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Soundscapes and protected area conservation: Are noises in nature making people complacent?

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Abstract

This study explores how existing connections to natural places may affect PA visitors' experiences and perceptions within the PA. Specifically, outside-the-PA soundscape perceptions are examined to better understand how their experiences outside the PA may affect perceptions of PA soundscapes and visitors' ability to effectively contribute to conservation monitoring. Survey research (n=389) of recent urban visitors to the Chilean Coyhaique National Reserve (CNR) in Patagonia unpacked perceptions of the acoustic environments within the places where participants felt most connected to nature, including landscape features, favorite and prevalent sounds, and acceptability of particular anthrophonic sounds. Favorite and prevalent sounds were open-coded, and anthrophonic sounds were rated for prevalence and acceptability. The mountain landscape features and sounds ('wind', 'running water',' birds') participants described as prominent within the places where they felt most connected to nature aligned well with CNR characteristics. Participants who 'sometimes'/often' heard certain anthropogenic sounds (vehicles, aircraft, machines, city sounds), within the places where they felt most connected to nature, rated those sounds as more acceptable than participants who reported 'never' hearing them, raising concerns about complacency toward anthrophony in natural settings. Continued research efforts are warranted to better understand visitors' frames of reference, their influence on the reliability of social norm data for PA soundscape monitoring, and their influence on PA managers' ability to protect conservation values.

Keywords

Anthrophonic sounds, connections with nature, conservation values, protected area, soundscape, structural social norms

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Introduction

Research has suggested that an increasing number of protected area (PA) visitors live within urban areas, where access to nature may be limited, and natural spaces may be quite different in character as compared to the PAs they visit in more remote locations, as tourists (Girault 2016; Marques et al. 2010). Current PA management practices often utilize visitor perceptions data to inform monitoring and management protocols relating to PA conservation and visitor experiences. Research typically collects basic visitor demographic and travel characteristics to classify and understand visitor experience preferences; however, information about visitors' home-based experiences and environments is seldom considered (e.g., Marques et al. 2010). PA managers must recognize that visitor perceptions within PAs are influenced by the frames of reference through which they relate (Kogan et al. 2017; Axelsson et al. 2019; Gale et al. 2021), including their experiences within their home environments and the places where they connect to nature. A more holistic understanding of how visitors connect to nature in their familiar places can complement PA-based studies and support PA ecosystem protection mandates since connection to nature has been linked to support for conservation (Mackay and Schmitt 2019).

The literature has identified several determinants that foster the development of a connection with nature, including childhood experience with nature, purposeful thought about one's feelings toward nature, and pleasant experiences in nature (Hosaka et al. 2017; Rosa et al. 2018; Mackay and Schmitt 2019; Duron-Ramos et al. 2020; Rosa 2020). However, little is known about what types of natural environments, or immersive nature experiences may best facilitate the development and strengthening of connections to nature, how such connections may be maintained over time, and how they may impact experiences in other natural settings. It is important for PAs to understand the types of environments where visitors have already connected with nature and consider how those connections may shape their motivations and behaviors within the PA.

Experiencing natural sounds has been found to meaningfully connect people to natural places (Dumyahn and Pijanowski 2011); yet the role of anthrophony (human-caused sounds) within connections to nature is not well understood. Little is known about how connections to nature that were developed in contexts containing higher levels of anthrophony may shape visitor perceptions and beliefs about a more natural PA context. Addressing this research need is particularly relevant because of a growing recognition of the vital role of natural sounds for both ecosystem health and visitor experiences within PAs (USNPS 2010, 2013; Brady 2017; Francis et al. 2017; Miller et al. 2020). Increasingly, soundscape researchers are focusing on the interrelatedness among healthy natural systems, predominant natural soundscapes, and quality visitor experiences in PAs (Francis et al. 2017; Ferraro et al. 2020; Levenhagen et al. 2020). They hypothesize that when PA systems are healthy and capable of providing ecosystem services including natural soundscapes, the quality of visitor experiences is enhanced.

These authors call for the development of effective integrated soundscape research approaches that highlight the interrelationships between human and natural systems to inform PA management (de Almeida et al. 2016; Bushell and Bricker 2017; UNEP-WCMC et al. 2018). Protected area soundscape research had traditionally focused on natural systems and animal behavior, helping to understand how animals communicate and detect predators or prey (Fletcher 2014; Duarte et al. 2018). Beginning in the 1980s, another branch of PA soundscape studies began to include visitors and their perceptions of sounds to develop indicators of soundscape quality, and improve visitor experiences (Marin et al. 2011; Miller et al. 2018; Gale and Ednie 2020; Gale et al. 2020). While specialized research remains important for PA conservation, as these two strains of research have evolved, they have begun to intertwine. For example, when visitor perceptions research contributes to effective monitoring of natural system health, it offers an efficient triangulation mechanism for integrated research.

Visitor perceptions have served to identify indicators and thresholds of quality, and the documented appreciation for natural sounds has led managers to utilize findings to monitor their soundscape protection missions. Structural social norms, or "shared beliefs about the acceptability of an action or situation" (p. 650, Zinn et al. 1998) have been studied through time in a variety of conservation contexts, including wildlife, wilderness, and marine PA management to inform conservation monitoring processes (Shelby et al. 1996; Zinn et al. 1998; Bell et al. 2011). Similarly, visitor perceptions of sound acceptability have demonstrated promise as a way to examine social norms of the acoustic environment within the context of PA soundscapes. Specific anthrophonic sounds, or the dominance of anthrophonic sounds within a soundscape, have typically been used to identify thresholds and standards within PA contexts (Tarrant et al. 1995; Pilcher et al. 2009; Marin et al. 2011; Miller et al. 2018).

Recent studies suggest that salience, or prominence, is likely to be a useful consideration for evaluating the reliability of soundscape social norms. For example, Miller et al. (2020) compared motorized and non-motorized user groups' standards of acceptability for the sounds (dBA levels) of natural gas compressors in Pennsylvania State Forests. Very different social norms resulted for these two groups; results indicated that the noise level put out by a natural gas compressor was not a salient concern for motorized users. These results from Miller et al. (2020) align with other researchers who have emphasized the importance of understanding salient sounds within visitors' experienced environments (Kogan et al. 2017). Sound salience may be different for visitors from urban areas who are exposed to anthrophony on a regular basis as compared with those who have more access to natural soundscapes. A better understanding of the sounds that are salient to urban visitors in their experienced environments outside of PAs may help managers align structural norm monitoring protocols for soundscapes with PA conservation goals.

The current study informs management within the Coyhaique National Reserve (CNR), one of the highest visited PAs in the Aysén Region of Chile, located five kilometers from the regional capital of Coyhaique. Visitation to PAs in Aysén has

dramatically increased during the past decade; use of National System of Terrestrial Protected Areas (SNASPE) PAs tripled between 2012–2017, reaching 109,000 visitors in 2017 (Chilean National Tourism Service Aysén [Sernatur] 2017; CONAF 2018). Considering these trends and projected regional development (e.g., airport infrastructure expansion and the paving of the region's primary terrestrial connection with the rest of Chile), regional SNASPE planners have projected that current visitation numbers will quadruple in the coming years, reaching 440,000 visits or more by 2025 (CONAF 2017). While the COVID-19 pandemic has paused visitation growth, as Chile gradually reopens domestic tourism dynamics are predicted to intensify, with an even greater flow of visitors coming from the highly urbanized central regions of Chile (e.g., Santiago) toward more remote peripheral regions (World Tourism Organization 2020; Zalaquett and Wolleter 2020). As such, PAs within the region must be prepared to monitor for changes that exceed acceptable levels of visitor impacts and that may threaten conservation goals.

This paper explored how urban PA visitors' frames of reference with respect to the places where they feel most connected to nature may affect their PA soundscape perceptions and capacity to contribute to conservation monitoring in PAs. Specific research questions (RQs) included: 1) With what landscape characteristics do participants tend to connect?; 2) How do participants' favorite sounds and prevalent sounds compare within the places where they feel most connected to nature?; 3) How acceptable are the anthrophonic sounds observed by participants within the places where they feel most connected to nature?; and 4) Do participants' anthrophonic sound acceptability ratings differ based on the prevalence of those sounds within the places where participants feel most connected to nature?

Methods

Study area and context

The CNR is bordered by the Lakes Region to the north, Argentina to the east, the Magallanes Region to the south, and the Pacific Ocean to the west (Fig. 1). As the third largest and lowest populated region of Chile, Aysén's varied terrestrial and aquatic ecosystems, and abundant freshwater reserves, make it a critical area for biodiversity conservation (CONAF 2016). The region's landscapes are diverse, with abundant forests and grasslands that extend along the southern stretches of the Andes and the world's third-largest freshwater reserves (Northern and Southern Patagonia Ice Fields) whose glaciers and melts filter down through an extensive series of lakes and rivers to join the fiords. More than half of the Aysén region is protected through the National System of Terrestrial Protected Areas (SNASPE), forming 18 PAs, under national park, national reserve, and natural monument designations. Several other marine PAs exist or are in the process of being established in the region, protecting the unique biodiversity in the coastal waters of the Aysén and Taitao peninsulas.

Data Collection

This paper presents research conducted as a follow-up to a recent soundscape study with visitors to the CNR (Ednie et al. 2020; Gale et al. 2020; Gale and Ednie 2020). Participants in the original CNR study were asked to provide their email addresses if they were interested in participating in a follow-up web-based survey

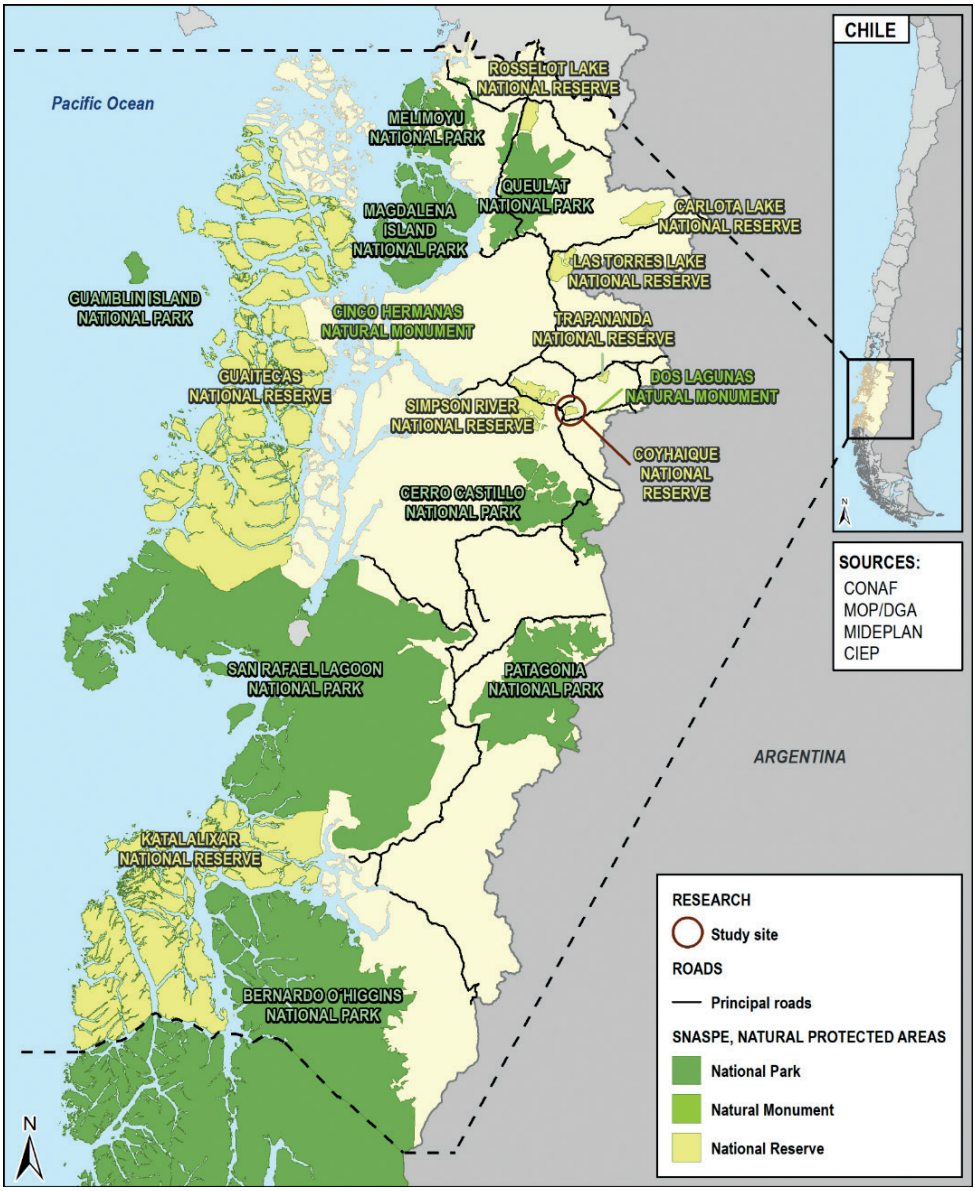

Figure 1. Study context.

about soundscapes. Of the 899 participants in the original study, 810 participants (90.1%) volunteered their contact information for the follow-up study.

After obtaining CONAF's formal project approval as the PA's managing agency, and the Institutional Review Board ethics approvals from the lead author's university, volunteers were contacted via email and invited to complete an online survey, delivered via the Qualtrics application (qualtrics.com). Surveys were conducted between May and July 2019. Up to five reminder emails were sent at three- to five-day intervals from the initial request, following a process outlined by Dillman et al. (2014). All communications with participants were personalized and accompanied by photos to remind them of their visit to the CNR (during which they were initially intercepted). The emails included a unique link leading to the Qualtrics survey, which was developed in both English and Spanish (Qualtrics 2018). 276 responses were collected, representing a 35.4% response rate after removal of 30 unusable email addresses.

Limitations

The survey instrument scales were adapted from English to Spanish, using a translation process between bilingual native speakers of both languages that focused on achieving a contextually correct translation, rather than a literal translation. A rigorous process was undertaken to assure the proper contextual translation; however, it is possible that some of the terms were understood differently in Spanish, provoking contextual differences. Specific measures included triangulation and member-checking following the initial translation, involving dialogue between members of the bilingual team. Following this phase, the instrument was tested with the field research team (six people), using a focus group setting, to confirm understanding amongst native speakers.

Measures

The online survey inquired about basic participant demographics (age, gender, residence city size), and landscape characteristics and soundscape perceptions within the places where participants felt most connected with nature. See Suppl. material 1 "Soundscapes and nature connection survey instrument" for the original survey used in this study. Three groups of questions asked participants to reflect on the natural area they had selected, with respect to the landscape and its features, prevalent and favorite sounds, and prominence and acceptability of common anthrophonic sounds. With respect to landscape features, participants were asked to rate the prominence of a list of common landscape features on a four-point scale, ranging from 1=not present, to 4=very prominent. Landscape features were selected from regional visitor-use planning documents (CONAF 2017). Participants were also asked to list the three most prevalent sounds (in order of prevalence) and their favorite sound within their chosen natural place. These responses were collected in open-ended format. For frequency and acceptability of anthrophonic sounds, participants were presented with a list of anthrophonic sounds (generated from previous CNR soundscapes research) and asked to first

indicate how frequently they heard each sound (1=never, 2=sometimes, 3=often) and then to rate the acceptability of each sound on a five-point scale ranging from totally unacceptable to totally acceptable.

Data analysis

Open-coding methods (Elliott and Timulak 2005; Humble 2009) were used to categorize the prevalent sounds that participants listed in open-ended format. Following methods outlined by Vaughn and Turner (2016) and Williams and Moser (2019), researchers first listed and thematically sorted the open-ended prevalent and favorite sound responses. This process resulted in a dictionary of thematically sorted sound codes. Second, the sound codes were combined into sound categories. For example, participants described a variety of sound codes that reflect wind blowing through trees (e.g., wind in branches, wind in leaves, and foliage rustling). These responses were grouped together into the sound category, 'wind interacting with trees'. When participants provided less-descriptive responses (e.g., wind, birds, water), the resulting sound category was identified with ('generic') following the category name. Ultimately, the sound categories were thematically grouped into geophony, biophony, and anthrophony sound themes, consistent with existing acoustic research completed within PA settings (e.g., Benfield et al. 2010; Gale et al. 2020; Rice et al. 2020).

Since the soundscape experience and rating variables were measured on ordinal scales and data for several variables were not normally distributed, requirements for parametric tests were not met and non-parametric comparisons were selected. MANN-WHITNEY U tests were completed to test for differences in acceptability ratings when particular anthrophonic sounds were "never heard", or "sometimes/often heard" in participants' chosen natural places. SPSS version 27 (2020) was used for data analysis, and $p<0.05$ was used to determine statistical significance.

Results

Study participants were relatively young, with 70.91% of respondents between the ages of 18–35 years and balanced in gender (50.92% female). Most participants resided within major cities and large metropolis areas (74.45% within major cities with >200,000 population and an additional 16.79% in cities 50,000–199,999 population). The places where participants felt most connected to nature spanned contexts; most were described as designated natural PAs or rural greenspaces (74.82%), and the remaining quarter (25.18%) were described as urban greenspaces.

RQ1: With what landscape characteristics do participants tend to connect?

The most prominent features within the places where participants felt most connected to nature were "forests", and "rivers/streams", which were rated 'prominent'

by 70.04% and 67.30% of participants, respectively (Fig. 2). More than half of the participants also indicated that "rocky settings above treeline" were 'prominent' (53.46%). Slightly fewer than half of the study participants rated "grasslands", "landscaped greenspaces", and "lakes/ponds" as 'prominent' (45.85%, 43.41%, and 40.71%, respectively). "Waterfalls", "wetland areas", "beaches", "volcanos", "glaciers", and "desert" were either 'not prominent', or 'not present', within most of the places where participants felt most connected to nature, even though many of these features are common in much of Chile and within close proximity to the urban areas where the majority of participants resided.

Figure 2. Prominence of common landscape features within the places where participants felt most connected to nature.

RQ 2: How do participants' favorite sounds and prevalent sounds compare within the places where they feel most connected to nature?

Figs 3 and 4 outline the results of the open-coded favorite and prevalent sound descriptions provided by participants with respect to the places where they felt most connected to nature. Overall, the majority of both favorite and prevalent sound categories were within the geophonic sound theme (70.37% favorite; 56.07% prevalent). The most frequently described geophonic sounds were related with wind ('wind-generic' or 'wind interacting with trees': 35.22% prevalent and 41.57% favorite), followed by the category of 'moving water' (8.84% prevalent; 11.93% favorite). 'Ripples and waves in lakes or ponds' and 'sea waves' were less prevalent geophonic sounds (3.69% and 1.98%, respectively); yet, tended to be listed more frequently as favorites (6.58% and 5.35%, respectively). Comparing across participants' listings of their first, second, and third most prevalent sounds, the proportion of geophonic sounds decreased, representing 70.70%, 50.80%, and 46.34% of sound descriptions, respectively.

Biophony was the second most frequently reported sound theme (33.77% prevalent; 28.80% favorite), with bird sounds being the most prevalent biophonic sound category ('birds/birdsong': 26.52% prevalent; 25.93% favorite). 'Animals', including dogs and pets, represented 6.20% of the prevalent sounds, and 2.88% of favorite sounds. 'Insects' were listed as prevalent sounds by 1.06% of participants but were not listed as favorite sounds. Biophony-themed sounds represented a smaller proportion of participants' first most prevalent sound list as compared with their second and third-most prevalent sounds lists (23.05% of first prevalent sound v. 41.80% and 36.59% of second and third most prevalent sounds, respectively).

Anthrophonic-themed sounds represented 0.82% of the reported favorite sounds and 10.16% of prevalent sounds. The two instances of favorite anthrophonic sounds were associated with the category of 'people-generic'. Anthrophonic-themed sounds represented 10 of the 20 overall sound categories that emerged from the data, as they were described with greater specificity than geophonic- or biophonic-themed sounds (Fig. 3). The most prevalent anthrophonic sound categories were 'people-generic' (3.83%), 'general traffic' (1.85%), and 'people walking' (1.72%). Anthrophonic-themed sounds represented a larger proportion of participants' third most prevalent sounds lists (17.07%), as compared with their first or second-most prevalent sounds lists (6.25% and 7.42%, respectively).

RQ 3: How acceptable are anthrophonic sounds participants observe within the places where they feel most connected to nature?

Mean acceptability ratings for four anthrophonic sounds, including 'personal sounds' (wind on one's clothes, one's breath, etc.), 'children's voices', 'adult' voices, and 'music' categories, were above neutral, although the standard deviation for music spanned the neutral line (Fig. 5). Sounds of 'vehicles', 'aircraft', 'city sounds', 'drones', and 'ma-

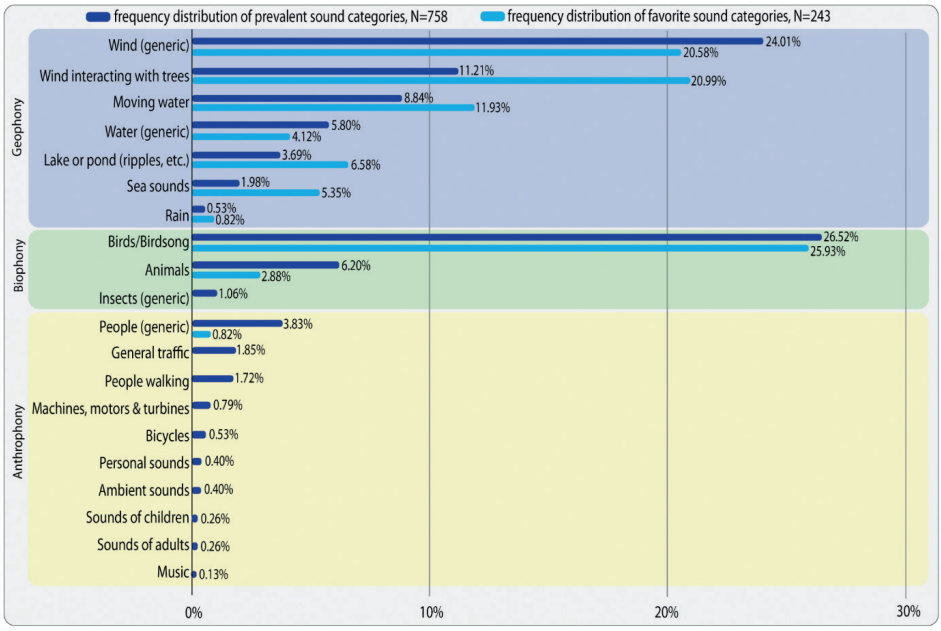

Figure 3. Frequency distributions of prevalent and favorite sound categories.

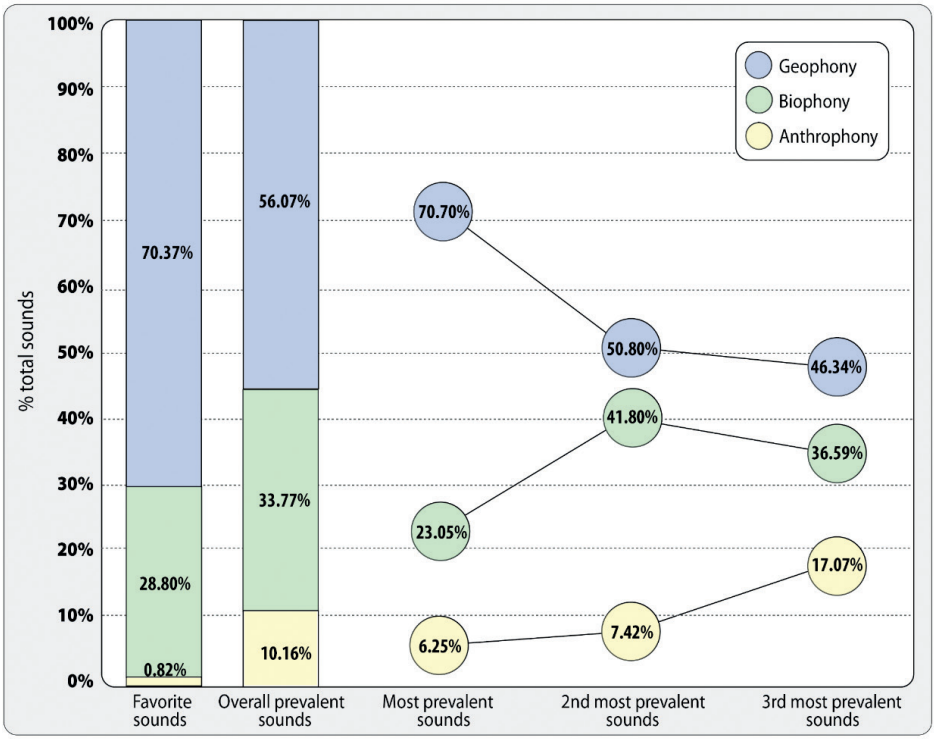

Figure 4. Frequency of favorite and prevalent sound themes, and order of prevalent sound themes.

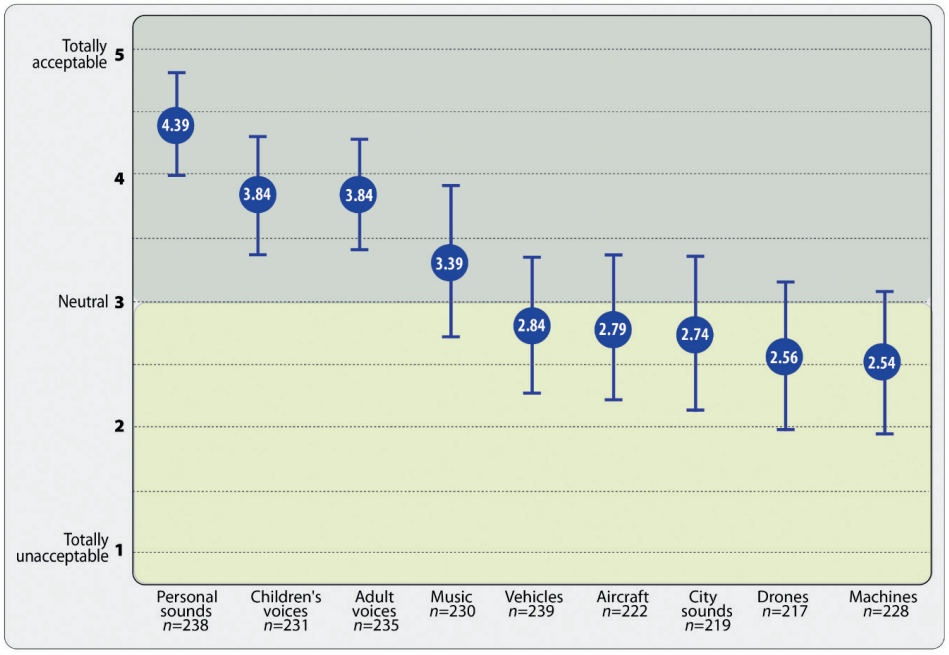

Figure 5. Mean acceptability ratings for anthrophonic sounds.

chines' received mean acceptability ratings below neutral, although their standard deviations did span into positive ratings. Mean acceptability ratings were lowest for the sound categories of 'drones' and 'machines' (M=2.56 and M=2.54, respectively).

RQ4: Do participants' anthrophonic sound acceptability ratings differ based on the prevalence of those sounds within the places where participants feel most connected to nature?

For five of the nine anthrophonic sounds, participants who indicated that they were "sometimes" or "often" heard rated them as significantly more acceptable than the participants who indicated they "never" heard them (Fig. 6): 'vehicles' (Mdn Never Heard=2.35, Mdn Heard=2.94, U=3778.50, p=.01), 'aircraft '(Mdn Never Heard=2.50, Mdn Heard=2.96, U=4789.50, p=.02), 'machines' (Mdn Never Heard=1.95, Mdn Heard=2.75, U=4528.00, p=.00), 'city sounds' (Mdn Never Heard=2.19, Mdn Heard=3.09, U=4144.50, p=.00), and 'music' (Mdn Never Heard=3.21, Mdn Heard=3.73, U=5118.50, p=.01). The mean acceptability rating for 'city sounds' was below neutral for participants who "never" heard 'city sounds' in the places where they felt most connected to nature (M=2.48), and above neutral for those who indicated they heard 'city sounds' "sometimes" or "often" (M=3.05) within these places. All other anthrophonic sounds remained on the same side of neutral regardless of whether they were heard. 'Drones' were the least acceptable sound category for participants who heard them "sometimes" or "often", and their acceptability rating was consistent regardless of whether they were heard (M=2.57 when "never" heard, M=2.54 when heard "sometimes" or "often").

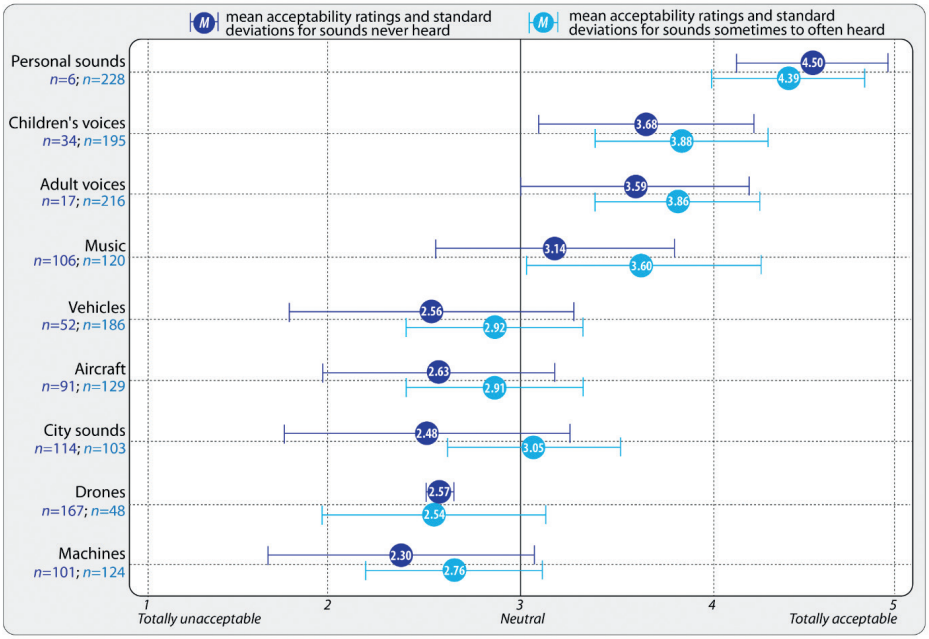

Figure 6. Comparison of mean anthrophonic sound acceptability ratings between participants who reported never hearing v. those who sometimes/often hear the particular sounds.

Discussion

Landscape features and favorite/prevalent sounds in the places where CNR visitors felt most connected to nature (RQs 1 and 2)

This study helps us to understand that the people visiting the CNR are already connected to places with the CNR's features - forest, rocky settings above the treeline, rivers/streams, etc. Our sample of visitors to the CNR tended to be people who are connected to rural mountain landscapes. This suggests that connections play a role in visitor's selection of places to visit and supports the need for further research into how visitors align their personal contexts with the visit destination. Considering the familiarity of these landscapes to our visitors - managers should expect that they are coming with expectations and naturally comparing the PA they are visiting to the places to which they feel most connected. Therefore, it becomes important for perceptions-based soundscape monitoring initiatives within PAs to understand visitors' contexts and preferences outside the PA setting, as these likely form the basis for their perceptions during travel to new places (Kogan et al. 2017; Axelsson et al. 2019; Gale et al. 2021). Participants' lists of favorite sounds also aligned with the forest/mountain landscape features of the CNR ('wind', 'its interactions with trees',' birds/ birdsong', and 'moving water', 'water', or 'waterfalls'). This supports previous research finding visitor preferences for natural sounds (Francis et al. 2017; Miller et al. 2020); and also

supports the utility of perception-based monitoring using social norms to identify indicators and thresholds (Pilcher et al. 2009; Miller et al. 2018) because visitors are likely to expect and respond positively to sounds characteristic of natural landscapes.

Wind-related sounds dominated participants' responses about the places in which people most connected with nature. These sounds were participants´ favorite sounds (eclipsing 'birds/birdsong', and all the water sounds combined) and represented the majority of participants' first most prevalent sounds. Wind sounds dropped in proportion within the lists of 2nd and 3rd most prevalent sounds. This is of relevance for PAs in Patagonia, as wind is such a dominant feature within the Patagonian landscape. While many have considered wind a deterrent to positive visitor experiences, this study has suggested the salience of wind within the places with which participants felt most connected with nature. So, social norm researchers should expect wind sounds to be sought out, noticed, and positively evaluated, and continue to probe for other sounds heard that may be less obvious and/or preferred. Moreover, social monitoring protocols should be designed to capture a range of wind and weather conditions, including times/places with less wind in order to capture a complete range of existing sounds and to better understand the masking effects of wind. For example, biophonic sounds were seldom listed as the most prevalent sound because of wind, yet it is important to monitor biophonic sounds to make sure ecosystems are intact and not being overwhelmed by anthrophony (Fletcher 2014).

The order of sound category prevalence becomes particularly informative when we consider anthrophonic sounds. Anthrophonic sounds increased in prevalence from first to third order of mention. The fact that participants listed anthrophonic sounds (most frequently vehicle and traffic sounds) within the three most prevalent sounds of the places where they felt most connected to nature suggests that these sounds are likely to be salient within those natural places. This is concerning as anthrophony has been linked to changes in animal behavior, reproduction, and distribution, amongst other ecosystem impacts (Francis et al. 2017; Duarte et al. 2018). If anthrophony sounds are prevalent in the places visitors are using to form their expectations for PAs, managers should be aware that visitor expectations may not align with soundscape protection mandates. The results for research questions 3 and 4 help us to understand the implications of these results.

Social norms and the acceptability of anthrophonic sounds in the nature places with which CNR visitors felt most connected (RQs 3 and 4)

Our research raises questions about whether PA managers will receive the data they expect from appeal/acceptability research. We found that participants who heard anthrophony ('vehicles', 'aircraft', 'machines', 'city sounds', and 'music') "sometimes" or "often", in the places where they felt most connected to nature, rated them as being significantly more acceptable than participants who indicated that they "never" heard these sounds. PA managers should be concerned about the possibility that this pattern may affect their perceptions of PA soundscapes. As outlined in previous research (Pilcher et al. 2009; Marin et al. 2011; Miller et al. 2018), soundscape indicators are often determined through the identification of sounds that visitors consistently con-

sider to be unacceptable and annoying. If managers are counting on visitors to find anthrophonic sounds annoying, yet visitors are becoming more accepting toward those sounds, monitoring protocols built on social norms will be affected. Parallel research has documented similar tendencies, for example, Miller et al. (2020) found motorized recreationists to be more tolerant of the noise created by gas compressors located in a multi-use PA in the eastern United States, than non-motorized recreationists.

This is particularly concerning, with respect to the study results for 'vehicles', which were one of the most permeating sounds within the places where participants felt most connected to nature. For PAs in Aysén, and in other similar world regions where territorial transitions are being accelerated through new public works and infrastructure designed to provide better connectivity, access, and traffic flows, these types of participant ratings should raise important conservation concerns. Vehicles have been identified as one of the most problematic of the anthrophonic sound categories, as road encroachment in and around PAs has been shown to alter natural soundscapes and contribute to vehicular noise pollution (Mcdonald et al. 2009; Francis et al. 2017; Arévalo 2018; Buxton et al. 2019). Gale et al. (2018) identified increasing concern on the part of researchers and managers in Aysén who were worried about negative wildlife impacts associated with paving processes for the region's main roads that run adjacent or intersect several PAs.

To address desensitization, managers should consider programming and facilities that can help educate about the growing prevalence and impact of anthrophonic sounds, and particularly vehicular noise, on natural systems and visitor experiences. While managers have increasingly brought the benefits of natural soundscapes to visitors through a range of programs, including listening trails, interpretive resources, and soundwalk programs (Pilcher et al. 2009; Ednie et al. 2020; Gale and Ednie 2020), they may want to also focus visitors on understanding the risks of increasing anthrophony within natural soundscapes. Interpretative materials and programs could inform visitors about the importance of natural sounds and teach them to recognize and listen more attentively for signs of healthy and/or degraded soundscapes. For example, certain sites/trails could be designed to include settings with and without vehicular sounds, and facilitators could help participants develop/regain their focus on healthy natural systems, by identifying vehicular sounds and cognitively separating them from a natural soundscape. Such efforts, made by PAs, to educate and monitor visitor perceptions of these anthrophonic sounds would, in turn, help PA researchers align social norm data with soundscape protection mandates.

Conclusions

Are noises in nature making people complacent? This study's results suggest that this may be the case. PA managers need to carefully consider their settings and conservation objectives, being aware that the natural settings with which their visitors feel connected may differ in character. Most of the current study participants were from urban areas and described landscape features in the places they felt most connected to that are similar to the CNR (rocky settings above treeline, forest, rivers/streams); yet indicated a wide range of anthrophony as being present. Moreover, their responses suggest that

as they became accustomed to hearing anthrophony in these places, their tolerance for these sounds increased. PA managers may be able to address this trend of anthrophonic sound complacency through education and programming that will contribute to visitor sensitivity. Doing so may improve the potential for visitors to contribute to PA conservation goals, through perceptual soundscape research that integrates human and natural systems. Future research should test this hypothesis.

Considering the importance of protecting natural soundscapes, visitors' acceptability ratings of anthrophonic sounds in PA settings must align with appropriate limits that adequately protect natural systems and functions. When visitor perceptions align with PA soundscape management conservation values, they can provide valuable social norm data for soundscape monitoring. Nevertheless, managers who depend on social norm data must feel confident that the perceptual information being provided by visitors is consistent with PA conservation values for protecting natural soundscapes. Thus, incorporating similar research within other PA settings offers managers a mechanism for achieving a better understanding of the sounds that are salient to urban visitors in their experienced environments outside of the PA that may help them align structural norm monitoring protocols for soundscapes with PA conservation goals.

Understanding visitors' experiences in their varied environments, and not only the small amount of time they spend in a PA context, is important for other reasons as well. For example, in this study, participants (who were CNR visitors) described landscape characteristics that were similar to those of the CNR in their descriptions of the natural places to which they feel most connected. It would be valuable to know how much their connections influenced their choice to visit the CNR, and their motivations and behaviors within the PA. It would be interesting for managers of PAs within different landscapes (coastal, desert, glacial, etc.) to examine whether their visitors also tend to be already connected to similar features. Future research should consider how existing nature connections with specific landscapes affect visitors' motivations to visit PAs with distinct landscapes. For example, how do existing nature connections affect visitor expectations and social norms for PAs with distinct landscapes? Should perceptions-based monitoring initiatives consider the feedback of persons with little to no connection to a particular landscape differently than those with higher levels of connection? And, how do existing connections with particular landscapes affect visitors' interest in the conservation of PAs with ecosystems and settings that are distinct?

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Supplementary material 1

Connections to nature survey

Authors: Andrea Ednie, Trace Gale

Data type: Survey

Explanation note: Copy of Qualtrics online survey used for the study.

Copyright notice: This dataset is made available under the Open Database License (http://opendatacommons.org/licenses/odbl/1.0/). The Open Database License (ODbL) is a license agreement intended to allow users to freely share, modify, and use this Dataset while maintaining this same freedom for others, provided that the original source and author(s) are credited.

Link: https://doi.org/10.3897/natureconservation.44.69578.suppl1