel cost variable, we apply the same country-specific per-km costs for each mode of transport as in Börger et al. (2021), namely: personal motorized transport, bicycle, train, taxi, hired car, ferry, other (for walking, running and jogging the cost was set to zero) (Supplementary Material section B.2).[4] If the visit involved the use of a personal motorized transport (e.g. car, van, motorbike), taxi or hired car, the travel cost expenses are shared among the adults taking part in the visit.

Since not accounting for the value of time can lead to an underestimation of consumer surpluses (Ward and Beal, 2000), in this paper we expand the work by Börger et al. (2021) by including the opportunity cost of travel time, a frequent practice in TCM studies. In order to compute the opportunity cost of time for each visit, the travelling time to reach the coastal environment is extracted dividing the home-site distance by the average speed of each mode of transport. These values and respective sources are provided in the Appendix (Table A1). The opportunity cost of travel time is then obtained by multiplying the round-trip time by one third of the hourly income of the respondent, following an established practice in the travel cost literature (Cesario, 1976; English et al., 2018; Ward and Beal, 2000). The income per respondent is divided by the average number of annual hours worked per country (OECD, 2022) to retrieve the respondent's hourly income.

A limitation of individual TCM applications is their inability to properly account for substitution effects across recreational sites (Perman et al., 2003). On the contrary, the random utility TCM is considered to be the most appropriate model when the visitor's choice involves multiple locations, as it allows to identify the trade-offs between money (trip cost) and other characteristics varying among sites (Parsons, 2003; Phaneuf and Kerry Smith, 2005). The random utility TCM model more faithfully accounts for substitution effects by identifying why a site is preferred over another given its characteristics and travel costs (Phaneuf and Requate, 2016). However, the random utility TCM is not compatible with our dataset due to missing information necessary to calculate the travel cost to other sites in the choice set (see footnote 4).

3.2. Fisheries data

In this paper, the underlying variable of interest is the attractiveness of a harbor, as we hypothesize that attractive fishing harbors draw visitors. However, the attractiveness of a harbor is a latent variable that we cannot properly measure. It is also unclear which particular feature of a fishing harbor attracts visitors. To measure attractiveness, we account for various characteristics of the fishing fleet registered at each harbor given available data. We collect fishing fleet data from the European Commission's Fleet Register for the year of 2018.[5] We define SSF vessels as those with a length under 12 m and using passive gears (STECF, 2021).[6] Coordinates for each fishing harbor are collected from Maratlas and then matched with the 2018 fishing fleet data using harbor codes.[7] The result is a set of six variables representing capacity of fishing harbors, namely number of vessels, power and tonnage, for either LSF or SSF vessels. If a harbor is located within a 5-km radius, then the six fishery variables take the capacity values that the Fleet Register assigns

[2] The BlueHealth International Survey data was created using funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 666773.

[3] Unlike the dataset used by Börger et al. (2021), the public version- deposited in the UK Data Service- does not report information for respondents from the following countries: Finland, Ireland and Portugal. In the analysis we do not consider respondents from Czech Republic because of the lack of marine fisheries in its territory.

[4] Due to privacy reasons, any information about the home address of respondents (e.g. the geographic coordinates, latitude and longitude, or postal codes) has been removed from the dataset. We were thus not able to compute the route from the home location to the site, but an additional variable reporting the travelling distance in kilometers (Supplementary Material section A.2) from the home address to the blue space visited has been generously provided by the dataset creators Lewis Elliott and Mathew White.

[5] Data was collected from: https://webgate.ec.europa.eu/fleet-europa/search_en

[6] The following acronyms were used to identify vessels that use a passive gear: LNB, LNS, GNS, GND, GNC, GTR, GTN, FPO, LHP, LHM, LLS and LLD (Macfayden et al., 2011).

[7] Data was collected from: https://maratlas.discomap.eea.europa.eu/arcgis/rest/services/Maratlas

to that harbor (and zero otherwise). To test for presence rather than capacity of the fishing fleet, we also create a dummy variable that takes value 1 if a fishing harbor is within a five-kilometer radius of the chosen coastal environment (i.e. the recreational destination). The distance threshold was set at five kilometers because it allows the fishing harbor to be within a walkable distance from the visited site. However, sensitivity analysis is provided in the Discussion (Section 5.1) by varying this threshold.

The descriptive statistics are summarized in Table 1. As shown by the low mean of the fishery-related variables, the majority of respondents visited coastal environments more than 5 km away from a fishing harbor. By controlling for different attributes, we wish to capture the attractiveness of a fishing harbor and investigate which features affect the demand for recreational visits. Descriptive statistics of the non-fisheries variables included in the model can be found in Table A2.

4. Results

To model the demand curve for recreational visits, we use the Truncated Negative Binomial regression model, a common procedure in the TCM literature (Du Preez and Hosking, 2011; Twerefou and Ababio, 2012; Zhang et al., 2015).[8] The Truncated Negative Binomial model allows for both overdispersion (i.e., the conditional variance of the underlying distribution of trips can exceed the conditional mean) and zero-truncation (i.e., only respondents who made at least one visit to a coastal environment in the previous four weeks are considered). Maximum likelihood estimation is used to obtain the coefficients of the model.

4.1. Estimation results

We run the regression for three different specifications by changing the measure of the fishing capacity of both SSF and LSF vessels. These variables indicate the number of vessels, the total tonnage (measured in Gross Tonnage) and the total power (measured in Kilowatts) of the vessels registered in the harbor, which are highly correlated. In Table 2 we present only the estimates for the fishery variables and the travel cost. The full regression output including all control variables can be found in Table A3.

The likelihood-ratio chi-square test shows that the overdispersion parameter alpha is different from zero at the 95% confidence level in the three models under consideration. This implies that the use of the (zero-Truncated) Negative Binomial regression should be preferred to Poisson, whose assumption of equidispersion is here violated (Haab and McConnell, 2002).

First, it emerges that the sign associated with the coefficient for the travel cost variable is negative, as dictated by economic theory. The travel cost is always significant at the 1% level across the three models. This confirms the notion that individuals having higher travel expenses take less visits to the coastal environment reported in the survey.

When looking at the fishery variables, it emerges that the dummy (i.e., taking value 1 if there is a fishing harbor in the proximity of the visited site) is significant in Models 1 and 3. Such a variable is here used as fishing presence regardless of capacity, with the aim of testing whether if the presence of a harbor hosting at least one fishing vessel suffices to attract visitors. The results indicate that the presence of a fishing harbor is in itself an attractive feature for coastal spaces. However, as suggested by the statistical significance of the other fishing variables, the capacity of the fleet also plays a role in the participation decision.

The estimated coefficients providing a continuous measure of fishing capacity suggest that the composition of the fleet registered at the harbor can influence the choices of recreationists. In particular, we see that the variables associated with SSFs are all positive and statistically significant across the different specifications. Notwithstanding this, the support in favor of the hypothesis that an increase in the capacity of SSFs positively impacts visitation rates is not equal across specifications. When attractiveness of a harbor is measured in terms of the total tonnage of these vessels (Model 2), the corresponding coefficient is positive but only statistically significant at the 5% level. Stronger evidence backing the recreational potential of SSFs can be found when the capacity of SSF vessels is described by their total number or power: in Models 1 and 3 these variables are significant at the 1% level.

Opposite results emerge when we focus on the variables indicating the industrial vessels registered at the harbor. Indeed, it appears that the presence of LSFs has a negative influence on the frequency of visits to blues spaces. This argument holds in all the three models under consideration, especially when capacity is measured through the number of vessels or their total power (statistically significant at the 1% level in Model 3).

Concerning the statistical fit of the models, no major differences are found. Nevertheless, Model 3 shows both the lowest AIC (Akaike's information criterion, 4916.7) and BIC (Bayesian information criterion, 5132.9) values, meaning that describing the fishing capacity of SSF and LSF vessels through their total engine power outperforms the use of total tonnage or number of vessels as a unit of measurement. Based on these results, we could argue that the activity of SSFs tends to impact visitation positively, while LSFs have a negative effect.

4.2. Welfare analysis

Using these estimates, we calculate the welfare effects of changes in fishing capacity by estimating the changes in Consumer Surplus (CS) derived by a decrease in the capacity of SSF vessels. In a (Zero-Truncated) Negative Binomial model, the variation in CS due to a change in one of the explanatory variables is given by (Hanley et al., 2003):

$$\Delta CS_{i=}\frac{exp\left(\sum_k \gamma X_k + \delta Z_i^* - \alpha TCost_i\right)}{\alpha} - \frac{exp\left(\sum_k \gamma X_k + \delta Z_i - \alpha TCost_i\right)}{\alpha}, \quad (2)$$

where X is the vector of k explanatory variables with γ coefficient, Z_i^* indicates the change in the capacity of SSF vessels from the baseline Z, δ is the associated coefficient and α is the country-specific travel cost coefficient. The formula indicates that the change in CS for individual i after a change in one of the explanatory variables is equal to the variation in the predicted number of visits divided by the travel cost coefficient (Johnstone and Markandya, 2006). Using the whole TCM sample (1128 observations), we use Eq. (2) to compute the change in CS for each respondent due to a one unit decrease in the three fishing capacity indicators. Moreover, in order to inspect CS variations at the national level, we rerun Models 1, 2 and 3 separately for a subset of countries, namely Greece, Spain and Sweden.[9] The welfare change results, obtained by applying the newly estimated coefficients to Eq. (2), are included in Table 3.

We also calculate the potential welfare loss in a hypothetical scenario characterized by the complete removal of the small-scale fleets registered at the harbors covered by the sample. Setting the number of SSF vessels equal to zero, the difference in the number of visits to the coastal space- divided by the travel cost coefficient- indicates that the monetary value of having an SSF fleet in the proximity of coastal sites is far from negligible. If we multiply such figures by the average number of individual visits to coastal spaces during the year and the 2017/2018 national population (reported in Börger et al. (2021)), we obtain the total recreational value of SSFs (see Table A4). We find substantial

[8] Our approach diverges from the modelling approach adopted by Börger et al. (2021) by omitting analysis of Contingent behavior responses from the experimental section of their survey.

[9] Only these three countries were considered due to convergence issues with the Truncated Negative Binomial model.

Table 1
Summary statistics of subsets of variables included in the models.

Variable	Full sample (after exclusion criteria)					TCM sample*				
	Obs	Mean	Std. Dev.	Min	Max	Obs	Mean	Std. Dev.	Min	Max
Fishery variables										
Harbor dummy	1728	0.38	0.49	0	1	1128	0.38	0.48	0	1
Number of LSF vessels	1661	7.46	19.08	0	178	1128	8.37	20.16	0	178
Tonnage of LSF vessels (GT)	1661	597.55	1764.43	0	11,133	1128	625.70	1772.49	0	11,133
Power of LSF vessels (kW)	1661	1780.89	4708.39	0	40,119	1128	1954.96	4966.36	0	40,119
Number of SSF vessels	1661	33.93	100.69	0	595	1128	36.65	104.36	0	595
Tonnage of SSF vessels (GT)	1661	67.47	194.33	0	1138	1128	72.40	200.65	0	1138
Power of SSF vessels (kW)	1661	925.51	3034.59	0	25,632	1128	986.44	3104.54	0	25,632
Other variables										
Number of visits to this blue space in the last 4 weeks	1728	4.23	5.82	1	56	1128	4.27	5.75	1	56
Income (€)	1507	17,670	11,344	1498	43,922	1128	18,266.06	11,548	1498	43,922
Travel Cost (€)	1728	10.58	23.73	0	240	1128	10.78	24.01	0	240

* This is the final sample. Observations with missing values for one or more variables are excluded from the regression.

Table 2
Truncated Negative Binomial model estimation results.

Variable	Model 1	Model 2	Model 3
	Number of visits to this blue space in the last 4 weeks	Number of visits to this blue space in the last 4 weeks	Number of visits to this blue space in the last 4 weeks
Travel cost	−0.0483***	−0.0483***	−0.0484***
	(−9.45)	(−9.45)	(−9.46)
Harbor dummy	0.255*	0.168	0.256**
	(1.91)	(1.30)	(1.99)
Number of SSF vessels	0.00327***		
	(3.38)		
Number of LSF vessels	−0.0163***		
	(−3.10)		
Tonnage of SSF vessels		0.000924**	
		(2.34)	
Tonnage of LSF vessels		−0.0000716*	
		(−1.70)	
Power of SSF vessels			0.0000970***
			(3.50)
Power of LSF vessels			−0.0000586***
			(−3.11)
Constant	−1.470	−1.404	−1.335
	(−1.08)	(−1.03)	(−0.98)
lnalpha	1.303***	1.334***	1.306***
	(5.72)	(5.73)	(5.73)
N	1128	1128	1128
AIC	4917.1	4924.1	4916.7
BIC	5133.3	5140.3	5132.9

Note: ***, **, * denote significance at the 1, 5, and 10% levels, respectively. Standard errors in parentheses.

recreational values of SSFs in aggregate terms, ranging from 49.4 million EUR in Sweden and 189.4 million EUR in Spain to nearly 4 billion EUR in Greece.

5. Discussion

The results suggest that the total economic value of SSFs includes substantial recreational benefits. Despite their variation in magnitude and statistical significance, the fishery variables included in the model indicate a positive effect of SSFs on the attractiveness of coastal sites. This conclusion holds using total number of vessels, power or tonnage as alternative indicators of fishing capacity, as well as for the presence of a fishing port. Here we infer on the robustness of our results when changing some assumptions of our analysis. Overall, we find that SSF capacity, as well as the presence of a fishing harbor, positively affect the recreational value of a trip.

5.1. Model specification and sensitivity analysis

First, we recognize the possibility of having non-linear marginal effects of changes in the fishing fleet on the frequency of visits. Therefore, we allow for the possibility of having decreasing or increasing marginal effects of the fishery variables by re-estimating the three models with the addition of squared terms for both number of vessels, tonnage and power. However, they do not yield economically significant results: the sign of the coefficients confirms the results from Models 1, 2 and 3 (a positive relationship between visits and SSFs and a negative one when LSFs are considered) with no tipping point. Moreover, the quadratic models do not provide higher statistical fit when considering the AIC and BIC criteria. The results are reported in the Appendix (Table A5).

In addition, we recognize the arbitrariness of choosing a five-kilometer distance as the threshold to define the presence of a fishing harbor in the proximity of the visited site. For this reason, we rerun Models 1, 2 and 3 by increasing and decreasing the walkable distance by two kilometers. The results, shown in Tables A6 and A7 – respectively for the three kilometers and the seven kilometers thresholds-, tend to confirm the sign and significance of the coefficients associated with the variables previously obtained and reported in Table 2. However, the influence of the harbor dummy appears to be more subject to the threshold choice, to the extent that it looses significance when the radius is broadened to seven kilometers. Contrarily, the positive effect of SSFs on recreation is robust to both specifications.

Concerning the variations in CS estimates, the results displayed in Table 3 indicate that these values differ among Member States. The scope of this paper is not to explain differences across countries. Apart from differences in income among the population, it goes without saying that reductions in fishing capacity would have a higher impact in coastal areas characterized by a higher frequency of either fishing harbors, SSFs vessels or recreational visits to marine sites. This explains why in Greece- where the recreational value of artisanal vessels is relatively smaller than Spain- the CS reduction due to the loss of all national SSFs (Table A4) would be considerable (see Table A9 for a descriptive summary of the distribution of SSF vessels in the coastal sites included in the survey). This is due to the combined effect of a strong presence of

Table 3
Change in Consumer Surplus (CS) for a one unit decrease in SSF capacity.

Individual ΔCS per visit (€)	Observations	Number of SSF vessels			Tonnage of SSF vessels			Power of SSF vessels		
		N-1			GT-1			kW-1		
	N	*Mean*	*Std.Dev.*	*95% Conf. Interv.*	*Mean*	*Std.Dev.*	*95% Conf. Interv.*	*Mean*	*Std.Dev.*	*95% Conf. Interv.*
TCM sample	1128	−0.05	0.09	[−0.06,-0.04]	−0.01	0.02	[−0.02,-0.01]	−0.002	0.003	[−0.002,-0.001]
Greece	301	−0.06	0.1	[−0.07,-0.05]	−0.02	0.03	[−0.02,-0.01]	−0.002	0.003	[−0.002,-0.001]
Spain	159	−0.08	0.11	[−0.09,-0.06]	−0.02	0.03	[−0.02,-0.02]	−0.002	0.003	[−0.003,-0.002]
Sweden	65	−0.07	0.1	[−0.09,-0.06]	−0.02	0.03	[−0.02,-0.02]	−0.002	0.003	[−0.003,-0.002]

artisanal fisheries along the coastline and high frequency of recreational visits to marine locations by the Greek population. In addition, there might be other latent factors determining the relevance of the fishing sector in the countries under analysis and thus influencing recreational behavior. Further research could potentially investigate this issue by analyzing the correlation between the societal value of SSFs in European countries and the local social, historical and cultural role of fisheries. Nevertheless, the results for our multi-country TCM sample highlight the importance that European citizens engaging in outdoor recreation place on the presence of SSFs in coastal sites.

We could have concentrated the CS analysis on the effects of an addition in fishing capacity rather than a decrease. The estimates for one-unit increase in both number of vessels, tonnage and power are very close in magnitude (but with opposite sign) to the ones showed in the paper for a one-unit decrease. Such an approach could be used in a cost-benefit analysis comparing, for instance, the subsidies that the EMFF grants for the acquisition of SSF vessels to young fishermen (European Parliament, 2021) with the recreational benefits that these vessels would generate. However, we decided to focus on the consequences on recreation of capacity reductions because it is more realistic to expect a declining trend for SSFs in the EU context. The latest Annual Economic Report on the EU Fishing Fleet clearly identifies the complexities currently experienced by the small-scale segment of the fleet, which constituted 76% of the active fleet and 50% of the engaged crew as of 2020: −21% in Full Time Equivalents and a reduction in net profit larger than 60% between 2018 and 2020, with SSFs being especially affected by the value chain disruption due to COVID-19 (STECF, 2022). The previous discussion on multifunctionality suggests that the consequences of small-scale fishers leaving the sector would not be limited to a decrease in landings. Recreational habits in European coastal areas could be negatively affected as well.

To control for nearby economic activity shaping the recreational appeal of the visited sites, we include two additional variables describing the socio-economic condition of the area visited by the respondent, in order to isolate potentially confounding factors. Using the geographic coordinates of the visit, we retrieve the 2018 local GDP and population density of corresponding the NUTS 3 level from Eurostat (Eurostat, 2023a; Eurostat, 2023b) and complemented with UK data (Office for National Statistics (ONS), 2023). The values are later divided by the territorial average - to account for the relative importance of the region when compared with the NUTS 3's average - and included among the regressors in Model 1. The negative coefficients associated to the relative GDP and population density (Table A8) indeed suggest that recreational visits in coastal environments may be discouraged by the presence of intense economic activity in the area. It is worth stressing that the previously obtained results concerning the positive effect of SSFs are robust to these additional model specifications.

5.2. Study limitations

As stated in the Data description (Section 3.1), our variable of interest is the attractiveness of a harbor. We have used presence and capacity of nearby fishing harbors as measures of harbor attractiveness. A related discussion in the literature is the "virtual fishery hypothesis". Andersson et al. (2021) raised the argument that the identity of a place as a fishing village could be more influential than the actual fishing capacity in determining the level of attractiveness of coastal sites. As noticed by Waldo et al. (2023) during the interviews with local stakeholders in Sweden, while the identification as a fishing village positively affects tourism, there is uncertainty whether an active fishery (with vessels traffic by the harbor and catch unloading) is needed. In other words, a "virtual" fishing industry through imagery and symbolism (Brookfield et al., 2005) may be more valued than the concrete presence of fishing vessels.

Our data is not adequate to infer on this hypothesis. We account for a harbor dummy in order to test whether the presence of a fishing fleet matters- rather than its capacity- and find some support for the intuition that keeping at least one or few vessels registered at the harbor is an effective way to attract visitors. However, this measure does not fully capture what the fishing image of a harbor is. In addition, both the capacity and the composition of the fleet seem to influence recreational behavior, meaning that visitors are not indifferent to the most visible aspects of a fishing harbor (i.e. the vessels). We also suggest that, in order to understand whether the fishery-related historical image of a place is more attractive that its current fleet, the association of capacity with effort statistics (ideally as a time series) would help differentiate between thriving harbors and sites where the fishing activity is marginal or declining. Where possible, further insights could be provided by the inclusion of other relevant factors contributing to build the image of a fishing town, such as the presence of fishing museums, fishing markets or the promotion of marketing strategies capitalizing on the fishing tradition of the community, for instance through pictures in postcards and brochures. The negative coefficient associated to LSFs variables could correspondingly capture other environmental factors (e.g. noise pollution) that have not been included in the analysis.

Moreover, while we look at vessels registered at the harbor, it is likely that larger vessels will spend more time on sea and therefore will not be seen by recreationists. Similarly, it is also possible that fishing vessels registered in one harbor will operate in a different fishing harbor. However, the use of official data from the Fleet Register was the only way to get detailed information of the fishing activity that is supposed to take place in European harbors. Further valuation studies focusing at the regional level or even considering only one coastal site may include other measures of fishing effort we do not possess information over.

Our use of a pooled single site travel cost model is motivated by the available data (i.e. inability to calculate travel costs to alternative sites due to data privacy reasons). While the use of this model may not reflect the best practices in the recreation literature (Lupi et al., 2020), it is a large dataset with unusual large coverage, which presents other important advantages such as the ability to generalize the results to a large fraction of EU countries. We estimate the recreational value of SSFs across different countries, and show that this value is substantial in the ten countries under analysis. Future work focusing on the recreational benefits of SSFs could apply the random utility TCM, which accounts for site substitution, in those contexts where enough information is provided to construct the choice set.[10]

6. Conclusions

The present study is based on the application of the TCM to analyze the relationship between frequency of visitation to European coastal environments and the capacity and presence of a fishing harbor in the proximity of the visited locations. Using three different indicators of fishing capacity (number of vessels, total tonnage and engine power) and controlling for a number of other relevant variables normally included in the TCM literature, the results highlight the different potential of SSFs and LSFs in determining the frequency of visits to coastal spaces. While an increase in the capacity of the former segment of the fleet is supposed to attract visitors, it seems that respondents have been discouraged by the presence of industrial fisheries. In summary, the existence of a fishing harbor is by itself an appealing amenity, but the capacity of the whole fleet registered at the harbor also plays a role. Investigating the welfare effects of reductions in fishing capacity, we compute the hypothetical variations in CS per visit after a one vessel reduction in the small-scale segment of the fleet in the harbors covered by the survey, obtaining an average value of −0.05€.

This is one of the first papers to empirically support the claim that fishing harbors attract local visitors. The recreational value lost due to a hypothetical withdrawal of SSF vessels is considerable (see Table A4): 49.4 million EUR in Sweden, 189.4 million EUR in Spain and 3.9 billion EUR in Greece. It ultimately emerges that the total recreational benefits of SSFs far exceed their market value- measured in terms of gross value of landings in the year 2018- in each of these three countries (STECF, 2020). These are external non-market benefits beyond food provisioning and justify the allocation of some economic support for the SSF sector. Similarly, Waldo et al. (2023) also claim that the presence of positive externalities on tourism might motivate the subsidization of SSFs in particularly picturesque areas, provided that the cost of maintaining fishing-related components of local cultural heritage does not exceed their benefits.

The positive effect of the SSFs variables on trip frequency provides clear support for the inclusion of non-market value estimates in bioeconomic modelling of fisheries management, especially in those contexts where effort needs to be split among different fishing fleets (e.g. small-scale and industrial). This argument is not new. For instance, in his bioeconomic model incorporating the interactions between fisheries and tourism, Bull (2007) assumed that "the model should allow for a positive interaction between tourism and small-scale fishing harbors, but a negative interaction between tourism and large-scale ones". Consideration of the multiple dimensions of fisheries externalities has also been advocated for the development of bioeconomic models expanding the traditional focus on the direct use value of single species fisheries (Kronbak et al., 2013), hence responding to the increasing need for ecosystem-based management of marine resources (Ryan et al., 2014). It follows that socially efficient fisheries management should be based on the assessment of the broad spectrum of externalities (both positive and negative) associated with fishing activities. The recreational value of SSF vessels can be included among the positive externalities.

It is hence important to remark that, focusing on the recreational value of a small-scale fleet, this article looks at only one component of the total economic value of the fishing sector. We argue that the whole spectrum of externalities (both positive and bad) related to the fishing industry should be assessed in order to realize its contribution to societal welfare. This is especially important in the case of the impacts of fishing practices on marine ecosystems, since the magnitude of these externalities is far from negligible (Dayton et al., 1995; Jones, 1992; Pennino et al., 2011), to the extent that society may be willing to let the fishing sector experience a decrease in revenue in order to have stricter measures for ecosystems preservation (Aanesen et al., 2015). However, the positive results emerged in this study- together with the numerous evidence supporting the notion that SSF vessels have a less harmful impact on the ecosystem than industrial vessels (Lowitt et al., 2020; Pascual-Fernández et al., 2020; Sartor et al., 2019)- suggest that potential additional reductions of fishing capacity in the EU should be also confronted with the extensive application of non-market valuation methods to the small-scale segment of the fishing fleet.

CRediT authorship contribution statement

Alberto Ceccacci: Conceptualization, Data curation, Formal analysis, Methodology, Software, Visualization, Writing – original draft, Writing – review & editing. **Ana Faria Lopes:** Data curation, Formal analysis, Methodology, Software, Writing – original draft, Writing – review & editing. **Luca Mulazzani:** Supervision, Writing – review & editing. **Giulio Malorgio:** Supervision, Writing – review & editing.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

Data will be made available on request.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.ecolecon.2024.108197.

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[10] Although the controversy over the existence and inclusion of substitute sites in TCM has been raised for both cultural (Bedate et al., 2004) and nature-based recreation (Mayer and Woltering, 2018), it is acknowledged that the omission of substitution possibilities in revealed preference studies could lead to biased WTP estimates (Cutter et al., 2007). Individual TCM applications are limited in their ability to capture substitution effects, and the random utility TCM is considered to be more appropriate when the visitor's choice involves multiple locations, as it allows to identify the trade-offs between money (trip cost) and other characteristics varying among sites (Parsons, 2003; Phaneuf and Smith, 2005).

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