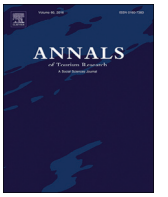
Annals of Tourism Research 107 (2024) 103794

Contents lists available at ScienceDirect

Annals of Tourism Research

journal homepage: https://www.journals.elsevier.com/annals-of-tourism-research



Full Length Article

Combining polar cruise tourism and science practices

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ARTICLE INFO

Article history:
Received 26 October 2023
Received in revised form 14 May 2024
Accepted 16 May 2024

Available online xxxx

Associate editor: Scott McCabe

Keywords:
Arctic tourism
Expedition cruise
Svalbard
Social practice theory
Citizen science
Polar science

ABSTRACT

Polar tourism is continuously diversifying in order to provide unique experiences to travellers. One of the ways in which this currently happens is by increasingly integrating scientific activities into tourism expedition cruises. While there are mutual benefits of combining science and tourism, this does not mean that the production of joint expeditions is seamless and unproblematic. We apply a practice theory approach to analyse the practical and organisational implications of combining tourism and science practices during two enactments, with a seven-years interval, of the unique Scientific Expedition Edgeøya Svalbard (SEES), organised by The Netherlands. Our results demonstrate that irregularly organised combinations of different sets of practices require higher levels of adaptivity, communicability and reflectivity to be reproduced successfully.

Introduction

Cruise tourism in the Polar Regions is growing and diversifying rapidly over the last decades (Hovelsrud et al., 2023; Liggett et al., 2023; Makanse, 2024; Van Bets et al., 2017). Visitation is undertaken in increasingly diverse forms, from trips on large cruise ships with thousands of passengers to small yacht voyages (Johnston et al., 2017). In most Polar Regions ship-based tourism is dominated by expedition-cruise vessels, many of which operating in both the Arctic and Antarctic (Liggett et al., 2023). Expedition cruising uses vessels between 20 and 500 passengers, offers shore landings and exploration using rubber boats, extensive interpretation, on-site wilderness experiences, and endeavours to minimise environmental and social impact while ensuring human safety. During such cruises, passengers engage in an increasing variety of coastal and marine activities, including hiking, camping, climbing, skiing, kayaking, scuba diving, and citizen science projects (De la Barre et al., 2016; Lamers & Gelter, 2012; Makanse, 2024; Stewart et al., 2020).

One of the key ways in which product diversification takes form in polar tourism is through increasing interactions of expedition cruises with scientific activities. Interaction and interrelations between science and tourism in the Polar Regions are not new. For example, in both the Arctic and Antarctic, scientific research stations have long been visited as tourist attractions by ex-

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https://doi.org/10.1016/j.annals.2024.103794

pedition cruise ships, while scientifically trained guides provide interpretation. In some of the most popular polar destinations (e.g. Antarctic Peninsula, Svalbard), science and tourism are the two dominant human activities occurring in the same locations and using partly the same infrastructures. On Arctic Svalbard, science and cruise tourism have been framed as two activities that co-exist, due to strict regulations and a collaborative spirit in local governance (Hovelsrud et al., 2023; Van Bets et al., 2017; Viken, 2011).

However, in the past decade the growth of polar tourism has led to an intensification of joint science-tourism activities, including citizen science and vessels of opportunity. Citizen science is a practice in which professional and non-professional scientists (e.g., the general public or tourists) work together in producing knowledge for science and society (Vohland et al., 2021). On board of polar cruises this includes contributing to wildlife censuses (e.g. whales, birds), cloud observations, sea ice data, phytoplankton monitoring or marine litter collection (Cusick et al., 2020; De la Barre et al., 2016; Farmer, 2019; Taylor et al., 2020). Testament to the growing development of citizen science in polar tourism is the establishment of the Polar Citizen Science Collective in 2018, to "grow citizen science projects in the polar tourism industry and create efficiency around the development, implementation and data delivery of these programs" (Farmer, 2019, p. 11). Another example of intensified science-tourism interrelations are the growing number of cruise companies offering researchers possibilities to conduct science on board as part of vessels of opportunity programmes (e.g., Ponant, Lindblad, Hurtigruten, Bark Europa). Cruise vessels provide laboratory facilities and unique opportunities for scientists to carry out research in some of the most remote parts of the Polar Regions where government-owned science vessels may not visit frequently (De la Barre et al., 2016).

Polar science and tourism may be combined in different ways, for different reasons and with different implications. Combinations may result from a desire to create synergies and efficiencies between science operations and commercial tourism operations, as forms of public – private partnerships. Polar science projects and researchers in search for societal valorisation of scientific results may be increasingly driven in the direction of commercial tourism operators. Tourists form a direct audience that enable scientists to explain the relevance of public funding of scientific research in areas far away from the taxpayers' home. At the same time, product diversification by offering scientific activities allow cruise operators to provide unique experiences and distinguish themselves from an increasing number of competitors. However, polar tourism operators have also been criticised for exploiting science in developing positive narratives to legitimize the growth of the sector in the Polar Regions in light of its impact on climate and environment (Löf et al., 2023; Varnajot et al., 2024).

This paper aims to contribute to our understanding of the ways in which science and cruise tourism activities can be successfully combined by addressing the following research questions: 1) How can science and tourism practices be combined in the context of polar expedition cruising? 2) What are the implications of combined science and tourism practices for managing experiences and impacts? We will draw on social practice theories (Schatzki, 2002; Shove et al., 2012) to explore how science and tourism activities are relating and affecting one another, as well as how challenges arising from their interaction are and can be dealt with. Practice theory provides conceptual and practical guidance for in-depth analysis of individual practices, as well as connections between different sets of practices, including tourism (De Souza Bispo, 2016; Lamers et al., 2017).

Empirically, this paper focuses on the combined science-tourism approach of the Netherlands' organised Scientific Expedition Edgeøya Svalbard (referred to as 'the expedition' hereafter) (Lamers et al., 2017; Löf et al., 2023; Van Soest, 2023). The expeditions were organised by the Netherlands in 2015 and 2022, involving researchers, tourists, media and policy makers. In contrast to regular polar citizen science activities on contemporary expedition cruises, the Scientific Expedition Edgeøya Svalbard represents a more profound combination and integration of science and tourism activities with around 50 % scientists, 35 % tourists and 15 % media and special guests (e.g. policy makers, artists) on board of the ship (Löf et al., 2023). The expedition provides a unique case study of a science-tourism event that is irregularly reproduced, i.e. organised two times with seven year interval. It is an extreme manifestation of the ongoing integration of polar science and cruise tourism. The scale of the science presence during the expeditions was very high, which amplifies organising challenges and raises questions about which activities take priority, how activities can be productively combined and the implications for managing and governing science-tourism expeditions. Thematically the expeditions were explicitly about observing and assessing climate change effects. We argue that an analysis of the practical and organisational implications during the two episodes of the Scientific Expedition Edgeøya Svalbard provides an opportunity to draw lessons for managing citizen science and other forms of scientific tourism in both Polar Regions, and beyond.

Understanding science-tourism practices

Social practice theories have recently gained attention in tourism studies as a way to understand the role of human and non-human material components as part of routinized and recursive interactions in tourism. Social practice theories aid in obtaining a better comprehension of how certain activities, such as polar cruises and nature experiences are performed and materially and symbolically shaped (De Souza Bispo, 2016; James et al., 2018; Lamers et al., 2017). Social practices can be conceptually understood in different ways (Spaargaren et al., 2016). For example, Shove et al. (2012) conceive practices as constituted of three elements that are integrated and transformed in action: materials, competences and meanings. In this study, however, we will use Schatzki (2002) more elaborate conceptualisation of social practices as consisting of 'doings and sayings' and material arrangements, held together and organised by rules, practical and general understanding, and teleoaffective structures (see Table 1). For example, expedition cruising can be understood as a configuration of material arrangements (e.g. ships, Zodiacs, remote environments), practical understanding (e.g. navigation, guiding, interpretation), general understanding (e.g. environmental sustainability, adventure, safety), rules (e.g. permits, insurance, operating procedures) and teleoaffective structures (e.g. wildlife

Table 1
Organising elements of social practices (adapted from Schatzki, 2002).

Material arrangements	Linked people, organisms, artifacts, technologies, infrastructures, and things of nature
Rules	Explicit formulations, principles, precepts, and instructions that people, in conducting 'doings and sayings', take account of and adhere to.
Practical understanding	Competences or abilities that pertain to the actions constituting a practice.
General understanding	Shared ideas of what a practice entails and what the meaning of the practice is, including the mental image of what the practice is about.
Teleoaffective structure	Range of acceptable ends, purposes, beliefs, projects and tasks that ought to be accomplished, including the manner in which these projects and tasks should be executed.

viewings, experiences, learning). We argue that the organising elements proposed by Schatzki (2002) allow for a rich analysis by providing useful clues for identifying and analysing frictions when two or more sets of practices are combined.

Joint science and tourism activities, can be seen as made up of bundles of multiple practices and material arrangements (see Schatzki, 2016). The practices forming these bundles can be persistently connected through shared material arrangements, understandings or rules, or by bringing them together by means of other practices (Lamers et al., 2016; Vegas Macias et al., 2023; Zwart et al., 2021). From this perspective, combined science-tourism activities consist of bundles of expedition cruise practices (e.g. navigating, landing, lecturing, dining) and science practices (e.g. measuring, recording, analysing, modelling, publishing). Cruise tourism and science practices can be combined in their sharing of the material arrangement (e.g. ship, Zodiacs, sites), general and practical understandings (e.g. programming and communication by the expedition leader), rules (e.g. meal hours) and teleoaffective structures (e.g. jointly watching polar bears or whales). What is less clear is how the process of bundling practices and material arrangements occurs, and how in this process different practices mutually influence one another, or cause frictions and confusion for the participants.

For understanding the process of bundling, or how connections between practices are formed we turn to Shove et al. (2012), who propose that connections resulting from the co-location of different practices can result in new hybrid practices. These can take the form of loosely associated bundles or more tightly bound complexes. Bundles of practices are "loose-knit patterns based on co-location and co-existence, complexes represent stickier and more integrated arrangements including co-dependent forms of sequence and synchronization" (Shove et al., 2012, p. 84). It is through recurrent enactments that stable connections between practices are established over time.

The notion of 'circuits of reproduction' (Shove et al., 2012) points to a number of requirements for practices to endure over time, that is: the configuration of the practice to be consistent and recurrent (circuit 1), the configuration is shaped by previous and coexisting practices (circuit 2), and sufficient feedback is generated between subsequent enactments and co-existing practices (circuit 3). In the case of the science-tourism expeditions, there is no consistent reproduction of the bundle of practices (circuit 1). However, the practices bundle is shaped by coexisting practices (science and cruise tourism), by previous enactments of the bundle (circuit 2), as well by feedback in the form of reflection by the organisers and the participants (circuit 3). For example, before, during, between and after the two expeditions, the organisers of the expeditions engage in reflection moments to think through and programme how the connection between the tourism and science practices bundles are to be forged (see Fig. 1). In the remainder of this paper we will analyse how a temporary and irregular bundling of tourism and science practices can be

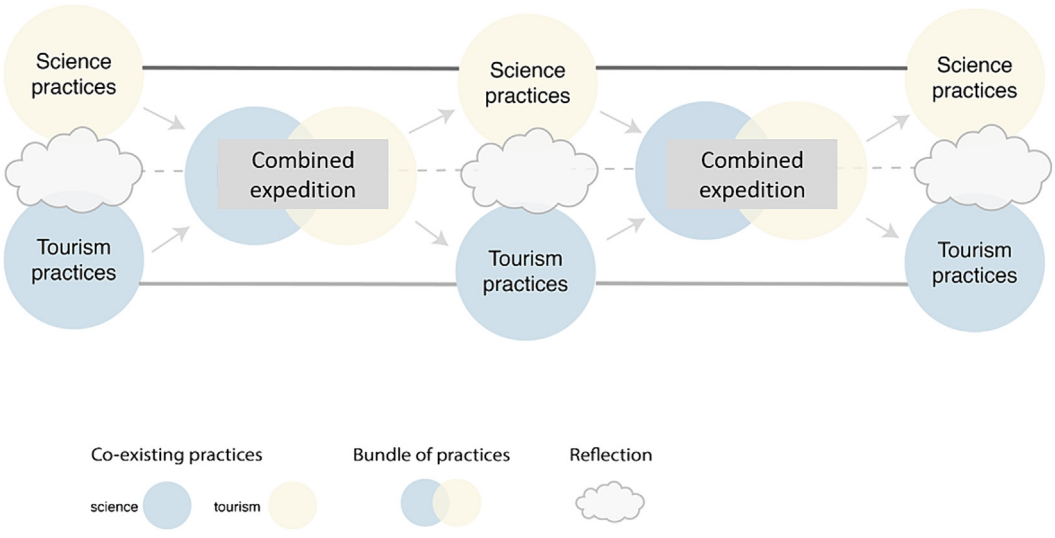

Fig. 1. The Scientific Expedition Edgeøya Svalbard as irregular performances of bundled polar science and cruise tourism practices.

Table 2
Overview of the two expeditions on Oceanwide's MV Ortelius. Sources: www.sees.nl; authors' field notes.

	Expedition 1	Expedition 2
Dates	19–28 August 2015	13–22 July 2022
#scientists	51	52
#tourists	38	35
#policy (ministries, Dutch Research Council)	5	7
#media and artists	8	8
#Oceanwide staff (adventure expedition leader, guides, hotel crew, vessel crew)	50 (±)	50 (±)
Top 5 science projects themes	Biology (42 %), Geology (8 %), Climate (8 %), Toxicology (8 %), Archaeology (6 %)	Biology (23 %), Ecology (23 %), Geology (12 %), Climate (12 %), Social sciences (7 %)

successfully enacted when coexisting practices (i.e. science and tourism) are sufficiently aligned, and when ample reflection before and during enactments of the bundling is warranted.

Material and methods

The Scientific Expedition Edgeøya Svalbard

This paper explores and compares performances and reflections of key organisers on preparations and performances, of two expeditions in August 2015 and 2022. What makes these cruises unique is the composition of its passengers and their activities. Approximately 50 scientists from different disciplines, 35 tourists and a dozen representatives from policy and media joint together on board of expedition cruise vessel "MV Ortelius" operated by Oceanwide Expeditions (Table 2). The overall objective of the cruises was to gain new insights in the consequences of human activity, particularly human-induced climate change, in the Arctic. More specifically, the expeditions had multiple aims, amongst which: (1) ecological, environmental and archaeological data collection and monitoring in an area of Svalbard that is usually difficult to access (Edgeøya); (2) encouraging transdisciplinary collaborations through the so-called Arctic Academy for tourists; (3) creating network opportunities for polar researchers of various disciplines, including polar early career scientists; and (4) generating awareness of, and media attention for polar research and climate change (Löf et al., 2023; Van Soest, 2023). The Arctic Academy offered paying tourists the opportunity to be involved in knowledge co-production, exchange and dissemination (Löf et al., 2023). As social scientists, the authors were part of the science group of the two expeditions, investigating how the two sets of practices of tourism and science co-exist, how they mutually affected each other, and what management implications arise from this combination.

Study methods

Data were mostly collected through qualitative methods, complemented with quantitative surveys (Table 3). Participant observation (Atkinson & Hammersley, 1994) was an important source for data collection during both expeditions, with field notes taken during the day. During the 2015 expedition, data collection focussed mostly on participant observation, some interviewing before and after with key organisers of the expedition, and a brief open-ended post-trip survey per email to the tourists. During the 2022 expedition the data collection effort was more diverse and extensive. Next to field notes, interviews were held with organisers and participants from the tourism and science group. Furthermore, a pre-boarding and post-trip survey for both the science group and the non-science group (tourists, policy, guides, media) formed an additional part of the data collection. In addition, data from an on-board workshop organised by a group of social scientists during the 2002 expedition (Löf et al., 2023) was used for this paper. In 2015, oral consent from research participants was asked during a plenary meeting at the start of the

Table 3
Overview of data collected during the 2015 and 2022 expeditions.

Method type	2015	2022
Interviews (#), of which:	4	17
#scientists	–	4
#tourists	–	5
#policy (ministries, Dutch Scientific Research Council)	–	1
#expedition team (organisers, Oceanwide)	4 (2 pre-trip, 2 post-trip)	7 (incl. 2 pre-trip + post-trip)
Structured surveys (#), of which:	–	4
Pre-trip survey non-scientists	–	($n = 50$) 76 %
Pre-trip survey scientists	–	($n = 52$) 81 %
Post-trip survey non-scientists/tourists	($n = 20$) 53 %	(n = 50) 66 %
Post-trip survey scientists	–	(n-52) 87 %
Field diaries (notes from participant observation, informal talks)	Yes	Yes
Workshop (Löf et al., 2023)	No	Yes

expedition. In 2022, a consent form was distributed amongst all passengers; the one passenger who did not consent to observations or information from them being used was excluded. In 2015, interviews and field notes were manually coded; in 2022, Atlas.ti software was used. The surveys were analysed using MS Excel. Personal data were pseudonymised and stored in a secure location.

The combination of qualitative and quantitative methods (Table 3) helped us to deepen our understanding of the different processes at play in combining cruise tourism and polar science as well as participants' perceptions about this. The structured surveys enabled data collection amongst all participants prior and post-trip (response rates in Table 3), with of the interviews providing additional depth. This approach provided insights for our analysis of organising elements of social practices (Schatzki, 2002, Table 1) and how bundling of practices (Shove et al., 2012) takes shape, which we would not have had by relying on one method or qualitative methods alone.

Prior to and after the 2022 expedition, the authors met several times to discuss and ensure consistency in the data collection during these two expeditions to address the research questions for this paper. It is important to note that data collection during the two expeditions did not take place as part of an overarching, joint project. Authors Lamers and Van Bets participated in 2015. Their study focused on the social dynamics and network building resulting from the combination of tourism and science practices, and the implications for organisation and management. Author Steins joined the expedition in 2022. Her study concentrated on the research collaboration between scientists and tourists, by assessing their perceptions of collaborative research, its potential benefits, the factors that contribute to successful collaboration, and the on-board outreach objectives of the Arctic Academy concept.

Science-tourism practices during the two expeditions

The 2015 expedition was the first edition of this unique kind of combined science-tourism expedition, which resulted in a wealth of lessons, insights from learning-by-doing and adaptive measures important for successfully conducting and managing such expeditions. Our data confirms that the large majority of the passengers was aware of the presence of scientists and policy and media representatives from the start. For most tourists, the Arctic Academy setup, i.e., the presence of the scientists and the data collection, provided a key motivation to take part in the expedition to learn from the scientists and by actively participating in scientific projects. In 2022, 79 % of the tourists who completed the pre-trip survey ($n = 28$) selected “I wanted to go to Spitsbergen / Svalbard and because this voyage is part of a scientific expedition” when asked why they booked this voyage. The limitations and implications of this unique combination of science and tourism was something most participants experienced once on board. The organisers did not anticipate many of the frictions and challenges that bringing together different practices entailed, and adaptations and solutions were developed on the go (Interview scientific expedition leader, 2015), in close collaboration between the scientific expedition leader and the adventure expedition leader (the term we will use to refer to the expedition leader responsible for the Arctic Academy tourists). Despite a lack of organised evaluation of the 2015 expedition, lessons learnt were translated into adapted approaches and practices during the 2022 expedition. Nevertheless, challenges remained. We will discuss the challenges during the two expeditions and implications in the next paragraphs using Schatzki's framework (see Table 1).

Material arrangements

The presence of scientists on a cruise vessel brings activities and materials that are not part of the average expedition cruise. A first anomaly are obviously the scientists themselves, who contrary to the tourists did not book their journey through a tourism operator. In 2015, scientists were selected by personal invitation of the scientific expedition leader, who also participated in particular research projects. In addition to research activities, there was a strong focus on (media) outreach and networking between scientists, some of whom were not even involved in doing research. This was a direct result of the funding source: the remaining budget at the Dutch Research Council for education, outreach and communication of the 2007–2009 International Polar Year. The 2022 expedition witnessed several changes in the selection of scientists. On initiative of the Dutch Research Council, a formal procedure was set up for scientists applying for a position on board. The application form included a question on whether the project offered opportunities for tourists/other researchers to participate and, if so, how. In addition, selection of the projects was done by an independent committee. Compared to the 2015 expedition, this resulted in a greater diversity of scientists regarding scientific disciplines and career stages, including a larger contingent of social scientists. Also, the scientific expedition leader was no longer involved in conducting projects himself, but focused on managing the interests of others, including the collaboration between scientists and tourists. Science and collaboration were, hence, more firmly institutionalised in the rules of the expedition. Outreach, through media participation, remained an important aspect.

Combined polar science-tourism expeditions also differ materially from a regular adventure cruise in that (most) scientists bring equipment, including a laboratory. This means sharing ship space and key logistical equipment, which limits the possibilities of others in using the same space or equipment. An example is the installation of a bird watching booth at the front deck. From here ornithologists monitored birds, but this also limited the possibilities for tourists to stand at the bow, typically the most favourite spot.

Another example were the Zodiacs, used for transporting tourists to shore, which had to be shared with scientists. The limited number of Zodiacs and drivers meant that both the scientists and the tourists were confronted with choices and priorities that were given each day to particular science projects. Tourists had to wait until these science groups were transported. As a result, in 2015 some tourists felt they were ‘a lower class passenger’. During the 2022 expedition, it was clearly communicated that (only) scientists who had a project at a particular landing site and tourists who assisted these scientists had priority in landing, and these were

clearly communicated in the Zodiac transportation schedule. Nevertheless, some tourists did feel annoyed when they had to wait or when scientists who were not in the allocated schedule skipped the queue. Furthermore, decisions on the deployment of Zodiacs frequently had to be adapted as a result of weather, sea ice conditions, or the presence of polar bears, leading to uncertainty and anxiety amongst both tourists and scientists. The latter group was eager for their own scientific mission to be completed, but could only conduct their research if the voyage itinerary and logistical capacity (Zodiacs, crew) allowed this.

Rules

Rules prohibit or allow certain practices, or regulate how practices are to be carried out, but when combined can also lead to frictions or ambiguity. In preparing for the 2015 expedition there had been communication between its organisers and the Governor of Svalbard about the applicability of various regulations regarding the operation of the passengers and the ship in the nature reserve of Southeast Svalbard and the combination of multiple science projects and tourism activities as part of the same expedition (correspondence on file with the authors). The Governor of Svalbard confirmed that in this case, the expedition cannot be regarded as a single project, but that every single science project on board had to be registered separately. In the correspondence the Governor also expressed his concern:

"The combined concept of tourism and research is new to the governor, and gives rise to concern if it generates increased traffic in vulnerable areas" (Governor of Svalbard, 2015)

Besides the acquisition of the various research permits, a few weeks before the 2015 expedition, the science organisers were confronted with feedback from legal experts on the consequences of different insurance regulations of scientists and tourists with regard to safety (i.e., polar bears, rifles). This complicated the science-tourism collaboration process in the field (Interviews scientific expedition leader and key logistical organiser post, 2015). While the rules of the science practice allows armed scientists to operate largely independently, tourists can only participate in scientific projects if a tourist guide employed by the tour operator would join them and if the ship would stay close by. These regulations presented a logistical puzzle, which was exacerbated by preferential treatment of some of the special guests, who despite having no science activities were allowed to join science activities that were not accessible to the Arctic Academy tourists. This caused disappointment and frustration within this group, as some had expected to be collaborating closely with particular scientists. This was how the expedition was promoted and sold to them. To enable the participation of some of these disappointed tourists in science projects, a tourist guide would be allocated to a combined science-tourism activity. This could, however, only be done if this would not disrupt the organisation of the itinerary for the tourist landings.

These practical experiences resulted in an emerging rule: 'during landings, scientists, tourists and special guests (politicians, policy, media personalities, media) with no science activities are considered to be tourists'. This rule was formalised and adopted from the start of the 2022 expedition. In the first briefing after boarding explicit attention was paid to both the collaborative nature of the expedition and the consequences of different insurance regulations. It was made clear that different insurance rules for scientists and tourists, including special guests, would at times affect project participation in the Arctic Academy. For example, tourists could not assist scientists who were left behind by the ship. Furthermore, attention was paid to enabling more mixed science-tourism landings by allocating a tourist guide to such groups. Nevertheless, also during the 2022 expedition a few tourists expressed concerns that their desire to assist the science projects was not given sufficient priority in the allocation of activities and tourist guides.

Prioritisation was also an issue in relation to balancing the needs of science and tourism. During the 2015 expedition, as discussed above, there were several frictions in relation to 'science being first'. This was self-evident for the scientific expedition leader, but not for the tourists. In 2022, it was made clear from the first briefing on day one that science had the priority in this expedition, and all scientists (and assisting tourists) who had a project to do had priority in landing. This clarity helped managing expectations, but nevertheless was occasionally challenged in conversations in the bar or during dinner when landing opportunities turned out to be scarce due to polar bear presence and weather conditions. Interestingly, none of the participants ever raised this as an issue during the daily briefings.

The 2022 expedition also saw new rules and related challenges. First, Covid-19, which had already resulted in a two-year delay of the expedition, disturbed the routines. Many passengers caught the virus. For some, this meant that they had to stay in bed for days; others had little symptoms and could continue participating in the schedule and outdoor activities as long as they stuck to distancing rules, avoided the common rooms, and wore facemasks on board and on the Zodiac transfers. This also affected the hotel crew, who initially took meals to infected passengers' cabins; a practice that was abandoned after a few days when infection rates were so high that this was simply not feasible anymore and a dedicated area in the restaurant was assigned. Infected Oceanwide guides and staff had to remain in quarantine as per company regulations. Thus, Covid-19 further restricted the flexibility and adaptability needed to manage expectations during a combined expedition.

Second, the presence of social scientists brought some new challenges in relation to rules. Social scientists, when observing or interviewing people or when administering questionnaires, must ask their research subjects for consent and agreement on how data provided by research subjects is being treated. In 2015, the general practice for participatory observation and interviews was to still do this by verbal consent. The implementation of the General Data Protection Regulation of the EU (2018) meant that documented consent must be given. For the 2022 expedition this implied that consent forms for social science projects had to be signed by all participants irrespective of their role. The same was the case for taking and using photos, videos and

audio recordings featuring participants. During the expedition, repeated attention had to be given to the signing of the forms. This put social scientists somewhat 'on the spot' and resulted in some anxiety and discomfort about 'being observed', particularly amongst natural scientists (Steins et al., 2023).

General and practical understandings

On-board lectures are one way of improving general understanding of the various science projects. In 2015, the Arctic Academy included a few lectures, as well as brief evening updates from lead scientists, and participants expressed a clear desire for more. In 2022 the lecture programme formed a more integral part of the schedule. Per instruction of the scientific leader, all lectures were limited to 15 min and aimed at speaking to a non-academic audience. If a scientist would not already cover this, a returning question would be: 'Are there opportunities for science supporters to assist?' Disruption of landing opportunities due to polar bear presence or weather conditions could result in a more extensive lecturing programme, with multiple lecture slots, consisting of three or four talks each. This resulted in 'lecture fatigue' amongst some participants, and thus lost opportunities to further enhance general understanding.

During the 2015 expedition, tourists thought that, in addition to lectures, the Arctic Academy programme would provide more opportunities to increase their general understanding of the science projects by actively participating in them. However, not all scientific activities were suitable for tourist engagement due to a lack of practical understanding or competence to perform particular tasks. For example, in addition to restricting rules, setting up a weather station on a glacier requires both technical and physical competence, and was therefore conducted by a small team of scientists and expedition staff. Another example where specialist skills were needed, and tourists could not assist, was in collecting (uncontaminated) DNA samples. Projects where tourists could help in 2015 were largely developed 'on the go', such as collecting insects or identifying reindeer jaw bones. In 2022, in the preparation phase much more attention was paid to creating opportunities for involving tourists, for example, by explicitly including this in the science project selection procedures (see under Material arrangements).

However, in some cases scientists who were very open to involving tourists found out that the citizen science method developed at home was not practical in the context of the voyage (e.g. groups on the move, insurance rules). Furthermore, weather circumstances and polar bear presence disrupted the execution of many scientific projects, including those with assisting opportunities for tourists. Nevertheless, 81 % of the tourists who filled out the 2022 post-trip survey ($n = 26$) actively assisted in science projects, for example, by setting up, operating or carrying equipment, collecting biological samples, identifying fungi or reindeer antlers, participating in interviews and questionnaires, and collecting marine litter.

The selection of science projects for the 2022 expedition also included some bridging projects and dedicated activities aimed at fostering active interactions between the groups. One example was the marine litter project, where during beach walks litter was collected and sorted using established scientific monitoring protocols. A total of 37 % of the tourists who filled out the 2022 post-trip survey (n = 26) participated in this project, the main reasons being *"it's rewarding"*, *"it's a sociable activity"* or *"it's easy to do"*. Another example of a dedicated bridging activity was a social science workshop on board that focussed on 'what does it mean to experience Svalbard sustainably?' in which all groups participated and shared their experiences, observations, perceptions and ideas (Löf et al., 2023). These bridging projects and activities contributed to practical and general understanding and expectation management. Furthermore, in 2022 there was a larger number of active social science projects on board. Some of these contributed to reflection and 'boundary spanning' (Tushman, 1977), and hence general understanding, between different disciplines, and between science and tourism, because of their research focus.

Another difference in 2022 related to the framing of the tourists. From the first briefing, the scientific leader explicitly identified Arctic Academy tourists as 'science supporters', a term coined during the 2015 expedition per suggestion of one of the tourists (Löf et al., 2023). This term was consistently used in 2022 by the scientific and the adventure expedition leaders when referring to tourists who were listed to actively participate in projects. This, combined with the operationalised insurance rule ('when not doing science, you are a tourist' – see under Rules), contributed to the general understanding amongst participants about roles and rules, and the prioritisation of activities and groups. It also contributed to some extent to expectation management. However, the term 'science supporter' also resulted in misunderstanding as some tourists (incorrectly) thought they were financially supporting the berths for the scientists. In addition, the term implies a hierarchy.

In this context, we note that in both expeditions, the tourists participating in the Arctic Academy were not aware of all science-relevant activities. For example, both expeditions were closed with a scientific symposium in Longyearbyen the day after returning. This was neither included in the Arctic Academy programme nor in communications of Oceanwide or agents selling the trip. Only tourists who had consulted the expedition website or knew the organisers could have been aware of it and considered this in booking their return flights. Of the tourists who responded to the 2022 post-trip survey ($n = 29$), only 29 % attended the symposium, while 42 % selected the answer "I was not aware there was a symposium, if I had known, I would have attended". Most 'science supporters' were also not invited to the scientific meeting, six months after the expeditions, where preliminary results were presented. These observations suggest that the involvement of the science supporters beyond the data collection during the expeditions was not foreseen or clearly communicated to all the Arctic Academy tourists.

Next to lectures, general understanding was also facilitated through information provision on the science projects and associated scientists to the Arctic Academy participants. While the expedition website included an overview of all projects, this was not clear to all tourists. Following experiences in 2015, some scientists had suggested a booklet or poster with a photograph of each scientist and their project to be made available on board of the 2022 expedition, comparable to those of the guides. They had also offered to assist in its preparation, but all this was kindly dismissed by the organisation. From field notes and the post-trip survey

Table 4
Overview of participants' advice on continuation of science-tourism expeditions. Source: post-trip email survey tourists 2015, post-trip survey tourists and scientists 2022.

Question: Would you advice the tourism operator or scientific organisation to organise combined adventure and science expeditions to the Arctic region more often in future?	2015 (tourists) ***n*** = 18	2022 (tourists) n = 26	2022 (scientists) ***n*** = 21
Yes	90 %	77 %	51 %
No	0 %	12 %	17 %
Don't know	10 %	12 %	32 %

for tourists, however, it became clear that such a booklet or poster would have made an important contribution to identifying projects and scientists when looking for opportunities to assist.

Finally, there was the practical understanding related to the planning and communication practices of the organisers. During the 2015 expedition it became clear that adaptive management, clear communication and expectation management were crucial aspects in a smooth performance of combined science and tourism practices. The organising team was learning by doing; upcoming issues were solved on the spot and relied much on improvisation. The 7 a.m. morning meeting of the adventure expedition leader and the scientific expedition team formed a key structure for trouble-shooting. During dinner, a table was reserved for the expedition team, providing opportunity for reflection and decision-making. This was also the case in 2022.

Teleoaffective structures

Science and tourism practices hold widely different teleoaffective structures (Table 1), resulting in differing interests and goals. In 2015, for example, taking data samples by scientists during tourist walks slowed down the walking and created challenges for the guides to keep everyone focused. As was mentioned (under 'Rules'), the scientific expedition leader clearly prioritised the science projects, including his own, which were already difficult to realise. This created an unbalance in the beginning between tourism and science activities. The further the expedition progressed, the more participants got used to and adapted to the differing interests in the expedition, and the more relaxed the atmosphere became. Socially, the different groups also increasingly bonded due to the shared experiences. For example, spotting wildlife seemed to be on top of everybody's priority list, and dominated everybody's teleoaffective structure, no matter if they were a tourist or a scientist. Lectures and group pictures were paused or delayed because of humpback, fin whale or polar bear sightings, and scientists rushed from the onboard laboratories to the main deck to take part in the excitement.

In 2022, social bonding had already started prior to arriving in Longyearbyen as a multi-day airline strike jeopardised timely arrival of over half of the passengers, whom in the end, all just made it. During the 2022 expedition, the severe disruption of the landing schedule due to polar bear presence and weather conditions, as well as the Covid-19 outbreak, also contributed to bonding. The immediate and explicit attention to rules and priorities, and the more inclusive approach with respect to citizen science, fostered practical and general understanding and expectation management, but did not prevent issues and incidents in relation to the combined science-tourism practices from occurring. Some of these resulted from situations outside the control of the scientific and adventure expedition leaders, such as the presence of polar bears and the weather conditions, which challenged the expedition throughout its duration. Others were related to the availability of Oceanwide guides to accompany 'science supporters' during landings with a large number of individual tourism groups.

A final friction in the teleoaffective structures of the science and tourism practices related to hospitality practices (cf. Van Soest, 2023), which hold a central position in cruise tourism. On regular Arctic expedition cruises, three meals a day are provided at fixed times on board and landings are organised around these. Meals were also quite luxurious, with two three-course meals per day and a wide choice of food. Such luxurious services are a clear trend in expedition cruises, which are starting to resemble regular cruise tourism practices. The expeditions, however, attract a special kind of tourist who is generally acutely aware of climate change and the carbon-footprint of travel and food production, and who generally has a keen interest in nature (Löf et al., 2023). These traits are shared with the scientists, who eat when hungry doing fieldwork and are not used to luxurious hospitality and the interruption of land-based fieldwork when it is mealtime on board of the vessel. During both expeditions, regular hospitality practices were challenged a few times when 'packed lunches' for all passengers were organised to enable more effective data collection for scientists and science supporters and, consequently longer landings for tourists. The packed lunch experience was appreciated very much by scientists and tourists alike. Once, during the 2022 expedition, a polar bear prevented such a longer landing, and resulted in all passengers having to consume their packed lunch during the lunch time on board. The sight of their guests eating sandwiches whilst they could have been served a three-course meal, caused some anxiety amongst the hotel staff, even when they were assured by these same guests that it did not bother them. The luxury on board was questioned during the social science workshop on board (Löf et al., 2023), as well as in a published reflection (Van Soest, 2023). In the post-trip surveys for tourists and scientists, 'less luxury' and 'more packed lunches' returned multiple times as an open recommendation.

Reflection

Next to these observations and results related to the combined practices during the two expeditions, we also want to discuss moments of reflection in preparing and evaluating the expeditions (see Fig. 1). Overall, the large majority of the tourists were

Table 5
Overview of participants' responses to the question how the presence of 'the other party' influenced their Svalbard experience or project Source: post-trip email survey tourists 2015, post-trip surveys tourists and scientists 2022. n/a = answer option not included.

Question: How did the presence of 'the other party' influence your Svalbard experience	2015 (tourists about scientists) n = 18	2022 (tourists about scientists) n = 26	2022 (scientists about tourists) ***n*** = 41)
Positively influenced it	90 %	96 %	29 %
Negatively influenced it	0 %	4 %	7 %
Did not influence it	0 %	0 %	64 %
Mixed	10 %	n/a	n/a

very satisfied with the experience provided during the two SEES-expeditions. Most tourists would recommend the organisers to continue organising such trips (Table 4). In 2022, also scientists were included in the post-trip survey. Their response gives a more mixed picture in relation to organising future science-tourism expeditions. Nearly half of the scientists (49 %) were in the 'no' and 'don't know' group. This group included scientists who felt that their scientific routines were not or less compatible with the tourism routines (see 'Material arrangements' and 'General and practical understandings'; cf. Van Soest, 2023).

The vast majority of tourists in both 2015 and 2022 felt that the presence of scientists and scientific projects had positively influenced their voyage (Table 5), despite the organisational implications. They considered the presence of scientists as 'enriching' and valued their presence as being inspirational, educational or the main reason for booking the trip (Fig. 2). However, they were also critical about the science getting priority over their needs (Fig. 2). The scientists, in contrast, valued the positive influence of the tourists' presence much lower (29 %) or noticed no influence at all (64 %) (Table 5). The most mentioned 'positives' of the presence of tourists on the science expedition were the provision of reflection and discussion, enabling direct outreach about science to the public, and extra hands in the field. The main negative influence from tourists' presence, according to the scientists, was the decreased flexibility in conducting the science work.

Both in 2015 and 2022, participants proposed recommendations to overcome some of the challenges in future editions (see Table 6). The recommendations proposed by tourists in 2015 were never formally shared with the organisers. Nevertheless, several of these recommendations were implemented in 2022. It is remarkable that considering the expedition being a big, high-profile and costly event, there has never been a formal evaluation of the 2015 expedition by its organisers. Such a formal, documented evaluation is even more important when it concerns combining irregular sets of practices for which no routine or standard procedure has yet been developed. Despite the implementation of some of the recommendations from tourists in 2015, many recommendations by tourists and scientist in 2022 were similar to those from the first expedition. The evaluation results from the 2022 surveys have been presented to Oceanwide Expeditions and shared with the scientific expedition leader. To date, no joint evaluation by the organising parties of the 2022 expedition has taken place.

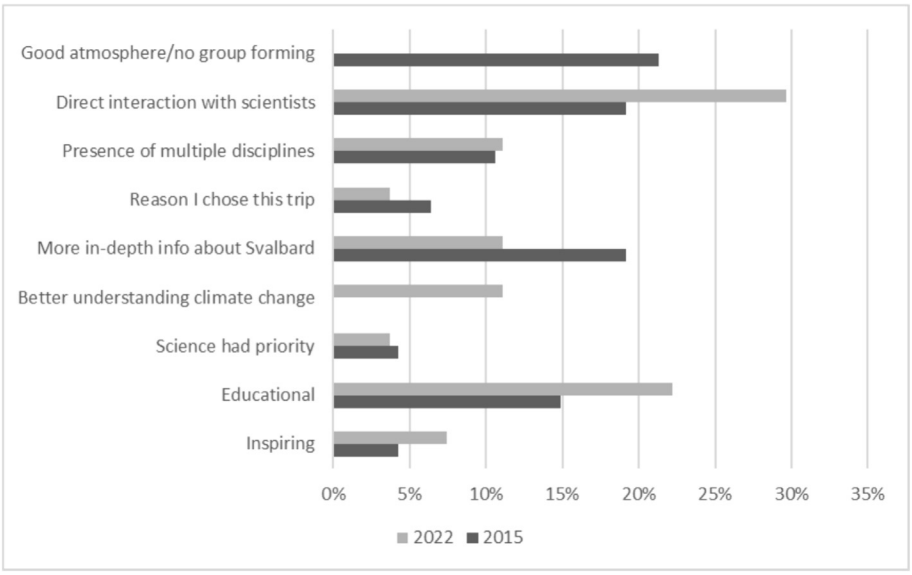

Fig. 2. Overview of answers to open question (tourists) "How did the presence of scientists influence your Svalbard experience?" Answers grouped in categories. Source: post-trip email survey tourists 2015, post-trip survey tourists and scientists 2022.

Table 6
Recommendations by participants on the organisation of future science-tourism expeditions (based on science-tourism combination).

Recommendation	2015 (tourists)	2022 (tourists)	2022 (scientists)
Clarify legal and organisational issues	√	√	√
Enable and stimulate mingling of scientists and tourists	√	√	√
More communication and engagement afterwards	√	√	
More attention and discussion on sustainability issues during the voyage	√	√	
Clear and consistent communication beforehand	√		√
Clear communication during the voyage	√		√
More Oceanwide guides to enable tourists to participate in fieldwork		√	√
Less luxury (food) and (more) packed lunches to make most of the day		√	√
Change the voyage area (less polar bears)		√	√
'Who is who?'-list on board of scientists and their projects		√	√
Appoint coordinator for science-tourism interaction/collaboration (pre and during trip)			√
Oblige science projects to involve tourists or limit number of projects that cannot involve tourists			√

Discussion

The Dutch science-tourism expeditions are a unique manifestation of the diversification of tourism activities in the Polar Regions, particularly in the way that science and tourism activities are combined. Forms of citizen science in the context of polar expedition cruises are evidently on the rise the last decade (Bergmann et al., 2017; Cusick et al., 2020; De la Barre et al., 2016; Farmer, 2019; Taylor et al., 2020). These citizen science approaches develop ways to involve passengers in scientific data collection as part of the activities offered during a conventional polar expedition cruise. In contrast, the Dutch expeditions attempt to combine science and tourism practices on a more equal footing. Despite their unique character, and the 'special kind of tourists' that the expeditions attract (Löf et al., 2023), we argue that the challenges experienced and lessons learned from the two expeditions generate a range of valuable points for discussion in the context of the diversification of polar cruising and the usefulness of the practice approach in tourism studies.

Our results show that forging connections between science and tourism is generally regarded by the passengers and the organisers as generating positive outcomes for the visitor experience and the popularisation of polar science, but there are also challenges and concerns. At a more operational level, these challenges include questions about which of the two activities has priority, how to practically deal with different regulations for science and tourism practices, how to forge the connections between tourists and scientists on board, and how to design projects to enable practical assistance by tourists. In addition, factors like weather conditions, Covid-19 infections on board, and (in the Arctic) polar bear presence can disrupt science-tourism practices. In terms of more general concerns, similar to Antarctic tourism diversification (i.e., Lamers & Gelter, 2012), we observed in this Arctic case a concern that combining various practices in the context of polar tourism cruises could lead to new unexpected behaviours, management implications and unintended impacts in vulnerable polar destinations (cf. Löf et al., 2023).

It is evident that polar tourism remains a balancing act between the natural environment, economic development, and social and cultural considerations (Hovelsrud et al., 2023; Löf et al., 2023). In this light, critical perspectives and organising dialogue between stakeholders involved are crucial (Löf et al., 2023). This aligns more broadly with processes of diversification whereby tourism practices connect with other sets of practices, such as fisheries, agriculture, cultural heritage, religion or health care (Bowers & Cheer, 2017; Brandth & Haugen, 2010; Connell, 2013; Vegas Macias et al., 2023). Such connections can be productive, generate mutual benefits or inclusivity, but in cases where business logics or tourism practices dominate it could also lead to the commodification of public goods, exploitation by some powerful tourism actors, or a way to legitimize or greenwash tourism development in vulnerable and remote areas (Bowers & Cheer, 2017; Connell, 2013; Löf et al., 2023; Varnajot et al., 2024).

The social practices lens applied in our study has proven useful for exploring processes of tourism diversification in general and the interactions between science and tourism as performed during the expeditions in particular. Social practice theory enabled us to carry out an in-depth analysis of the frictions and implications resulting from combining two sets of routine practices in a shared performance. Our analysis drew mainly on the work of two social practice theorists. The conceptualisation proposed by Schatzki (2002) (see Table 1) in particular proved helpful for our analysis. This conceptualisation emphasises the position of rules and teleoaffective structures as factors in organising practices and material arrangements, which are missing in the three-elements approach proposed by Shove et al. (2012). We argue that particularly the different regulations and institutional requirements that go along with distinct sets of practices, such as science and tourism, hold considerable explanatory power in understanding frictions in bundling different sets of practices (Lamers et al., 2017; Schatzki, 2002), and may be difficult to reconcile in a combined performance. At the same time, Shove et al.'s concepts of bundles and circuits of reproduction (Shove et al., 2012) have proven useful for understanding the process of how connections between practices are formed. The two conceptual approaches are in that sense compatible (see also Schatzki, 2016).

Previous research has focused on the forging of connections between sets of practices as a strategy to generate mutual benefits and sustainable outcomes (Lamers et al., 2016; Vegas Macias et al., 2023; Zwart et al., 2021). Our study shows that sets of practices can also be deliberately connected in irregular performances. Other tourism related settings where this may be the case include one–off expeditions, event-related travel (e.g. unique sport events) and new or innovative tourism experiences (e.g. deep sea travel, space tourism). During the expeditions two sets of practices were bundled with a time interval of about seven

years. Our results emphasise the importance of organisational reflection, feedback and evaluation, expectation management and clear communication, as "connecting practices" (Lamers et al., 2016; Vegas Macias et al., 2023). Such connecting practices help to overcome differences and frictions between co-existing sets of practices in a combined performance. It also helps clarifying the who, what, how and why of the routines to be connected for the organisers and carriers of the practices. Different carriers of practices (e.g. scientists, tourists, crew), bring their routines to the site of performance, leading to expectations and possibly frictions, if their joint performance is disrupted (e.g. Covid-19, polar bears) or not managed well.

The social practice approach allows us to unravel combined activities and provide timely feedback to organisers and policy actors. We argue that irregularly performed connections between different sets of practices should not be taken for granted, but taken seriously by organisers, policy actors and researchers. Organisers should ensure sufficient reflective moments to think through combined practices both before and after the event in terms of priorities, expectations, and communication. The organisers of the expeditions should have reflected and evaluated more systematically before and after the first expedition to anticipate particular challenges and frictions to be taken into account in the second expedition. However, it should also be noted that institutionalising such reflection is difficult when the next iteration is uncertain. At the same time, this gave us a unique opportunity to observe how practices evolve in a subsequent iteration without being based on a formal evaluation. We have seen during the expeditions that scientific and adventure expedition leaders, as well as guides, can really show their performative and adaptive capacity in their ability to connect tourism and science practices (under uncertain circumstances) in a smooth and successful way. Expectation management and clear communication are key, and that is where expedition leaders and guides can make a difference (La Cour, 2023; Nielsen & Roldan, 2023; Taylor et al., 2020).

From our comparison of two episodes of the Scientific Expedition Edgeøya Svalbard, we extract three main lessons for successfully combining tourism with science practices in Polar Regions. First, organisers should build in time for organisational reflection and invite participant feedback prior, during and after combined tourism-science practices. In case of citizen science activities that are less routinely or regularly organised, such as the two expeditions, a formal evaluation should be conducted. Second, starting prior to the expedition, researchers and the scientific expedition leader should work closely together with the adventure expedition leader to maximize efficiencies in combining and in balancing science and tourism activities. Even though plans often change due to weather or polar bear conditions, having a basic plan for managing scientific and adventure activities and their interaction will assist efficient use of resources as well as expectation management. Third, expectation management and clear communication are essential ingredients for successful integration of tourism and science practices (cf. Löf et al., 2023). This is a (joint) responsibility between the scientific expedition leader, the adventure expedition leaders and the tourism operator, and should not be limited to the period of the expedition, but also prior to and following the expedition. The latter includes documenting and communicating results of citizen-science activities to participants, the scientific community and the wider public, which currently seems lacking (Taylor et al., 2020).

Regarding the sustainability impact of polar expedition cruises we observed that sharing ships or facilities may not necessarily be leading to energy efficiencies or other sustainability benefits (cf. Löf et al., 2023; Van Soest, 2023). For example, a more complex set of activities on board could very well lead to more shipping time or a more intense use of Zodiacs to facilitate all the different kinds of groups. During the expeditions many of the scientists had to accept a trade-off between the scientific value of the expedition and other benefits, such as the networking opportunities, the media attention for their science or the polar cruise experience itself. Moreover, due to the presence of tourists as well as social science researchers on board, sustainability issues were more explicitly discussed (cf. Löf et al., 2023). This contributed to a paradoxical response. Normally polar scientists embark on energy intensive science cruises or stay at polar stations with a considerable environmental impact on the Polar Regions, but with the possibility for justification through their work or 'hiding away' by focusing on their work. Now, scientists were confronted with their environmental impact because of the presence of tourists as a direct audience, providing a societal mirror or sounding board (cf. Van Soest, 2023). The realisation that they are merely tourists, made several scientists feel uncomfortable.

In view of the current growth of polar tourism and the increasing number of citizen-science activities, we argue it is important to critically assess and organise dialogue about the associated sustainability issues (Löf et al., 2023; Van Soest, 2023; Varnajot et al., 2024). Policy makers are increasingly considering restrictions to cruising activities in Polar Regions,[2] but should also consider if and how the diversification of tourism in general, and combinations tourism and science, should be allowable and if current management standards and instruments are effective in dealing with more complex (or combined) activities (cf. Hovelsrud et al., 2023; Taylor et al., 2020).

Conclusion

We conclude that combining science and tourism practices in polar expedition cruising is an attractive proposition, but should not be taken for granted. Whilst benefits in terms of visitor experience, diversification of tourism practices, networking opportunities and scientific outreach are evident, if not managed carefully, such combined activities could also have negative implications for various groups of practitioners or vulnerable polar environments. Misunderstandings, surprises due to regulatory complexities, or flexibilities in the itinerary can be expected as part and parcel of irregularly performed combinations of practices and bundling processes, and the importance of enhanced levels of reflection and communication cannot be underestimated. Careful preparation and communication, continuous on-board reflection and formal evaluation are key to managing experiences and impacts, and en-

[2] See: https://polarjournal.ch/en/2024/02/14/environment-over-tourism-on-svalbard-new-rules-from-january-2025/

suring that the roles and expectations of groups of carriers of practices are clear before, during and after a combined performance. The social practices lens, combining conceptualisations proposed by Schatzki (2002) and Shove et al. (2012), is useful in analysing and unravelling the implications of combined practices in detail. The growing diversification of tourism products and services in the Polar Regions, warrants greater attention for the organisational and sustainability impacts of these implications.

CRediT authorship contribution statement

Machiel Lamers: Writing – review & editing, Writing – original draft, Visualization, Validation, Methodology, Investigation, Funding acquisition, Formal analysis, Conceptualization. **Nathalie A. Steins:** Writing – review & editing, Writing – original draft, Validation, Project administration, Methodology, Investigation, Funding acquisition, Formal analysis, Data curation, Conceptualization. **Linde van Bets:** Writing – review & editing, Validation, Data curation.

Data availability

Data will be made available on request.

Declaration of competing interest

Hereby we confirm that we have no interests to declare in relation to the contents of this manuscript.

Acknowledgements

The Dutch Scientific Expedition to Edgeøya Svalbard in 2015 and 2022 and our participation were made possible by the Netherlands Polar Programme of The Dutch Research Council (NWO). We are grateful to the SEES organisers, and particularly NWO and the Arctic Centre of the University of Groningen, for the opportunity to participate the expeditions. We thank all participants in the expeditions for their cooperation in our research projects, and Oceanwide Expeditions for their hospitality. We value the input of the anonymous reviewers in improving our paper.

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