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Beyond setting conservation targets: Q-method as a powerful tool to collectively set an action plan agenda

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Nature conservation begins with detailed knowledge of the ecosystem based on inventories and maps. A difficult part of the conservation process subsequently starts, namely, the design of an action plan that achieves the desired protection outcome. As both funding and time are limited, conservation is subject to difficult trade-offs among competing land uses. We present a novel approach based on the Q-method to support local stakeholders that go beyond its usual use in assisting decision-making. We suggest a new usage of the Q-method: a tool to support conservation action prioritization. Our results indicate that the Q-method has valuable attributes, as (1) it encourages individual reflection on one's own priorities; (2) it identifies different prioritization patterns among respondents; (3) it provides input to later collective discussions, ultimately contributing to establishing consensus; (4) it brings additional arguments to conservation planners based on the latter's declared priorities. Overall, this use of Q-method can help stakeholders prioritize conservation actions, a crucial step toward achieving ecologically and socially robust conservation action plan.

KEYWORDS

Q-methodology, biodiversity, conservation planning, public participation, decision-making, mixed-method approach

Introduction

The last five decades have seen rapid declines in wild populations including 40% of Earth's terrestrial species, 84% of its freshwater species and 35% of its marine species (IPBES, 2019). To lessen this biodiversity erosion, local stakeholders' participation in decision-making occupies a central place in conservation. Their participation *"may lead to greater efficiency, effectiveness and equity"* in terms of outcomes of conservation policy-making processes at the local level (Secretariat of the Convention on Biological Diversity, 2004, p. 10).

Involving stakeholders in conservation decision-making can take different forms, from passive participation such as consultation to more active forms such as deliberation (Reed, 2008). Action prioritization plays a key role in conservation, despite local communities being frequently limited by human and material resources. In fact, prioritization helps conservation planners estimate the contribution of an action to reach conservation objectives, while contributing to track the costs and time of its implementation, which are critical elements of any prioritization process (Game et al., 2013). Although participatory conservation planning rarely fulfills everyone's needs, it can increase stakeholders' understanding of the needs of others, and supports learning and acceptance within a group (Young et al., 2013).

A great conservation challenge is establishing actions that will achieve social fits (Galaz et al., 2008). Social scientists help stakeholders capture various viewpoints during conservation planning to highlight uncertainties, ignorance, power relations, values, attitudes and needs that are at stake in a given community (Ban et al., 2013). Many methods support prioritization and conservation planning, from simple common ranking (for instance Likert scale), to more complex one such as multi-criteria decision making methods (e.g. analytic Hierarchy Process) (Vacik et al., 2014). Each has its advantages (e.g., ease of use for researchers such as Best-Worst Scaling or focus group) and disadvantages (e.g., demanding considerable effort from respondents such as Delphi or nominal group techniques), depending upon the specific context of conservation planning (Loureiro and Arcos, 2012; Hugé and Mukherjee, 2018; Mukherjee et al., 2018).

Here, we share our experience with using the Q-method as an action prioritization approach to building a robust conservation action plan. Q-methodology (or Q-method) was created by the British psychologist (and physicist) William Stephenson (1935) and has since been used by various disciplines interested in the study of human subjectivity (Amin, 2000; Gao and Soranzo, 2020; Lundberg et al., 2020). Based on multivariate data reduction techniques such as Factor Analysis (FA), Q-method is particularly useful to reveals shared perspectives (or discourses) within a group rather than just exploring the variety of opinions on environmental issues, including conservation (Sandbrook et al., 2013; Zabala et al., 2018).

Stephenson (1953) describes Q-method as an inversion of conventional FA. In that sense, it is the person that become the variables, so it is a by-person FA. The goal of this method is to discover the relationship patterns between the respondents' responses and to reveal factors representing the diversity of views on the issue under study. To achieve this, the Q-method relies on a Q-concourse, a Q-sort and by-person FA (Gauzente, 2005). The Q-concourse refers to the perspectives, ideas, and the reasoning of people about an issue (Brown, 1993) captured by gathering statements on the issue at stake (Q-sample). This iterative task can rely, among other methodologies, on interviews or a (sometimes grey) literature (Watts and Stenner, 2012). The Q-sort refers to subjective judgment made by each participant on the Q-sample by ranking them in a forced distribution grid (Gauzente, 2005). Based on FA of the Q-sort, researchers can characterize and compare respondents' viewpoint on the issue. Despite the use of FA, Q-method constitutes a mixed method approach with a strong qualitative facet (Ramlo, 2016). Indeed, the ranking process (Q-sort) is done by the respondents as they prioritize and give sense to the statements. However, the interpretation of FA results are done by the researcher whose mandate is to ensure that the respondents' opinions are well represented (Gauttier, 2021).

In recent years, Q-method has gained growing popularity for supporting decision-making in the field of conservation (Mukherjee et al., 2018). As an example, Q-method is used to establish collaboration among researchers based on common definitions (Edgeley et al., 2020), to combine and compare perspectives based on ecosystem services and on conservation viewpoints (Rastogi et al., 2013; Dean, 2019; Armatas et al., 2022). Despite the relevance of the Q-method to foster public participation in decision-making (Doody et al., 2009), to the extent of our knowledge, no study has explicitly used this method for the purpose of ranking conservation actions. The present study attempts to fill this gap.

We argue that the Q-method supports prioritization of conservation actions in various ways. Besides allowing individual reflections on priority actions, Q-method makes prioritization processes interesting because participants must rank a set of actions depending upon their relative importance. This method asks participants to classify statements on a forced choice distribution grid. Therefore, Q-method forces participants to organize their views into a normal distribution, whereas simple ranking method forces a uniform distribution. This key difference allows Q-methodologists to identify different patterns of prioritization among respondents through FA. This specificity of the Q-method is an asset for prioritization, because it focuses on intra-individual rather than inter-individual variation at the analytical stage, which common simple rankings or decision matrices cannot do. This uniqueness of Q-sort can be compared with the sowing of a patchwork quilt (Trudel et al., 2017). Each patchwork quilt pattern is unique. It is the same during the Q-Sort process: individual can rank the statements (Q-sample) according to their personal degree of importance, thus representing their own representation of the Q-concourse under study. This unique characteristic of Q-method is therefore very useful to understand the interlinkage between prioritization patterns (Mukherjee et al., 2018). Examining intra-individual variation provides reliable indications for opinion building (Trudel et al., 2017) toward conservation issues, particularly uncovering obstacles or concerns vis-à-vis certain actions, or identifying links in the interdependence between actions. In addition, the Q method allows to explicitly identify the different opinions within a group on a given subject, which can make the subsequent stages of the decision-making process more transparent than a standard open dialogue among the stakeholders based on simple ranking techniques (Sy et al., 2018). This inductive method could therefore leave more room for emergence of information that originates from respondents, which allows researchers *"to surrender the monopoly of control of their relationship"* with them (Robbins and Krueger, 2000, p. 636). Results from Q-method can also foster subsequent powerful discussion that could be combined with other approaches (e.g., focus groups or questionnaires) used in environmental policy building (Steelman and Maguire, 1999).

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A local context of biodiversity conservation – Papineau Regional County

Our research began when the Biodiversity Committee of Papineau Regional County (hereafter, referred to as Papineau County; Figure 1) invited us to support their action prioritizations for their Conservation Planning Strategy. Papineau County is a county corporation composed of 24 municipalities. The biodiversity strategy forms part of the County's efforts to achieve the provincial government's target of increasing conservation of Quebec territory by 30%. Currently, 6.4% of Papineau County has protected status.

The Committee consists of 15 members, fairly representative of the territory under study, i.e., municipal and provincial government representatives, biologists, forest and social scientists, conservation and watershed organizations, forest owners, non-profit organizations, and farmers' union. The Committee's mandate is to support Papineau County Land Use Planning Department (PCLUPD) in developing its conservation plan through research, stakeholder involvement and community engagement.

Methods and analysis

Figure 2 summarizes the process initiated by PCLUPD to prioritize its actions. Since 2018, PCLUPD has gathered biodiversity information through faunal and floral inventories together with geospatial data. It has also created a Committee and consulted local municipalities and other county partners regarding the implementation of the strategy. From these activities and consultations, 45 actions (falling within the decision-making power of the County) were identified during a consultation forum, which brought together elected officials and employees from 24 subdivisions (local municipalities) within the Papineau County. Some of these actions address specific issues, e.g., establishing, with local municipalities, a mechanism for monitoring invasive alien species across the County, while others are aimed at regulatory actions, e.g., integrating the ecological connectivity concept into the county's Land Use Development Plan (LUDP). Furthermore, some actions created synergies with other community initiatives, e.g., considering opportunities to combine ecological corridors and trails for recreational tourism.

The Q-method consisted of three main stages: 1) creating a set of statements (Q-sample) to be ranked; 2) conducting the ranking with respondents (Q-sort); 3) data analysis thought FA and interpretation of results (Brown, 1993). As above mentioned, the first step is crucial to this method because the Q-sample must span a broad range of possible opinions (the Q-concourse) of the participants on a given subject (Stephenson, 1953). In a context of prioritization of actions, the Q-sample has relied on prior consultations to arrive at a full range of conservation actions identified through a series of consultations in fall and winter 2020.

Sampling was conducted purposively to gather a wide range of opinions regarding prioritizing conservation actions (Zabala et al., 2018). Here, we were interested in the viewpoint of stakeholders engaged in designing the Strategy but also at its implementation and follow-up stages. Given public COVID-19 health concerns, data for the action prioritization exercise was mostly collected online using qmethodsoftware.com, after invitations were emailed by PCLUPD to all respondents (committee members, elected officials, municipal employees). The details of the respondents and the recruitment strategy for establishing the P-set (i.e. research participants) are provided in Appendix A.

As the Q-method stipulates, respondents had to rank each action according to their own opinion of prioritization using a grid (Figure 3) with an appreciation scale. This grid has the same number of boxes as they are conservation actions (Q-sample) to prioritize. Each action can be placed anywhere in this forced distribution grid. However, respondent must respect the number of actions that could be placed on each rating scales. For example, in this research, only one action could be placed in the +5 box, while three actions could be placed in the +4 box. At the end of each

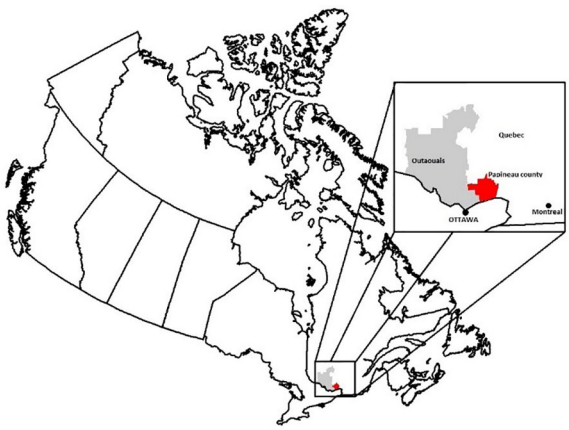

FIGURE 1
Papineau County (in red), Quebec, Canada.

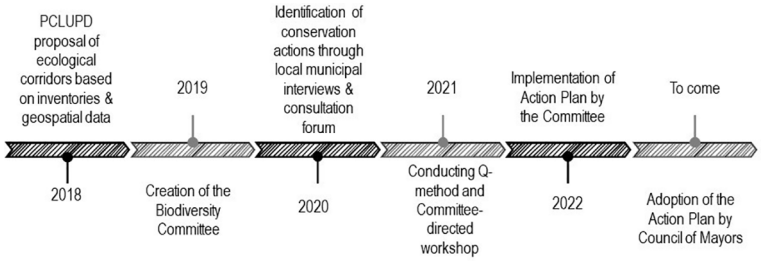

FIGURE 2
Timeline of the Committee's mandate for carrying out conservation planning.

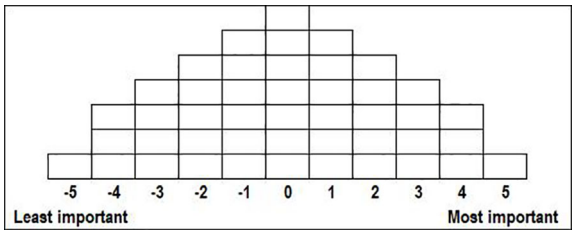

FIGURE 3
Prioritization grid.

classification, respondents answered several questions to provide feedback on their final Q-Sort, together with socio-demographic questions to contextualize the data.

Between February and March 2021, 36 participants completed the Q-sort. Given than Q-method is a by-person FA, Q-method requires only a small number of respondents, where the Q-sample (here, the 45 action statements) is often larger than the P-set (West et al., 2016; Walder and Kantelhardt, 2018). All statistical processing was performed using PQMethod version 2.35 (Schmolck, 2014). In addition to PQMethod, the are several software packages available for Q-method analysis, including qmethod for R (Zabala, 2014) and Qfactor (Akhtar-Danesh, 2018).Analyses were carried out in five steps. First, each individual Q-sort was correlated with the set of collected Q-sorts to generate a correlation matrix (Watts and Stenner, 2012). Second, principal component analysis (PCA) was conducted to determine axes explaining the most variation in the data, based on the Kaiser-Guttman criterion (eigenvalues > 1). Third, three factors were retained using Horne's parallel analysis (Watts and Stenner, 2012). The factor analysis revealed two respondents on the second factor with significant negative correlation coefficient. A negative correlation coefficient indicates that the respondent has an opposite perspective to what is represented by this factor based on positively correlated respondents. To account for two significant negative scores present in the second factor, we drew on Brown (1980) and split this factor in two (factors two and three) by duplicating the second factor and inverting the new one using manual rotation (180 degrees). Fourth, centroid FA was performed to find the strongest correlations among the different Q-sorts. Fifth, we performed a varimax rotation to increase possible correlations (Watts and Stenner, 2012) and maximize the correlation of individual points of view similar to one another (Brown, 1993; Davies, 2017). Detailed information on statistical principles specific to the Q-method can be found in Brown (1980).

Results and discussion

Our research mandate was to identify different prioritization patterns among conservation planners, administrative staff, and elected officials – and not to determine the one with the most respondents. In our eyes, using Q-method was successful, because our results represent 36% of explained variance, and remarkably include virtually all of the respondents (an explained variance exceeding 35% is considered satisfactory (Watts and Stenner, 2012).

The Q-method allowed us to identify four factors (hereafter worded as patterns to prioritize the actions of the conservation plan). We labeled them to facilitate their presentation (Table 1). Appendices B and C provide the correlation matrix between factors, ranking of the conservation actions and the Z-score of each action for each of the prioritization pattern. The Z-score represents *"a standard score or average"* given to each conservation action by the participants who executed the Q-sorts (Hutson et al., 2010, p 425).

Using Q-method as an action prioritization tool first highlights its capacity to make the constraints of decision-makers and local implementers more tangible to conservation planners. Indeed, this connection is frequently missing for successful conservation, and needs to be addressed from the very beginning of any prioritization

TABLE 1 The four prioritization patterns.

Prioritization pattern	Actions deemed a priority	Respondents
#1: The integrated-strategic approach	Integration of ecological corridor concept into the County LUDP is prerequisite to conducting later concrete actions. Strengthening the links between Papineau County and its municipalities to identify their needs and to reconcile their different land uses.	3 Committee members 5 municipal employees 1 elected official 2 others* 1 N/A**
#2: The active-realistic approach	The realization of exhaustive faunal and floristic inventories is a central element of the Strategy before creating ecological corridors. This pattern stresses the importance of financial means to support conservation actions, and of knowing more about the County municipality's needs and realities. Networking with conservation organizations is also deemed a priority.	2 municipal employees 1 elected official 1 N/A
#3: The consultation-support approach	Emphasis on the consistency and knowledge transfer with other County committees (e.g., Forest or Economic Development committees). This pattern would have the County support external specialists to bridge different sectors of activity: biologists monitoring fauna and flora, agricultural organizations, and forestry producers. The approach goes along with the aim of preventing spread of invasive alien species.	1 municipal employee 1 N/A
#4: The regulatory-targeted approach	Specific focuses on regulatory restrictions regarding human activities in biodiversity hotspots, and expanding ecological corridors. To do so, upgrading the County LUDP and municipalities' urban planning by-laws is a priority, along with funding and partnerships.	9 Committee members 1 elected official 1 other 2 N/A

*Other = professionals from watershed organizations bordering Papineau County.
**N/A, not available, these respondents chose not to disclose their identity during the survey.

exercise (Armatas et al., 2021; Game et al., 2013). With Q-method, explicating the functioning and needs of one to the other first relies on ranking one's preferences on the "what", "why" and "how" of conservation. When operated in a safe environment allowing for one's genuine expression, this provides foundation elements for later collective negotiations. This can be illustrated by the issue of using regulatory approaches to protect biodiversity, a legal tool backed by proponents of pattern #4. Thanks to the preliminary ranking exercise of Q-method, they might better understand the viewpoint of patterns #1 and #2 supporters. Those supporters indicate the importance of getting back to municipalities to fully understand their implementation capacity before enforcing new regulations. Thanks to Q-method ranking, participants could further realize that this debate on regulatory approaches are but a small part of a broader debate, as other respondents are more concerned about the spill-over effects of conservation on the use of other land. They would better conceptualize why supporters of pattern #3 pledge for more information dissemination with other County Committees, to alert conservation planners to other territorial issues. Therefore, prioritization patterns highlight the different visions and frames of stakeholders' involved both in the planning and in the implementation of conservation actions.

In line with this, Q-method can then support the community of practice in identifying consensual and plausible conservation actions. We illustrate here by a workshop undertaken with the Committee in May 2021. We presented the patterns in an interactive online question and comments session with the Committee. Our Q-method results enabled Committee members realize (as a community of practice) that they share similar desires for integrating the concept of ecological connectivity into the LUDP (patterns #1 and #4) and for upgrading municipal urban planning by-laws (pattern #4) that would restrict harmful activities in biodiversity hotspots. These actions are mainly based on Papineau County environmental planning and regulatory tools, a finding consistent with Peters (2005) considering that the County favors conservation tools on which it has most control (here, regulatory tools). In that context, using Q-method as a prioritization tool promotes concrete dialogue on the means of conservation, going beyond common debates on the goals of biodiversity plans.

It could also have been interesting to work on a collective Q-sort with the Committee based on the four prioritization patterns to collectively finish the conservation action prioritization exercises. Although the Q-sort process is generally done on an individual basis, deliberative Q-Sort can support social learning, identify biases and disagreements within a group, as well as foster consensus building (Mabon and Shih, 2022).

Taking into account both biological and socio-political outcomes of conservation actions can help meet biodiversity targets (Mair et al., 2018). Last, but not least, Q-method as a prioritization approach is replicable. This is a key feature to document the decision-making process over time, a central element to achieving conservation goals (Adams et al., 2019). In our eyes, these positive feedbacks from testing the Q-method as a prioritization tool call for its inclusion in the stakeholder's help toolbox to reach their conservation targets.

Conclusion

Conservation researchers and planners have dedicated overarching effort to prioritize conservation hotspots. Subsequent conservation planning requires serious efforts to design a relevant action strategy, as both funding and time are limited. Based on our experience in Quebec, we contend that using Q-method can help

overcome the delicate task of identifying and prioritizing conservation actions among multifarious stakeholders. Indeed, Q-method is a relevant, replicable and cost-efficient approach for guiding these efforts. Thanks to its ease of use, we hope to see it mobilized in tackling the important issues of current conservation such as adaptive management, or collaborative learning.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

The studies involving human participants were reviewed and approved by Comité d'éthique à la recherche sur les êtres humains de l'université du Québec en Outaouais. The patients/participants provided their written informed consent to participate in this study.

Author contributions

AL, TF, and JD contributed to conception and design of the study. AL collected the data and organized the database. AL performed the statistical analysis. AL wrote the first draft of the manuscript. All authors contributed to the article and approved the submitted version.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's note

Supplementary material

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fcosc.2023.1097360/full#supplementary-material

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