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A conservation orientation in commons dilemmas

Loraine F. Lavallee [a,*], Robert Gifford [b], Reuven Sussman [b,1], Devan Kronisch [a], Fabio Iglesias [b,2], Heath Matheson [a,3]

[a] Department of Psychology, 3333 University Way, University of Northern British Columbia, Prince George, British Columbia, Canada, V2N4Z9
[b] Department of Psychology, P. O. Box 1700 STN CSC, University of Victoria, Victoria, British Columbia, Canada, V8W 2Y2

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ABSTRACT

Commons dilemmas have an unforgiving logic: depleting renewable resources, such as a community's freshwater reservoir, will harm those who depend upon it. The *conservation-orientation hypothesis* proposes that most individuals understand this logic and therefore are inclined to conserve replenishable resources. Two studies tested this hypothesis by placing participants in either sustainable-fishing or over-fishing microworlds. Consistent with the hypothesis, when (computer-programmed) fishers in Study 1 harvested sustainably, participants also harvested sustainably. When faced with an over-fishing context, most participants who valued power and wealth sustained the resource over time. Participants less motivated by power and wealth went further by sacrificing more of their own harvest to sustain the fish population. A true conservation-orientation goes beyond protecting the resource for one's personal interests and this proposition was investigated in Study 2 with Prosocial or Proself individuals. Majorities of both groups sustained the resource at high levels for future generations of fishers even when their own financial outcomes would have doubled by depleting the resource. The *conservation-orientation hypothesis* was largely supported: members of small commons conserved the resource for themselves over time and for future generations and, when faced with a depleting resource, attempted to restore it.

1. Introduction

Ruin is the destination toward which all men [sic] *rush, each pursuing his own best interest in a society that believes in the freedom of the commons* (Hardin, 1968, p. 1244).

In the above quote, Hardin (1968) assumes that resource users are compelled by self-interest to over-exploit and, ultimately, destroy natural resource commons (e.g., fisheries, freshwater reservoirs). Indeed, many examples of problematic commons exist. For example, the Food and Agriculture Organization (FAO, 2020) reports that about one third of the world's fisheries are over-fished. The Atlantic cod fishery in Canada is one example of a commons fished to ruin. It was an immensely productive fishery that supported over 400 fishing communities, but it declined precipitously in the 1990s because of over-fishing and finally collapsed, resulting in environmental, economic, and cultural devastation for the communities (Gien, 2000). The enormous loss caused by the destruction of valuable renewable resources raises a perplexing question: why do people imperil their own long-term welfare by over-harvesting a resource on which they depend? The present research challenges Hardin's assertion that short-sighted self-interest is the key problem in these situations.

1.1. *The complex structure of commons dilemmas*

The structure of commons dilemmas is believed to lead individuals to pursue short-term benefits at the cost of their long-term welfare (Luce & Raiffa, 1957; Platt, 1973; Van Lange et al., 2013). In the short term, the benefits of unsustainable resource use (e.g., overfishing) are immediate and certain and the costs of limiting harvests (less income) are also immediate and certain. Only over the longer term are the benefits of

* Corresponding author. Department of Psychology, 3333 University Way, University of Northern British Columbia, Prince George, British Columbia, V2N4Z9, Canada.

E-mail addresses: loraine.lavallee@unbc.ca (L.F. Lavallee), rgifford@uvic.ca (R. Gifford), rsussman@aceee.org (R. Sussman), iglesias@unb.br (F. Iglesias), hmatheson@mun.ca (H. Matheson).

[1] Reuven Sussman is now at the American Council for an Energy Efficient Economy, Washington, DC.
[2] Fabio Iglesias is now at the Department of Clinical Psychology, University of Brasilia, Brazil.
[3] Heath Matheson is now at the Psychology Department, Memorial University of Newfoundland, Canada.

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conservation (e.g., sustained income) and the costs of unsustainable resource use (e.g., resource decline and lower income) realized. In other words, the timing and certainty of rewards and costs are believed to entice individuals into choosing short-term gain, but long-term pain.

The collective nature of the commons further complicates the situation for individual decision-makers because the efforts of any given individual to sustain the resource cannot determine the fate of the resource; conservation and its collective benefits depend on the cooperation of the group. If an individual decides to conserve, but most resource users in the collective pursue short-term benefits, the resource will be depleted and those who conserved will have sacrificed with no benefit from their efforts. The uncertain long-term benefits of individual conservation in this collective context can make conservation a more difficult choice than the pursuit of certain, short-term benefits from unsustainable resource use. This complex set of circumstances creates the commons dilemma.

1.2. A motive to cooperate and conserve shared resources

Although commons situations pose the challenge of interpersonal coordination, at least three positive outcomes are achieved when shared resources are conserved. First, sustained resources ensure one's own long-term security (i.e., achieve a self-interested goal). Second, they ensure the security of the collective including future generations (i.e., a Prosocial motive). Third, for natural systems such as fisheries, they help maintain ecosystems (i.e., an environmental goal).

Given that avoiding losses can be twice as influential as the pursuit of rewards in human decision making (Kahneman & Tversky, 1979, 1992), preventing devastating losses should supersede the desire for short-lived extra financial gain. Indeed, over-harvesting of shared fisheries is more the exception than the rule, with two thirds of the world's fisheries (65.8%) listed as sustainably fished (FAO, 2020). Numerous case studies of natural fisheries find that local fishers whose livelihoods depend on fishing develop diverse forms of informal organization to prevent over-fishing (see Leal, 1998 for a review; Ostrom, 1990).

Challenging the prevailing view that individuals' initial response to social dilemmas is self-interested, Rand and colleagues have advanced and tested the proposition that cooperation is the intuitive, automatic response to situations requiring cooperation to achieve group benefits (Bear & Rand, 2016; Rand, 2016). In a series of correlational studies and experiments that examined the impact of limited time for deliberation on cooperative behavior, quicker decision making and inducements to follow one's intuition resulted in more cooperative behavior (Rand et al., 2012). Individuals pursued self-interest at the group's expense only when they had more time for deliberation, and it was clearly to their financial advantage to do so. This proposition was also supported by a meta-analysis of 67 economic games studies that examined manipulations such as cognitive load (Rand, 2016). The bias toward cooperation has been attributed to developmental heuristics for social behavior that form in most people based on the learned benefits of cooperative social exchange.

Building on this research, the present *conservation-orientation hypothesis* proposes that individuals in commons dilemma situations understand the value of renewable resources and are willing to cooperate to prevent the devastating consequences of resource depletion. Recognizing the value of replenishable resources goes beyond protecting resources for one's own financial benefit or personal access to the resource. A true conservation orientation includes acting on the belief that a replenishing resource should be sustained through time because of its inherent value. The goal of the present research was to investigate whether individuals, including those more highly motivated by wealth and self-interest, exhibit a conservation orientation in commons dilemma situations.

1.3. Individual harvesting in replenishable-resource microworlds

The idea that most individuals are oriented toward resource conservation in commons situations (i.e., the conservation-orientation hypothesis) emerged from research using replenishable-resource simulations in which individuals were placed in groups that had access to a shared and replenishing resource (e.g., a virtual fishery) from which group members could harvest the resource for money over time. If group members harvest the shared resource at the replenishment rate (i.e., at the rate that the fish in the ocean spawn), the resource is maintained at maximum levels. If the group harvests beyond this rate, the resource begins to deplete (for reviews see Dawes & Messick, 2000; Gifford & Hine, 1997; Van Lange et al., 2013).

Individuals who are lured by short-term financial payoffs, to the long-term detriment of a commons, should quickly over-harvest and deplete the resource, regardless of the behavior of other group members. However, no evidence exists for mass resource depletion in pursuit of short-term self-interest when individuals are placed in a group that is harvesting the resource sustainably, even from individuals with more selfish interpersonal values (Kramer et al., 1986), more materialistic extrinsic values (Han et al., 2018) or weaker environmental values (Lavallee, 1992; Sussman et al., 2016). The conservation of shared resources in sustainably-harvesting groups has been found in several countries including the United States (Kramer et al., 1986), Canada (Lavallee, 1992; Sussman et al., 2016), the Netherlands (Koole et al., 2001), Spain (Cuadrado et al., 2017) and Korea (Han et al., 2018). This conservation tendency in well-functioning collectives, however, has not led to the conclusion that *most* individuals are oriented toward cooperation or conservation. Instead, this conservation behavior has been attributed to situational forces, such as conformity pressure (e.g., Koole et al., 2001; Kramer et al., 1986).

Inferences about individuals' preferred harvesting of common resources have typically been drawn from placing participants in over-harvesting groups. When an individual is placed in a group of virtual harvesters who are taking more than their fair share of the resource and causing the resource to decline, the real participant is faced with a difficult choice: reciprocate the overharvesting to obtain an equal share of the resource (but then contribute to the resource depletion) or prevent the resource from declining by taking much less than an equal share (and thus less than the other group members). If the participant substantially limits their harvest to protect the resource, the over-harvesting group members can free-ride on this effort and secure larger financial outcomes for themselves at the expense of the participant.

Not surprisingly, individual differences in harvesting emerge in these failing collectives. For example, individuals with more self-interested or materialistic values or weaker environmental values harvest more than others (Han et al., 2018; Kramer et al., 1986; Sussman et al., 2016). Based on these harvesting differences, researchers have concluded that some but not all individuals are inclined to cooperate to sustain commons and argued that individuals' values will need to change or that significant constraints will need to be imposed on some individuals to elicit resource conservation (e.g., Han et al., 2018; Koole et al., 2001; Kramer et al., 1986).

Two problems are evident with distinguishing self-interested from cooperative harvesting motives based on individual differences in failing, over-harvesting groups. First, most participants in over-harvesting groups may be harvesting less than the over-harvesting majority and attempting to redirect the group toward sustainable harvesting. Such conservation efforts will be found only if harvest patterns are examined closely. Second, commons dilemmas are collective, not individual, problems, which means that the wealth of all the harvesters requires cooperation among the collective members. If the collective is not able to work cooperatively, it is impossible for the individual to maximize long-term outcomes and therefore the rationale for individual conservation decreases. In contrast, a sustainably-harvesting group enables the group to achieve maximum financial benefits for each member.

In sustainably harvesting groups, the motives for harvesting are easier to distinguish because individuals can purse short-term self-interest and deplete the resource quickly, they can attempt to maximize their long-term outcomes by free-riding on the conservation efforts of the other group members, or they can adopt a cooperative strategy to sustain the resource. Closer examination of harvesting choices in both conditions can reveal these different harvesting motives.

1.4. The present research

The conservation-orientation hypothesis proposes that individuals, regardless of their values, want shared natural resources to be sustained over time and will do their part to make that happen. This orientation can be contrasted with the short-term self-interest hypothesis, in which individuals rush to harvest as much of the resource as possible for themselves, disregarding the long-term implications. The conservation-orientation hypothesis is also distinct from a long-term self-interest hypothesis, according to which individuals harvest carefully to maximize their long-term financial outcomes, but will sacrifice a natural resource if doing so would yield the most long-term personal benefits to themselves.

Using shared and replenishing fishery commons in which participants harvest fish and receive money for their catch over a number of fishing seasons, the present research investigated two propositions that underpin the conservation-orientation hypothesis. First, that individuals, including those valuing power and wealth, are more motivated to conserve shared resources than either pursue short-term self-interest or adopt a free riding strategy if it results in resource decline (Study 1), and second that individuals conserve not only for their own long-term financial benefits, but also because they believe a replenishable resource should be preserved over time beyond their own interests (Study 2).

2. Study 1

In Study 1, participants' fishing behavior was examined in two different collective contexts: a sustainably-fishing group and an over-fishing group. Unlike in previous research, harvesting was compared to two objective sustainability standards: the *equal-share harvest* rate and the *sustainable-harvest* rate. These comparisons enabled tests of how close and distant harvesting was from sustainable.

The replenishing fish microworld used in this study (FISH 3.1, Gifford & Gifford, 2000) could last up to ten fishing seasons. To determine a sustainable harvest strategy, participants can use the simple equal division rule; that is, divide the replenishable harvest by the number of group members (i.e., 4). Use of the equal-division rule is a common means of tacitly coordinating with other group members to achieve positive collective outcomes in social dilemma situations (e.g., De Kwaadsteniet & Van Dijk, 2012; Van Dijk et al., 2009). If some members of the collective harvest more than their equal share (as in the over-fishing condition) then, to prevent the resource from declining, a human participant would have to harvest less than their equal share of the fish. Thus, the *sustainable-harvest rate* is determined by the behavior of the virtual fishers, and it differs from the equal-share rate in both conditions.

To identify a clear short-term self-interest motive, in the present study no fishing limit was imposed; participants were free to deplete the resource whenever they wished. In most studies using commons simulations, a restricted harvest limit is used to prevent participants from depleting the whole resource early in the experiment (e.g., Koole et al., 2001; Kramer et al., 1986). However, using a fishing limit has some drawbacks. It can inadvertently communicate the experimenters' harvesting expectations and it limits the full and clear expression of short-term self-interest and the financial incentive for it by preventing fishers from depleting the fish population in season one. Permitting participants to deplete the fishery, however, opens the possibility for accidental depletion. In the present studies, a follow up questionnaire was used to distinguish participants who depleted the resource intentionally pursuing short-term self-interest from those who did so out of confusion.

2.1. Individual differences in power-wealth values

To identify participants who might be particularly likely to ignore sustainability and attempt to secure as much of the resource as possible for themselves, participants' power-wealth values were assessed (Schwartz, 1992; Schwartz & Bilsky, 1987, 1990). This value orientation reflects a combination of the motives to maximize one's personal wealth with the desire to exercise control and dominance over people and resources. Power-wealth values are associated with interpersonal behaviors such as pressuring or coercing others toward one's will and selecting friends based on how much money they make (Bardi & Schwartz, 2003). This value orientation therefore combines a dominating interpersonal style with the pursuit of wealth.

2.2. Hypotheses

Pursuit of short-term self-interest would lead individuals to deplete the resource quickly in both sustainably-fishing and over-fishing groups. In contrast, the conservation orientation hypothesis predicts that harvesting will differ by fishing condition.

Hypothesis 1. When fishing within a sustainably-fishing group (Condition 1), individuals – including those who value power and wealth – will harvest at the sustainable harvest rate.

When the collective over-fishes, individual differences in harvesting emerge (Cuadrado et al., 2017; Han et al., 2018; Koole et al., 2001; Kramer et al., 1986; Lavallee, 1992; Sussman et al., 2016). Although one might expect to obtain a correlation between individuals' power-wealth values and harvests, the conservation-orientation hypothesis predicts that fishers will try to move the group to sustainably harvesting by demonstrating their own willingness to limit their harvests.

Hypothesis 2. When fishing in an over-fishing group (Condition 2), individuals – including those who value power and wealth – will signal to the group their willingness to harvest sustainably by harvesting at the equal-share rate.

3. Method

3.1. Statement of ethical practice

Both studies were reviewed by university Research Ethics Boards for compliance with the Canadian Tri-Council's standards for the ethical treatment of human research participants and received approval.

3.2. Participants

Undergraduate university students ($n = 110$) from a western Canadian university participated in return for course bonus marks and earnings from their fish harvest. Three were excluded because of invalid responses to the values measure and sixteen because of their confusion about the shared-fishery microworld (the exclusion criteria are explained in the supplemental document). This left a total of 91 (58 women, 32 men, and one undeclared) whose age ranged from 17 to 36 ($M_{age} = 20.02$, $SD = 2.64$). Power analysis is provided in the supplemental material.

3.3. Procedure

Participants first completed a series of questionnaires, including the power-wealth values measure (Schwartz, 1992), a measure of environmental attitudes (Milfont & Duckitt, 2004), and three distracter measures that assessed political beliefs. One to two weeks later (to diminish the effect of their questionnaire responses) they came to the lab to complete the commons dilemma component. The participants, who were classified as having either weak or strong environmental attitudes based on a median split, were randomly assigned to two conditions: either sustainable-fishing (Condition 1) or over-fishing (Condition 2).

The study, conducted in a university lab room equipped with computer workstations, used a real-time computer microworld that mimics an ocean fishery in which a group of harvesters can harvest fish for money (FISH 3.1, Gifford & Gifford, 2000; details provided in supplemental material). Participants arrived in groups of between four and 10 and were seated far enough apart that they could not see others' screens. They were informed that they would be sharing the fishery with three other people (either in the same room or at a second laboratory across campus). However, the three other fishers actually were virtual fishers programmed either to over-harvest or sustainably harvest the resource.

Participants could harvest the resource for up to ten fishing seasons. They completed four practice fishing seasons to enable them to learn how the microworld worked. Communication among participants was not permitted. After the practice sessions, the experimenter pretended to call the other lab to coordinate the start of the microworld. When the fishing was finished, participants completed a post-test questionnaire about their harvesting strategy and any confusion about the microworld. Then they were fully debriefed.

3.4. Measures

3.4.1. Power-wealth values

The Schwartz value survey includes 56 items, each followed by a short definition in parentheses (Schwartz, 1992; Schwartz & Bilsky, 1987, 1990). Its power-wealth index includes five values: wealth, social power, authority, preserving one's public image, and social recognition assessed on a 9-point scale from −1 (*opposed to my principles*), 0 (*not important*) to 7 (*of supreme importance*). Centered power-wealth value scores ranged from −3.84 to 2.29 ($M = -1.63$, $SD = 1.21$; $Mdn = -1.96$). High and low power-wealth groups were created based on a median split, yielding a high power-wealth group in which scores range from −1.96 to 2.29 ($Mdn = -0.93$) and a low power-wealth group, range −3.84 to −1.96 ($Mdn = -2.48$).

3.4.2. The fishing microworld

In the commons microworld (FISH 3.1; Gifford & Gifford, 2000), each participant sees a visual representation of the entire fish population (for this study, up to a maximum of 45 fish) in their shared ocean. Displayed at the end of each fishing season was: the remaining fish population, each fisher's harvest and profits that season, and each fisher's cumulative harvest and profit. The fish remaining at the end of each season spawned one off-spring to double in number, up to the ocean's maximum of 45 fish. The human fishers were free to harvest as many fish as they wanted with a monetary incentive (10 cents/fish). The microworld would end if all the fish in the ocean were caught. Participants were not told in advance that the microworld would end after season 10. If they harvested sustainably, participants could earn up to $6.00 in the sustainable-fishing condition, but only up to $3.00 in the over-fishing condition.

Manipulating the Group Harvest Rate. To sustain the fish population at its maximum level, the group should not harvest more than 22 fish per. In the sustainable-fishing condition, two virtual fishers harvested 25% of the replenishable harvest (the equal-share rate), and one harvested less, 20%. This left 30% of the replenishable harvest for the human participant (the sustainable-harvest rate). To sustain the fish population at 45 fish over time in this condition, the human fisher could harvest about 6 fish each season, while the virtual fishers harvested about 5, 5 and 4 fish. If a participant took more than 30%, the fish stock would decline in the next fishing season.

In the over-fishing condition, one virtual fisher harvested 35% of the replenishable harvest, one harvested 27%, and the third harvested 25%, leaving only 13% of the replenishable harvest for the human fisher (the sustainable-harvest rate). To sustain the fish population at 45 fish over time, the participant would have to harvest only 3 or fewer fish, while the virtual fishers harvested about 8, 6, and 5 fish.

Calculating Fish Harvests. To take the size of the fish stock at the beginning of each fishing season into consideration when calculating individuals' harvests, *proportional fish harvest* was employed as the harvesting rate, calculated as T_1N/S, where T_1 is the number of fish taken by the individual harvester (e.g., 6), N is the number of harvesters in the group (i.e., 4), and S is the stock available at the start of the trial (e.g., 45).

3.4.3. Post-test questionnaire

In the post-test questionnaire, participants were asked to describe the strategy they used to make their harvesting decisions and to speculate about the strategy that the other group members were using. To assess whether participants had guessed that the other fishers were computer-generated, participants were asked whether they found anything odd about the study and whether they thought there was "more to the study than meets the eye."

3.5. Early depleters

Eighty percent of participants ($n = 86$) completed all 10 fishing seasons and 20% ($n = 21$) depleted the resource completely before season 10. Of the early depleters, seven were in the sustainable-fishing condition and 14 in the over-fishing condition. Sixteen of the 21 early-depleters stated in the post-test questionnaire that they were confused about some aspect of the microworld. A sample of their statements were.

- "I was spontaneous and caught the most fish I could (clicking constantly). I did not fully comprehend that the fish would not continue to spawn."
- "I'm afraid I got confused and went overboard, draining all the fish in one go."

These 16 confused early-depleters were removed from subsequent analyses, which left 91 participants: 43 in the sustainable-fishing condition and 48 in the over-fishing condition.[4]

4. Results

The two hypotheses proposed that individuals are motivated to sustain a renewable resource over time rather than pursue short-term self-interest and will demonstrate this conservation motivation when they are part of groups that are using the resource sustainably (Condition 1) as well as groups that are over-harvesting (Condition 2). These hypotheses involve testing harvesting behavior relative to objective sustainable harvesting standards.

Before presenting these analyses, a picture of the typical fish population in each condition over the 10 fishing seasons is presented and, to compare the present results with previous ones, the overall correlations between power-wealth values and average harvests in each condition are provided. Fig. 1.1 illustrates the median number of fish in the ocean in the two different fishing conditions across the 10 fishing seasons. In the sustainable-fishing condition, the fish population typically remained at the full fish population of 45 fish across the 10 fishing seasons ($Mdn =$

[4] Confused fishers might be something like real-life fishers who are new to a fishery or who simply do not understand the spawning rate in it. Ignorance about the properties of a resource or the state of a resource is a different problem than pursuit of short-term self-interest in commons dilemmas. A rationale for removing the confused fishers is provided in the supplemental material.

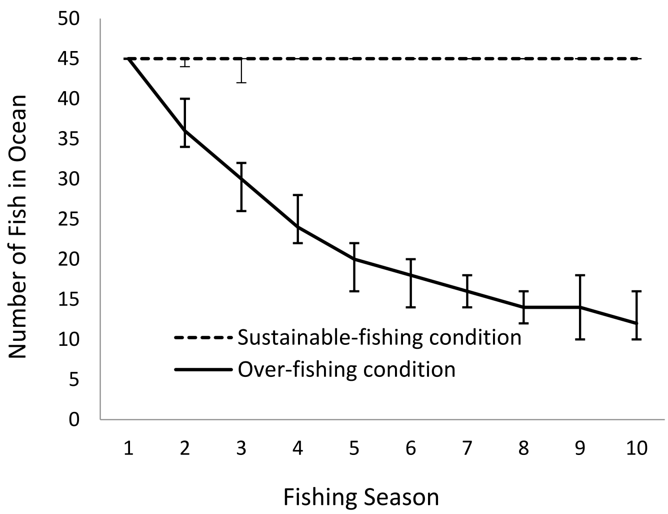

Fig.1.1. Median fish population at the start of each fishing season.
Note. The initial fish population was 45. Error bars represent the 95% confidence interval of the median.

45 fish). In fact, the 95% confidence interval around the median for fishing seasons 4 through 10 included only the full population (i.e., 45 fish). In the over-fishing condition (see the solid line in Fig. 1.1), the fish population declined, on average, in a steady, negative pattern until season 10 when the stock was reduced to one-quarter of the original population size.

For the subsequent analyses, fish harvests were assessed as proportional fish harvests (see Calculating Fish Harvests in the Method section). Many participants frequently harvested only their equal share of the sustainable harvest, creating in many fishing seasons a skinny (leptokurtic) distribution of harvest scores clustered between 0.50 and 0.60. Given this distribution, even moderately high or low harvests could be outliers. Extreme outliers (e.g., a proportional harvest >2.00) were also possible because no fishing limits were imposed. When the distribution of scores deviated substantially from normal based on Shapiro-Wilk tests (Shapiro & Wilk, 1965) and contained many outliers, non-parametric tests that can accommodate outliers were used (supplemental material provides details of statistical analyses).

4.1. *Correlations between power-wealth values and harvests in each condition*

The correlation between participants' power-wealth values and fish harvests averaged across the 10 fishing seasons was computed for each condition. Replicating previous research investigating individual differences in harvesting (Cuadrado et al., 2017; Han et al., 2018; Koole et al., 2001; Kramer et al., 1986; Sussman et al., 2016), in the sustainable-fishing condition power-wealth values were not significantly correlated with average harvests either for women (Kendall's tau-b rank correlation T_b (28) = 0.20, p = .12, 95% CI [-0.05, 0.43] or men T_b (13) = −0.03, p = .87, 95% CI [-0.42, 0.36]. However, in the over-fishing condition, they were significantly correlated for men, T_b (17) = 0.43, p = .01, 95% CI [0.11, 0.66], and correlated to a lesser degree and not significantly for women, T_b (28) = 0.23, p = .08; 95% CI [-0.02, 0.46]. In other words, harvesting levels were more likely to be associated with power-wealth values when participants were in an over-fishing group. This correlation does not, however, preclude efforts to conserve the resource by those with higher power-wealth values in over-fishing groups (see section 4.2.2).

4.2. *Fish harvests relative to sustainability standards*

To address the central hypotheses, the harvests of participants with high power-wealth values and low power-wealth values were examined relative to the equal-share rate (proportional fish harvest = 0.50) and the sustainable harvest rate. The sustainable harvest rate in Condition 1 allowed for a higher harvest than the equal-share (proportional fish harvest = 0.62) and in Condition 2 was a lower harvest than the equal-share (proportional fish harvest = 0.31). No significant gender differences in fish harvests were found; therefore, results presented are collapsed across gender.

4.2.1. *Fishing in a sustainable-fishing collective (condition 1)*

High Power-Wealth Value Participants. Among the 21 participants who more strongly endorsed power-wealth values, only one chased short-term self-interest and completely drained the resource in the first fishing season. The others sustained the resource for the 10 fishing seasons. A descriptive picture of median harvests over time relative to the sustainable harvesting standards is provided in Fig. 1.2. A tendency toward over-harvesting by many participants occurred in the early fishing seasons: season one *Mdn* = 0.80, 95% CI [0.62, 0.98] and season two, *Mdn* = 0.46, 95% CI [0.44, 0.80] (see Fig. 1.2, dashed line, double error bars). Early over-harvesting suggests an attempt to free ride on other group members.

By season three, however, the higher power-wealth participants were, on average, harvesting sustainably (*Mdns* for seasons 3 to 10 were 0.46, 0.44, 0.49, 0.44, 0.55, 0.52, 0.53, and 0.49). Reducing their harvests below the 0.62 sustainable harvest rate would restore the damage to the resource caused by initial over-fishing. Consistent with the conservation orientation hypothesis, when their harvests were averaged across all fishing seasons, the median (*Mdn* = 0.54) fell between the sustainable-harvest rate (i.e., 0.62) and the equal-share rate (i.e., 0.50). The median was significantly higher than 0.50 (V = 179, z = −1.9, p = .03, 95% CI: [0.51, 0.64, effect size r = 0.45) but did not differ significantly from the sustainable harvest-rate (V = 68.5, z = −1.25, p = .11, 95% CI: [0.51, 0.64], effect size r = 0.35). In sum, higher power-wealth participants generally harvested sustainably over time, after a brief unsustainable start.

4.2.2. *Fishing in the over-fishing context*

When they were placed in an over-harvesting group, participants – including those who valued power and wealth – were expected on the basis of the conservation orientation hypothesis to signal an interest in harvesting sustainably by harvesting at or less than an equal-share proportion of the replenishable harvest. In Fig. 1.3, median proportional fish harvests for each fishing season for the two value groups are plotted relative to the harvest standards. An additional reference line indicates the average harvest of the over-harvesting (virtual) group members. As the resource declined over time, the harvests of both high and low power-wealth value participants became more sustainable

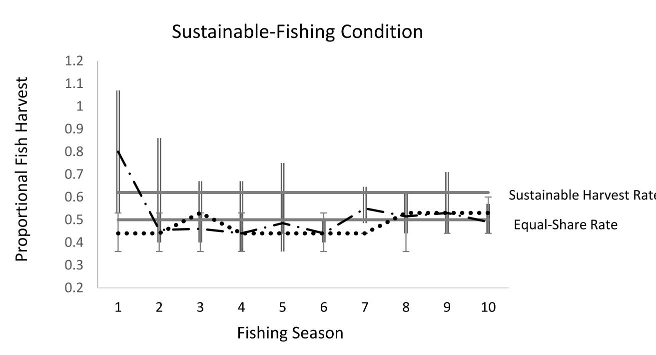

Fig.1.2. Proportional fish harvest for each fishing season within a sustainably-fishing group.
Note. Sustainable-harvest rate ≤.62. Equal-share rate = 0.50. Error bars represent the 95% confidence interval of the mean.

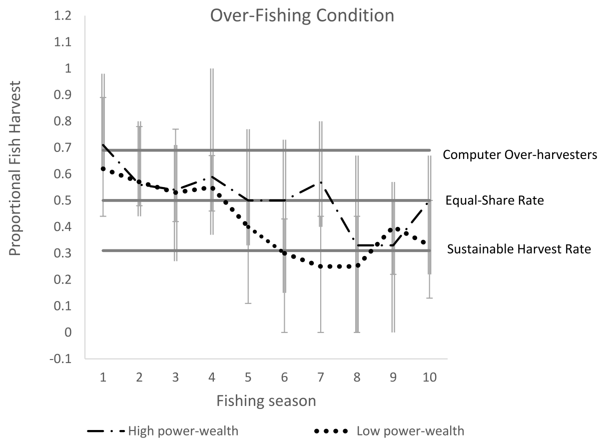

Fig.1.3. Proportional fish harvest for each fishing season within an over-fishing group.

Note. Virtual fishers' over-harvest rate = 0.69. Equal-share rate = 0.50. Sustainable harvest rate ≤0.31. Error bars represent the 95% confidence interval of the mean.

relative to the over-fishing majority.

Low Power-Wealth Value Participants. Surprisingly, participants with lower power-wealth values initially over-harvested along with the over-fishing majority (see Fig. 1.3, dotted line). To match the over-fishing of the virtual fishers, however, would cause the resource to decline very quickly. Faced with this rapid decline in the fish population, by season five they had turned to sustainable harvesting, taking very few fish each season. On average, they harvested at or below the equal-share rate for six of the ten fishing seasons ($M = 6.35$, $SD = 2.10$, range 3–10 times). Their harvests averaged across seasons fell between the equal-share and the sustainable harvest rates ($M = 0.44$, $SD = 0.12$; $Mdn = 0.45$), and was significantly less than the equal-share rate of 0.50; $M_{diff} = -0.06$, $t(22) = -2.46$, $p = .02$; 95% CI: [0.44, 0.56]; Cohen's $d = 0.12$; but significantly more than the sustainable harvest rate of 0.31; $M_{diff} = 0.13$, $t(22) = 5.43$, $p < .001$; 95% CI: [0.39, 0.49]; Cohen's $d = 0.12$.

High Power-Wealth Value Participants. Four participants with high power-wealth values depleted the resource before season 10, in seasons 2, 4, 5, and 7, and three of those participants never harvested sustainably (i.e., at or below the equal-share rate). In contrast, the others ($n = 21$) signaled their willingness to harvest sustainably, on average, for four of the 10 fishing seasons ($M = 4.08$, $SD = 2.34$, range 1–8 times). As can be seen in Fig. 1.3, the wide confidence interval in many fishing seasons indicates that an over-fishing group elicted more extreme harvests in response.

When harvests were averaged across completed fishing seasons ($Mdn = 0.53$), they were on average significantly higher than the sustainable harvest rate of 0.31 ($V = 324$, $z = 4.18$, $p < .001$, 95% CI [0.50, 0.70], effect size $r = 0.87$), but were not significantly different from the equal-share rate of 0.50 ($V = 217.5$, $z = 1.6$, $p = .06$, 95% CI: [0.50, 0.74], effect size $r = 0.38$).

5. Discussion

The greatest wealth comes to a community that sustainably harvests a renewable resource over time. To accomplish this, harvesters must resist pursuing short-term self-interest. The conservation-orientation hypothesis postulates that they will do so, and Study 1 provided support for this postulation. When placed in a group of (computer-programmed) harvesters who were fishing sustainably, only one participant depleted the resource in pursuit of short-term self-interest. Those who protected the resource over time earned more than the one participant who pursued short-term wealth. Six other participants also depleted the resource in the first fishing season, but in their case this was caused by their confusion about how the resource replenished.

In previous research using sustainable harvesting microworlds, when individuals who were expected to pursue short-term self-interest instead harvested sustainably, their harvesting choices were attributed to conformity rather than to the wisdom of a conservation orientation (Koole et al., 2001; Kramer et al., 1986). If participants simply conform to the behavior of the majority in commons dilemma microworlds, however, then in over-fishing microworlds they should follow the over-harvesting group norm. Instead, most participants in the present study resisted the over-fishing norm. In fact, 90% signaled their interest in harvesting sustainably by harvesting at or below the equal-share rate at least three times. They did so even though the over-harvesting group members were damaging their future financial outcomes. Choices made in the two commons dilemma scenarios indicate that most participants from both value groups purposefully tried to sustain the resource over time.

5.1. Motives for conservation

Although most participants demonstrated that they were motivated to sustain the resource, their reasons for doing so may have differed. Prosocial motives for conservation were manifested in the harvesting patterns of participants who held lower power-wealth values. In the sustainable-fishing condition, few of these participants harvested above the equal-share rate even when they could have collected more fish sustainably. An equal division of resources was a strong motivator for these individuals. A commitment to the equal division of resources and equal wealth within a group helps to promote inter-group trust and reduce competitive resource depleting spirals (Stouten et al., 2005; 2007; Van Lange, 1999).

If equal resource sharing within the group is important to individuals with low power-wealth values, then finding themselves in an over-fishing context would present a difficult challenge. In that context, pursuing an equal distribution of resources within the group would require them to over-harvest along with the majority and therefore put the sustainability of the resource at risk. And, indeed, the harvesting strategy of fishers with lower power-wealth values reflected this tension. Initially, they over-fished along with the (computer-programmed) over-fishing majority, which pointed toward pursuit of equality of outcomes, but also caused the resource to decline quickly. So, after several seasons, they changed to sustainable harvesting, which strongly suggests that they made preserving the resource their top priority. Ultimately, their average proportional fish harvest was much less than that of the over-fishing majority and less than the equal-share rate, which indicates that conservation became a higher priority for them than equality of outcomes. This harvesting pattern suggests that these individuals will respond to a depleting resource with efforts to conserve and be willing to do their share to restore the resource, but that non-compliance by other group members will make this a difficult choice for them.

The pattern of results was different for participants who more strongly valued power and wealth. Although conserving the resource over time was important to most of them, achieving that through an equal wealth distribution within the group appeared to be less important (at least for some). Free riding on the conservation efforts of other fishers in the collective is a harvesting strategy that can yield the greatest long-term personal wealth for an individual if other members of the commons do more than their share to sustain the resource. Half of the participants with stronger power-wealth values initially pursued this free-riding strategy in the sustainable-fishing context. One such fisher described his understanding of the fishing task as one in which the fishers were in a competition to secure as much of the replenishable harvest for oneself as possible. This participant could not understand why, after he had quickly caught most of the replenishable harvest for himself, the other (virtual) fishers continued to fish (their equal share). In the first two fishing seasons many harvested more than the sustainable harvest rate. However, because the virtual fishers did not compensate for over-fishing, these free riding participants adjusted their harvesting, in concordance with a conservation orientation, to ensure that the resource would remain plentiful over time.

Although sustainable, this harvesting pattern leaves open the possibility that individuals who strongly value power and wealth will conserve the resource only when it serves their long-term financial interests to do so. If they are placed in a situation in which their long-term financial interests are maximized by depleting the resource, they might prioritize their own financial interest even if doing so harms the resource and the broader collective. Study 2 explored this possibility.

6. Study 2

Study 1 established that most fishers followed the logic of long-term conservation in a commons dilemma situation in which sustainable harvesting benefitted them financially over time. However, a true conservation orientation should lead fishers to harvest sustainably even when they would benefit financially from harvesting unsustainably. Study 2 investigated this by creating a commons dilemma in which fishers' financial outcomes would be maximized by destroying the resource upon which future generations of fishers would depend. In real world fisheries, fishers who have alternate sources of income or who are close to retirement could benefit financially from over-fishing and damaging the health of the resource. A conservation orientation would prevent this selfish pursuit.

Three experimental conditions were created in Study 2, all of which shared the basic structure of the sustainable-fishing condition in Study 1: participants fished in four-person groups in which their (three virtual) group members harvested sustainably. Condition 1 was a replication of Study 1 in which participants believed that the resource existed only for their current group; that is, the fish population existed only for one generation of fishers (current generation only). In Conditions 2 and 3, participants were told that they had inherited the ocean of fish from a previous generation of fishers and that a future generation of fishers would inherit the fish left by them. They were also told that if their group depleted the resource, future groups would enter the fishing microworld and learn that the resource had been depleted and would not be able to earn money in the experiment.

In Conditions 1 (current generation only) and 2 (future generations - end unknown), participants did not know when the microworld would end. Therefore, to maximize their earnings, they should sustainably harvest to keep the resource at its highest levels throughout the microworld. To create a conflict between financial and conservation interests, participants in Condition 3 (future generations - end known) were told that season 10 would be the final season. In this condition, a participant's financial outcomes could be doubled by ignoring the needs of future generations and depleting the resource in season 10. Therefore, Condition 3 distinguished long-term self-interest from a true conservation orientation.

Long-Term Self-Interest Hypothesis: In Conditions 1 and 2, participants will sustain the resource, but in Condition 3 they will deplete the pool in season 10.

6.1. Individual differences in social value orientation

In Study 1, participants' likelihood of prioritizing self-interest and financial outcomes was assessed with a continuous measure of power-wealth values and groups were based on a median split. In Study 2, Social Value Orientation (van Lange et al., 1997) was used instead because it specifically distinguishes Proself individuals who prioritize their own financial interests over the financial outcomes to others from Prosocial individuals who prefer an equal division of financial outcomes in the group.

6.2. Conservation orientation

The conservation orientation hypothesis differs from the self-interest hypothesis based on the premise that individuals will abhor the destruction of a wealth-generating resource. Research on intergenerational dilemmas has demonstrated that situations in which the pursuit of wealth by the current generation creates hardship for the next generation are typically viewed as more ethically laden than social exchanges within the same generation because the future generation is powerless to influence the outcome, yet is vulnerable to the damage done (Wade-Benzoni et al., 2008; Wade-Benzoni & Tost, 2009). Consequently, inter-generational dilemmas can elicit stronger feelings of social responsibility. When choosing between maximizing their own financial outcomes versus sustaining the resource for future fishers, the conservation orientation hypothesis predicts that even Proself individuals will prioritize resource conservation over personal financial gain.

Conservation Orientation Hypothesis: All Prosocial and Proself participants will sustain a healthy fish population over time when future generations depend on their choices (in Conditions 2 and 3).

7. Method

7.1. Participants

Undergraduate university students ($n = 199$) from a different western Canadian university from Study 1 were recruited for the study through a web-based participant pool system. They received course bonus marks and money based on their fish harvesting. Sixteen participants were excluded because of their confusion about the microworld or their suspicion about the study after it was completed (explained below). This left a total of 183 (138 women and 45 men) whose age ranged from 16 to 46 ($M_{age} = 20.34$, $SD = 3.70$). Power analysis is provided in the supplemental material.

7.2. Procedure

The study had three components, all online: (1) a pre-test questionnaire that included measures of social value orientation (van Lange et al., 1997) and Schwartz's (1992) value survey; (2) FISH 4.0, which has a more advanced graphical display than FISH 3.1, and (3) the post-test questionnaire.

After completing the pre-test questionnaire, participants signed up for a later day to participate in the fishing microworld. The evening before the scheduled fishing microworld experiment, they received an email with complete instructions. They were told they would be in the experiment with three other participants who had signed up for the same time slot and that they should therefore be careful to join the study on time. As in Study 1, the three others were actually virtual fishers who were programmed to harvest the resource sustainably. Participants completed a practice session to familiarize them with the microworld (maximum of four fishing seasons) and then they were linked to the actual experiment. After completing the fishing experiment, participants were linked to the post-test questionnaire, instructed on how to collect their earnings (usually around $5), and provided a debriefing.

7.3. Measures

7.3.1. Social value orientation

Using the triple-dominance measure of social value orientation (van Lange et al., 1997; see supplemental material), participants who selected a majority of cooperative point distributions were classified as *Prosocial* and participants who selected a majority of individualist or competitive point distributions were classified as *Proself*. Proself participants endorsed significantly higher power-wealth values ($M = -1.35$, $SD = 1.18$) than the Prosocial participants ($M = -1.94$, $SD = 1.01$), $M_{diff} = 0.59$, $t\,(181) = 3.09$, $p = .002$; 95% CI: [0.21, 0.96].

7.3.2. Fishing microworlds

The three experimental conditions all included the following features:

Fish population: maximum was 80 fish, but the microworld began with 76 fish in the ocean. The microworld opened with less than the full population to support the cover story in Conditions 2 and 3 that the pool of fish was inherited from a previous group.

Replenishment rate: at the end of each fishing season the fish remaining in the ocean doubled in number to a maximum of 80 fish for the next fishing season.

Harvest incentive: participants were free to harvest as many fish as they wanted in any fishing season and were encouraged to do so with an incentive of 5 cents/fish harvested.

Virtual fishers and harvest rates: two of the three virtual fishers harvested at the equal-share harvest rate, which in an ocean of 80 fish was 25% of the 40-fish replenishable harvest (i.e., 10 fish). One virtual fisher under-harvested by catching only 9 fish when the population was at 80. Therefore, the human participants could harvest 11 fish or 27.5% sustainably. The variable catch function in FISH 4.0 created slight variations in the catch so that, if the population size remained at 80 fish, a fisher's harvests would vary from time to time. The microworld would end either when the fish in the ocean were depleted or after season 10.

7.3.2.1. Instructions for the experimental conditions. In Condition 1 (current generation only), participants were told that a full ocean contains 80 fish however, to simulate natural fluctuations of fish populations, the number of fish in the ocean at the start of season 1 would be a random number between 70 and 80 fish. Participants were not told the number of fishing seasons.

In Condition 2 (end unknown), the participants were told that they inherited the ocean from the previous group of fishers and that there were 76 fish left in the ocean that could support a maximum of 80 fish. They were also told that next group to inhabit the microworld would inherit the fish remaining in the ocean left by their group. Participants were not told the number of fishing seasons.

In Condition 3 (end known), participants were given the same information as Condition 2, but were told that season 10 was the final fishing season.

7.3.2.2. Fish population measures. The final fish population was calculated as the fish remaining in the ocean after the four group members (real plus three virtual fishers) completed their fishing in season 10 plus the normal fish replenishment. The final population could range from 80 fish (maximum) to 0 fish (depleted pool).

7.3.4. Post-test questionnaire

The post-test questions (see supplemental material) assessed whether participants understood the microworld, whether they remembered the specific features of their experimental condition (e.g., that future generations would inherit the resource; that the microworld would end at season 10), and whether they guessed that any features of the microworld were fabricated.

7.4. Early depleters

Twenty participants depleted the population of fish before reaching the 10th fishing season. Based on the post-test questionnaire, four depleted the resource intentionally. The remaining 16 participants (10 Prosocial, 6 Proself) provided explanations other than self-interest for early depletion: 13 indicated that they were confused about the procedures (for example, some believed the fishing microworld was supposed to end at season 4 as was the case with the practice session), two guessed that the other players were computer simulations, and one did not take the experiment seriously, stating that he used a random approach to fishing. These 16 participants (8 % of the sample) were removed from further analyses.

8. Results

The long-term self-interest hypothesis focused specifically on whether the fish population was depleted in Condition 3 and the conservation-orientation hypothesis focused on the size of the fish population available to the next generation of fishers (Conditions 2 and 3). Across the three experimental conditions, the majority of participants (81.3%) left a robust fish population of between 60 and 80 (the maximum) fish at the end of season 10.

8.1. Testing the self-interest hypotheses

According to the long-term self-interest hypothesis, participants would deplete the fish population when it was clearly in their self-interest to do so (i.e., later fishing seasons in Condition 3), and would sustain the resource when it was in their financial interest to do so (i.e., Conditions 1 and 2). Across all conditions, only eight participants (four Prosocial and four Proself) depleted the resource intentionally. Table 2.1 provides the number and percentage of Prosocial and Proself participants in each condition who depleted the fish population. Of these, three pursued short-term self-interest, depleting the resource in the first fishing season (one from Condition 1 and two from Condition 2). Four of the remaining depleters were from Condition 3 (two Prosocial; two Proself). The four fishers who were the top earners of the study (3 Prosocials and one Proself) caught between 129 and 158 total fish using the long-term self-interested strategy of maintaining the resource at high levels through seasons 1 to 9, and then depleting or almost depleting the resource in season 10.

The long-term self-interest hypothesis was tested using Fisher's exact statistic, which examines whether depleting the fish population was related to experimental condition.[5] Of the Prosocial participants, 2.1% depleted the resource in Condition 2 versus 4.3% in Condition 3, but this difference was not statistically significant, $p_{\text{one-tailed}} = 0.49$ (odds ratio = 0.48, 95% CI [0.04, 5.47]). A higher percentage of Proselfs than Prosocials depleted the resource in both Conditions 2 and 3, with 15.4% doing so in Condition 2 and 14.3% in Condition 3, but Proselfs were not significantly more likely to deplete the fish resource in Condition 3 than in Condition 2, p one-tailed = 0.67 (odds ratio = 1.09, 95% CI [0.13, 9.12]). In sum, the long-term self-interest hypothesis that fishers would harvest primarily according to their financial interests was not supported.

Table 2.1
Number and percentage of participants who depleted the fishery.

Condition		Prosocial		Proself	
		%	freq/*n*	%	freq/*n*
1	Current generation only	2.0	1/50	0	0/11
2	Future generations - end **un**known	2.1	1/48	15.4	2/13
3	Future generations - end known	4.3	2/47	14.3	2/14

Note. n = number of fishers in the experimental condition; freq = number of fishers in the condition who depleted the resource.

[5] When testing for associations between two dichotomous variables, the Fisher's exact test is used rather than Chi Square with small samples and with rare outcomes (e.g., depleting the fish population was a rare outcome). For all analyses predicting a depleted or severely reduced fish population, at least one cell had fewer than 5 counts. The odds ratio is reported with 95% confidence intervals (CI). Non-significance is indicated when the CI includes 1.0. No significant gender differences were found in any of the Study 2 analyses.

8.2. A conservation orientation

A conservation orientation is demonstrated when harvesters sustained a healthy fish population for future generations of fishers (Conditions 2 and 3). The distributions of the final fish populations for Prosocial and Proself participants, collapsed across Conditions 2 and 3, are provided in violin plots (see Fig. 2.1). The most common harvesting practice was to leave a full ocean of 80 fish for the next generation of fishers; this was done by 64.2% of Prosocials and 48.1% of Proselfs. Across Conditions 2 and 3, very few fishers left a depleted or substantially depleted pool of fewer than 20 fish; only 6.3% of Prosocials and 14.8% of Proselfs did this. The majority of fishers, although not all, demonstrated a conservation orientation.

9. Discussion

To ensure resource protection over time, individuals in collectives must value resource conservation over maximizing their personal financial interests. In most simulated commons dilemmas, long-term self-interest cannot be distinguished from a conservation orientation because participants benefit the most financially when the resource is conserved over time. Study 2 separated these motives by including two features that are not normally part of common dilemma simulations. They were: (1) participants were informed that subsequent groups of participants would be inheriting the remaining fish, and (2) participants knew when the microworld would end. These conditions placed financial gain in direct conflict with conservation, because participants who depleted the resource in season ten could almost double their earnings.

Contrary to the self-interest hypothesis, only a small minority of participants intentionally depleted the resource in Condition 3. Even most Proself participants sacrificed their own financial gain for the welfare of future generations. In fact, the most common choice for participants was to leave the ocean at the maximum fish population for the next generation of fishers. Study 2 therefore demonstrated that for the large majority of participants the desire to conserve a renewable resource was stronger than the pursuit of maximum personal financial benefit. Prosocial individuals are expected to protect the collective welfare, but Proself individuals are not. The present research identifies a conservation motive that even most Proselfs appear to share with Prosocials.

10. General discussion

Depleting and destroying renewable resources by over-harvesting is truly a tragedy (Hardin, 1968). Blaming tragedies of the commons on short-sighted human self-interest is a seductively simple explanation,

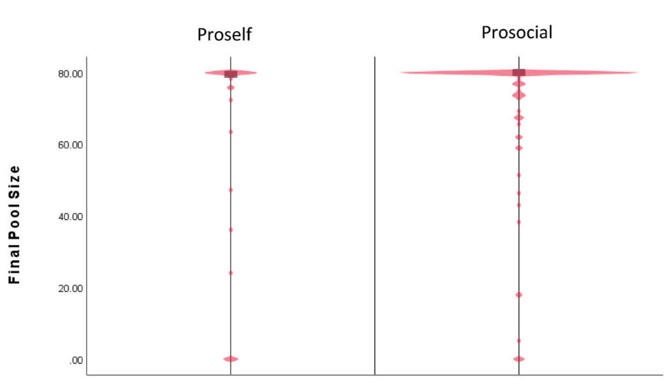

Fig. 2.1. Violin plots of the final fish population for Proself and Prosocial fishers' when future generations were depending on conservation (conditions 2 & 3).
Note. Medians are indicated with the grey rectangle at or near the maximum pool of 80 fish.

which is consistent with the common bias to over-estimate the influence of individual self-interest on others' behavior (Lerner, 2003; Miller & Ratner, 1998). The conservation-orientation hypothesis offers a different perspective. It proposes that individuals who benefit from access to renewable resources understand the significance of resource depletion and the importance of conservation for themselves and future generations.

10.1. Evidence of a conservation orientation in commons dilemmas

To the best of our knowledge, no one has previously proposed that most individuals possess a conservation orientation. Earlier research identified self-interested versus cooperative harvesting tendencies linked to individual differences in attitudes, values or personality based on harvesting in failing, over-harvesting groups (Cuadrado et al., 2017; Koole et al., 2001; Kramer et al., 1986; Sussman et al., 2016). However, relying on simple correlations with harvesting in over-harvesting groups provides very limited information about individuals' harvesting preferences in commons dilemmas. If harvest levels are not compared to objective standards of conservation, individuals' efforts to sustain the resource can be easily overlooked. In the over-fishing condition of Study 1, 84% of individuals who valued power and wealth sustained their fishery over the ten fishing seasons by frequently limiting their harvests to the equal-share rate or less. This was the case even though there was a strong financial incentive to pursue short-term self-interest by harvesting all the fish in the ocean. Although power-wealth values did correlate with harvest levels, to conclude that individuals with higher power-wealth values made no efforts to sustain the resource would be incorrect.

The larger problem with relying exclusively on behavior in over-harvesting groups to identify harvesting motives is that commons dilemmas are collective, not individual, problems; this means that the wealth of all requires cooperation among the collective's members. Placing individuals in a failing collective that is destroying the group's ability to achieve collective wealth forces individual harvesters to choose between securing their fair share of a declining resource or conserving the resource, essentially, for the benefit of the other harvesters. When participants were placed in a cooperative group that harvested the fish resource sustainably; almost all participants (98%) resisted short-term self-interest and sustained the resource over time regardless of their values. Given that conserving a shared resource at high levels maximizes one's own longer-term financial interests, it should not be surprising to learn that self-interested individuals who value wealth prefer resource conservation to resource depletion as much as others.

After determining in Study 1 that most participants were motivated to sustain replenishable resources, Study 2 investigated whether this conservation orientation goes beyond one's own self-interested long-term financial interests. When testing whether individuals would resist certain financial benefits to protect the resource for future generations (Study 2, condition 3), the dominant harvesting decision was to leave a full ocean or very close to a full ocean for the next generation of fishers. Only 4.3 % of Prosocials and 14.3% of Proselfs sacrificed the resource and future fishers' access to it for their own financial gain. Taken together, these results support the conclusion that a large majority of individuals value and choose conservation above their own personal financial benefits.

The sustainable-fishing microworld, in which the vast majority of participants sustained the resource at high levels, created the conditions that allowed individuals to act on their conservation orientation. Many of these conditions are not present in real-world environmental problems. For example, there was no ambiguity about the state of the resource or about the impact of resource decline on the financial outcomes for the members of the collective. Each individual's harvesting was consequential for the resource, whether positive or negative. Individual's sustainable harvesting levels were easy to determine. Their harvest choices, although anonymous, were displayed publicly along with that of the three virtual fishers. The consistent sustainable fishing behavior of the virtual members of the small collective made it clear to participants that their group could achieve the maximum financial benefits with the participant's cooperation. All the above conditions might be needed for some individuals to act on their conservation orientation. For others, simply knowing the sustainable harvesting level might be sufficient. Determining the most important conditions for eliciting cooperation from the largest number of people in both commons dilemmas and also public goods dilemmas (which model climate change) is the goal of future research.

10.2. Equal division of resources and conservation

Although most participants demonstrated a willingness to conserve shared resources, they did not necessarily agree that resources needed to be allocated equally within the group. Individuals with low power-wealth values demonstrated a commitment to both conservation and equal resource distribution within the group. When placed in a sustainable-fishing group, a situation in which the participant could harvest more than an equal-share of the resource sustainably, they chose to leave the extra resources in the ocean in each fishing season. For these fishers, financial equality within the group seemed to be more important than their own personal financial benefits.

Participants who more highly valued power and wealth did not necessarily show a commitment to wealth equality. This is consistent with previous research demonstrating that equality of resource distribution within a group is more important to individuals with Prosocial values than those with Proself values (De Cremer & Van Lange, 2001; Hu & Mai, 2021). Although participants appeared to agree that sustaining the resource over time was important, their views differed in how that could and should be achieved. Nevertheless, participants with stronger power-wealth values were ultimately willing to prioritize conservation over their competitive fishing strategy to sustain the resource over time.

Individual differences in the importance of equal resource distribution can explain how unsustainable harvesting spirals can overtake a group. If some individuals approach commons situations as a competition for the available resource rather than as an equal distribution situation, their competition might provoke reciprocal over-harvesting from equality-oriented individuals (as it did for participants low in power and wealth values in Study 1, condition 2). Competitive individuals might not realize the impact of their fishing approach. Given these individual differences, collectives would benefit from developing agreed-upon individual sustainable harvest levels (Leal, 1998; Ostrom, 1990).

10.3. Not all Fishers demonstrated a conservation orientation

In a real replenishable resource such as a fishery upon which individuals depend financially, we would predict that all (100%) resource users would hold a conservation orientation and would join a collective effort to maintain the resource at healthy levels. In laboratory commons microworlds, resource depletion is not very costly to the individual. Nevertheless, only two percent of participants across the two studies (5 out of 274; 2 Prosocial) employed a harvesting strategy that intentionally depleted the resource within the first two fishing seasons. In Study 2, when future generations were dependent on conservation, two percent (again including 2 Prosocials) pursued longer-term self-interest by sustaining the resource overtime but then depleting it. Ultimately, only a very small minority of participants intentionally destroyed the resource.

Using a convenient sample of university students to test the conservation orientation hypotheses restricts the generalizability of the study. Although psychology student samples are dominated by younger people, they do draw from a large diversity of academic disciplines. In Study 2, only 20% of the students were psychology majors. A large proportion were majoring in business, economics, and computer science. We viewed individual differences in power-wealth values and social value orientation as the key factors that might yield different harvesting strategies. And, indeed, individual differences in harvesting strategies did emerge between these value groups, but evidence of a conservation orientation was clearly present in all value groups.

11. Conclusions

Given climate change, a life threatening anthropocentric environmental problem on which humanity has been slow to act, it is easy to lose faith in our ability to make environmental conservation the priority that it needs to be. The present study offers hope by providing evidence of most individuals' preference for, and willingness to, conserve shared resources. The present findings are consistent with other research in the laboratory and real-world that demonstrate a human tendency toward cooperation and collective organization (e.g., Leal, 1998; Rand, 2016). The assumption that over-harvesting is caused by self-interest rather than by insufficient collective coordination could be a critical error in identifying the most effective and least costly methods for managing the commons.

One of the most important reminders from commons dilemma research is that environmental problems are fundamentally collective problems, not individual problems. To act on their conservation orientation, individuals within the collective need to see evidence of others' commitment to achieving the collective goal. An example of a carbon mitigation policy based on coordinated collective action that could provide this type of reassurance, is personal carbon allowances and trading (i.e., personal cap and trade; Capstick & Lewis, 2010; Fawcett & Parag, 2010; Fuso Nerini et al., 2021; House of Commons Environmental Audit Committee, 2008). This approach for reducing carbon pollution can increase citizens' attention on climate change, create awareness about personal contributions to the problem and individual-level carbon reduction targets, while creating a collective approach for addressing the problem.

Author statement

Reuven Sussman is now at the American Council for an Energy Efficient Economy, Washington, DC. Fabio Iglesias is now at the Department of Clinical Psychology, University of Brasilia, Brazil. Heath Matheson is now at the Psychology Department, Memorial University of Newfoundland, Canada.

Author contributions

Loraine Lavallee: Overall project supervision, study conceptualization and design, project administration, resources, data curation and analysis, writing (original and editing). Robert Gifford: Conceptualization, writing (original and editing), software, resources. Reuven Sussman: project administration of Study 1, conceptualization and methodology, investigation, writing (original and editing). Fabio Iglesias: project administration of Study 1, methodology, formal analysis editing. Devan Kronisch: project administration of Study 2, methodology, editing. Heath Matheson: formal analysis, editing.

Declaration of competing interest

We have no known conflict of interest to disclose.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.jenvp.2024.102252.

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