

Article

Informing Protected Area Decision Making through Academic-Practitioner Collaborations

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Received: 31 July 2020; Accepted: 2 October 2020; Published: 7 October 2020



Abstract: This study examined knowledge mobilization and collaboration practices of practitioners in a Canadian provincial park agency, BC Parks. Data was collected through four focus groups, an on line survey (N = 125), and a follow up workshop. Results showed that the most important information sources used by the agency were “internal” (e.g., policy and management guidelines), while “external sources” such as academic researchers or journals were rated lower. However, those who collaborated with outside groups, including academics, and those working in a science capacity within the agency, rated external information sources more positively. Barriers and enabling conditions for effective knowledge mobilization were identified.

Keywords: knowledge mobilization; protected areas; evidence-based decision making

1. Introduction

For at least the last two decades, there has been a growth in the literature that describes the need for, but suggests a lack of, evidence-based decision-making among conservation practitioners [1–6]. Somewhat more recently, a number of contributions have sought to explain the persistent gaps between science and decision-making by conservation practitioners, and to offer solutions for bridging those gaps [7–10]. Despite this growth in the literature, however, relatively few contributions examine these gaps [10,11], and this has been noted for decision making within protected areas (PAs) [3,11]. Accordingly, this article provides a specific, empirical focus on the relationships between academic researchers, and practitioners within British Columbia (BC) Parks, North America’s third largest parks system.

The specific questions of this study were: (1) What is the overall perceived importance of research to BC Parks practitioners in fulfilling their job responsibilities? (2) What levels of importance do BC Parks practitioners assign to different information sources in guiding decision-making? (3) With whom do BC Parks practitioners interact or collaborate with to gather information to guide decision-making? (4) What are the perceived advantages and disadvantages of collaboration with university-based researchers? These questions have been elaborated into hypotheses, described later in the paper. This paper describes the relevant literature (next section), methods used to conduct the study, research findings, discussion, and conclusion.

2. Literature Review

Several authors have charged that conservation practitioners, for a variety of reasons, tend not to rely on scientific evidence in decision-making, but rather adopt ad hoc processes, relying on experience, anecdote, and informal relationships to make decisions [1,5,9]. Descriptions of, and suggested solutions to, the gaps between science and practitioner decision-making tend to fall into two overlapping general perspectives. The first, sometimes described as the ‘engineering’, ‘linear’, or ‘science push’ model frames scientists and practitioners as being in somewhat different domains, and essentially posits that ‘good’ science produced by scientists will be valued and used by decision-making practitioners [8,10,12]. The characteristics that make for ‘good science’ vary in the literature, though there are some common themes. For example, authors have pointed to the importance of asking better/different questions, including adopting interdisciplinary approaches, bringing in the social sciences, attacking ‘real-world’ and/or ‘relevant’ problems, and producing results within time-frames that more closely match the needs of practitioners [7,10,13,14]. In addition to this attention to the nature of science produced, others have focused on the importance of science communication. Authors in this vein have emphasized factors such as the lack of access to scientific sources (e.g., subscription journals), prohibitively complex language, inadequate ‘translation’ and the absence of explicit connections to decision-making, and the tendency of some scientists to simply avoid policy/decision-making arenas [7,10,15–17]. This engineering model has implications for the present study, as the model suggests that those conservation practitioners employed in a science capacity may be more supportive of the use of science in decision making, and attach more importance to the use of information sources external to the agency.

The engineering model has also been criticized for being overly simplified. In contrast, the social or ‘two-way’ model focuses on the interactive social aspects of knowledge utilization. For example, researchers have pointed to (a lack of) opportunities for direct interactions between scientists and practitioners such as informal personal contacts, participation in committees, and other mechanisms [10,18]. Some authors have suggested that cultural, organizational, or ideological differences between scientists and practitioners can lead to difficult communication and barriers [10,14,19], while others have suggested that developing more participatory and inclusive processes of research objective setting and knowledge production (including the useful roles that intermediary ‘knowledge brokers’ and/or boundary spanners can play) will lead to better understanding and uptake [8,9,20]. This social model has implications for the present study, as the model suggests that those conservation practitioners who have collaborated with other groups external to the agency may be more supportive of the use of science in decision making, and attach more importance to the use of information sources external to the agency.

Despite the elaboration of these conceptual models, and the wide range of barriers and solutions identified, there has been relatively little empirical investigation of how these apply in practice [2,9,21]. There are important exceptions, however, some of which are useful to mention here. For example, in a study of Australian protected area managers’ use of evidence-based knowledge (derived from research, monitoring, and/or formal assessment), Cook et al. [3] found that 2% to 20% of conservation managers used evidence-based knowledge exclusively to support their management decisions. Managers tended to use multiple sources of evidence, including general and specific management plans (termed “intermediate evidence”); and observational and anecdotal data (“experience-based evidence”) in addition to evidence-based knowledge. Further, the type of evidence used varied substantially depending on the management issue at hand. For example, 57% of managers used experience-based evidence when addressing visitor impacts, whereas approximately 20% of managers reported using evidence-based sources to address management of cultural heritage use [2,3]. Findings also indicated that although managers valued empirical evidence, they reported insufficient access to empirical evidence to support decision-making [2]. Similarly, Sutherland et al. [1] found that practitioners (wetland managers) in the UK overwhelmingly favored ‘common sense’, personal experience and talking to other managers over the primary scientific literature. Likewise, Pullin et al. [15] surveyed compilers of management plans within UK conservation organizations and found that existing

management plans, opinions from outside experts, reference to previous management plans and public reviews were accessed much more frequently than published science.

Although the gaps between science and decision-making in conservation are well documented, recent evidence suggests there appears to be much consensus regarding the barriers and solutions. For example, a recent global survey involving 758 respondents, selected to represent the fields of policy, practice, and research in 68 countries were asked to describe barriers to knowledge mobilization, and possible solutions [22]. The top 10 barriers reported in this study were: (1) lack of policy relevant science; (2) lack of a political priority for conservation; (3) mismatch of time scales; (4) complex uncertain problems; (5) little understanding of science by policy-makers; (6) lack of funding for conservation science; (7) priority of the private sector agenda over conservation; (8) insufficient consideration of stakeholders; (9) lack of understanding by scientists about how policy is made; and, (10) bad communication between scientists and policy makers. Five solutions emerged from the study: (1) provide incentives for scientists to work on policy issues; (2) translate key findings in journals into different languages; (3) create more collaborations between scientists and policy makers (meetings, projects, etc.); (4) provide more knowledge brokers and; (5) tailor evidence to audience (blogs, open access, policy briefs, etc.). These listings of barriers and solutions to knowledge mobilization can be linked to the present study, in that they suggest, in part, that those conservation practitioners who are based at BC Parks headquarters in Victoria will have better access to academic researchers (that is, near to 5 universities) and may be more supportive of the use of science in decision making, and attach more importance to the use of information sources external to the agency.

Further insights into social processes involved in knowledge mobilization are provided by Reed et al. [23]. Moving beyond describing the barriers to knowledge mobilization, the authors suggest that the social learning model of knowledge mobilization can be improved through the application of five principles, developed from interviews conducted with 32 researchers and stakeholders involved in 13 environmental projects in the UK: (1) incorporate knowledge mobilization as part of research processes from the outset of a project, to develop trust and shared ownership; (2) understand the needs of all stakeholders in a project; (3) build long term, trusting relationships; (4) deliver tangible results as soon as possible; and (5) consider how to sustain stakeholder relationships beyond the life of a project.

Of course, 'science/scientist' and 'practitioner' are general (and overlapping) categories and science-practice gaps can occur across a wide range of contexts. Further, we recognize that there are different types of knowledge that are pertinent to decision making in the context of conservation and PAs [24,25], and this would include: academic knowledge (natural sciences and social sciences); local knowledge; indigenous knowledge; and expert professional knowledge (e.g., knowledge gained from experience by PA managers). In this article, we are particularly interested in the relationships between academic (university-based) research related to decision-making by BC Parks, a government agency that administers Provincial Parks in British Columbia, Canada. Parks and protected areas have long been the sites of academic research, and Canadian PAs are no exception. For example, a ProQuest dissertation search revealed a listing of 734 theses and dissertations completed at 98 Canadian universities, but we have no sense of the impact of this research on decision making in PAs. Further, we have little knowledge of the needs of practitioners (such as government park agencies), how they perceive the advantages and limitations of working with academic science/scientists in relationship to other sources, and how they utilize it in decision-making information (see also [4,26,27]). Accordingly, this paper explores the usefulness of academic research as perceived by practitioners within a conservation agency, BC Parks, and examines three possible explanatory factors identified in this literature review, leading to the following hypotheses:

Hypothesis 1 (H1). *External information sources of information (outside of BC Parks) will be perceived to be more important by those practitioners who have collaborated with "external sources" (such as academics); are employed in a science capacity; or are employed in Victoria headquarters.*

Hypothesis 2 (H2). *Overall importance of research is perceived to be more important by those practitioners who have collaborated with “external sources” (such as academics); are employed in a science capacity; or who are employed in BC Parks headquarters in Victoria, BC.*

3. Methodology

3.1. Study Background: BC Parks

BC Parks, as part of the Provincial Ministry of Environment, is responsible for the designation, management and conservation of a system of protected areas located throughout the province. BC Park’s mission is to protect representative and special natural places within the Province’s Protected Areas System for world-class conservation, outdoor recreation, education, and scientific study. BC Parks’ services and management are delivered through a headquarters office in Victoria and regional offices in five regions located throughout the province. As of 2019, the system managed by BC Parks included 1034 protected lands, covering approximately 14.4% of BC or approximately 14 million hectares [28]. British Columbia’s protected areas system is the third largest in North America (after the Canadian and United States national parks systems) and the largest provincial/territorial system in Canada [28]. There are a number of employment categories within the organization, including natural science, visitor management, planning and protected area designation, and field operations.

3.2. Research Design

The research incorporated a phased design that was developed in close collaboration with two senior staff affiliated with BC Parks. Data collection consisted of two main stages: the first stage was a series of four focus groups, the primary purpose of which was to inform the development of an online survey comprising the second stage of the research. Results of these two stages were presented to attendees at a subsequent annual BC Parks employee conference. Though unstructured, this feedback process generated some useful insights, some of which are presented here. All of this work was conducted with the approval of the relevant University research ethics boards.

Focus groups were led by university-based researchers (authors on this study). Groups were designed to include a number of different types of BC Parks employees (working in different job types), and to include representatives from different parts of the Province. The first focus group was conducted by telephone with seven resource conservation officers employed by BC Parks, representing different administrative regions within the Province. The second focus group was conducted by telephone with six visitor service officers employed by BC Parks, also representing different administrative regions within the province. The third and fourth focus groups were undertaken in a face-to-face format at two provincial parks with two BC Parks employees at each venue. At each focus group, we asked questions relating to: (1) pressing management issues or challenges faced (these data are not presented here); (2) types of information used (or planned to use) in developing policy or decisions regarding those management issues; and (3) experience with university researchers, including professors and students, in helping to make management decisions.

3.3. Questionnaire Survey Design

Findings from these focus groups were incorporated into the design of an online questionnaire, used to collect data from all BC Parks employees located in Victoria, B.C. head office and regional offices located throughout the province.

Two dependent variables indicated in the hypotheses were included in the questionnaire. The first dependent variable was “overall importance of research”, measured on a five-point Likert style scale from 1 ‘not too important’ to 5 ‘extremely important’. The second dependent variable examined the importance of 16 information sources (identified during the focus groups as potentially being important) including external sources (such as university research) and internal sources (such as

government reports and websites) to fulfilling their job responsibilities. Response categories to these items also were measured on a five-point Likert style scale from 1 'not too important' to 5 'extremely important'. This response scale is ordinal, but was analyzed as interval data in order to produce mean scores and to generate t test findings when comparing mean scores between groups, as indicated in the research hypotheses and tables of findings below. Treatment of ordinal data in this way is a common procedure in social sciences [29].

Three independent variables were indicated in the hypotheses as possibly influencing the responses to the dependent variables described above. The first independent variable is "collaboration with an external group", where respondents were asked to indicate how many times in the past 12-month period they had collaborated with external groups, through a partnership or short term research contract. A three-category response format was provided: 'never', '1 to 5 times' and 'more than 5 times'. For analysis, these responses were collapsed into two categories: (1) did collaborate; and (2) did not collaborate. It was reasoned that respondents who had collaborated with an external group would rate the use of science more highly, as well as the use of external sources of information.

The second independent variable was "type of employment", where respondents were provided with the following response categories: natural science, visitor management, planning, or field operations. BC Parks staff informed the researchers that the agency employed scientists in the natural science category but not in the other categories. Therefore, for analysis, type of employment was later recoded as (1) science (natural science) or (2) other (merging the other remaining categories). It was reasoned that respondents with a science type of employment in the agency would rate the use of science more highly, as well as the use of external sources of information.

The third independent variable was "location" where respondents were coded as (1) located in the park headquarters in Victoria; or (2) located in one of the regional offices located in more remote areas of the province. It was reasoned that respondents located in Victoria would have greater access to other external information sources, compared to respondents located in more remote locations, and would rate the use of science more highly, as well as the use of external sources of information.

Lastly, an open-ended response format was used to capture the perceived advantages and disadvantages of having university researchers undertake studies for BC Parks.

3.4. Pilot Studies and Survey Administration

In April, 2016, two pilot studies were undertaken prior to administering the questionnaire to assist with questionnaire development and field-testing. Questionnaires were then administered online in May, 2016, using Grapevine Online Survey Tool to 178 BC Parks employees located in Victoria, B.C. head office and regional offices located throughout the province.

These efforts resulted in 125 useable questionnaires and an overall response rate of 70%. Of the 125 respondents, 78% were located in regional offices throughout BC and 22% of respondents were located at BC Parks head office in Victoria. Data on attributes of respondents were not recorded. Quantitative data was exported from the online format and analyzed using SPSS software. Differences in mean responses between groups on Likert-style questions were tested using the student's *t*-test for independent samples. Effect sizes were measured with Cohen's *d* [29], which can be interpreted as "minimal" ($d = 0.20$), "typical" ($d = 0.50$), or "substantial" ($d = 0.80$). Qualitative data gathered from open-ended questions was analyzed for themes using an inductive approach within the range of responses to each open-ended question. In this paper, we focus on the findings obtained from the online survey, though we occasionally add insights from the focus groups and feedback workshop that inform the analysis of the results.

4. Results

In this section the results of the on-line survey are presented, focusing on the two dependent variables: (1) importance of specific information sources in making decisions; and (2) overall importance

of science in decision making. Both of these independent variables are examined with three independent variables: (1) location; (2) type of employment; and (3) collaboration.

4.1. Importance of Specific Information Sources by BC Parks Employees

Respondents were asked to rate the importance of information sources to their work, using a 5-point scale ranging from 1 = not too important, to 5 = extremely important. Table 1 displays the mean responses, standard deviation, and rank order (based on mean scores). These results indicate that the five most important information sources used to make management decisions were internal to BC Parks and include, (1) advice from BC Parks staff; (2) advice from Ministry of Environment (MOE); (3) PA management plans; (4) BC Parks policy; and (5) in house workshops. External information sources ranked lower, including: (6) informal meetings with interest groups; (8) advice from consultants; (10) consultant reports; (11) advice from academic researchers; and (16) academic journal articles, which ranked the lowest of all information sources.

Table 1. Mean importance rankings of internal and external information sources.

| Information Source | Mean Importance | s.d. | Rank |
|---|-----------------|------|------|
| Internal sources | | | |
| Advice from BC Parks staff | 4.4 | 0.63 | 1 |
| Advice from Ministry of Environment staff | 4.0 | 1.01 | 2 |
| BC Parks management plans | 3.9 | 1.05 | 3 |
| BC Parks policy and guidelines | 3.9 | 0.93 | 4 |
| In house workshops | 3.5 | 1.19 | 5 |
| Advice from other parks agencies | 3.3 | 1.04 | 7 |
| BC Parks web-based tools | 3.1 | 1.08 | 9 |
| Other government web-based tools | 3.0 | 1.17 | 12 |
| Government data bases | 2.8 | 1.04 | 14 |
| Government research and technical reports | 2.7 | 1.18 | 15 |
| External sources | | | |
| Informal meetings with interest groups | 3.4 | 0.95 | 6 |
| Advice from consultants | 3.3 | 1.11 | 8 |
| Consultant reports | 3.1 | 1.10 | 10 |
| Advice from academic researchers | 3.1 | 1.15 | 11 |
| Professional conferences | 2.8 | 1.05 | 13 |
| Academic journals | 2.3 | 1.09 | 16 |

4.2. The Effect of Type of Employment on Importance of External Information Sources

External sources of information are of particular interest in the present study, and were examined more closely in the next stage of analysis. The first comparison (Table 2) compares those BC Parks employees involved in “science”, with those employed in “other” capacities. As described in the methods section, the “science” group consisted of natural scientists employed by the agency, and the “other” group consisted of those employees assigned to other positions, including visitor management, planning, or field operations. The independent samples *t*-test analysis indicates that those employed in science tend to have higher mean ratings for most external information sources, including: advice from consultants, consultant reports, advice from academic researchers, professional conferences, and academic journals. *D* values ranged from 0.49 to 1.63, suggesting typical to substantial effects [29].

Table 2. The effect of type of employment on importance of external information sources.

| External Information Source | Mean Importance, by Type of Employment | | t | df | p-Value | d |
|--|--|---------------|------|-----|---------|------|
| | Science | Other | | | | |
| Informal meetings with interest groups | 3.1 (n = 20) | 3.5 (n = 100) | 1.56 | 118 | 0.121 | |
| Advice from consultants | 3.7 (n = 20) | 3.2 (n = 99) | 2.01 | 117 | 0.047 | 0.49 |
| Consultant reports | 3.8 (n = 20) | 3.0 (n = 99) | 3.02 | 117 | 0.003 | 0.74 |
| Advice from academic researchers | 3.7 (n = 19) | 3.0 (n = 101) | 2.80 | 118 | 0.006 | 0.70 |
| Professional conferences | 3.7 (n = 19) | 2.7 (n = 98) | 4.09 | 115 | 0.001 | 1.03 |
| Academic journals | 2.6 (n = 20) | 2.1 (n = 101) | 6.64 | 119 | 0.001 | 1.63 |

4.3. The Effect of Location of Employment on Importance of External Information Sources

The analysis was repeated to compare mean importance scores for those working in Victoria with those working in other regions of the province. These comparisons indicated no significant differences between these two groups for any of the external information sources.

4.4. The Effect of Collaboration on Importance of External Information Sources

Respondents were asked to indicate how many times in the past 12 months they had collaborated with different groups to undertake research. The majority of respondents had collaborated with consultants (65.6%), local clubs or organizations (65.8%), and students (50.4%). Respondents collaborated the least with instructors or professors (39.2%). Each of these four types of collaboration were explored separately to determine possible relationship with each type of external information (Table 3).

The first column of Table 3 lists the four types of collaboration and the six types of external information sources. Columns 2 and 3 compare the mean importance scores between those respondents who collaborated with the mean importance scores of those who did not. For example, the first segment of the table examines the effect of collaborating with consultants. The first line examines the importance of academic journals, comparing the mean importance scores for those who did collaborate with consultants (mean = 2.3), with those who had not collaborated with consultants (mean = 2.2). This difference was not statistically significant, as indicated by the *p* value of 0.306. However, this part of the table indicates that those who collaborated with consultants rated three types of external information sources significantly higher than those who did not collaborate with consultants, as follows: advice from academic researchers, advice from consultants, and consultant reports.

The rest of Table 3 indicates a number of significant comparisons, with higher importance scores in all cases for those respondents who had collaborated. The second segment of the table examines the impact of those who had collaborated with local groups, and indicates just one significant finding, a higher mean importance score for informal meetings by those who had collaborated with local groups. The most consistent difference in importance ratings occur between those BC Park practitioners who collaborated with students or instructors/professors and those that did not. For those that had collaborated at least once with students, five of the six possible comparisons were significant, with effect sizes (*d*) between 0.29 and 0.57. Similarly, for those BC Parks' practitioners who had collaborated with instructors/professors, four out of six comparisons were significant, and effect sizes (*d*) varied between 0.25 and 0.66.

Table 3. The effect of collaboration (yes, no) with external groups on the perceived importance of external information.

| Type of External Group, and Information Source | Mean Importance of External Information | | t | df | p-Value | d |
|--|---|---------------------|------|-----|---------|------|
| | No- Do Not Collaborate | Yes- Do Collaborate | | | | |
| Collaboration with Consultants | | | | | | |
| Academic journal articles | 2.2 (n = 36) | 2.3 (n = 83) | 5.07 | 117 | 0.306 | |
| Advice from academic researchers | 2.6 (n = 35) | 3.2 (n = 83) | 2.43 | 116 | 0.008 | 0.48 |
| Advice from consultants | 2.8 (n = 36) | 3.4 (n = 81) | 2.76 | 115 | 0.003 | 0.53 |
| Professional conferences | 2.6 (n = 34) | 2.8 (n = 81) | 1.06 | 100 | 0.144 | |
| Consultant reports | 2.6 (n = 36) | 3.3 (n = 81) | 3.12 | 115 | 0.001 | 0.62 |
| Informal mtgs w/interest groups | 3.2 (n = 35) | 3.4 (n = 83) | 0.88 | 53 | 0.189 | |
| Collaboration with local groups | | | | | | |
| Academic journal articles | 2.2 (n = 46) | 2.3 (n = 71) | 2.72 | 115 | 0.393 | |
| Advice from academic researchers | 2.8 (n = 45) | 3.1 (n = 71) | 1.61 | 114 | 0.054 | |
| Advice from consultants | 3.0 (n = 47) | 3.3 (n = 69) | 1.30 | 114 | 0.097 | |
| Professional conferences | 2.5 (n = 44) | 2.9 (n = 69) | 1.59 | 96 | 0.056 | |
| Consultant reports | 2.9 (n = 46) | 3.1 (n = 69) | 1.00 | 113 | 0.159 | |
| Informal mtgs w/interest groups | 3.1 (n = 45) | 3.5 (n = 71) | 2.11 | 74 | 0.019 | 0.20 |
| Collaboration with students | | | | | | |
| Academic journal articles | 2.1 (n = 57) | 2.4 (n = 63) | 2.00 | 118 | 0.023 | 0.36 |
| Advice from academic researchers | 2.7 (n = 56) | 3.3 (n = 63) | 2.98 | 117 | >0.001 | 0.54 |
| Advice from consultants | 3.0 (n = 58) | 3.4 (n = 60) | 1.82 | 116 | 0.035 | 0.32 |
| Professional conferences | 2.5 (n = 54) | 3.1 (n = 62) | 3.01 | 110 | 0.001 | 0.57 |
| Consultant reports | 2.7 (n = 56) | 3.3 (n = 62) | 3.32 | 97 | >0.001 | 0.29 |
| Meetings with interest groups | 3.3 (n = 56) | 3.4 (n = 63) | 0.79 | 117 | 0.214 | |
| Collaboration with academics | | | | | | |
| Academic journal articles | 2.0 (n = 69) | 2.6 (n = 49) | 2.74 | 86 | 0.003 | 0.25 |
| Advice from academic researchers | 2.9 (n = 68) | 3.3 (n = 49) | 1.83 | 115 | 0.035 | 0.34 |
| Advice from consultants | 3.1 (n = 70) | 3.4 (n = 43) | 1.32 | 115 | 0.093 | |
| Professional conferences | 2.5 (n = 66) | 3.1 (n = 48) | 2.83 | 110 | 0.003 | 0.54 |
| Consultant reports | 2.7 (n = 68) | 3.4 (n = 48) | 3.46 | 114 | >0.001 | 0.66 |
| Informal mtgs w/interest groups | 3.3 (n = 68) | 3.4 (n = 49) | 0.81 | 115 | 0.235 | |

4.5. Overall Importance of Research to Their Work

When asked about the overall importance of availability of research to their work, the majority (54%) of respondents stated that research studies were extremely important (10%) or very important (44%) in decision-making. Less than half the respondents felt that research was moderately important (28%) or slightly or not important (18%). The average response for the importance of research was 3.39 on a five-point Likert-style scale. These findings suggest variability in perceptions of the overall importance of research, an observation that is taken up in the following sections that examine the effect of collaboration, type of work, and location of work.

4.6. The Effect of Collaboration on Overall Importance of Research to Their Work

Table 4 examines each type of collaboration and compares those who collaborated with those who had not collaborated. Those respondents who collaborated with consultants, local clubs, or with students indicated significantly higher overall importance of research compared to those who had not collaborated. For example, lines 1 and 2 compare those respondents who collaborated with consultants with those who had not collaborated with consultants. The mean importance score of those who had collaborated with consultants was 3.5, compared to 2.9 for those who had not collaborated with consultants, and this difference is statistically significant. Similar results are apparent for those who collaborated with local clubs, and with students. D values ranged from 0.32 to 0.57. However, this pattern did not extend to those who collaborated with instructors/professors, where observed differences were not significant.

Table 4. The effect of type of collaboration on the overall importance of research.

| Type of Collaboration | Mean Importance of Research | T | df | Prob | d |
|---|-----------------------------|------|-----|-------|------|
| Did collaborate with consultants | 3.5 (n = 82) | 3.01 | 119 | 0.001 | 0.57 |
| Did not collaborate with consultants | 2.9 (n = 39) | | | | |
| Did collaborate with local clubs and organizations | 3.5 (n = 71) | 1.72 | 117 | 0.043 | 0.32 |
| Did not collaborate with local clubs or organizations | 3.1 (n = 48) | | | | |
| Did collaborate with students | 3.6 (n = 63) | 2.70 | 120 | 0.003 | 0.49 |
| Did not collaborate with students | 3.1 (n = 59) | | | | |
| Did collaborate with instructors or professors | 3.5 (n = 49) | 1.40 | 116 | 0.082 | |
| Did not collaborate with instructors or professors | 3.2 (n = 71) | | | | |

4.7. The Effect of Type of Work and Location of Work on Overall Importance of Research to Their Work

The “type of work” analysis involved a comparison of those who were employed in a science capacity with those employed in other areas. Those employees involved in science had a significantly higher mean rating for the overall importance of research to their work (mean = 4.0) compared to other BC Parks employees (mean = 3.3; $df = 33.8$, $t = 3.54$, $p = 0.001$, $d = 0.86$).

Analysis by “location of work” involved comparisons similar to those in Table 4, but in this case comparing mean responses of those respondents living in Victoria (near to park headquarters) in with those living in more remote regions of the province. These comparisons were not statistically significant.

4.8. Advantages and Disadvantages of Collaboration

Respondents were asked to provide open-ended responses about their perceived advantages and disadvantages of having university/college instructors or students undertake research studies for BC Parks. These findings are presented in Table 5. The most cited advantage was the low cost (for BC Parks) of university research (46%), followed by increased information (27%), and a cutting-edge perspective (23%). Disadvantages cited included more work for the respondents to supervise, manage and provide permits for outside research (27%), low quality of research (22%), and that the research was not useful

(17%). Fewer respondents reported lack of organizational understanding (of academic scientists of BC Parks), available time (of BC Parks employees for collaboration), and lack of access to findings as disadvantages.

Table 5. Perceived advantages and disadvantages of University- British Columbia (BC) Parks collaborative partnerships.

| Advantages/Disadvantages | % |
|---|----|
| Advantages | |
| Low cost | 46 |
| Increased information | 27 |
| Cutting edge perspective | 23 |
| Networking and profile building | 18 |
| Eagerness and enthusiasm; fresh perspective | 15 |
| Unbiased perspective | 08 |
| Disadvantages | |
| More work | 27 |
| Low quality | 22 |
| Not useful | 17 |
| Lack of understanding of BC Parks | 10 |
| Time available | 10 |
| Lack of access to findings | 03 |

Further analysis of this data was not carried out, due to concerns stemming from lower response rates to this question, and the subjective nature of qualitative data obtained in this question. Hence comparisons by location, type of work, or collaboration are not provided.

Findings from the focus groups and workshop shed additional light on impediments to collaboration between university researchers and BC Parks employees and/or the use of collaboratively generated research findings, including: time lag for academic researchers to complete the research, lack of contact with researchers, lack of confidence and trust in the information, and lack of communication of research findings.

Respondents were also asked whether the agency should give, more, less, or the same attention to developing academic partnerships (if funding could be secured for 'applied research projects in BC parks'). The majority (57%) felt that more attention, and 27% felt that 'much more' attention should be placed on this type of partnership.

5. Discussion

This study examined the types of information used by BC Parks in decision making, and specifically the role of external sources such as academic research. The main findings of this study can be summarized as follows: (1) internal sources of information are generally more important to BC Parks practitioners than external sources of information; (2) those employed in science roles within the agency tend to attach greater importance to external sources of information than do those working in other capacities; (3) those respondents who had recently collaborated with external groups (including academics), tend to attach greater importance to external sources of information compared to those who had not collaborated recently; (4) respondents identified many advantages of collaborating with academics, including obtaining low cost, increased information, and cutting edge perspectives, and, (5) disadvantages of collaborating with academics included needing to do more work, low quality perspectives, and collaboration not always being useful. These findings are discussed in the following sections.

5.1. Relative Importance of Internal and External Information Sources

One of the interesting outcomes of this project lies in the relationship between the findings that suggest, on the one hand, BC Parks practitioners value research in decision-making and wish to see more

university partnerships, but that on the other, 'typical' academic products (journal papers, conferences, interaction with academics) are seen as among the least important sources of information. These findings are consistent with many other studies [1,5,9,30,31]. Together, these findings demand attention towards other 'pathways' by which scientifically derived information can enter into decision-making, including the role of collaborations with different groups (including, but not limited to, scientists) and drawing on information sources other than typical academic products. There are several other findings that are worth highlighting in this vein.

For example, the results suggest that internal sources such as advice from BC Parks staff, MoE employees, BC Parks policy, and management documents are more important to respondents (as a whole) in fulfilling their work responsibilities than external sources, such as advice from academic researchers, conferences and academic journal articles. These results resonate with other studies that have found conservation managers tend to rely on informal sources, internal interactions, and 'experience' [1,3,5,15].

5.2. The Effect of Type of Work and Location of Work

The findings indicate that BC Parks practitioners vary somewhat in their opinions, with those employed within the science realm of the agency attaching greater importance to external sources of information, such as consultant reports, advice from academics and academic journals. In contrast to Landry et al. [7], who found no evidence that position predicts knowledge utilization across several policy domains, this study found that although BC Parks practitioners as a whole valued research highly, there were differences among these practitioners in terms of the importance assigned to different information sources. 'BC Park practitioners' are not a homogeneous group, but rather represent an amalgamation of employee 'types' with different responsibilities and information needs. Specifically, regarding overall importance of research, the mean importance reported by employees involved in 'science' was higher than for employees in other roles. Further, importance ratings for half of the external information sources, including advice from academic researchers, professional conferences, and academic journal articles, were significantly higher for those in science than those in other positions. On the other hand, employee work location (BC Parks headquarters or outside of headquarters) provided little or no explanatory power for variation in mean importance rankings for external information.

Further, just because a source is 'internal' (or what Cook et al. [3] might call 'intermediate') does not mean that the internal source is not itself built on, or informed by, other sources of information (including academic science). However, Cook et al. [3] express some concern towards some intermediate information sources that have not verified the information through monitoring or other reliability testing. This is an area warranting further research.

5.3. The Effect of Collaboration

The findings highlight the importance of collaboration, which often involves knowledge transmission. Up to two thirds of BC Parks' practitioners had engaged in some forms of collaboration but about 40% had not, a finding similar to Crona and Parker [20], who found that 44% of scientists and practitioners had no interaction with each other. However, while many BC Parks practitioners had collaborated at least once with other groups, this study did not explore the nature or meaningfulness of these collaborations. This is an area for future research.

Collaboration (with various groups) was correlated with BC Parks practitioners' overall perceptions of the importance of research (Table 4). BC Parks practitioners who have collaborated with instructors/professors and students tend to perceive academic journal articles, advice from researchers and professional conferences as more important than those who do not collaborate. The implication that university collaboration may enhance knowledge utilization has been supported in previous studies that found the number of direct contacts and intensity of links between policy makers/decision-makers and researchers to be good predictors of knowledge utilization [20,27,32,33]. Belkhdja et al. [32],

for example, examined organizational determinants of research use in the Canadian health system and found that formal linkages between producers and users of research as the most important organizational determinant of research use. Overall, these studies identify the importance of personal interaction and linkages between producers and users of research [20,22,23], with calls for more empirical work examining collaboration processes as a means of improving knowledge utilization [17].

5.4. Perceived Advantages and Disadvantages of Collaborations

This study provided several insights about the perceived advantages and disadvantages of practitioner-academic collaborations (Table 5). Several advantages to University-BC Parks collaboration were directly identified in the results, including low cost, increased information and the provision of a cutting-edge perspective. At the same time, several disadvantages were also identified, including more work for BC Parks practitioners, low quality and usefulness of research, lack of contact with researchers, lack of confidence and trust in the information, and a lack of access to findings (though this last one was mentioned by a small number of respondents). Responses related to a lack of understanding of BC Parks and a lack of access to available research resonate with previous research that has identified similar barriers [2,7,10,15–17]. Many of these barriers may be related to instances of lower collaboration or ineffective collaboration, such that relationships of trust and mutual understanding are not developed leading to lost opportunities for mutual understanding of agency needs (see [22,23]). As McNie [4] states, simply providing more research is often inadequate if it does not correspond to the information needs of the decision makers. Participants in focus groups also noted that this mismatch can stem from the fact that BC Parks has a limited budget to initiate research and that collaboration between BC Parks and academics tends to occur when academic institutions choose to initiate collaboration with BC Parks.

On the other hand, both lack of access and a lack of fit with BC Parks needs were mentioned much less frequently than practical considerations related to the time/work demands of supporting university research, as well as concerns about the quality of work. These two disadvantages were frequently discussed in focus groups, and often centered on the role of students. Students were described as playing central roles in academic efforts in BC Parks and, on the one hand, were frequently described as providing fresh, timely perspectives at low cost. At the same time, however, they were often described as requiring a lot of work (mentorship, oversight, and guidance), and producing results of uneven quality. These findings suggest that effective collaborations may take time to initiate and sustain, to allow for academics to better understand the needs of a PA agency, and for a PA agency to realize the benefits that can accrue from investing some time and effort with an academic partner. In this vein, Reed et al. [23] describe how knowledge mobilization should be part of a research project, not just a component added once the research is completed, in order to create relevance, reliability, and accessibility to academic research.

The role of internal BC Parks scientists in bridging the academic knowledge/decision-making gap emerged from this study as an important area for additional research. For example, while many BC Parks practitioners tend not to utilize traditional academic outputs, those that identify as scientists appear more likely to do so. Additionally, by far the most important sources of information for decision-making are advice from BC Parks staff, as well as the ‘codified knowledge’ present in management plans (what Cook et al. [3] call ‘intermediate knowledge’). Presumably, internal scientists play a role in providing this advice and developing these ‘intermediate’ forms of knowledge. The importance of another informal pathway created by internal scientists was highlighted in a description, offered in more than one focus group, of a former employee who took it upon himself to act as a ‘boundary spanner’ by providing, via email, a brief summary of current, relevant research findings to interested employees. Many participants noted how important this source of information was, and how disappointed they were when this employee stopped doing so. These findings point to the utility of adopting a perspective that looks at the complex ways, often based on personal interactions, by which science can move into

decision-making [8,9,20,27,33]. Network analysis, as adopted by Crona and Parker [20], shows promise as a tool to investigate these types of interactions.

In considering these findings, it should be noted that they are case specific, and limited to the context of BC Parks and collaborations with academic scientists. Further, this study focused on the importance of research and specific information sources—findings cannot speak to the impact or influence of research on actual policy making. Future research could incorporate knowledge utilization measures, as adopted in other studies [20,27,34] to address levels of impact and influence of scientific knowledge on decision-making.

6. Conclusions

This study explored the use and relevance of research to BC Parks practitioners, the level of collaboration with university researchers and other external groups, and the influence of this collaboration on perceptions of the importance of research. We found that while BC Parks practitioners consider research to be important in their work, and would like to see more collaboration with academic scientists, they also rank traditional academic venues (journal articles, conferences, etc.) as among the least important sources of information. Rather, they tend to rely on personal interactions within their own agency, and on ‘intermediate’ forms of knowledge as embedded in policy guidelines and management plans [3]. These findings suggest that cultural and/or ideological differences do not play simple roles as barriers; nor do they suggest that producing ‘more or better science’ (as suggested by linear model ways of thinking) are likely to bridge the science–practice gap in isolation. Those in ‘science’ positions within the agency also appear to play an important role in processes by which academic types of knowledge are utilized. Moreover, collaboration levels positively influence perceptions of research and the perceived importance of information sources. Given the findings in this study and others [20,27], future research adopting a social interactions framework to examine social linkages between researchers and practitioners and the influence of those linkages on knowledge utilization is warranted. As described in Allen [24], this process involves moving beyond the engineering model described in this paper toward a multi stakeholder approach in which participants, including decision-makers, scientists, and other stakeholders are empowered to work collaboratively to develop the research project. This approach is more likely to create a shared understanding of the findings and contribute to on the ground decisions.

While this study has examined the barriers and enabling conditions for the mobilization of academic knowledge within the context of protected areas, future studies could expand this research to examine other types of knowledge thought to be relevant to the management of protected areas, including local community knowledge and indigenous knowledge, as outlined in Allen et al. [24].

Author Contributions: Conceptualization and methodology used in the project was undertaken by G.M. and R.R. Project funding and project management was undertaken by G.M. Data collection and storage was undertaken by R.R. and G.M. Data analysis and visualization (tables) was undertaken by C.R. Initial drafts of the paper were developed by C.R. and G.M. Review and editing of the paper was undertaken by R.R. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Conflicts of Interest: The authors declare no conflict of interest.

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