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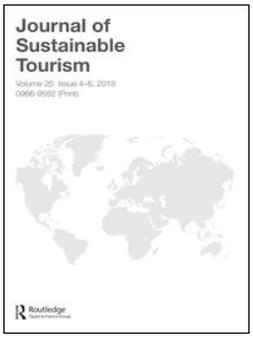

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Conceptualizing nature-based science tourism: a case study of Seili Island, Finland

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ABSTRACT

Nature-based tourism has been widely addressed, yet research on nature-based science tourism, founded on science, scientific knowledge, and/or engagement in scientific research, is still scarce. Drawing on tourist motivation, nature-based tourism, special interest tourism, and science tourism, a novel theoretical conceptualization of nature-based science tourism was developed. The framework identified three categories of science tourism with intensifying levels of tourists' interest in scientific knowledge and tourist engagement: tourism based on scientific knowledge, tourism with scientific adventure or volunteering, and scientific research tourism. In the empirical part, the framework was applied to Seili Island, Finland, and tourist motivation to nature-based science tourism was examined through a survey (n = 518). According to the results, tourists were interested in science and nature-based science tourism products, especially guided tours involving scientific interpretation, but also in intensive scientific excursions. Learning was a dominant motivation, but enjoying nature and escape and relaxation were also significant. When moving from guided tours to more intensive scientific excursions, motivations diversified; besides learning, other tourist motivations also need to be addressed in developing nature-based science tourism experiences. The study contributes to nature-based tourism and underresearched science tourism literature and provides practical implications for developing nature-based tourism.

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Nature-based tourism; wildlife tourism; nature-based science tourism; science tourism; tourist motivation; tourism experience

Introduction

Nature-based tourism has been extensively researched in recent decades. A growing global desire for tourism and recreation is nature-based, involving interactions with or appreciation of the natural environment (e.g., Margaryan, 2018; Mehmetoglu, 2007). Nature-based tourism is an umbrella term including various forms of niche tourism (Novelli, 2005) such as wildlife tourism, ecotourism, and adventure tourism. It can also be considered a form of special interest tourism (Agarwal et al., 2018; Trauer, 2006), in which a tourist's special interest acts as a guiding force in travel decision-making and motivation to participate in specific activities (Volgger et al., 2021). Despite the many forms of nature-based tourism, it often takes place in protected areas and is dedicated to protecting natural and cultural heritage and to maintaining biodiversity and

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ecosystem services (Spenceley, 2008). The current study discusses *nature-based science tourism*—an emerging form of both nature-based and special interest tourism in which science, scientific knowledge, and/or engagement in scientific research are essential for tourist motivation and leisure tourism experiences (Räikkönen et al., 2019).

Previous tourism literature has discussed two types of scientific or science tourism and has used these terms somewhat interchangeably, although they are conceptually different (Räikkönen et al., 2019; see also Laarman & Perdue, 1989; Slocum et al., 2015; West, 2008). *Scientific tourism* refers to international travel for a scientific inquiry conducted by scientists (incl. researchers and students), a phenomenon rooted in the scientific discovery and exploration of 19th-century Europe (Slocum et al., 2015). In contrast, *science tourism* is leisure tourism in which science, scientific knowledge, and/or engagement in scientific research are essential for tourist motivation and tourism experiences (Räikkönen et al., 2019). Science tourism is an extension of educational tourism that developed from the Grand Tours of the 17th–19th centuries (Ritchie et al., 2003). Here, we follow and further conceptualize this latter approach and address nature-based science tourism in light of tourist motivation.

Motivation is the psychological and/or biological needs and wants that provoke, direct, and integrate a person's behavior and activity; accordingly, tourist motivation refers to the needs and wants that influence tourists' behavior and activity (Dann, 1981; Yoon & Uysal, 2005). Previous studies have shown that motivation is a combination of many motives, which makes it a complex issue. Besides destination choices, tourist motivation is closely linked to experiences and activities that tourists seek, pursue, and share with other tourists (Munar & Jacobsen, 2014; Yoon & Uysal, 2005). From the various theoretical perspectives on tourist motivation, the dominant paradigm has been the push-pull approach, addressing factors associated with both the individual and the tourism destination itself (e.g., Dann, 1977; Gnoth, 1997).

This study identifies two major knowledge gaps. First, while nature-based tourism has been widely examined, research on nature-based science tourism is still scarce. Nevertheless, scientific aspects have been discussed in previous studies, for instance those on learning, environmental education, and knowledge sharing between academic researchers and tourism practitioners (e.g., Bertella, 2011; Dinets & Hall, 2018; Gössling, 2018a; Higuchi & Yamanaka, 2017; Hoarau & Kline, 2014; Rodger et al., 2010; Rodger & Moore, 2004). To increase the theoretical foundations of nature-based science tourism, there is a need to better understand the principles of this emerging niche tourism market. Thus, the study contributes to the theoretical understanding of under-researched nature-based science tourism.

Second, although tourist motivation has been intensively studied and has proven critical for understanding and explaining tourist behavior, very few studies have addressed tourist motivation in the context of nature-based science tourism (e.g., Räikkönen& Suni, 2020). Notably, nature-based tourism and science tourism share common tourist motivations. Nature-based tourism centers around enjoying and learning about natural resources and environments (e.g., landscapes, habitats, water features, and species) and biodiversity conservation (Goodwin, 1996; Luo & Deng, 2008; Mehmetoglu, 2007). Science tourism is also inherently related to learning and self-development (cf. Bourlon & Torres, 2016; Gössling, 2018a; Hoarau & Kline, 2014; West, 2008). Furthermore, both have been discussed in relation to special interest tourism, especially adventure tourism, which involves varying levels of tourist engagement and motivations related to risk and thrill (Bourlon & Torres, 2016; Fennell, 1999; Giddy & Webb, 2018; West, 2008). Accordingly, research that sheds light on tourist motivation regarding nature-based science tourism is vital for understanding tourist decision-making and behavior as well as for developing commercial nature-based science tourism experiences.

To address these knowledge gaps, the study aims to present a novel theoretical conceptualization of nature-based science tourism and to empirically investigate tourist motivation within this context. This purpose is achieved through the following research questions:

RQ1: How can nature-based science tourism be conceptualized?

RQ2: To what extent are tourists motivated to engage in nature-based science tourism ?

The study is structured as follows. To answer the first research question, we draw on the previous literature on tourist motivation, nature-based tourism, special interest tourism, and science tourism to conceptualize nature-based science tourism. From these discussions, we create a framework of science tourism to facilitate future research and the development of nature-based science tourism experiences. We apply the framework to the case of Seili Island and design potential nature-based science tourism products, which are examined in the empirical part of the study. We then describe the data collection and analyses, after which we present the results and answer the second research question. We finish with a discussion addressing the limitations of the study and suggesting an agenda for future research, as well as conclusions, including managerial implications.

Literature review

Wildlife tourism and ecotourism as forms of nature-based tourism

Nature-based tourism is an umbrella term that includes various forms of tourism that rely on relatively undisturbed natural environments or features, such as wildlife tourism and tourism based on plants, vegetation, and natural scenery (Buckley, 2009). In its broadest terms, wildlife tourism incorporates both fauna and flora, but it most often refers to tourism encounters with animals, including both free-range and captive wildlife (Newsome et al., 2005; Newsome & Rodger, 2013). Moreover, it encompasses both consumptive (e.g., hunting and fishing) and non-consumptive (e.g., viewing and photographing) uses of wildlife (Fennell, 2012; Higginbottom, 2004; Lovelock, 2008).

Ecotourism, in turn, is a widely used concept that moves nature-based tourism toward sustainable tourism. Although there is no universally accepted definition, it is generally perceived that ecotourism relies on natural resources, environments, and nature-based attractions; employs best-practice environmental management; contributes to conservation; involves local communities and sustains their well-being; and offers effective interpretation and education (Buckley, 2015; Fennell & Weaver, 2005; TIES, 2015; Weaver, 2005; Weaver & Lawton, 2007). Ecotourism emphasizes non-consumptive wildlife tourism (in which animals and plants are not purposefully removed or permanently affected by humans) as well as in-situ locations, such as parks and protected areas rather than zoos and other captive sites (Duffus & Dearden, 1990; Fennell & Yazdan Panah, 2020; Tremblay, 2001).

In nature-based tourism, revenue is created by transforming natural resources into products as tourists are willing to spend money on viewing and experiencing wild animals and specific landscapes (Brockington & Duffy, 2010; D'Cruze et al., 2018). Previous studies indicate that nature-based tourism has become economically significant (Fernández-Llamazares et al., 2020). Notably, most nature-based tourism products contain both natural and cultural features and attractions as well as adventurous elements and activities (Buckley, 2009; Fennell, 1999). Furthermore, Markwell (2018) has argued that meanings related to nature vary across time, space, and culture, making nature as much a product of history and culture as it is a product of biophysical and ecological processes. Thus, besides commodifying nature and wildlife, tourists also culturally and socially construct them in different ways (Fennell & Yazdan Panah, 2020).

Although economic profitability and tourist satisfaction often conflict with conservation and animal welfare, wildlife tourism is frequently portrayed as a win-win in providing livelihoods while simultaneously protecting wildlife (Brockington & Duffy, 2010; D'Cruze et al., 2018; Moorhouse et al., 2017; Reynolds & Braithwaite, 2001). The revenue of nature-based tourism can be used to secure the existence of natural resources through practical efforts by tour operators or tourists or for local economic income generation and education initiatives (D'Cruze et al., 2018; Powell & Ham, 2008). But despite the positive conservation outcomes (Buckley et al., 2012), nature-based tourism also raises issues for wildlife, inducing behavioral changes, stress and other

physiological responses, injuries, and diseases for individual species, populations, and communities (Buckley, 2004; Fernández-Llamazares et al., 2020; Moorhouse et al., 2015).

Tourist motivation in nature-based tourism

The push-pull motivational theory is among the most commonly used approaches to study tourist motivation. Originating from psychology literature, the theory was first introduced by Dann (1977) and has since been widely addressed in tourism literature (e.g., Cocolas et al., 2016; Crompton, 1979; Dann, 1981; Gnoth, 1997; Kim et al., 2003; Tangeland et al., 2013; Yoon & Uysal, 2005). Push-motivational factors are related to tourists' motivations to travel, while the pull factors concern the attractiveness of a particular destination (Cocolas et al., 2015; Dann, 1977; Kim et al., 2003; Yoon & Uysal, 2005).

Internal push factors reflect tourists' inherent psychological needs and wants, which most commonly include escape, relaxation, physical activity, enjoying nature, learning something new, or engaging in social interaction (Cocolas et al., 2015; Devesa et al., 2010; Tangeland et al., 2013; Uysal & Jurowski, 1994). Previous studies on nature-based tourism, whether visiting national parks or watching wildlife, have highlighted both emotional and educational motivations (Curtin, 2013; Kim et al., 2003; Mutanga et al., 2017; Pratt & Suntikul, 2016). Push factors often derive from the Recreation Experience Preference (REP) scale, which measures what motivates individuals to perform activities in natural areas and engage in outdoor activities (Manfredo et al., 1996). Several tourism studies have also employed simplified REP scales to investigate push factors among tourists (e.g., Kim et al., 2015; Luo & Deng, 2008; Tangeland et al., 2013). Several push factors have been identified in nature-based tourism: adventure and risk-taking, contemplation and escape from everyday routine, physical activity, enjoyment of nature, self-development, and socializing (Kim et al., 2003; Luo & Deng, 2008; Mehmetoglu, 2007; Tangeland et al., 2013).

External pull factors, however, concern situational or cognitive factors that are related to the attributes of the chosen destination, such as accessibility, tourism and hospitality services, and the surrounding environment (Cocolas et al., 2015; Devesa et al., 2010; Tangeland et al., 2013; Uysal & Jurowski, 1994). Previous research has identified certain common pull factors that are linked to nature-based tourism, such as landscapes and surroundings, opportunities to watch animals in their natural habitats, wilderness and remoteness, and outdoor activities (Kim et al., 2003; Tangeland et al., 2013). Nevertheless, identifying and generalizing pull factors from one study to another is more complicated, as these factors are directly connected to specific tourism destinations and their specific characteristics and available activities (Cocolas et al., 2015; Crompton, 1979; Kim et al., 2003). Although push and pull factors are considered to be independent, they influence each other (Tangeland et al., 2013). Incorporating the push-pull motivational theory into nature-based science tourism deepens the understanding of motivation and interest in science tourism experiences and products.

Conceptualizing nature-based science tourism

Science in nature-based tourism

While tourist motivation in nature-based tourism lays the groundwork for understanding nature-based science tourism, we need to discuss the scientific aspects more profoundly. Thus, we examine how science and scientists have been addressed in previous literature on nature-based and special interest tourism (e.g., Bertella, 2011; Dinets & Hall, 2018; Gössling, 2018a; Higuchi & Yamanaka, 2017; Hoarau & Kline, 2014; Rodger et al., 2010; Rodger & Moore, 2004).

Räikkönen et al. (2019) have discussed the educational and scientific dimensions of nature-based tourism, including both wildlife and ecotourism (Figure 1). Whereas wildlife tourism can be non-consumptive or consumptive, ecotourism is divided into either minimalist or

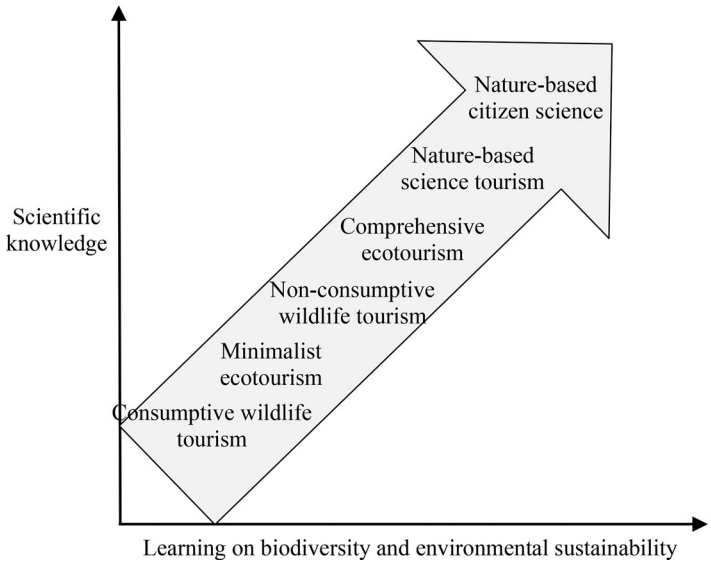

Figure 1. Intensification of the educational and scientific dimensions in different forms of nature-based tourism (Räikkönen et al., 2019, p. 75).

comprehensive depending on its educational impacts (Weaver, 2005). Minimalist ecotourism emphasizes superficial learning opportunities focused on charismatic megafauna, with mainly site-specific and status quo–oriented sustainability objectives. More holistic comprehensive ecotourism fosters environmental enhancement, a deep understanding, and even a transformation of tourist behavior (Weaver, 2005).

Moving from comprehensive ecotourism to nature-based science tourism increases not only tourist learning on biodiversity conservation and sustainability but also the production of scientific knowledge due to the active involvement of scientists (Räikkönen et al., 2019). Interestingly, Gössling (2018a) addresses the complexities of tourist learning in the context of sustainability, i.e., the knowledge acquired during travel, its influence on personal values and norms of consumption, and its repercussions for the sustainability of lifestyles after returning home. As global tourism strains biodiversity and ecosystems, tourists should learn about sustainability, namely aspects of ecosystem functioning, climate change, resource scarcity, and implications of the global economic system for sustainable resource use (Gössling, 2018a; 2018b). Gössling (2018a) has argued that although such learning is not currently taking place, nature-based tourism could be an exception as it may involve elements of 'transformative learning' or even 'transformative tourism' (see also Coghlan & Gooch, 2011; Wolf et al., 2017).

According to Räikkönen et al. (2019), nature-based science tourism includes an intense collaboration between scientists and tourists and, thus, requires a major step toward citizen science, i.e., conducting scientific research with a lay audience and enhancing public engagement with science (Bonney et al., 2016). Previous research implies that citizen science has excellent potential for generating and spreading scientific knowledge as it can improve communication, trust, and capacity-building and facilitate efficient collaboration in conservation initiatives (e.g., Thiel et al., 2014).

Because scientists have academic training, they may be better than tour leaders and guides at including scientific interpretation and transformative learning in nature-based tourism experiences (cf. Coghlan & Gooch, 2011; Walker & Moscardo, 2014). The role of scientists in sustainable nature-based tourism has been addressed in previous research (e.g., Higuchi & Yamanaka, 2017; Hoarau & Kline, 2014). Hoarau and Kline (2014) identified various forms of interaction between scientists and the tourism industry, such as providing knowledge and materials (Donnelly et al.,

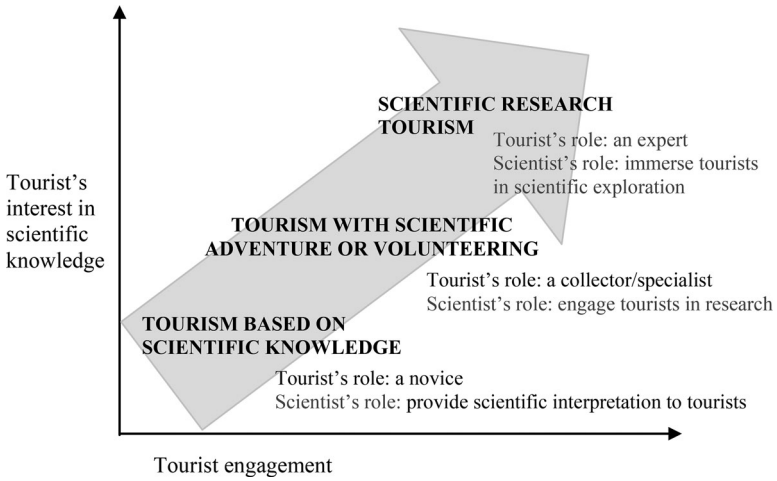

Figure 2. The framework of science tourism.

2011; Rodger & Moore, 2004), bringing credibility (Bertella, 2011; Coghlan, 2008), conducting research (Coghlan, 2008), and disseminating results, as well as creating social relationships needed for research funding (Rodger et al., 2010). Moreover, intensive interaction with scientists is suggested to increase organizational learning and development, to enhance cooperation between scientists and industry professionals, and to potentially create business opportunities and innovations (Hoarau & Kline, 2014). However, Räikkönen et al. (2019) argue that even though scientists are valued for bringing scientific content to various forms of nature-based tourism (e.g., Dinets & Hall, 2018; Hoarau & Kline, 2014), they still mainly serve to support the tourism industry rather than be an active part of it.

Framework of science tourism

We have created a framework of science tourism to further conceptualize and illustrate different types of nature-based science tourism (Figure 2). The framework is based on previous literature on science tourism, special interest tourism, and nature-based tourism. Bourlon and Torres (2016; see also Mao & Bourlon, 2012) categorized four types of science tourism: (1) exploration and adventure tourism with a scientific dimension, (2) cultural tourism based on scientific knowledge, (3) scientific eco-volunteering, and (4) scientific research tourism. Räikkönen and Suni (2020) have further developed these science tourism types by combining them with Trauer's (2006) categories of special interest tourists: novice, collector, specialist, and expert. The common denominator of these categorizations is the intensification of tourists' interests, challenges, specializations, and/or participation. Therefore, our framework highlights the intensification of tourists' interest in scientific knowledge and tourist engagement, reflecting Bourlon and Torres (2016) progression of scientific content from scientific interpretation to engaging in research and scientific exploration, as well as Weaver's (2005) ideas of minimalist and comprehensive ecotourism. The framework identifies three types of science tourism. First, in tourism based on scientific knowledge, tourists can be described as novices, and the scientist's role is to provide scientific interpretation for tourists. Second, in tourism with scientific adventure or volunteering, tourists are characterized as either collectors or specialists who are engaged in research by the scientist. Finally, in scientific research tourism, tourists are considered as experts who, following the scientist's lead, are immersed in scientific exploration.

To apply this theoretical framework in practice, we have designed five potential nature-based science tourism products to empirically examine tourist motivation in nature-based science tourism on Seili Island, located in the archipelago of Southwest Finland. The University of Turku has

Table 1. Potential nature-based science tourism products designed for the empirical study.

Science tourism category[a]	Potential nature-based science tourism products in each category
Tourism based on scientific knowledge **Tourist: Novice** **Scientist: Providing scientific interpretation**	***Science Island Seili – over 50 years of research in the archipelago, 1.5 h*** **A guided tour** exploring the biodiversity and scientific research on the island
Tourism with scientific adventure or volunteering **Tourist: Collector/Specialist** **Scientist: Engaging tourists in research**	***My day as an archeologist* or *Medical plants – from past to present, 4–6 h*** **A workshop** related to the cultural or natural environment that offers a possibility to experience scientific work with a researcher ***Bug/Bat labs* or *Grey seal safaris, 3 h*** **A scientific excursion** for the whole family that explores exciting animals in the field with a researcher
Scientific research tourism **Tourist: Expert** **Scientist: Immersing tourists in scientific exploration**	***A journey of exploration: The state of the Archipelago Sea* or *The exciting life of a Baltic herring, 6–8 h*** **A journey of exploration** that offers a deep dive into the state of the Archipelago Sea by collecting and analyzing samples with the researchers ***Ixodes ricinus – Ticks in the archipelago* or *Bats – Mysterious nocturnal animals, 6–8 h*** **A deep exploration** of the biodiversity of the island gives the opportunity to truly engage in fieldwork with the researchers

[a] Bourlon & Torres, 2016; Räikkönen & Suni, 2020;Trauer, 2006.

operated the Archipelago Research Institute on the island since 1964, focusing on the long-term monitoring of the marine environment. Seili has been permanently inhabited since the Middle Ages and is known for its long history of treating patients with leprosy and mental disorders. Due to its versatile natural and cultural resources, Seili gradually developed into an attractive nature-based and cultural tourism destination with nearly 10,000 annual tourists. Since 2016, that number has increased to nearly 25,000 as the University of Turku started cooperating with a local tourism company that heavily invested in tourism and hospitality services on the island. Currently, Seili offers various tourism and hospitality services to domestic and international tourists: e.g., accommodation services, restaurant and catering services, meetings and events, a guest marina, sauna and swimming facilities, and guided tours and exhibitions. Seili can well be called a 'Science Island'; over the years, the University of Turku has not only hosted various scientific seminars for researchers and field courses for students but has also organized science camps and other science-related activities for tourists of all ages.

The designed nature-based science tourism products are presented and classified into three categories in Table 1. The first category, tourism based on scientific knowledge, includes the softest and shortest product: a guided tour called *Science Island Seili – over 50 years of research in the archipelago*, in which scientists provide scientific interpretation to a novice audience. The second category, tourism with scientific adventure or volunteering, includes two slightly harder and longer products that engage tourists in research: a scientific workshop called *My day as an archeologist* or *Medical plants – from past to present* and a scientific excursion called *Bug/Bat labs* or *Grey seal safaris*. The third category, scientific research tourism, represents the hardest and longest products that immerse tourists in scientific exploration: *A journey of exploration: The state of the Archipelago Sea* and/or *The exciting life of a Baltic herring,* and a deep exploration called *Ixodes ricinus – Ticks in the archipelago* and/or *Bats – Mysterious nocturnal animals.*

Although the products were not available for tourists while the survey was conducted, they are based on research conducted on Seili Island, and some have previously been organized either in Seili or in other locations. The products involve various species (incl. both flora and fauna) and were designed to illustrate different types of products rather than specific species. Thus, from here on, the products are labeled as a guided tour (*Science Island Seili – over 50 years of research in the archipelago*), a workshop (*My day as an archeologist* or *Medical plants – from past to present*), a scientific excursion (*Bug/Bat labs* or *Grey seal safaris*), a journey of exploration (*A journey of exploration: The state of the Archipelago Sea* or *The exciting life of a Baltic herring*) and a deep exploration (*Ixodes ricinus – Ticks in the archipelago* or *Bats – Mysterious nocturnal animals*).

Data and methodology

Data collection

The empirical study adopted a quantitative approach, and self-administrated survey data were collected in three different ways between July and October 2018. First, a traditional self-reported questionnaire was available for tourists to fill out on both Seili Island and on the boat transporting tourists to the island. Second, during one weekend (August 10th–12th, 2018), two researchers handed out questionnaires on-site and collected them after tourists completed them. Third, an electronic questionnaire was offered (between July 1st and October 31st, 2018) by Webropol and was distributed through the Facebook pages of Visit Seili, Visit Turku, and the University of Turku. Because there were multiple data collection methods, respondents included past, current, and potential future tourists. A gift certificate for traveling to Seili Island (worth €144) was given to one randomly selected respondent. Altogether, 518 responses were received, 208 through the traditional questionnaire and 310 through an online questionnaire.

Survey questionnaire and measures

Based on the theoretical discussions of the study, a survey questionnaire consisting of three themes was developed: (1) tourist motivation for nature-based science tourism, (2) Seili Island as a science tourism destination, and (3) respondents' socio-demographic background.

To measure tourist motivation, we utilized push-pull motivational factors. The push factors were measured using a modified 26-item scale derived from the Recreation Experience Preference (REP) scale (Manfredo et al., 1996; Tangeland et al., 2013). Items were related to various push-motivational dimensions, such as *achievement/stimulation*, *risk-taking*, *learning*, *physical fitness* and *rest*, *enjoying nature*, and *escape*. Each item was measured using a 5-point Likert-type scale ranging from 1 (totally insignificant) to 5 (very important). The pull factors, in turn, focused on the aspects that drew tourists toward Seili Island; they were measured with 13 statements related to the *attractions and activities* that were available at the destination as well as to the *facilities*, including aspects such as accessibility and tourism and hospitality services. As Seili Island is considered a 'Science Island,' the questionnaire included specific statements related to science tourism services and *opportunities for learning* about nature, culture, and history (cf. Tangeland et al., 2013). The pull factors were also measured using a 5-point Likert-type scale ranging from 1 (totally insignificant) to 5 (very important).

Questions related to science tourism and Seili Island dealt with respondents' familiarity with Seili and the research conducted there. Furthermore, the questionnaire included statements related to tourists' interest in science in general and in science tourism on Seili in particular, measured with a 5-point Likert-type scale ranging from 1 (totally disagree) to 5 (totally agree). Moreover, respondents were asked to indicate their interests in the potential nature-based science tourism products designed for the current study, with a five-point Likert-type scale ranging from 1 (not interested at all) to 5 (very interested).

Finally, questions about respondents' socio-demographic backgrounds were included in the questionnaire: gender, age, nationality, education, and household monthly gross income.

Data analysis

The data were analyzed using the statistical software IBM SPSS 26. First, several descriptive analyses were conducted to examine the respondent profile and interest in science in general, Seili as a science tourism destination, and the potential nature-based science tourism products. Afterward, two separate principal component analyses (PCAs) were conducted with Varimax rotation to summarize the information of 26 original push-motivational and 11 original pull-

Table 2. Respondent profile.

		Frequency	%
Gender	Female	385	74.9
	Male	113	22.0
	Other	16	3.1
	Total	**514**	**100**
Age	Under 21 years	22	4.3
	21–30 years	111	21.6
	31–40 years	113	22.0
	41–50 years	110	21.4
	51–60 years	96	18.7
	61–70 years	48	9.3
	Over 71 years	14	2.7
	Total	**514**	**100**
Education	Primary education	16	3.1
	Vocational education	45	8.9
	College or upper secondary	98	19.3
	Academic education	349	68.7
	Total	**508**	**100**
Household monthly gross income	Under €1,200	95	19.6
	€1,200–1,599	31	6.4
	€1,600–3,199	100	20.6
	€3,200–5,599	139	28.7
	€5,600–7,999	61	12.6
	Over €8,000	59	12.2
	Total	**485**	**100**

motivational variables into a smaller set of new composite dimensions and to define the fundamental constructs assumed to underlie the original variables (see Tabachnick & Fidell, 2001).

Finally, as the aim was to examine the relationship between the motivation dimensions and perceived interest in five potential nature-based science tourism products, sum variables were created and analyzed with the Generalized Linear Model for ordinal response (logit). In addition, age, education, and household income were included in the analysis as control variables. This method was chosen because perceived interest in five potential nature-based science tourism products was measured by a Likert single-item scale and treated as ordinal variables.

Results

Respondent profile

As presented in Table 2, about 75% of respondents were female (n = 385), 22% male (n = 113), and 3% (n = 16) chose the option 'other' or did not want to indicate their gender. Nearly all respondents were Finnish (n = 494; 97%). Most respondents fell into the age categories of 21–30 years (n = 111; 22%), 31–40 years (n = 113; 22%), and 41–50 years (n = 110; 21%), while the groups under 21 years (n = 22; 4%) and over 71 years (n = 14; 3%) had the fewest participants. Respondents were highly educated; the majority had an academic education (n = 349, 69%) or college/upper secondary education (n = 98, 19%). Nearly 30% of respondents had a household monthly gross income of €3,200–5,599 (n = 139).

Interest in science, science tourism, and nature-based science tourism products

Nearly 80% of respondents found academic research interesting (n = 512; M = 4.14; SD = 0.90), and just 9% had no interest in science, at least while on holiday (n = 512; M = 1.95; SD = 1.06). Only 4% of respondents felt that scientific excursions are more suitable for children than for adults (n = 511; M = 1.70; SD = 0.91). Concerning Seili, 66% of respondents had visited the island (n = 342), 83% were aware that scientific research was conducted on the island (n = 425), and

69% were interested in research conducted there (n = 512; M = 3.85; SD = 0.90). Moreover, about 60% agreed that scientific research distinguishes Seili from other archipelago tourism destinations (n = 510; M = 3.75; SD = 0.92).

Somewhat expectedly, the most appealing nature-based science tourism product was the shortest and softest *guided tour*, as nearly 64% of respondents perceived it as interesting (n = 513; M = 3.69; SD = 1.03). The *scientific workshop* aroused interest in 55% of respondents (n = 512; M = 3.49; SD = 1.19), while 57% expressed interest in the *scientific excursion* (n = 512; M = 3.63; SD = 1.17). Interestingly, even the full-day *scientific exploration* (n = 512, M = 3.10; SD = 1.20) and the *deep exploration* (n = 511; M = 3.14; SD = 1.23) were perceived as interesting by about 40% of respondents, indicating that there is a niche market for even longer and harder science tourism experiences that come close to being citizen science projects.

Tourist motivation in nature-based science tourism

The number of push- and pull-motivational items was reduced by two principal component analyses, in which variables with loadings greater than 0.50 were included, and all components with an eigenvalue greater than 1 were retained in the solution. The results concerning push-motivational factors (n = 510) revealed five components that were named according to their content: (1) Excitement and adventure, (2) Active and passive enjoyment of nature, (3) Learning and knowledge, (4) Escape and relaxation in nature, and (5) Social recognition and interaction (see Table 3). Together, the components accounted for 59.65% of the explained variance. To assess reliability, Cronbach's alpha was calculated for the variables retained in each component, and all components were considered acceptable as coefficients ranged from 0.73 to 0.84, indicating good reliability. However, one variable ('I want to be with my family') was excluded from further analysis due to the result of the reliability test.

The first component, *Excitement and adventure*, clearly emphasized motives related to experiencing excitement, new challenges, and adventure in nature. The second component, *Active and passive enjoyment of nature*, included not only exercise and physical activity in nature but also more passive enjoyment and observation of flora and fauna, as well as the feeling of being close to nature or in harmony with it. The third component, *Learning and knowledge*, emphasized learning, improving knowledge, developing skills, and studying and understanding nature. The fourth component, *Escape and relaxation in nature*, highlighted nature as an escape from everyday routines, providing rest, relaxation, tranquility, and refreshment. Finally, the fifth component, *Social recognition and interaction*, focused on making a good impression on others and gaining social recognition in addition to meeting people with similar interests and spending time with friends and family.

Table 4 describes the results of the PCA on pull-motivational factors (n = 505), revealing three components that, together, accounted for 64.64% of the explained variance. Again, Cronbach's alpha was calculated for the variables retained in each component, and all components were considered acceptable. Nevertheless, two items ('Opportunity to learn about history and culture' and 'Reasonable travel expenses') were excluded from further analysis due to the result of the reliability test. The first pull-motivational component consisted of *Learning opportunities* concerning plants, animals and insects, and the surrounding area. The second component highlighted *Destination attractions and services*, which included statements related to a fashionable destination, famous attractions, and the availability of tourism and hospitality services and excursions. Finally, the third component, *Accessibility*, focused on good connections and ease of access.

In the next phase, sum variables were calculated for both push- and pull-motivational factors. In addition, a set of correlation (Table 5) and regression analyses (Table 6) were conducted to examine the relationships between tourist motivation and interest in the five potential nature-based science tourism products.

Table 3. Principal component analysis (n = 510) on push-motivational factors.

Components	Compo-nent loadings	Eigen-value	Variance explained (%)	Cronbach's alpha
Excitement and adventure (Push 1)		**6.721**	**25.820**	**0.834**
I want to experience excitement	.833			
I seek adventure	.807			
I get excited about new challenges	.747			
I want to experience new and different things	.649			
I want to challenge myself	.637			
Active and passive enjoyment of nature (Push 2)		3.467	13.336	0.820
I want to exercise in nature	.745			
I want to be close to nature	.738			
I want to experience peace and quiet in nature	.660			
I want to keep physically active	.624			
I enjoy observing flora and fauna	.597			
I want to enjoy the scenery, landscape, and moods of nature	.569			
I want to obtain a feeling of harmony with nature	.563			
Learning and knowledge (Push 3)		2.416	9.293	0.844
I want to learn more about nature and/or culture	.844			
I want to improve my knowledge of nature and/or culture	.810			
I want to understand nature and/or culture better	.791			
I want to study nature and/or culture	.737			
I want to develop my skills and abilities	.502			
Escape and relaxation in nature (Push 4)		1.595	6.136	0.760
I want to get away from daily routines	.805			
I seek rest and relaxation	.701			
I want to experience tranquility	.683			
I want to be refreshed	.643			
Social recognition and interaction (Push 5)		1.317	5.066	0.726
I want to make a good impression on others	.691			
I want to be with people with similar interests	.685			
I want to gain social recognition	.682			
I want to be with friends	.616			
I want to be with my family	.556			a

Kaiser-Meyer-Olkin measure of sampling adequacy = .863
Bartlett's test of sphericity = 5747.461.0 $p < .001$.
[a]: If item deleted, alpha 0.736.

Three push-motivational factors, *Learning and knowledge*, *Active and passive enjoyment of nature*, and *Escape and relaxation in nature*, explained the variance in three different nature-based science tourism products. By contrast, *Excitement and adventure* and *Social recognition and interaction* did not have a statistically significant effect on any product. From pull-motivational factors, *Learning opportunities* had a significant effect on interest in all nature-based science tourism products, while the other two (*Accessibility* and *Destination attractions and services)* had no effect.

Regarding specific products, the push-motivational factor *Learning and knowledge* and the pull-motivational factor *Learning opportunities* had significant effects on interest in both the guided tour and the scientific workshop. *Learning opportunities* had the strongest influence on interest in the guided tour (B = 0.84, Wald $\chi 2(1) = 32.247$, p = .000), while *Learning and knowledge* had the strongest effect on interest in the scientific workshop (B = 0.78, Wald $\chi 2(1) = 17.630$, p = .000). Moreover, the level of education significantly influenced interest in the guided tour (B = 0.26, Wald $\chi 2(1) = 4.983$, p = .026) but not in the workshop.

Three push-motivational factors, *Active and passive enjoyment*, *Learning and knowledge*, and *Escape and relaxation in nature*, and one pull-motivational factor, *Learning opportunities*, significantly affected interest in both the scientific excursion and the journey of exploration. *Learning opportunities* had the strongest effect on both the scientific excursion (B = 0.76, Wald $\chi 2(1) = 27.436$, p = .000) and the journey of exploration (B = 0.77, Wald $\chi 2(1) = 30.196$, p = .000). Age significantly influenced interest in the scientific excursion, as younger respondents were more interested in this product (B = −0.25, Wald $\chi 2(1) = 12.500$, p = .000).

Table 4. Principal component analysis (n = 505) on pull-motivational factors.

Components	Compo-nent loadings	Eigen-value	Variance explained (%)	Cronbach's alpha
Learning opportunities (Pull 1)		3.163	28.76	0.845
	Opportunity to learn about plants	.876		
	Opportunity to learn about animals/insects	.870		
	Opportunity to learn about the surrounding environment	.838		
	Opportunity to learn about history and culture	.697		a
Destination attractions and services (Pull 2)		2.355	21.41	0.732
	Famous attractions	.785		
	Fashionable/trendy destination	.764		
	Availability of accommodation and other tourism services	.709		
	Opportunity for excursions and guided tours	.661		
Accessibility (Push 3)		1.591	14.47	0.740
	Good connections to the destination	.871		
	Ease of access	.823		
	Reasonable travel expenses	.711		b

Kaiser-Meyer-Olkin measure of sampling adequacy = .723
Bartlett's test of sphericity = 2058.632 $p < .000$.
[a]If item deleted, alpha 0.860.
[b]If item deleted, alpha 0.835.

Finally, two push-motivational factors, *Active and passive enjoyment in nature* and *Escape and relaxation in nature*, and one pull-motivational factor, *Learning opportunities,* had significant effects, and the strongest, on deep exploration (B = 1.04, Wald $\chi 2(1) = 52.124$, p = .000). Younger respondents were, again, more interested in this product than older respondents, (B = −0.21, Wald $\chi 2(1) = 8.834$, p = .003) but interestingly, the push factor *Learning and knowledge* did not significantly influence interest.

Discussion

Within the next decades, humankind will face the consequences of an ecological crisis caused by accelerating global climate change and biodiversity loss. Nature-based tourism needs to adopt sustainable ecotourism practices and promote biodiversity conservation through effective interpretation and education (cf. Buckley, 2015). As there is no single solution, various means, techniques, and tools should be harnessed to achieve this goal. With this study, we aim to emphasize the experiential aspects of science, scientific knowledge, and research, as well as advance the role of scientists to active science mediators and enablers of nature-based tourism experiences.

The current study addressed *nature-based science tourism*, an emerging form of both nature-based and special interest tourism in which science, scientific knowledge, and/or engagement in scientific research are essential for tourist motivation and leisure tourism experiences. Built on previous nature-based tourism, special interest tourism, and science tourism literature, we conceptualized nature-based science tourism. Moreover, we created a framework of science tourism to serve as a foundation for future research and to facilitate the design of nature-based science tourism experiences. The framework was utilized in designing five potential nature-based science tourism products that differed according to their scientific intensity and level of tourist engagement. These products were included in the empirical study, which examined push- and pull-motivation on nature-based science tourism on Science Island Seili in the Finnish Archipelago.

The results indicated that tourists were interested in science and nature-based science tourism experiences, especially in short and soft guided tours with scientific content. When the scientific intensity and tourist engagement increased, tourists' interest slightly decreased, yet a substantial number of tourists were interested in even deep scientific exploration with scientists. Regarding tourist motivation, both push- and pull-motivations explained interest in nature-based science

Table 5. Correlation between push- and pull-motivations and interest in nature-based science tourism products.

	Push 1: Excitement and adventure	Push 2: Active and passive enjoyment of nature	Push 3: Learning and knowledge	Push 4: Escape and relaxation in nature	Push 5: Social recognition and interaction	Pull 1: Learning opportunities	Pull 2: Destination attractions and services	Pull 3: Accessibility	Guided tour	Workshop	Scientific excursion	Journey of exploration	Deep exploration
Push 1: Excitement and adventure	1.00	.37***	.38***	.18***	.49***	.18***	.22***	-.04	.05	.15**	.143**	.15***	.14**
Push 2: Active and passive enjoyment of nature		1.00	.49***	.47***	.15***	.44***	-.04	.03	.24***	.23***	.27***	.27***	.35***
Push 3: Learning and knowledge			1.00	.20***	.18***	.61***	.09*	-.01	.38***	.41***	.38***	.38***	.38***
Push 4: Escape and relaxation in nature				1.00	.13**	.14**	.05	.18***	.11*	.14**	.06	.04	.09*
Push 5: Social recognition and interaction					1.00	.07	.41**	.05	-.02	.07	.00	.05	.03
Pull 1: Learning opportunities						1.00	.13**	.03	.47***	.37***	.41***	.44***	.50***
Pull 2: Destination attractions and services							1.00	.26***	.11*	.06	.03	.04	.00
Pull 3: Accessibility								1.00	.03	-.01	.03	.00	.00
Guided tour									1.00	.33***	.36***	.47***	.41***
Workshop										1.00	.43***	.43***	.45***
Scientific excursion											1.00	.43***	.57***
Journey of exploration												1.00	.67***
Deep exploration													1.00

Method: Spearman's Rank-Order Correlation; Note:.
***$p < 0.001$,.
**$p < 0.01$,.
*$p < 0.05$.

Table 6. Ordered logit regression coefficients, omnibus test for model and Nagelkerke Pseudo R^2.

	Guided tour	Workshop	Scientific excursion	Journey of exploration	Deep exploration
Push 1: Excitement and adventure	-.22	-.08	.01	-.06	-.22
Push 2: Active and passive enjoyment of nature	.05	.09	.64**	.42*	.84***
Push 3: Learning and knowledge	.74***	.78***	.43*	.54**	.21
Push 4: Escape and relaxation in nature	.04	.09	-.41*	-.47**	-.45*
Push 5: Social recognition and interaction	-.10	-.02	-.24	.03	.02
Pull 1: Learning opportunities	.84***	.52***	.76**	.77***	1.04***
Pull 2: Destination attractions and services	.18	-.01	.07	-.06	-.01
Pull 3: Accessibility	.06	.06	.13	.06	.07
Age	.13	-.13	-.25***	-.06	-.21**
Education	.26*	.08	.02	.03	.09
Income	-.05	-.08	.09	-.07	-.08
Threshold (dependent = 1)	3.26**	2.29*	1.24	1.66	2.22*
Threshold (dependent = 2)	5.07***	3.67***	3.01**	3.47***	3.93***
Threshold (dependent = 3)	6.67***	5.02***	4.42***	4.78***	5.37***
Threshold (dependent = 4)	8.94***	6.68***	5.89***	6.48***	7.04***
Likelihood Ratio Chi-Square	145.98***	105.00***	123.33***	126.42***	171.21***
Nagelkerke Pseudo R^2	.282	.208	.247	.244	.316

Note:.
***$p < 0.001$,.
**$p < 0.01$,.
*$p < 0.05$.

tourism products. Previous studies on nature-based tourism (e.g., watching wildlife and visiting natural parks) have highlighted both educational and emotional motivations (Curtin, 2013; Mutanga et al., 2017; Pratt & Suntikul, 2016). As expected, the key motivations of nature-based science tourism were related to learning and enjoying nature. Notably, interest in guided tours and workshops was influenced by learning motivation only, while interest in scientific excursions and explorations was explained by more diverse motivations: enjoying nature as well as escape and relaxation. This implies that besides learning—the crucial content of nature-based science tourism—other motivations also need to be addressed, especially when designing products with a higher intensity of scientific content and tourist engagement.

To our knowledge, similar studies on tourist motivation related to nature-based science tourism in general and nature-based science tourism products in particular do not exist. Thus, comparing our results to previous studies is challenging. However, some studies (Bourlon & Torres, 2016; West, 2008) have associated science tourism with excitement and adventure, but in our study, these motivations were not significant. There are at least two potential explanations. First, the natural beauty and unique environment of the Finnish Archipelago consists of more than 20,000 islands and islets. But for domestic tourists, which formed the majority of our sample, these are quite familiar and may not be perceived as an exciting adventure, at least when compared to destinations like Papua New Guinea (West, 2008) or Patagonia, Chile (Bourlon & Torres, 2016).

Second, in the global context, wildlife tourism tends to evoke images of charismatic megafaunas, such as lions and elephants. In the Finnish Archipelago, wildlife is more subtle, consisting of species that are exciting but less charismatic, such as the grey seals, Baltic herrings, bats, and ticks included in our study. Nevertheless, we suggest that including elements of excitement and adventure in nature-based science tourism may be beneficial for addressing varying tourist motivations and achieving meaningful tourism experiences.

Limitations of the current study mostly concern the empirical data and data collection. First, as mentioned above, Finnish tourists were overrepresented in the sample and, therefore, it was not possible to analyze the motivations of international tourists in a wider scope. Second, we aimed to examine nature-based science tourism products regarding their intensity of scientific content and tourist engagement. However, respondents may have evaluated these products

based on specific species (e.g., bats or grey seals) rather than on actual product types (e.g., guided tours or scientific excursions). Moreover, the products were designed for this study and were not available for tourists during data collection. Finally, respondents' interests in specific products do not necessarily indicate their actual intent to purchase, which is influenced by various other factors (e.g., price). These issues need to be acknowledged as they may have affected the results of the empirical study.

Both the conceptual and empirical parts of the study create potential avenues for future research. In outlining the future research agenda, we suggest extending the scope of science tourism toward citizen science projects conducted in the context of nature-based tourism (cf. Thiel et al., 2014). Moreover, tourists' increasing interest in transformational experiences involving learning and self-development offers possibilities to address science tourism in relation to transformative tourism (Wolf et al., 2017) and transformative learning (Coghlan & Gooch, 2011).

In particular, future research should enhance understanding of the role of scientists in nature-based science tourism and beyond. Although the results indicated that the most appealing nature-based science tourism products were targeted to novice audiences and involved only scientific interpretation, there is still a niche market for science tourism that involves engaging in research and scientific exploration with real scientists. Thus, more research is needed to shed light on science mediation and interpretation in different tourism contexts (cf. Walker & Moscardo, 2014). For example, research should address the added value that scientists can bring to tourism experiences as compared to other professionals (e.g., tour guides) or digital devices (e.g., virtual reality applications). Accordingly, future research should also examine scientists' role in the value co-creation of tourism experiences (cf. Higuchi & Yamanaka, 2017) and address, for instance, experience value in science tourism.

Another topical research theme concerning scientists, namely conservation messaging (Fernández-Llamazares et al., 2020), highlights the need to advance sustainable tourist behavior through mediating knowledge about biodiversity and ecosystem functioning, climate change, resource scarcity, and sustainable use of resources (cf. Gössling, 2018a). We suggest that, in this topical task, scientists may often have the most up-to-date, first-hand knowledge of sustainability issues, and therefore, they should have a more significant and visible role as gatekeepers of wildlife.

Conclusions

Our study makes insightful theoretical contributions to various streams of tourism research. First, it contributes to the nature-based and special interest tourism literature by highlighting the role of science, scientific knowledge, and/or engagement in scientific research in tourism experiences. The conceptualization of nature-based science tourism creates a foundation for examining science-related issues within the current discussions of both nature-based and special interest tourism.

Second, the study adds to the science tourism literature by distinguishing *science tourism*, which emphasizes experiential aspects of science and learning in leisure tourism, from *scientific tourism*, referring to scientists' work-related travel for scientific inquiry (cf. Slocum et al., 2015). The framework of science tourism that was created in the study can be used as a basis for future research that integrates science tourism into tourism research. This task should not be limited to nature-based science tourism only but rather should be applied across disciplinary boundaries and different forms of tourism.

The managerial implications concern both tourism businesses and universities as well as the cooperation between tourism professionals and scientists in nature-based tourism and beyond. The companies can apply the results of the study by designing commercial science tourism products with varying levels of scientific content and tourist engagement. Universities, in turn, can

use science tourism to develop more meaningful science popularization and societal interaction. In this context, an interesting practical implication concerns target segments as the results indicated that science tourism was, by no means, considered suitable for children only. Both tourism businesses and universities often target science activities mainly to children and families, but adults seem to be equally interested in science excursions, suggesting an opportunity to widen the scale and scope of nature-based science tourism experiences.

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