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Research Article

Not so demanding! Employing the Fuzzy-hybrid TOPSIS to explain (un) demanding whale-watcher behaviour

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ABSTRACT

Whale-watching is a significant economic activity in many regions worldwide. However, meeting whale-watchers' expectations present sustainability challenges. This study analyses the demanding behaviour of whale-watchers using a Fuzzy-Hybrid TOPSIS method to empirically validate a 'whale-watching (un)demanding behaviour' synthetic index. This index predicts how socioeconomic and travel-related factors influence the level of demand placed on the activity. We assessed 19 '*importance-items*' (i.e., key aspects of the whale-watching experience) identifying critical covariates that shape the synthetic index. Our fieldwork surveyed 490 travellers following whale-watching excursions in the Canary Islands, Madeira and the Azores. Findings indicate that undemanding behaviours are desirable in whale-watching. The feature of being 'undemanding' is present in tourists who consider the activity's educational content and responsible environmental management over close-up whale encounters. From a managerial perspective, the index serves as a decision-making tool to promote more responsible practices in the industry.

1. Introduction

Following the 1982 whaling ban, which took effect in 1986, whale-watching became a win-win activity, providing ongoing economic benefits to many developing and developed regions (Cisneros-Montemayor et al., 2010). Whale-watching is a two-billion-dollar industry promoted in over 100 countries and involving 15 million tourists annually (International Whaling Commission, 2023). Apart from observing cetaceans in their natural habitat, whale-watching offers other experiences to customers (e.g., learning about marine life, sailing or nature photography) (Lopez & Pearson, 2017; Mitra et al., 2019; Tkaczynski & Rundle-Thiele, 2018).

What kind of tourist books a whale-watching tour? Many tourists confirm that they plan trips specifically to encounter cetaceans in their natural habitat (Bentz et al., 2016; Koetje, 2020), while others join these tours more spontaneously (Suárez-Rojas et al., 2023a).

There remains uncertainty over the profile of whale-watching customers. This lack of information has occasionally led operators to overestimate consumers' desires for close encounters and to see spectacular whale behaviour. These 'unrealistic' expectations are perceived as being of paramount importance to tourists (Rocha, 2023). Consequently, operators often neglect their obligations to conduct their tours responsibly (Dybsand, 2020; Filby et al., 2017; Simpson et al., 2020).

From the demand side, some tourists lack awareness of the harmfulness of certain practices, which can encourage operators to behave irresponsibly and put cetaceans at risk (Moorhouse et al., 2015; Suárez-Rojas et al., 2023a). Thus, education is of great importance for making progress in sustainable whale-watching (Suárez-Rojas et al., 2023a). As Rocha (2023) underlined, well-educated and informed tourists have the potential to encourage operators to comply with regulations.

There is also evidence of tourists who do not want close and animal-abundant observations (Lück & Porter, 2019; Orams, 2000) but expect perfect navigation to ensure a satisfactory experience (Suárez-Rojas et al., 2023b). Some even 'punish' bad practices, such as improper approaching manoeuvres during the encounters (Avila-Foucat et al., 2025; León et al., 2025). Others are uninterested in learning about wildlife protection (Malcolm et al., 2017).

Hence, it is important to closely analyse whale-watchers' demands as a heterogeneous segment (Malcolm et al., 2017; Senigaglia et al., 2020),

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in order to provide tailored recommendations on how the activity can be managed to ensure both a satisfactory and environmentally-friendly experience (Tkaczynski, 2021).

This paper focuses on the lack of understanding of the elements influencing tourists' opinions about what is important when watching whales. Hence, this study goes a step further regarding the comprehension of the natural heterogeneity of whale-watchers' preferences, to address a gap in the tourism literature.

To do so, we implemented a Fuzzy Hybrid Technique for Order Preference by Similarity to the Ideal Solution (TOPSIS) (Benitez et al., 2007), and empirically validated a synthetic index of 'whale-watching (un)demanding behaviour'. This method is recognised as being highly effective when working with noisy and ambiguous information, which is typical of self-reported opinions (Zimmermann, 2013).

The TOPSIS is a widely used multi-criteria, decision-making technique in social sciences (Liao et al., 2023). Specifically, in the tourism literature, studies have assessed service supplier selection and service quality evaluations (Leon & Martín, 2020; Secundo et al., 2017); the analysis of destination competitiveness, attractiveness and environmental suitability (Martin & Viñán, 2017; Liao et al., 2023); and the preferences for tourist sites from the perspective of risk and exposure to diverse threats (Hosseini et al., 2021; Yamagishi & Ocampo, 2022). To the best of our knowledge, this is the first time that this method has been applied in a multi-criteria evaluation of whale-watching attributes (Suárez-Rojas et al., 2023a).

The empirical application involved tourists who went whale-watching during their visits to Madeira, Azores or the Canary Islands. We assessed the strength of the demands and desires of the whale-watchers according to socioeconomic and travel-related features. The robustness of this analysis was confirmed by calculating the index elasticity with reference to subsamples.

The results indicate that destination managers and local operators should address their marketing efforts towards attracting family groups and environmentally-sensitive costumers; avoid discounts and unrealistic images of the tour; use technology to generate more sensorial experiences, and; maintain a connection with experienced whale-watchers who can have a 'nudge' effect on the *expectancy-transformation* of the more spontaneous customers.

2. Literature review

2.1. Sustainability in whale-watching

Whale-watching involves admiring cetaceans, especially whales and dolphins, in the wild (Hoyt, 2021). It is a tourist activity that has grown in many destinations, resulting in pressure on cetaceans and their habitats that has compromised its sustainability (Gleason & Parsons, 2019).

The last three decades of research have therefore focused on: i) identifying the vectors of disturbance and their exposure levels (vessel manoeuvring, interaction time, distance, noise, swimmers, etc.); ii) animal behavioural patterns (respiration rates, swim speed, resting time, foraging, socialisation, etc.); and iii) the most affected coastal regions and sites (see, for example, Amerson & Parsons, 2018; Arias et al., 2025; Arranz et al., 2021; Bejder et al., 2006; Forli et al., 2024).

For instance, there is evidence that the 'swim-with cetaceans' activity contributes to increase stressor patterns, such as swim speed, avoidance behaviour, the creation of population subgroups (Brensing et al., 2005; Rocha, 2023) and/or a decrease in animals' energy reserves (Filby et al., 2017; Stack et al., 2021). However, studies have also reported, in some cases, little or no response of cetaceans due to human presence (Filby et al., 2017; Peters et al., 2013). This could be due to a behavioural habituation of animals to vessels and swimmers (Bejder et al., 2009), or due to the lack of baseline information (i.e., before the existence of the activity) and longitudinal data (evidence on the evolution of cetaceans' responses) (Peters et al., 2013). In any case, more research is needed as previous efforts have not succeeded in guiding the industry towards adopting more responsible behaviour towards cetaceans' wellbeing (Bentz et al., 2016; Curtin, 2010; Simpson et al., 2020).

An issue that has been partly overlooked is the social component, especially regarding operators' commitment to tourist expectations (Affatati et al., 2024) or their capacity to deal with both a competitive market and environmental norms (Affatati et al., 2024; Cave et al., 2022). According to Affatati et al. (2024), whale-watching operators are rarely involved in the decision-making process for regulating the activity. In this context, Rocha (2023) found that operators sometimes doubt whether to follow or break the rules when tourists pressure them to stay longer or swim closer to animals, despite tourists desiring a well-regulated tour. Hence, more social science research should be directed to identifying straightforward, adaptive solutions for balancing whale-watching competitiveness and sustainability (Avila-Foucat et al., 2025).

2.2. Why 'importance' matters in tourism

Tourists have varied expectations concerning travel experiences, products and/or services they purchase (Kline et al., 2016). The relevance of studying expectations lies in the fact that it is a reference point against which performance is evaluated by tourists, explaining, in turn, consumer (dis)satisfaction and (dis)confirmation (Kline et al., 2016).

In the tourism literature, there is evidence that expectations are generated according to aspects perceived as important by holidaymakers (Kline et al., 2016). The more important an element of a destination is to a tourist, the more they may investigate it before their holiday, thereby shaping their expectations and reinforcing an image (Beall & Boley, 2022).

For instance, tourists visiting an eco-site will evaluate their experiences according to the desired 'performance' (expectations) of those features that they consider 'important'. These can be the natural environment, the site's conservation status, and/or the opportunity to see tangible benefits for locals (Beall & Boley, 2022). Furthermore, paying attention to 'what is important' for some tourist groups has also led to new sustainable forms of tourism, such as slow tourism or more accessible sites to respond to the requirements of travellers with special needs (Abrate et al., 2021).

'Importance', as a measure, also gives us insight into attitudes and intentions. For instance, Beall and Boley (2022) proved that tourists who attach greater importance to the differentiating tenets of ecotourism compared to nature-based tourism (i.e., the educational component, community engagement and sustainable management) are more likely to engage in genuine ecotourism experiences.

For this reason, studying importance is strategic. It provides valuable information to guide managers in developing programmes and marketing directions that reconcile operators and consumers diverse objectives (Abrate et al., 2021). To date, it is widely known that importance is highly sensitive to previous experiences, socio-psychological factors, tourist motivations (Abrate et al., 2021; Tkaczynski & Rundle-Thiele, 2018), personal identities, internal needs, values and norms, and the particular interests of each individual (Steg & Nordlund, 2018). This complexity requires an unpacking of segmented analyses of tourist importance and the application of more advanced tools to allow the differentiation of consumers at the individual level (Udall et al., 2020), which is an aim of this study.

2.3. What is important to whale-watchers?

Whale-watching is a wildlife activity that is also considered a form of ecotourism. It aims to maximise the benefits for destinations while minimising the negative impacts on the natural environment and the target species (Connell, 2009; Rocha, 2023).

Whale-watchers are a heterogeneous group with varying demands in the context of environmental responsibility and wildlife protection (Bentz et al., 2016; Malcolm et al., 2017), particularly when

destination-specific idiosyncrasies affect their travel decisions (Senigaglia et al., 2020). There is evidence that tourists idealise whale-watching tours, expecting to see spectacular behaviour from the animals (Malcolm et al., 2017; Pacheco et al., 2021). Advertising, for example, dolphins' impressive jumps and pirouettes, the whale tail's splash, etc., contribute to raising false hopes and, thereby, the idealisation of the experience (Judge et al., 2020).

Since advertising is an essential element in establishing tourist expectations (Finkler & Higham, 2019) and an effective means for the activity's promotion (Howard and Parsons, 2006), whale-watching marketing should be more aware of the consequences of misleading tourists, especially in the e-media era (León et al., 2025).

Research in recent decades has been directed towards bridging the gap between what customers really desire and what operators think they want to enjoy for a memorable experience (Affatati et al., 2024; Curtin, 2010). Studies reported that there are even more important aspects than observing cetaceans close-up, such as boat and service features (Suárez-Rojas et al., 2023b), the trip's cost (Bentz et al., 2016; Ziegler et al., 2012), on-board information (Bentz et al., 2016; León et al., 2025), the possibility of observing other wildlife and taking photos (Bentz et al., 2016; Lück & Porter, 2019), and/or responsible practices (Bentz et al., 2016; Cárdenas et al., 2021; Tkaczynski, 2021). Meanwhile, crowdedness and risky manoeuvres negatively affect tourists' satisfaction (Cárdenas et al., 2021; León et al., 2025; Torres Matovelle & Molina Molina, 2019). In other words, good practice and regulation compliance are paramount factors for ensuring a satisfactory tourist experience (Tkaczynski, 2021; Rocha, 2023; Avila-Foucat et al., 2025).

2.4. Behavioural research approaches in whale-watching

Studies on whale-watching behaviour have expanded over the last few decades in two main directions: i) importance (expectancy)/performance (satisfaction) analyses (e.g., Bentz et al., 2016; La Manna et al., 2020; Lück & Porter, 2019; Tepsich et al., 2020) and, ii) market segmentation (e.g., Dolnicar, 2008; Suárez-Rojas et al., 2023b). In so doing, self-reported surveys have been preferred for data gathering.

'Importance–Performance' analysis is one of the most common methods in the whale-watching literature (Bentz et al., 2016; Cornejo-Ortega et al., 2018; Lück & Porter, 2019; Patterson et al., 2017; Simpson et al., 2020; Suárez-Rojas et al., 2023b). It has been widely adapted to several destination case studies, such as Ecuador (Torres Matovelle & Molina Molina, 2019), Panama (Cárdenas et al., 2021), Croatia (La Manna et al., 2020), the United States (Schwarzmann & Shea, 2020), New Zealand (Lück & Porter, 2019), and France (Tepsich et al., 2020), among others.

It has been useful for determining whether whale-watchers' expectations about the experience impact their evaluation of performance, which, ultimately, determines their satisfaction (Bentz et al., 2016; Tkaczynski, 2021; Torres Matovelle & Molina Molina, 2019). However, Importance-Performance analysis has a critical weakness because it assumes that individuals constitute a homogenous group (Bentz et al., 2016; Bruyere et al., 2002; Wade & Eagles, 2003). In response, authors have started to segment the market before the Importance-Performance analysis (Cornejo-Ortega et al., 2018; Suárez-Rojas et al., 2023b).

Market segmentation is a suitable method to predict tourists' heterogeneity by grouping them according to those similarities that are often difficult to observe (Dolnicar, 2008; Mancini et al., 2020; Tkaczynski & Rundle-Thiele, 2018). Hence, market segmentation is established as an effective planning tool for competitiveness (Dolnicar, 2008; Leon & Martín, 2020). Studies in whale-watching research have been commonly grounded in classic clustering methods, such as *k*-means (Dolnicar, 2008; Suárez-Rojas et al., 2023b), rather than Fuzzy clustering. According to Ayed et al. (2014), the latter better resolves heterogeneity problems, as in this method, data elements can belong to more than one cluster.

This study goes a step further by employing alternative methods for analysing the segmented importance values of the whale-watching activity. The Fuzzy method is also a helpful tool for handling data that is based on subjective and vague judgments from self-report surveys, which is the case in rating the importance of multiple aspects of the tour (Cantillo et al., 2023; Secundo et al., 2017; Yamagishi & Ocampo, 2022).

All the questions related to opinions are destined to be imprecise, and their subjective nature makes them impossible to answer with a single correct response (Martín & Indelicato, 2023; Secundo et al., 2017; Sie et al., 2021). This makes Fuzzy methods well-suited for real-world applications where uncertainty is a common problem (Biasetton et al., 2023; D'Urso, 2007; Lin & Yeh, 2013). As Zimmermann (2013) contended: "*Fuzzy set theory provides a strict mathematical framework (there is nothing fuzzy about Fuzzy set theory!) in which vague conceptual phenomena can be precisely and rigorously studied*" (p. 6).

In our study, the analysis of importance serves to crystallise the high heterogeneity that exists in whale-watching tourism demand, which is a necessary first step to progress toward 'socioecological' homogenisation (Kline et al., 2023). This research identifies not only strategic management areas to be improved by whale-watching operators, but also tourist profiles that mislead the important values of the activity. These are ultimately the market niches in which the levels of information and awareness should consistently improve.

3. Data and methodology

3.1. Study area

The empirical analysis involved five islands and archipelagos in the Atlantic Region (see Fig. 1). Specifically, data was collected in Tenerife and Gran Canaria (the Canary Islands, Spain), Madeira Island (Portugal), and Faial, Pico and San Miguel (the Azores, Portugal). All these islands have built up a significant image and tradition as whale-watching destinations and are declared marine protected areas. They are subjected to policies regulating whale-watching, in addition to voluntary good practice guidelines.

For example, in the Canary Islands, the minimum permitted observation distance is 60 m (100 m for cetaceans longer than 5 m, such as humpback whales), which increases to 300 m during the breeding season or when the animals are feeding or hunting. Failure to comply with these measures will result in sanctions. Moreover, the lack of a specific license for whale-watching, safety measures, and refusal to undergo an inspection or technical check will also be punished. Meanwhile, in Madeira and the Azores, the minimum distance for observing cetaceans is 50 m. In the Azores, regulations also stipulate that vessels must remain more than 500 m away from the animals if they are resting or if females are giving birth. Boats cannot approach whales closer than 100 m if they are alone at the surface or if they are calves.

These regions together host more than 30 species of cetaceans that are present all year-round and close to the coast (O'Connor et al., 2009). Whale-watching tourism represents approximately 13.4 % of tourist arrivals in these regions, generating over 35 million euros in (direct) revenues (International Whaling Commission, 2023).

The Canary Islands are among Europe's leading regions for whale-watching, based on annual tourist participation (Eurostat, 2023). Tenerife dominates the sector, comprising 85 % of the activity. Each year, around 850,000 tourists take part in whale-watching tours on the island, generating around 26 million euros in revenue (International Whaling Commission, 2023). One of the main reasons for tourists to visit the Azores is whale-watching (Bentz et al., 2016), making it one of the three leading whale-watching destinations in Europe (Hoyt, 2021). Our fieldwork was carried out on San Miguel Island, which hosts 60 % of the whale-watchers visiting the archipelago, followed by Pico and Faial (Bentz et al., 2016). The experience has also gained importance in Madeira and grown significantly since the whaling ban (O'Connor et al., 2009; Krasovskaya, 2017). While the main activity is focused on the island of Madeira, Porto Santo also promotes it during the high tourist

Fig. 1. Study sites.

season (Krasovskaya, 2017).

3.2. Survey and fieldwork

The empirical data was obtained through a questionnaire. The survey was designed to collect information about the socioeconomic and travel characteristics of individuals, motivations to engage in the tour, and to gather additional information related to previous whale-watching experiences.

The survey included a question with 19 'importance-items' about a whale-watching experience. For each item, respondents were asked to indicate the degree of importance, according to an anchored 5-point semantic scale, where 1 means 'not important at all' and 5 'very important'. The items illustrate key features of the whale-watching activity that had been previously signalled by tourists at other whale-watching destinations (Bentz et al., 2016; Cornejo-Ortega et al., 2018; Lück & Porter, 2019; Simpson et al., 2020). These features are:

- ✓ Watching performance: number of whales observed (at least one, a lot of them); close and prolonged observation; cetacean behaviour; photo opportunities.
- ✓ Trip and service features: boat type, comfort, safety; gift shop; crowdedness; cost of the trip.
- ✓ Learning experience: learn about whale behaviour, good practices, and preservation; information from a specialised guide.
- ✓ External elements: weather and sea conditions; observing other wildlife.
- ✓ Responsible actions: operator commitment; respectful observation; guidelines followed; appropriate encounter management.

To make the survey understandable to individuals, questionnaires were available in the mother tongues of the leading countries of origin of tourists visiting the study destinations: i.e., English, Portuguese, German, and Spanish.

During the fieldwork phase, questionnaires were randomly administered to tourists at the ports after the whale-watching tours. The period spanned July through September 2019 and covered the pre-test and final survey work. The pre-test stage aimed to validate the reliability of the questionnaire, which consisted of in-depth interviews and focus groups with tourists in Gran Canaria (Spain).

The final sample consisted of 490 whale-watchers. The sample was structured by quotas of the visited island in coherence with the whale-watching market sizes of the archipelagos under study. Representativeness was ensured following the formula of the finite large population (Israel, 1992). This formula has been widely employed in social sciences (Bolarinwa, 2020), and assumes that 80–95 % of the sample's results will represent the target population, plus or minus an acceptable sample error ranging between 1 and 10 % (Tosun, 2006). In addition, sample characteristics were aligned with official statistics about the profile of the average tourist who visits the archipelagos.

3.3. Variables

The 19 'importance questions' included in the survey were used as indicators of the 'whale-watching (un)demanding behaviour' (WW-DB) latent variable. These items were randomised to minimise potentially biased responses (Cantillo et al., 2023; Zimmermann, 2013). Variables in the model were labelled as *imp#* and correspond to the following wordings (Table 1).

The other fourteen observed variables collected through the survey regarding socioeconomic and travel-related characteristics were

Table 1
Variables utilised in the model.

Label	Statement
imp1	*See whales even if it is only one*
imp2	*See whales up close to the boat*
imp3	*See whales for a long time (more than 30 min)*
imp4	*See spectacular behaviours, such as jumping or a whale's tail as it dives*
imp5	*Good photo opportunities*
imp6	*To be with family/friends*
imp7	*Good weather conditions for navigation (sea, wind and air temperature)*
imp8	*To be comfortable on the boat*
imp9	*To feel safe on the boat (e.g., to wear a life-jacket)*
imp10	*Receive information from a specialised guide*
imp11	*Commitment to the environment by the operator*
imp12	*Cost of the activity accords with the quality of the experience*
imp13	*See a variety of different marine animals and birds besides whales*
imp14	*Absence of or only a few boats during the whale-watching activity*
imp15	*Learn about whales' biology (feeding, reproduction) and behaviour*
imp16	*Learn about protection and conservation of whales and other marine wildlife*
imp17	*Learn about how to identify different species of whales*
imp18	*Learn about the regulation and good practices of the whale-watching activity*
imp19	*Learn about whales in local culture*

included as covariates in the model. For instance, *age* is one of the most popular segmentation variables required to better understand the needs and interests of consumers (Cini & Saayman, 2014). *Gender* has also been found to affect tourism experiences differently, especially those involving wildlife and environmental conservation (e.g., see Tortolini et al., 2021). Including variables such as *previous experience* and *main motivation* were essential, as they can affect demanding behaviour (Lück & Porter, 2019; Patterson et al., 2017). The *island* visited when the interview took place was also considered. According to Bentz et al. (2016), carrying out a more or less responsible whale-watching activity could be site-specific. Table 2 summarises all the variables utilised in the study.

3.4. Methodology

We use the Fuzzy hybrid multi-criteria decision-making method (henceforth, Fuzzy-hybrid MCDM) to calculate the whale-watching (un) demanding behaviour (WW-DB) synthetic index. More specifically, the Fuzzy Hybrid TOPSIS was selected, as it offers advantages over any other method that exploit data collected via surveys (Zimmermann, 2013). It is built upon triangular fuzzy numbers (TFNs), implying a more effective treatment of vague information, compared to other Fuzzy sets like trapezoidal fuzzy numbers (Cantillo et al., 2023).

Following expert recommendations in the field (Martin et al., 2019; Saayman et al., 2016), this method is the most appropriate because the primary WW-DB latent variable is based on responses given in an anchored 5-point semantic scale. In this study, the Fuzzy-hybrid MCDM follows a series of steps (Cantillo et al., 2023; Leon & Martín, 2020; Martín & Indelicato, 2023). An in-detail description of these steps is presented in the Supplementary Material.

Step1- Triangularisation of fuzzy numbers (TFNs): To define Fuzzy sets based on the universe of discourse using the interval of real numbers (suitable for increasing effectiveness in the treatment of vague information).
Step2- Defuzzification of Triangular Fuzzy Numbers (TFNs) information matrix: To convert the Fuzzy set into a crisp set (helpful in clarifying the information provided by the Fuzzy sets).
Step3- Technique for Order Preference by Similarity to Ideal Solution (TOPSIS): To calculate the WW-DB index and compare the set of alternatives (valuable for making informed decisions about the demanding behaviour of respondents, considering a wide range of factors).
Step4- Elasticity valuation: To assess the sensitivity of the synthetic index WW-DB (helpful in identifying the key items that drive the behaviour of each segment).

In the first step we compute TFNs. The popularity of TFNs remains high due to their computational simplicity and effective treatment of vague information, which is usually due to the concept of linguistic variables (Del Chiappa et al., 2016; Zadeh, 1975). The concept includes a component list formed by the variable's name, the set of terms used for the answer format, a syntactic rule that generates the set of terms, and a semantic rule that associates each linguistic term with a Fuzzy set within the universe. Fuzzy sets extend the classical tools for formal modelling, reasoning and computing by using a certain degree of uncertainty (Zadeh, 1965). One advantage of the Fuzzy set method is that it allows for an aggregation of the TFNs based on various segmentation variables (e.g., socioeconomic variables like age, gender or income), resulting in another TFN.

Table 2
Variables in the model.

Information	Variables
Socioeconomic and demographic characteristics	Gender; Age; Nationality; Education level; Income; Belonging to an environmental association
Travel characteristics	Travel group; Accommodation; #nights; Expenditure per night
Whale-watching activity	Destination; Previous whale-watching experience; Main motivation; Overall satisfaction
WW-DB	19 importance items rated through a 5-point semantic scale

In empirical applications, it is a regular practice to define Fuzzy sets based on the universe of discourse, using the interval of real numbers between 0 and 100 (Leon & Martín, 2020; Martín & Indelicato, 2023; Martin & Viñán, 2017). The universe of discourse of the present study is thus an interval of real numbers between 0 and 100. The 5-point semantic scale of the survey instrument that represents the set of linguistic terms according to {'not important at all' to 'very important'} is then associated with the corresponding triangular fuzzy numbers included in the universe of discourse.

In the second step, the linguistic terms are associated with TFNs to convert the crisp matrix into a matrix of fuzzy sets. 'Crisp' means binary variables of the 'yes-no' kind rather than a degree of probability. The dimension of the TFN matrix depends on the number of items included in the scale of the WW-DB latent variable (19 in our study) and the extension and type of information asked in the survey instrument (130 segments). The results (TFNs matrix of dimension 19, 130) require defuzzication methods to clarify the information provided by the Fuzzy sets. That is, through defuzzification, we convert a Fuzzy set to a crisp set (Kumar, 2017).

Thirdly, after obtaining the clarified information matrix through the defuzzification method, we use the TOPSIS to calculate the WW-DB index. This involves comparing a set of alternatives based on their proximity to an ideal solution and their distance to the worst-case scenario. The WW-DB index is particularly useful for ascertaining the extent to which some respondents exhibit more or less demanding behaviour, facilitating consideration of the 19 'imp1, imp2 … to imp19' items simultaneously (Hwang & Yoon, 1981; Zeleny, 1982).

After computing the optimal solutions, it is possible to determine the synthetic WW-DB index for every population group of interest by considering the distances of each observation relative to the ideal solutions that were obtained. A particular segment is very demanding when the index is close to one. Thus, it is possible to identify which segment is the most and least demanding in regard to the whale-watching product by ranking all the segments in the analysis according to the descending order of WW-DB. The fuzzy-hybrid TOPSIS index ranks segments based on the relative scores. The score assigned to segments is determined based on the proximity of their crisp information vector to the virtual positive ideal solution (A+) and the distance from the virtual negative solution (A). This ranking rationale is transparent and easy to comprehend.

The final step is dedicated to measuring the elasticity or sensitivity of the synthetic index WW-DB. The elasticity is used to evaluate the degree to which changes in the values of each item or linguistic term included in the scale of the studied latent variable impact the WW-DB index. By analysing the elasticity of the synthetic index, we can determine the extent to which the individual items and linguistic terms influence the overall score.

4. Results

4.1. Whale-watchers' socioeconomic and travel characteristics

Table 3 shows the descriptive statistics of the most relevant socio-demographic and trip-related variables that characterise the sample (see Appendix for further details). The gender distribution is balanced, at around 50 per cent for the sample. By age, the most well-represented segments are those between 26 and 35, and between 36 and 45, with 32 and 28 per cent of the sample respectively. The education level of the respondents is high, as 50 per cent have a bachelor's degree. 32 per cent

Table 3
Descriptive statistics of the most relevant socio-economic and demographic characteristics.

Variable	Category	N	Percentage[a]
Gender	Male	253	51.63
Age	26–35	157	32.04
	36–45	138	28.16
	46–55	90	18.37
Nationality	UK	120	24.49
	Germany	69	14.10
	Portugal	55	11.22
Education level	Technical/vocational	93	18.98
	Bachelor	245	50.00
	Master's or PhD	89	18.16
Income	24,001–36,000 €	106	21.63
	>48,000 €	97	19.80
	NA	159	32.45
Environmental Association	I do not belong	453	92.45
Travel group	My partner	174	35.51
	Relatives and other	103	21.02
Accommodation	Hotel	289	59.00
# Nights	1–5	126	25.71
Average: 7.40	6–10	303	61.84
Expenditure	*Individual* per *night*	141.11 € (av.)	
	Total individual	1044.22 € (av.)	
Destination	Gran Canaria	100	20.41
	Tenerife	150	30.61
	Madeira	80	16.33
	Pico	56	11.43
	San Miguel	56	11.43
Previous WW experience	Never	262	53.47
	Once	99	20.20
Main motivation	Recommendations	122	24.90
	Whales, dolphins	99	20.20
	Sea, animals, nature (Love)	85	17.35
Overall satisfaction		7.00 (av.)	

[a] Only the most frequent categories are reported in the table. Therefore, some categories do not total 100 % (490 observations).

of the sample preferred not to declare their income, while 21 per cent declared an income of between 24,001 and 36,000 euros per year. 92 per cent of the sample do not belong to any environmental association.

Half of respondents joined the whale-watching tour on Tenerife and Gran Canaria (the Canary Islands). For the majority, it was their first time on a whale-watching tour, while 13 per cent had already experienced the product more than three times. Regarding the main motivation to watch whales, *recommendation by friends, hotel or travel agency* is the most important item (25 %), followed by *passion for animals, whales and dolphins* (20 %). With respect to group composition, most consumers were with their *partner* (35.5 %) or *relatives* (21 %).

4.2. TFNs and Defuzzifying

Table 4 shows the TFNs and defuzzified values for the total sample, and those who answered the questionnaire in Tenerife and Pico. The fuzzy numbers for Tenerife and Pico are presented as examples. Upon careful observation, it becomes apparent that the three distinct TFN matrices are full of valuable information. Each row of the matrices is denoted by a TFN, which may pose a challenge for individuals who are not well-versed in Fuzzy set theory to comprehend. Upon a closer look at the rows of each of the TFN matrices, it can be seen that the intervals of the TFNs overlap in all cases. This observation can provide deeper insights into how the values in the matrices are related to one another, thereby helping in the interpretation of the information provided by the TFNs.

Accurate and fair ranking of the TFNs is a challenging undertaking, and several ranking methods have been proposed by researchers (Leon & Martín, 2020). In our study, we utilised the centroid-index ranking crisp method (Cantillo et al., 2023; Martín & Indelicato, 2023), which is thoroughly explained in the Supplementary material. The crisp value is

Table 4
TFNs and defuzzified values for the total sample, Tenerife and Pico.

Item	Total sample		Tenerife		Pico	
	TFN	Crisp	TFN	Crisp	TFN	Crisp
imp1	(62.31, 85.53, 90.33)	80.92	(66.20, 91.93, 94.67)	86.18	(60.89, 81.79, 87.68)	78.04
imp2	(49.49, 66.67, 77.55)	65.10	(57.33, 74.47, 83.00)	72.32	(43.39, 59.64, 72.68)	58.84
imp3	(41.67, 57.67, 70.00)	56.76	(51.47, 69.20, 78.53)	67.10	(29.11, 43.39, 59.29)	43.79
imp4	(51.84, 70.24, 79.47)	67.95	(58.40, 77.60, 84.80)	74.60	(44.82, 62.86, 74.46)	61.25
imp5	(48.86, 66.45, 77.06)	64.70	(56.60, 75.33, 83.27)	72.63	(37.50, 50.71, 65.00)	50.98
imp6	(51.55, 70.08, 79.43)	67.79	(59.47, 80.47, 86.87)	76.82	(44.11, 59.82, 71.79)	58.88
imp7	(54.88, 73.73, 82.00)	71.09	(61.53, 83.60, 88.87)	79.40	(44.11, 58.39, 71.07)	57.99
imp8	(53.18, 71.94, 80.71)	69.44	(58.47, 79.00, 85.73)	75.55	(43.75, 58.57, 70.18)	57.77
imp9	(57.18, 78.27, 85.20)	74.73	(62.40, 85.00, 89.80)	80.55	(51.25, 71.07, 80.18)	68.39
imp10	(58.37, 78.55, 85.69)	75.29	(58.07, 77.40, 84.93)	74.45	(62.32, 85.36, 90.18)	80.80
imp11	(60.67, 81.96, 88.06)	78.16	(59.00, 78.13, 85.67)	75.23	(63.75, 89.46, 93.21)	83.97
imp12	(58.45, 77.49, 85.20)	74.66	(59.27, 78.33, 85.60)	75.38	(55.18, 73.04, 81.79)	70.76
imp13	(56.12, 74.51, 83.04)	72.05	(57.60, 75.87, 84.13)	73.37	(54.11, 71.25, 80.36)	69.24
imp14	(48.76, 65.71, 76.43)	64.15	(48.93, 65.47, 76.00)	63.97	(42.14, 57.50, 69.64)	56.70
imp15	(54.33, 73.04, 81.65)	70.52	(49.93, 67.13, 77.73)	65.48	(60.00, 81.61, 87.68)	77.72
imp16	(55.04, 75.24, 83.14)	72.17	(47.47, 64.53, 75.60)	63.03	(63.21, 86.25, 90.54)	81.56
imp17	(50.49, 68.35, 78.31)	66.37	(45.53, 61.87, 73.80)	60.77	(56.96, 76.61, 83.93)	73.53
imp18	(51.08, 69.57, 79.31)	67.38	(44.60, 61.80, 74.00)	60.55	(58.57, 77.86, 84.29)	74.64
imp19	(51.94, 70.33, 79.90)	68.12	(48.87, 64.87, 76.27)	63.72	(57.14, 78.21, 85.36)	74.73

also included in the table. Researchers can combine all the crisp elements to obtain the crisp information matrix, which is then utilised for subsequent TOPSIS analysis.

Focusing on the results obtained for the cases of Tenerife and Pico, some of the 3-tuples for the case of Tenerife are higher than for those whose destination was Pico, like *imp1* or *imp2*, but the opposite results are observed for other items like, for example, *imp16* or *imp19*. Thus, it is not straightforward to conclude which observations would have the higher WW-DB index. Still, it provides some ideas about the potential existence of different consumer profiles.

Similarly, the row analysis for the total population sample of the crisp information column shows that the most important item of the

whale-watching product is imp1- *See at least one whale*. However, the individual analysis of the crisp columns for the case of Pico shows a different picture because the respondents consider the most important item to be *commitment to the environment by the operator* (imp11).

The analysis of the least valued items shows that for the whole sample, *seeing whales for a long time (more than 30 min)* (imp3) has the lowest importance. This fact is also observed in the case of Pico. However, in the case of Tenerife, *learning about how to identify different species of whales* (imp17) and *about regulations and good practices* (imp18) are less important than *seeing whales for a long time*.

4.3. Fuzzy Hybrid TOPSIS

The positive and negative ideal solutions (A+ and A-) resulting from the TOPSIS analysis are presented in Table 5. The table provides an overview of the ideal solutions for each importance item as well as the representative segment for each of those items. Additionally, it presents the percentage variation between the two ideal solutions, thereby offering a clear understanding of the differences between them.

This information can be particularly useful for identifying areas where the heterogeneity of responses helps whale-watching firms better tailor the activity for market segments, ensuring that the service would be more satisfactory to consumers. For example, the most heterogeneous items are found in imp3 - *Seeing whales for a long time (more than 30 min)*, imp4 - *Seeing spectacular behaviours such as jumping or a whale's tail as it dives* and imp16 - *Learning about protection and conservation of whales and other marine wildlife*.

The representative segments for both ideal solutions are also determined by disperse population groups which are characterised by the group composition, the nationality, the type of accommodation, the overall level of satisfaction, and the main motivation, among others. It is not possible to find any apparent pattern between both ideal solutions. For theoretical construction of the synthetic WW-DB index, it is evident that some of the representative segments of these two ideal solutions will be candidates to be among the most and least WW-DB demanding groups. The results will be discussed in the next section.

Here, it is important to note that for the items *imp1, imp2, imp3 and imp4*, the A+ positive ideal solutions were computed with the lowest values on the importance scale. This is because values close to 5 for these statements would mean that tourists attach high importance to *close-up encounters, stay for long time*, which are practices that can threaten the species. In turn, being low-demanding on these four aspects is an ideal A+ solution in our model, because it represents a tourist that can motivate more respectful operator behaviour; i.e., *Less time and fuel spent in finding one cetacean; More distance to see the species*. For the remaining aspects, the profile corresponding to A+ is that responding with the upper value in the anchored 5-points semantic scale. The greater importance attached to attributes from *imp5* to *imp 19* are, to some extent, beneficial for both the user experience and progress to sustainability.

Table 5
Fuzzy hybrid TOPSIS ideal solutions.

Item	A^+	A^+. Rep.	A^-	A^-. Rep.	Perc. Var.
imp1	92.50	Old-age group	66.07	Own house	40.0 %
imp2	85.00	Rural Hotel	47.75	Satis_5	78.0 %
imp3	81.25	Old-age group	27.29	Belgium	197.7 %
imp4	85.00	Previous experience	29.17	Satis_3	191.4 %
imp5	77.50	Photographs	49.64	Learning	56.1 %
imp6	82.31	Kids	46.00	Nights.11	78.9 %
imp7	88.75	Old-age group	45.75	Canada	94.0 %
imp8	92.50	Old-age group	54.50	Nights.11	69.7 %
imp9	88.00	Primary	58.33	The Netherlands	50.9 %
imp10	84.32	Birthday present	56.67	Rural Hotel	48.8 %
imp11	90.25	Canada	67.50	Previous experience	33.7 %
imp12	85.00	Previous experience	56.67	Rural Hotel	50.0 %
imp13	92.50	Old-age group	49.17	Rural Hotel	88.1 %
imp14	77.50	Photographs	46.25	Satis_2	67.6 %
imp15	85.00	Satis_2	49.58	Previous experience	71.4 %
imp16	87.78	Nights. 15 or more	29.17	Rural Hotel	201.0 %
imp17	87.50	Nights. 15 or more	46.67	Previous experience	87.5 %
imp18	81.53	The Netherlands	42.50	Rural Hotel	91.8 %
imp19	85.28	Nights. 15 or more	50.00	Previous experience	70.6 %

Table 6 shows the results of the WW-DB synthetic index for some population segments of interest. Generally, females, older people and Swedes are more demanding whale-watchers than males, younger generations and Belgians. Meanwhile, those with the highest educational level show the least whale-watching demanding behaviour. Unsurprisingly, those who belong to an environmental association are less demanding than those who do not belong. There is no clear pattern regarding the results observed for income and expenditure per night, but those whose expenditure per night is in the fifth quintile are less demanding than the tourists who spend less money per night.

Regarding the island destination in which whale-watching respondents answered the survey, the synthetic indicator shows something that was not obvious and impossible to identify with traditional methods. That is, an aggregate measure of the demanding behaviour. Tenerife respondents are, for instance, more demanding than Pico respondents.

It can also be seen that experienced whale-watching tourists are less demanding than novice whale-watchers. A similar result is also observed for the main motivation: those who have already experienced whale-watching are less demanding on average than those whose main motivation is 'going with the kids' or those who got their information from a brochure. Moreover, those who go with an older age group are less demanding than those who go alone or with children.

4.4. Elasticities

Table 7 shows the elasticity values of the synthetic index for the sample divided in four groups, according to their previous whale-watching experience. The subsamples were defined according to the answers given to the question: "*Have you done the whale-watching activity before?*" The possible answers were obtained using a four-points semantic scale from never, once, between 2 and 3 times, and more than 3 times.

Based on the elasticity values, it can be deduced that the synthetic index exhibits inelastic behaviour regarding all the items encompassed in the scale across all the segment groups analysed. As explained, the table can be analysed bi-dimensionally by each item of concern and segmentation group pair. Focusing first on the whole sample, it can be concluded that the index is more elastic for the following two items: imp16 - *Learning about protection and conservation of whales and other marine wildlife* and imp4 - *Seeing spectacular behaviours such as jumping or a whale's tail as it dives*.

On the other hand, the WW-DB index is more inelastic concerning the item imp5 - *To have good photo opportunities*. A similar pattern is observed for each of the four groups included in the table, so it seems that the WW-DB index is robust to the groups used in the analysis.

Table 8 presents the results of a one-way ANOVA analysis to determine if there are significant differences in the tourists' WW-DB using the individual TOPSIS values. The table shows the average values, standard deviation and discussion of whether there are significant differences according to whether the average of some categories is significantly lower than those that are marked through the respective super index. For brevity and concision, the table shows only those segmentation variables of interest for which significant statistical differences are obtained.

Table 6
Tourist whale-watching – Demanding behaviour Synthetic Index.

Variable	Category	WW-DB	Variable	Category	WW-DB
Total	Total	0.5822			
Gender	Male	0.5725	Environmental Association	Yes	0.5114
	Female	0.5923		No	0.5880
Age	<26	0.5570	Expenditure per night	Exp_per_night_NA	0.5460
	46–55	0.5574		Exp_per_night_5	0.5549
	>65	0.5741		Exp_per_night_1	0.5869
	36–45	0.5828		Exp_per_night_4	0.5904
	26–35	0.5843		Exp_per_night_3	0.6238
	Between 56 and 65	0.6459		Exp_per_night_2	0.6693
Nationality	Belgium	0.4594	Main motivation	Previous experience	0.5226
	The Netherlands	0.4808		Whales, dolphins	0.5402
	Austria	0.5148		Nothing particular	0.5462
	Canada	0.5191		Interest & curiosity	0.5521
	Spain	0.5570		Sea, animals, nature (Love)	0.5577
	Other	0.5579		New experience	0.5589
	Germany	0.5789		Learning	0.5696
	Italy	0.5879		Birthday present	0.5917
	U.S.A.	0.5918		Photographs	0.5931
	U.K.	0.6007		Recommendations	0.6167
	Denmark	0.6063		Brochure	0.7135
	France	0.6106		Kids	0.7317
	Portugal	0.6226	Destination		
	Sweden	0.6312		Pico	0.5161
Education level	Master's or PhD	0.5410		San Miguel	0.5474
	Primary	0.5710		Madeira	0.5477
	Secondary	0.5770		Gran Canaria	0.5761
	Bachelor	0.5884		Faial	0.6042
	Technical/vocational	0.6056		Tenerife	0.6178
Income	No income	0.5728	Travel Group	Alone	0.5021
	NA	0.5737		Organised group	0.5478
	12,001–24,000€	0.5746		My partner	0.5604
	36,000–48,000€	0.6061		Relatives and other	0.5792
	≤ 12,000€	0.6273		Friends/workmates	0.5926
	24,001–36,000€	0.6425		Other	0.6340
Previous	2–3	0.5427		My child/children	0.6680
WW experience	>3 times	0.5755		Old-age group	0.4983
	Never	0.5853			
	Once	0.6001			

Table 7
WW-DB elasticity values for the total sample and four segments according to their previous whale-watching experience.

Item	Total sample	Never	Once	Between2-3	>3 times
imp1	0.1264	0.1205	0.1307	0.1297	0.1292
imp2	0.1526	0.1513	0.1510	0.1469	0.1472
imp3	0.1830	0.1834	0.1794	0.1793	0.1737
imp4	0.2045	0.2026	0.1961	0.2137	0.1989
imp5	0.1081	0.1068	0.1105	0.1095	0.1014
imp6	0.1418	0.1402	0.1332	0.1417	0.1387
imp7	0.1774	0.1754	0.1709	0.1776	0.1721
imp8	0.1736	0.1729	0.1739	0.1703	0.1669
imp9	0.1319	0.1293	0.1245	0.1334	0.1315
imp10	0.1139	0.1145	0.1033	0.1213	0.1106
imp11	0.1117	0.1145	0.1072	0.1108	0.1023
imp12	0.1190	0.1165	0.1129	0.1240	0.1169
imp13	0.1888	0.1877	0.1825	0.1865	0.1829
imp14	0.1177	0.1175	0.1153	0.1223	0.1136
imp15	0.1448	0.1453	0.1385	0.1519	0.1395
imp16	0.2215	0.2189	0.2115	0.2418	0.2183
imp17	0.1687	0.1680	0.1665	0.1695	0.1631
imp18	0.1477	0.1472	0.1434	0.1578	0.1424
imp19	0.1467	0.1467	0.1427	0.1467	0.1395

Most of the rankings obtained in Table 8 are exactly the same as those obtained and commented upon already in Table 6. Some differences are observed in the main motivation to participate in the whale-watching activity. Regarding *gender* and *age*, the results are not reported in Table 8 because the average values were not statistically different.

The discussion column shows value 5 in Pico, meaning that the Pico average of 0.52 is statistically lower than the average of Tenerife, which is 0.60. Similarly, for the main motivation segmentation variable, the category *nothing in particular* shows 7 in the column; that is, the average of 0.54 is statistically lower than the average of the seventh group, which is *photographs* (0.59).

The results of the ANOVA show that the destination, main motivation, group composition, belonging to a nature association, and income and expenditure per night exhibit statistically significant differences for some of the categories included in the analysis.

5. Discussion

5.1. The effect of socioeconomic and travel characteristics on whale-watching (un)demanding behaviour

Tourists with the highest educational level and those who belong to an environmental association show a lower demanding profile than those with the opposite characteristics (i.e., lowest educational level). This result is aligned with previous studies in the field. Jensen (2015) found that less well-educated tourists commonly demand sole experiences just to impress others - relatives and friends. Gleason and Parsons (2019), and Durrheim and Leggat (1999) affirmed that ignorance of animal behaviour and regulation makes tourists take unnecessary risk and inadvertent antagonistic behaviour, which is harmful to wildlife. This evidence is of particular concern, especially when considering the influence of advertising and social media on consumer expectations and demands with wildlife. In this regard, publicity and on-board information, i.e., 'edutaining', must avoid the creation of false images about animal performance, such as spectacular jumps (Rocha, 2023).

Table 8
One-way ANOVA analysis of the WW-DB index.

Category	Average	SD	Disc.
Pico	0.5236	0.0151	5
San Miguel[1]	0.5417	0.0151	5
Madeira[2]	0.5469	0.0127	5
Gran Canaria[3]	0.5743	0.0113	
Faial[4]	0.5749	0.0163	
Tenerife[5]	0.6039	0.0092	
Nothing in particular	0.5418	0.0206	7
Animals, whales, dolphins[1]	0.5465	0.0113	9,11
Interest and curiosity[2]	0.5486	0.0146	11
Sea, animals, nature (Love)[3]	0.5510	0.0122	9,11
New experience[4]	0.5542	0.0194	11
Learning [5]	0.5543	0.0302	11
Birthday present[6]	0.5600	0.0340	
Photographs[7]	0.5925	0.0652	
Previous experience[8]	0.5965	0.0461	
Recommended by friends, hotel, travel agency … [9]	0.6045	0.0102	
Brochure[10]	0.6358	0.0313	
Kids[11]	0.6748	0.0313	
Alone	0.5221	0.0174	5–7
Organised group [1]	0.5503	0.0209	7
My partner[2]	0.5583	0.0085	6–7
Relatives and other[3]	0.5653	0.0111	7
Friends/work mates [4]	0.5709	0.0151	7
Other [5]	0.6143	0.0176	
My child/children[6]	0.6209	0.0180	
Old-age group[7]	0.4298	0.0460	
Nature Assoc. Yes	0.5288	0.0190	1
Nature Assoc. No[1]	0.5727	0.0054	
Inc. more than 48,000 €	0.5274	0.0115	4,6
NA[1]	0.5584	0.0090	6
No income[2]	0.5602	0.0377	
Inc. 12,001–24,000 €[3]	0.5680	0.0152	
Inc. 36,000–48,000 € [4]	0.5881	0.0152	
Inc. Less or equal to 12,000€ [5]	0.5942	0.0377	
Inc. 24,001–36,000 €[6]	0.6141	0.0110	
Exp_per_night_NA	0.5451	0.0076	4,5
Exp_per_night_5[1]	0.5501	0.0151	4,5
Exp_per_night_1[2]	0.5636	0.0149	5
Exp_per_night_4[3]	0.5876	0.0154	
Exp_per_night_3[4]	0.6134	0.0151	
Exp_per_night_2[5]	0.6329	0.0156	

The results related to *income* and *expenditure* variables suggest that tourists with higher expenditure levels during the trip and lower personal income attach greater importance on average to all aspects. The implication of this finding is important. In some destinations, competition leads operators to decrease the price of the tours to attract more customers. This promotion engages heterogeneous tourist profiles that include those who are price sensitive and try to 'make the most' of everything that consume of the whale-watching experience. In turn, the tour's price may be used as a tool for fair exclusion of more spontaneous tourists who are unaware of the activity's 'real' value, while it increases operators' marginal profits.

Individuals' closest and most significant emotional bonds are formed with their children (Li et al., 2020). Kids play an important role in family travel decision-making, pushing parents to be highly demanding to satisfy their 'calves' (Li et al., 2020). In this regard, it is not surprising the results indicating that tourists whose primary motivation was doing the tour with their children were more demanding than those who went alone or with their partners. These types of tourists also provided optimal A+ solutions in our model, for the highest importance attached to imp6 - *Being in a family experience*. Contrary to the case of *income* and *price,* their high-demand behaviour may provide multiple benefits to the activity.

As suggested by Johns and Gyimóthy (2003), parents' attitudes and demands concerning safety, order, organisation and cleanliness when travelling are shaped by seeking out the best value for money and are a kind of compensation for their sacrifice in cancelling personal aspirations to prioritise their kids' satisfaction. Meanwhile, the desires, experiences and creativity of children are moulded on each occasion by the way they interact in social spaces (Kyritsi, 2022).

In the context of a whale-watching experience, families can be among the whale-watching firms' priorities, especially if operators pay further attention to children's interests and demands to guide them to a whale-sighting game in which all gain (Li et al., 2020). Adapting some of the tours with more children's content might be a feasible win-win solution in which customers of all ages could be educated on the importance of cetacean protection and conservation.

Results show that elderly tourists and those who go with an older age group are less demanding than those in a younger group, which is consistent with earlier findings (Kamboj & Sharma, 2016). Notably, older people care more about comfort and time spent 'in nature', rather than being motivated by the need to 'experience everything', as younger generations generally are (Kamboj & Sharma, 2016; Patterson et al., 2017).

In our study, we confirm that the higher demands shown by elderly people participating in a whale-watching tour are concentrated on imp7- *Weather conditions* and imp8- *Boat comfort*. These aspects do not directly compromise the environmental impact of the activity. Moreover, for the aspects *See whales even if it is only one* (imp1) and *See whales for a long time* (imp3), the older age groups represent the 'ideal solution' (least-demanding behaviour). The market implications are clear. This niche is undergoing increasing growth, as older people seek more immersive, memorable experiences (Patterson et al., 2017). Hence, it is essential to sustain and promote the whale-watching experience at a certain level that increases its attractiveness for this segment (Sie et al., 2021), which is definitively a matter for destination managers.

Dybsand (2020) pointed out that tourists use internal sources - i.e., previous experiences - and external sources - e.g., brochures and advertisements - to form interests and expectations for their trips. In the present study, we found that internal and external sources affect whale-watchers' demands differently. Regarding the previous experience, results show that experienced tourists are on average less demanding than novice whale-watchers. This could be explained via the 'theory of the ceiling' effect, which emphasises how the interest-involvement relationship of tourists weakens when the involvement is higher (Pearce & Kang, 2009).

At the same time, among the group of tourists with previous experience there were the 'optimal solutions' for the aspect imp4 - *See spectacular behaviours such as jumping or a whale's tail as it dives*. Hence, operators are challenged to retain these types of customers for the potential 'nudge' effect in new customers.

Tourists who randomly choose the activity because they got information from a brochure, tend to be more demanding. These tourists are probably requesting precisely what was advertised (given the images), as it was the motivation for their purchase decision. In this regard, this research supports the hypothesis that the projected image pushes visitors to demand more close-up encounters with wildlife and question the need for compliance with regulations (Lenzi et al., 2020; Pagel & Lück, 2024). For instance, Ziegler et al. (2012) found that false advertising in the whale-shark industry caused tourists to construct unrealistic expectations and decreased their satisfaction as they did not receive what was promised in the brochure. Following the recommendations of Ziegler et al. (2012), we believe that it is paramount for (tour) operators to be 'conservative' regarding the information they provide in their brochures in order to moderate consumer expectations and their consequently demanding behaviour, otherwise the tourist experience and the 'correct development' of the tour will be compromised, which could also affect cetacean well-being.

5.2. *The importance of whale-watching attributes across destinations*

All this study's destinations have in common that they are in marine protected areas and are subjected to policies regulating whale-watching (observation distance, the direction of boats when approaching, the time

of observation, among others), in addition to voluntary good practice guidelines.

In our study, we found that the most heterogeneous 'demanding' items were: *Seeing whales for a long time (more than 30 min); Seeing spectacular whale behaviour*; and *Learning about protection and conservation of whales and other marine wildlife*. The first two items represent undesirable demands that promote breaking the law, and the third is precisely one key purpose that originated this activity as a more sustainable form of human-cetacean encounters.

The WW-DB index also explains this aspect from a regional perspective. The most important item for whale-watchers in Tenerife is to *See at least one whale* (imp1), while *Learning about how to identify different cetacean species* (imp17) and *about the regulations and good practices* (imp18) were the least valuable items. Meanwhile, in Pico, the respondents consider the *Operator's commitment to the environment* (imp11) to be the most important and *Seeing whales for a long time* (imp3) the least.

Our findings align with previous research highlighting that, in the Atlantic Region, tourism in general – and whale-watching in particular - is promoted and developed differently, thereby attracting different tourist markets, ranging from the more 'specialist' (i.e., *ecotourists*) in Pico, to the more 'generalist' (*sun, sea and sand* tourists) in Tenerife (Suárez-Rojas et al., 2023b). The results also confirm earlier evidence reporting that the more popular a tourist destination (i.e., concerning the number of tourist arrivals), the more attractive the destination is for new and less-specialised tourists (Bentz et al., 2016; Duffus & Dearden, 1990). This evidence indicates that Tenerife's whale-watching industry requires a focus on possible specialisation strategies, or different regulations and sanctions to the other Atlantic islands.

Similarly, these differences between destinations warn that the most challenging issue facing the whale-watching industry is the low capacity to converge society's interest in the activity with the educational value it represents. Operators are often choosing between the interests of their customers and the need to protect the cetaceans and comply with regulations, as divergent decisions. In other words, sustainability has failed to become their business model. Therefore, the sector needs to find a way to reconcile operators and customers' interests to maintain the activity, long-term, worldwide.

Tour operators should strictly follow the existing regulations to avoid distressing the animals. This means that they need to keep a specific distance from the cetacean and stay for a (limited) specific time. In her study, Rocha (2022) pointed out that despite operators being aware of regulations (and the penalties for non-compliance and beyond), the vast majority of tourists are not conscious of the specificities of the law. Additionally, because regulations vary from one region to another, a tourist can have a high level of sensitivity to the animals, and know that there can be some threat, and not want to cause that threat; but not know the exact limit to ensure this.

In this vein, it is crucial to redirect advertising and on-board storytelling about other aspects of the activity and curiosities that are also valuable for tourists (e.g., to avoid whales jumping, inform tourists about how many calves a whale can have, and the correct distance to protect the offspring, etc.). Similarly, tourists should be informed that observing cetaceans in the wild is not an '*à la carte*' tourist activity. This will help to moderate their expectations of witnessing acrobatic displays from whales and dolphins.

The use of technology can be a good ally to offer a more responsible tourism experience, while reducing impacts on the marine environment. For example, with hydrophones -location systems-one could both reduce navigation time and listen to whale songs. This sensory connection could make the experience more emotional and educationally successful, while reducing the importance of distance and visibility. This is ultimately a question of incentives and promotion of the use of advanced technology from the destination managers to the operators (Affatati et al., 2024). Following this recommendation will help to align customer interests with the importance of gaining knowledge about the conservation and protection of cetaceans and other marine life, thus contributing to a convergence of biological and social interests (Kline et al., 2023).

6. Conclusions

The complexity of tourist desires and preferences challenge the management of whale watching and the design of sound environmentally-friendly solutions (Suárez-Rojas et al., 2023a). As part of this research, we analysed the demanding behaviour of a representative sample of whale-watching tourists who were vacationing in the Canary Islands, Azores and Madeira, and empirically validated a WW-DB index using segmentation techniques.

From the methodological perspective, this is the first application of Fuzzy logic to analyse whale-watchers' latent demands. Thanks to the Fuzzy logic, the perceived importance of whale-watching attributes can be analysed more accurately in relation to 14 co-variates that had not been conjointly examined in previous whale-watching studies. This information is crucial as it enables stakeholders to make informed decisions about product features and marketing strategies that can ultimately lead to greater market success. For instance, how sensitive each type of customer can be to changes in being with family and friends during the experience, or other whale-watching product items.

The results show that whale-watching demanding behaviour is affected by several socioeconomic and demographic variables, and that highly demanding profiles do not ensure the desired environmental responsibility of the activity. Belonging to an older age group, having previous experience and/or being a member of a nature association are examples of desirable characteristics. This is mainly because these characteristics were present in individuals with less demanding profiles on average, and their higher demands appeared in aspects that converge with environmentally responsible management.

This might be explained by the fact that these tourists place more emphasis on navigation conditions and learning than on aspects that can disrupt whales' natural behaviour, such as feeding, breeding and communication (Forli et al., 2024). The noise from boats and engines can also stress these magnificent animals (Arias et al., 2025; Arranz et al., 2021).

Whale-watching is a form of wildlife tourism (Lenzi et al., 2020). Our results fully support this. As in any other wildlife-related activity, less information about security and regulations to tourists results in greater irresponsible behaviour. Also, the desire of *seeing at least one* …. is a very important item for the average wildlife tourist (Kline et al., 2023) and *close encounters for a prolonged period* lead to negative impacts on the animals (Bejder et al., 2006; Lenzi et al., 2020).

This study has yielded some helpful implications about how to respond to these desires without compromising a satisfactory experience. These include: more sensorial experiences through the use of technology; transparent information with key details of protection needs and local regulations (presented in an appealing way that is attractive to unexperienced tourists and the youngest members of the family); avoiding publicity and advertising with unrealistic situations that cannot be guaranteed; not offering large discounts, and; prioritising marketing efforts addressing more loyal and experienced customers, millennials and the X generations of tourists.

Some limitations remain that should be considered in future research. First, from a methodological perspective, the scale could be validated by introducing other items associated with the tourists' knowledge of marine ecosystems, protected areas or regulations. While Fuzzy logic is a valuable tool for dealing with vagueness in survey responses, it is important to also consider the suitability of adapting the answer format to the logic of the Fuzzy sets, as in other studies (Leon & Martín, 2020). By using more Fuzzy logic adapted questionnaires, researchers can ensure that the answers obtained are meaningful and relevant to the research question being investigated.

Second, our results show that some variables influence the synthetic

index, but the relative importance of their significance is still unclear, and this might also be worth investigating further. Finally, the study only analyses the case of six regions representing marine protected areas. It would, therefore, be interesting to see whether the results can be generalised to other tourism-heavy archipelagos or destinations around the world, such as the Caribbean, New Zealand and/or Vancouver Island.

CRediT authorship contribution statement

Chaitanya Suárez-Rojas: Funding acquisition, Writing – review & editing. **Yen E. Lam-González:** Formal analysis, Writing – review & editing. **Juan Carlos Martín:** Supervision, Data curation.

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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.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.jort.2025.100919.

Appendix 1
Descriptive statistics of the socioeconomic and demographic variables.

Variable	Category	N	Percentage*
Gender	Male	253	51.63
	Female	237	48.37
Age	<26	46	9.39
	26–35	157	32.04
	36–45	138	28.16
	46–55	90	18.37
	Between 56 and 65	39	7.96
	>65	20	4.08
Nationality	UK	120	24.49
	Germany	69	14.10
	Portugal	55	11.22
	Nordic countries	35	7.14
	EEUU	25	5.10
	Other countries	186	37,95
Education level	Primary	5	1.02
	Secondary	58	11.84
	Technical/vocational	93	18.98
	Bachelor	245	50.00
	Master's or PhD	89	18.16
Income	No income	9	1.84
	Less or equal to 12000€	9	1.84
	12001 - 24000 €	55	11.22
	24001 - 36000 €	106	21.63
	24001 - 36000 €	106	21.63
	36001 - 48000 €	55	11.22
	>48000 €	97	19.80
	NA	159	32.45
Environmental Association	I do belong	37	7.55
	I do not belong	453	92.45
Travel group	Alone	42	8.57
	My partner	174	35.51
	Friends/work mates	56	11.43
	Relatives and other	103	21.02
	My child/children	39	7.96
	Organized group	29	5.92
	Old-age group	6	1.22
	Other	41	8.37
Accommodation	Hotel	289	59.00
	Apartment	94	19.18
	Others	107	21.82
# Nights	1–5	126	25.71
Averag: 7.40	6–10	303	61.84
	11–15	52	10.61
	More than 15	9	1.84
Expenditure	*Individual* per *night*	141.11 € (av.)	
	Total individual	1044.22 € (av.)	

(*continued on next page*)

Appendix 1 (*continued*)

Variable	Category	N	Percentage*
Destination	Gran Canaria	100	20.41
	Tenerife	150	30.61
	Madeira	80	16.33
	Pico	56	11.43
	San Miguel	56	11.43
Previous WW experience	Never	262	53.47
	Once	99	20.20
	2–3	65	13.27
	>3 times	64	13.06
Main motivation	Recommendations	122	24.90
	Whales, dolphins	99	20.20
	Sea, animals, nature (Love)	85	17.35
	Previous experience	6	1.22
	Interest and curiosity	60	12.24
	New experience	34	6.94
	Kids	13	2.65
	Brochure	13	2.65
	Learning	14	2.86
	Birthday present	11	2.24
	Nothing particular	30	6.12
	Photographs	3	0.63
Overall satisfaction		7.00 (av.)	
# observations		*490*	

The present study empirically validates a 'whale-watching (un)demanding behaviour' synthetic index that predicts how socioeconomic and travel-related factors influence the level of demand placed on the activity. The index serves as a decision-making tool for destinations working on progress towards sustainability, as it easily identifies which market niches are the most demanding in regard to the whale-watching product, and may challenge the sustainable management of whale watching.

Data availability

The data that has been used is confidential.

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