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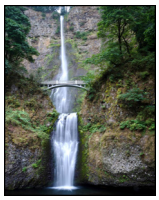

The roles of motivation and goals on sustainable behaviour in a resource dilemma: A self-determination theory perspective

Daniel Baxter*, Luc G. Pelletier

University of Ottawa, Ottawa, ON, K1N 6N5, Canada

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ABSTRACT

Environmental degradation and biodiversity loss are worldwide problems caused by human activities, which can often be classified as a resource dilemma. Across two studies, and using self-determination theory as a framework, we examine the relationships between motivation, goals, sanctioning systems and sustainable behaviour in a resource dilemma. The resource dilemma used was a 2-person partnered design where each participant was required to make decisions about recreational fishing harvests in a small, private lake with a simulated partner. Study 1 used mediational analysis to demonstrate that quality of motivation affects goal content, and goal content predicts sustainable behaviour. Study 2 introduced a centralized sanctioning system to the resource dilemma, and found that this type of sanctioning system increased sustainable behaviour in the resource dilemma when added, and decreased sustainable behaviour when removed, concomitantly affecting the quality of participant motivation and goal content. The results expand upon self-determination theory, and point to the importance of distinguishing motivation from goals, examining quality of motivation through degree of internalization, and how these constructs as well as sustainable behaviour can be affected by a centralized sanction system.

1. Introduction

A resource dilemma is any situation in which people choose how much of a shared, finite resource they will take for their own personal gains, and how much they will leave for the collective good, both in a spatial and a temporal sense (Balliet, Mulder, & Van Lange, 2011). Social dilemmas in general have generated a notable amount of research, with resource dilemmas representing a minority within the general social dilemma framework. Within this research, the construct of motivation has not received much attention, and unfortunately has been somewhat convoluted by the conflation of the constructs of motivation and goals. Moreover, no model or theory of motivation that has yet been applied to resource dilemmas has distinguished between the origin of the motivation, that is the distinction between a motivation that is autonomous or self-determined and a motivation that is controlled or regulated by sources outside the self. This is an area in which self-determination theory (Ryan & Deci, 2017) can help to guide research in resource dilemmas with respect to the influence of individual motivation, while creating theory-driven hypotheses about the relationships between motivation, goals, and behaviour.

1.1. Self-determination theory

Self-Determination Theory (Deci & Ryan, 2000, 2012; Ryan & Deci, 2017) is a theory of motivation that posits that motivation for important activities varies in terms of quality and source of origin. These different sources fall on a continuum of self-determination, from non-self-determined motives (amotivation, external regulation and introjection motivational subtypes/behavioural regulations) to self-determined motives (identified, integrated and intrinsic motivational subtypes). The least self-determined type of motivation is called amotivation, which can be categorized as a lack of behavioural regulation and internalization. It relates to experiences where there is a clear lack of understanding of the sources of regulation of behaviour or its purpose, an absence of motivation or intention to act. In other words, when individuals don't know why they should adopt certain behaviours, they don't see the point in doing so, or they don't see how it could lead to a desired outcome (Pelletier, Dion, Tuson, & Green-Demers, 1999), they are experiencing amotivation. The first type of extrinsic, non-self-determined motivation is external regulation. It consists of behaviours intended to obtain rewards, avoid punishment, or to satisfy or avoid social pressure (e.g., praise or criticism). For example, someone may enact certain behaviours in order to receive a monetary compensation,

* Corresponding author. School of Psychology, University of Ottawa, Canada
E-mail addresses: daniel.e.baxter@gmail.com, daniel.baxter@uottawa.ca (D. Baxter), social@uottawa.ca (L.G. Pelletier).

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or avoid harsh criticism or judgment. Introjected regulation is the first type of regulation where the internalization of behaviours is present. At this stage, behaviours are executed mainly to avoid negative emotions such as guilt or shame. Thus, someone engaging in certain behaviours in order to avoid feeling guilty is driven by introjected regulation. The first type of regulation on the self-determined end of the continuum is identified regulation. This type of regulation characterizes behaviours that are initiated and maintained because they are important to someone, or because they lead to the accomplishment of important personal goals. For example, someone who adopts behaviours because s/he values and understands their importance is displaying identified regulation. Next, there is integrated regulation, a more self-determined type of motivation where behaviours are enacted because they are considered to be fully internalized and coherent with different dimensions of one's self. For instance, integrated individuals will act because behaviours are considered to be part of their identity. Finally, the most self-determined type of motivation is intrinsic regulation. In this case, it is the pleasure and satisfaction of the activity that drive the behaviour (s). When intrinsically motivated, the simple act of performing certain behaviours brings pleasure to an individual when he or she is engaged in the activity. On this continuum, the quality of motivation is determined by the extent to which behaviours are internalized into the self in that fully internalized motives produce more desirable behavioural, cognitive, and affective outcomes than partially internalized and non-internalized motives.

In this way, extrinsic incentives (external punishments and rewards) are generally seen in Self-Determination Theory as controlling factors that undermine internalization of behaviour (by keeping the source of motivation external), thereby reducing self-determined motivation. With respect to punishments, these are ubiquitously controlling, and subvert the internalization of the motivation for a given activity, leading to greater non-self-determined motivation.

The Self-Determination Theory framework has been studied within a vast number of domains including the adoption of pro-environmental behaviours. In fact, many studies have looked at the possible effects of self-determined motivation and non-self-determined motivation on various proenvironmental behaviours (Pelletier & Aitken, 2014; Pelletier, Baxter, & Huta, 2011). Previous research has shown that the more self-determined forms of motivation, when compared to non-self-determined forms, are globally related to a higher frequency of pro-environmental behaviour, performing more difficult pro-environmental behaviour, a higher sustenance of performing pro-environmental behaviour over time, and persistence in performing pro-environmental behaviour in the face of obstacles (Green-Demers, Pelletier, & Ménard, 1997; Pelletier et al., 2011; Sheldon, Wineland, Venhoeven, & Osin, 2016). Also, Self-Determination Theory has been studied in relation to distinct environmental behaviours such as recycling and purchasing behaviours (e.g., Pelletier, Tuson, Green-Demers, Noels, & Beaton, 1998; Villacorta, Koestner, & Lekes, 2003), environmental activism (e.g., Seguin, Pelletier, & Hunsley, 1998), household energy-saving behaviours (e.g., Joachain & Klopfert, 2014; Webb, Soutar, Mazzarol, & Saldaris, 2013), employee green behaviours (e.g., Graves, Sarkis, & Zhu, 2013), and green information technology behaviours (e.g., Koo & Chung, 2014); as well, it has been studied in a wide variety of settings (ex., home, workplace, the classroom) and countries.

The types of motivation proffered by Self-Determination Theory are more extensive than previous conceptualizations of motivation in past research on resource dilemmas, and more easily distinguished from the desired outcomes of the task (i.e., goals). Thus, Self-Determination Theory can help advance the understanding of motivation with respect to behaviour in resource dilemmas by (1) giving a wider variety of motivations for being proenvironmental, (2) clearly separating motivation from goals, and (3) providing a theoretical framework from which to examine deeper impacts of sanctioning systems on quality of motivation and goal content.

Motivation has received relatively little attention in the overall social dilemma extant literature, comparatively speaking. What models and frameworks that do exist are further muddied by the conflation of the constructs of motivation and goal. A *goal* can be considered the desired or valued outcome to be derived from, or achieved by a particular behaviour or series of behaviours, while *motivation* can be considered the experiential, cognitive and emotional reason(s) why a person would desire that outcome, and the force of energy necessary to enact the behavior. In other words, while motivation refers to the reasons *why* people are engaging in a behavior or pursuing a goal, the goal itself refers to *what* people are pursuing (Deci & Ryan, 2000).

In some cases, authors explicitly identify their measure as 'motivation' or 'motives', even within the title of their article, when they are, in fact, actually measuring goals (e.g., Bosworth, Singer, & Snower, 2016); (Brucks & Van Lange, 2008). For example, Bosworth, Singer, & Snower (2016) discuss measuring participants' motivation, but their measure is actually of two goals, maximizing personal gain, or maximizing communal gain. (Brucks & Van Lange (2008)) also discuss a measure of motivation, which actually is measuring the goals of either preserving the resource pool as long as possible, or keeping the resource pool as high as possible. As these are direct outcomes of one's behaviour in a resource dilemma, they are better differentiated as goals rather than motivation, which can be defined and measured in a broader, more domain-general way, whereas goals are more task-specific. Other authors have adopted a broader definition of motivation, such as Markoczy (2004), who defined motives as "relatively stable individual tendencies to strive to approach a certain class of positive goals or to avoid some negative consequences or threats" (p.1018). This definition is exemplary of the conflation of goals with motivation, and the concept of motivational orientations (to achieve a positive goal, or avoid a negative consequence) within resource dilemma research. For example, it has generally been assumed by researchers from the prevalent economic model (see Markoczy, 2004) that individuals are purely motivated by self-interest, and that cooperation is simply a matter of making individual payoff greater in a cooperative structure than 'defection' (reaping largely for oneself and leaving less for others).

Self-Determination Theory distinguishes between why people engage in a behavior (i.e., their motivation) from what they try to achieve (i.e., their goal). As such, this theory can help provide a clearer distinction between motivation and goals, and conceptualizes motivation as a much deeper construct than simple self-interest. That is, "Self-Determination Theory differentiates the content of goals or outcomes and the regulatory processes through which the outcomes are pursued, making different predictions for different contents and for different processes" (Deci & Ryan, 2000, p. 227). For example, imagine a person who is engaged in cleaning a public park (a public goods dilemma). This person's *motivation* for cleaning the park could be because performing proenvironmental behaviours (in this case, contributing to cleaner parks) is a part of their self-concept, or identity (i.e., they consider themselves to be an environmentally friendly person). However, their *goal* for cleaning the park could be to make it a better place for neighborhood children to be able to play and experience nature. It is not that the two are unconnected, as more self-determined forms of motivation tend to lead to more intrinsic goals, whereas non-self-determined motivational subtypes are more associated with extrinsic goals. That is, "when people value intrinsic aspirations, they also tend to be more autonomous in pursuing them, whereas there is a tendency for people to be controlled in their pursuit of extrinsic aspirations" (Deci & Ryan, 2000, p. 245). Thus, a clear, conceptual distinction between the two will help to further research in this particular area.

Only two studies so far have examined self-determined/non-self-determined motivation and its relation to behaviour in a resource dilemma. Sheldon and McGregor (2000) examined the relationship between Extrinsic Value Orientation and sustainable behaviour in a resource dilemma, and found that people who have extrinsic value orientations (wealth, fame, etc.) are more likely to act selfishly and unsustainably in a resource dilemma, reaping large personal harvests in

the short run and leaving little for others or future generations. Darner (2012) found that when a sanctioning system is imposed on participants, it can have degrading effects on participants' sense of autonomy and whether they felt their harvesting strategy in a resource dilemma matched their own desires and values.

1.2. Sanctions in resource dilemmas

Contrary to the expectations and findings of Self-Determination Theory, studies investigating the use of sanctioning systems, particularly centralized sanction systems, tend to base their expectations from economic, ego-incentive, rational-choice models in which is it assumed that, given appropriate payoff structures and incentive programs, a person can be guided to more or less cooperation. In other words, it is assumed that everyone will act selfishly according to his/her own gains, and will expect others to do the same (Jackson, 2008); and, as such, the real means of inducing cooperation is to make it in each person's best interests to contribute via appropriate punishment and reward systems. Thus, a sanctioning system is a system of monetary punishment and/or reward that can be administered either centrally (by the task itself and under pre-set conditions) or in a decentralized way (by the participants in the dilemma according to their own criteria). Indeed, a comprehensive meta-analysis by Balliet et al. (2011) demonstrated that the presence of monetary punishments and rewards in a social dilemma does increase cooperation. Sanctions are most effective when participants believe they are administered based on a common concern for the collective outcome (Balliet et al., 2011).

However, there is research that has shown the potential for the presence of sanctioning systems, both centralized and decentralized, to have a negative effect on participants in a variety of ways. With respect to centralized sanctions, research has shown that the presence of such can actually lead to decreased cooperation when the sanction system is removed (Chen, Pillutla, & Yao, 2009; Mulder, van Dijk, De Cremer, & Wilke, 2006; Tenbrunsel & Messick, 1999) through the expectation that others will not be cooperative (Tenbrunsel & Messick, 1999), by decreasing trust in others (Chen et al., 2009; Mulder et al., 2006), and by changing the decision frame from a moral frame to a business frame (Tenbrunsel and Messick, 1999)). Therefore, getting a deeper understanding of why centralized sanctions can have a longer-term deleterious effect on cooperative, sustainable behaviour will help to refine the use of such interventions in resource dilemma.

1.3. Overall objectives of the present article

The overall aim of this research was to apply Self-Determination Theory to the study of resource dilemmas, and in so doing provide a theoretical framework of motivation that distinguishes between motivation and goals, internalized versus externalized motivation, intrinsic versus extrinsic goal content, and provides a foundation for future resource dilemma research.

For the research presented herein, recreational fishing was chosen as the resource dilemma. The fishing industry is a good representation of a contemporaneous resource dilemma in that many parties are harvesting from the same finite natural resource; however, if people harvest too greedily, then the resource will collapse catastrophically (Lloret, Zaragoza, Caballero, & Riera, 2008; Pauly et al., 2002), as primary production rates of fished species can easily be outweighed by consumption rates (Pauly & Christensen, 1995). Recreational fishing is open-access and largely unregulated in many countries (Lloret et al., 2008; McPhee, Leadbitter, & Skilleter, 2002), with recreational anglers spending an average total of 193 h per year per person fishing (Lloret et al., 2008), harvesting approximately 50,000 tonnes of fish per year in some countries (McPhee et al., 2002). As previously discussed, past research has often muddied the concepts of motivation and goals, has had a truncated perspective on what types of motivation may exist and has not yet included the concept of quality of motivation to the realm of resource dilemmas. Moreover, we sought to expand on the work by Sheldon and McGregor (2000) and Darner (2012) by using more detailed and expanded constructs and measures. Therefore, we sought to examine the influence of individual self-determined (SDM) and non-self-determined (NSDM) motivation on the determination of intrinsic (e.g., improving health and well-being) versus extrinsic (e.g., making or saving money, power and prestige) goal content, and how motivation and goals may relate to sustainable behaviour in a resource dilemma (Study 1). Moreover, this research also examined how the presence of a centralized sanctioning system may affect the quality of a person's motivation, the type of goals a person may pursue, the level of sustainable behaviour a person demonstrates, and how changes in motivation and goals may predict changes in behaviour (Study 2).

In Study 1, we expected that SDM would be a positive predictor of intrinsic goal pursuit, while NSDM would be a positive predictor of extrinsic goal pursuit (*hypothesis 1*). We also expected that SDM and intrinsic goals would be a positive predictor of greater amounts of fish left in the lake at the end of the task (i.e., greater sustainable behaviour), while NSDM and extrinsic goals would be a negative predictor of such (*hypothesis 2*). Moreover, we hypothesized that SDM would have an indirect effect on sustainable behaviour through intrinsic goals, while NSDM would have an indirect effect on sustainable behaviour through extrinsic goals (*hypothesis 3*).

In Study 2, we introduced a centralized sanctioning system into the resource dilemma task. We expected that (a) the addition of sanctions would lead to an increase in sustainable behaviour, shown by an increase in the mean number of fish left in the lake at the end of the task for the group of participants who conducted the resource dilemma without the sanction system present and then had it added in block 2 of testing (*hypothesis 4a*); (b) while the removal of sanctions would lead to a decrease in sustainable behaviour for the group of participants who conducted the resource dilemma with the sanction system present in the first block of testing and then subsequently had it removed in the second block (*hypothesis 4b*). We also expected that self-determined task motivation would be lower in the sanction condition compared to the no-sanction condition (*hypothesis 5a*), while non-self-determined task motivation would be higher in the sanction condition compared to the no-sanction condition (*hypothesis 5b*). Similarly, we expected that intrinsic goal pursuit would be lower in the sanction condition compared to the no-sanction condition (*hypothesis 6a*), while the pursuit of extrinsic goals would be higher in the sanction condition compared to the no-sanction condition (*hypothesis 6b*). Lastly, it was hypothesized that changes in quality of task motivation (self-determined vs. non-self-determined) and type of goal content (intrinsic vs. extrinsic) would significantly explain variance in the expected changes in behaviour in the resource dilemma as a result of the addition and removal of the centralized sanctioning system (*Hypothesis 7*).

2. Study 1

2.1. Objectives of study 1

The objectives of Study 1 were to (a) expand on previous research examining Self-Determination Theory and individual proenvironmental behaviours into the area of cooperative, interpersonal behaviours, and (b) to provide a pathway model by which general environmental motivation can be shown to predict task-specific goal content, which then will predict behaviour in a resource dilemma.

2.2. Method

2.2.1. Participants and procedure

A sample of first-year university students from a Canadian university enrolled in an introductory psychology course participated in this lab-based study in exchange for a course credit (sample size $N = 66$). A power analysis using G*Power 3 showed that a sample size

of $N = 58$ would be sufficient for the one-tailed individual beta t-tests (in G*Power, found under *t*-test, Linear Multiple Regression: fixed model, single regression coefficient) for the predictors in a multiple regression with five predictors with power set to 0.80, an alpha rate of 0.05, and effect sizes of $f^2 \geq 0.11$. When designing the experiment, and since the interest in a mediation analysis is generally on the individual beta values, a sample size of 60 or above was deemed appropriate in detecting moderate effect sizes for the individual beta t-tests for the largest (i.e., largest number of predictor variables) of the multiple regressions that would be used in the bootstrapped mediation analysis. A post hoc power analysis was conducted for the omnibus tests for each of the linear multiple regressions performed in the bootstrapped mediation analysis and can be found in Table 2.

The mode for responses for the age range of participants was '18 to 20' (78.8%) years of age. The majority of participants were female ($n = 45$), with 21 male participants. Most participants were Caucasian ($n = 44$), with a smaller sampling from other ethnicities. Prospective participants were invited to participate in a lab-based study under the premise that they would be participating in conjunction with a real partner, which was actually simulated using the resource dilemma program.

On arriving at the experimentation room, the study was explained to the participants, who were then given time to give informed consent. Afterwards, participants were given the *Motivation Toward the Environment Scale* to complete. Once this was done, participants completed 12 practice trials of the *Little Gull Lake Task*. Following this, participants conducted upwards of 48 real trials of the Little Gull Lake Task. Once the Little Gull Lake Task was completed, participants were given the goals questionnaire to complete on their own. Following this, participants were debriefed on the nature of the deception involved in the study. Any participants that answered that they did not believe the premise of their 'partner' during the debriefing would not have their data included in subsequent analyses; however, no participants were excluded on this basis.

Experimental Task: The Little Gull Lake Task. The Little Gull Lake Task is a real-time, virtual microworld, iterative, partnered resource dilemma, comparable to Gifford's FISH task (Gifford & Gifford, 2000). However, the Little Gull Lake Task is based on recreational fishing, and was created for the purpose of this research in order to be able to introduce a centralized sanctioning system into the resource dilemma in study 2. Otherwise, the two tasks are fairly comparable, with the exception of these differences, as Gifford's FISH task has proven useful in previous research (e.g., Cooke, Fielding, & Louis, 2016; Sheldon, Wineland, Venhoeven, & Osin, 2016).

In the Little Gull Lake Task, participants were asked to imagine that they had decided to live a nice, quiet life on a lake called Little Gull Lake. They had one neighbour that lived on the other side of the lake. They went out fishing on the lake every day, as did their neighbour. Each round would represent a month, during which time they needed to decide how many fish they would have been likely to keep (earning them $10 in in-task currency), and how many fish they would have thrown back (added back to the total population of the lake). Participants were made aware that after each round, the number of fish in the lake would replenish itself by a certain amount. On the interface for the Little Gull Lake Task, participants were able to see how many fish they caught that round, how many fish their 'neighbour' (i.e., the simulated partner) caught that round, what round they were on, how many fish were left in the lake, how much money they have made cumulatively off the fish they decided to keep, and how much money their neighbour had made so far.

The simulated partner would throw back varying amounts – between 60% and 73% (18–22 out of 30 fish, averaging to 20 fish) – of the fish that they caught each round, ensuring that whatever the goals were of the participant, they would not be thwarted by the behaviour of the simulated partner (Kerr & Kaufman-Gilliland, 1997). In addition, the program was constrained to draw 30 fish per round for both the participant and the simulated partner, or otherwise simply divide the number of fish left between the participant and the simulated partner. The program always started with 200 fish. The replenishment rate for the fish population was set at 20 fish per round.

Table 1
Descriptive statistics and correlations between variables for study 1 with and without transformations for sustainable behaviour in the little gull lake task.

Variable	*M*	*SD*	2	3	4	5	6	7
1. SB in LGLT (untransformed)	146.77	*103.20*	–	.21	.44**	-.33**	-.50**	-.37**
2. SB in LGLT (transformed)	11.40	*4.16*	–	.11	.30*	-.34**	-.49**	-.32**
3. SD Motivation	4.57	*.85*		–	.36**	.02	-.24	-.31*
4. Intrinsic Goal	3.27	*1.81*			–	.06	-.13	-.08
5. NSD Motivation	2.91	*.71*				–	.15	-.04
6. Extrinsic Goals	3.05	*1.69*					–	.29*
7. Reactive Goals	3.46	*1.48*						–

Note. SB = sustainable behaviour, the number of fish left in the lake at the end of the task, LGLT = Little Gull Lake Task, the experimental task used in this research, SD = Self-Determined, NSD = Non-Self-Determined. The transformed data for the SB in LGLT was the square root of the untransformed data used to correct for excess kurtosis in this variable. $^*p < .05$, $^{**}p < .01$.

2.2.2. Measures

Motivation Toward Environmental Behaviours. Participants' motivation to perform pro-environmental behavior in the context of their general lives was assessed using the Motivation Toward the Environment Scale which has been validated in previous studies (Pelletier et al., 1998; Villacorta et al., 2003). In agreement with past studies, for each participant, items from the identified, integrated and intrinsic subscales were averaged to form a self-determined motivation (SDM) index, while items from the introjected regulation, external regulation and amotivation subscales were averaged to form a non-self-determined motivation (NSDM) index. Table 1 shows the means and standard deviations for the SDM and NSDM indices. The Cronbach's alpha for the SDM index was 0.89, while the alpha for the NSDM index was 0.80.

Goals. Participants' goals during the Little Gull Lake Task were assessed using a novel questionnaire that was designed for the purposes of this research. The questionnaire contained 6 items pertaining to different goals that a person may have during the Little Gull Lake Task: (1) "to make more money than the other person", (2) "to keep my earnings even with the other person", (3) "to make the most money that I could every round", (4) "to return as many fish as I could to the lake every round, regardless of my total earnings", (5) "to throw back just enough to keep the population stable", and (6) "my strategy varied throughout all of the trials as I was trying to figure out how the other person was going to behave". Participants rated their responses on a 1 to 7 Likert rating scale (1 = does not correspond at all, 4 = corresponds moderately, 7 = corresponds exactly). A Principal Components Analysis (PCA) was performed in order to reduce the number of variables regarding goals. Three components with Eigenvalues greater than 1 were discovered, and together explained 71.5% of the variance. Component 1 (goals 1 and 3) was labeled "extrinsic goals"; Component 2 (goal 2 and 6) was labeled "reactive goals"; and Component 3 (goal 4) was labeled "intrinsic goal". Goal 5 "to throw back just enough to keep the population stable" had a negative loading on the Reactive Goals; so, in order to keep conceptual simplicity of this component, this goal was omitted from future analyses. Components were calculated by averaging scores for the goals that comprise them. Table 1 has the means and standard deviations for the three components.

2.3. Results

Descriptives for each variable and inter-variable correlations can be

seen in Table 1. The data was cleaned according to recommendations by Tabachnick and Fidell (2007). The dependent variable, the number of fish in the lake after the task was over, was found to be somewhat non-normal (kurtosis value > 3), and thus a square-root transformation was done on this variable in order to remove the influence of the non-normality of the data on the relevant parametric inferential statistics. The descriptives and bivariate correlations with the untransformed data as well as the transformed data can be seen in Table 1. Conclusions regarding intervariable correlations should be/are drawn from the transformed data to remove the bias of the kurtosis. Since the main analysis using this variable is a bootstrapped mediation analysis, and since this is a known technique for dealing with non-normal data (Tabachnick & Fidell, 2007), the untransformed data regarding the number of fish left in the lake at the end of the task was used for this procedure. The analysis was conducted in SPSS using the MEDIATE bootstrapping macro provided by Hayes and Preacher (2014). In this analysis, SDM and NSDM indices were both used as independent variables (Xs), goals (extrinsic goals, reactive goals, intrinsic goal) were used as the mediators (Ms), and the number of fish left in the lake at the end of the Little Gull Lake Task was used as the dependent variable (Y) as a measure of sustainable behaviour. The number of bootstrapped samples used by the analysis was set to 10,000. A visualization of the full model as supported by the results is presented in Fig. 1. The reporting of the results of the mediational analysis is broken down into four parts: testing the path of Xs to Y, testing the path from Xs to Ms, testing the path from Xs and Ms to Y, and then testing the indirect effects using 95% confidence intervals of the bootstrapped effect statistic. The results of the analysis testing the paths of Xs to Y, testing the paths of Xs to Ms, and testing the paths of Xs and Ms to Y is presented in Table 2; and lastly, the results of the analysis of indirect effects are presented in Table 3.

With respect to the relationships between the independent variables (Xs) and the dependent variable (Y), the results showed the NSDM motivation was a significant negative predictor of sustainable behaviour. While SDM did not have a significant direct effect on the dependent variable on its own, this is not a prerequisite for running a bootstrapped mediation (see Hayes & Preacher, 2014). With respect to the relationships between the independent variables (Xs) and the mediators (Ms), SDM was a significant positive predictor of having an intrinsic goal, a negative predictor of having reactive goals, and a negative predictor of having extrinsic goals. Conversely, NSDM was not a significant predictor of any of the goals. With respect to the relationships between the predictors (Xs) and mediators (Ms) with the dependent variable (Y), the overall model explained 54% of the variance in the dependent variable. With respect to individual predictors, NSDM, extrinsic goals and reactive goals were all negative predictors, while intrinsic goal was a positive predictor of sustainable behaviour. Lastly, three significant indirect effects were identified. Specifically, SDM was found to have a positive indirect effect on sustainable behaviour in the Little Gull Lake Task through increasing intrinsic goal strength, decreasing extrinsic goals strength, and decreasing reactive goals strength.

In sum, *hypothesis 1* was partially supported, as SD motivation was a positive predictor of the intrinsic goal of returning as many fish to the lake as possible every round. *Hypothesis 2* was also supported by the data, as the full model of motivation and goals was a significant predictor of participants' level of sustainable behaviour. Lastly, *hypothesis 3* was partially supported, as SDM had a significant indirect effect on sustainable behaviour in the Little Gull Lake Task through all goals, though NSDM, instead, was shown to have a direct, negative relationship with sustainable behaviour.

2.4. Discussion

Overall, the results of this study provide support for the application of Self-Determination Theory into the realm of cooperative behaviours over finite natural resources. In addition, the successful application of Self-Determination Theory to resource dilemma demonstrates the importance of taking in consideration the type of motivation, and the separation of motivation from goals in predicting cooperative, sustainable behaviour over finite natural resources. The results of the bootstrapped mediation showed that, when taken together, motivation and goals can explain a large portion of the variance in sustainable behaviour (54%), indicating a strong effect.

A pathway model by which motivational quality affects goal content, which, in turn, affects behaviour, was supported by the data. Results showed that the more self-determined a person is, the more they

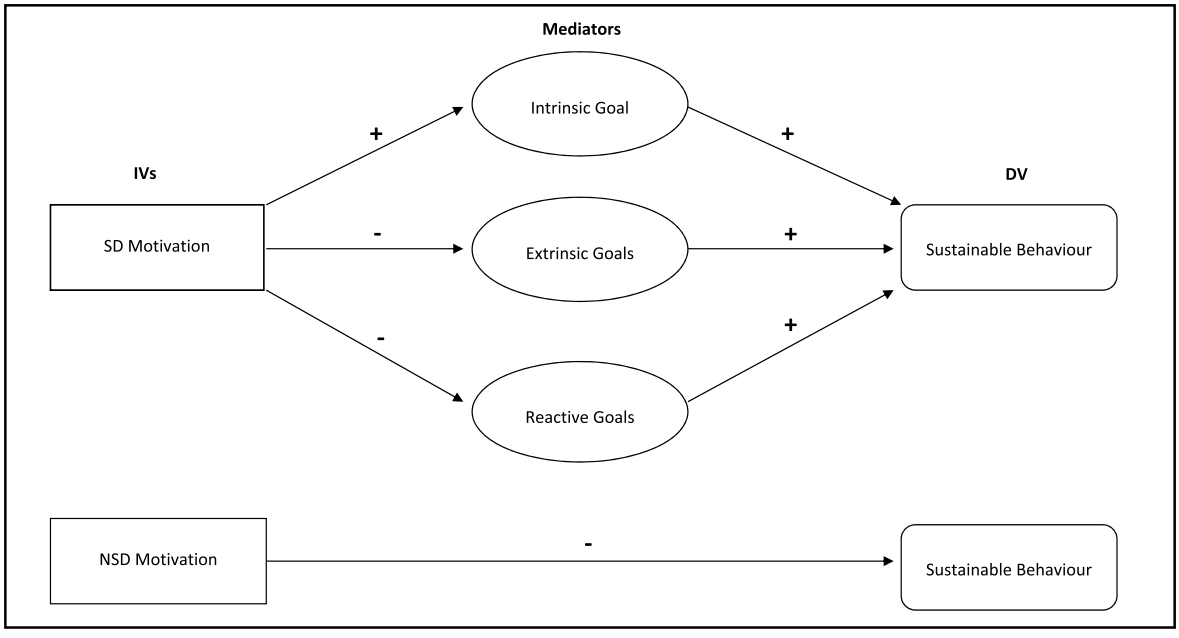

Fig. 1. Diagram of Final Mediation Model – Study 1. Fig. 1. Diagram of the mediation from Study 1. SD = Self-determined, Sustainable behaviour = the number of fish left in the lake at the end of the LGLT, NSD = Non-self-determined. Positive signs between IV and mediators indicate a positive predictive relationship, while negative signs indicate a negative predictive relationship. Positive signs between mediators and DV indicate an overall positive effect of IV on DV through an indirect effect via the mediator. Negative sign between IV and DV indicates a significant negative direct effect.

Table 2
Full bootstrapped mediation results for study 1.

Model	Independent Variable(s)	Dependent Variable(s)	Predictor Statistics			Model Summary				
			b (std. err.)	t	p	R	R^2	F	p	power
Xs predicting Y	SD Motivation	Sustainable Behaviour	26.74 (.14.28)	1.88	.07	.39	.15	5.56	.006	.87
	NSD Motivation		−47.98 (17.11)	2.80	.007					
Xs predicting Ms	SD Motivation	Extrinsic Goals	-.48 (.24)	−1.98	.004	.28	.08	2.65	.078	.69
		Reactive Goals	-.54 (.21)	−2.55	.013	.31	.10	3.30	.04	.75
		Intrinsic Goals	.76 (.25)	3.00	.004	.36	.13	4.62	.014	.82
	NSD Motivation	Extrinsic Goals	.36 (.29)	1.23	.224					
		Reactive Goals	-.06 (.25)	-.23	.819					
		Intrinsic Goals	.13 (.30)	.44	.664					
Xs and Ms predicting Y	SD Motivation	Sustainable Behaviour	−12.44 (12.25)	−1.01	.314	.73	.54	13.61	< .001	.999
	NSD Motivation		−45.07 (13.16)	−3.42	.001					
	Extrinsic Goals		−20.43 (5.88)	−3.48	.001					
	Reactive Goals		−20.01 (6.75)	−2.96	.004					
	Intrinsic Goals		24.44 (5.47)	4.47	< .001					

Note. Statistics are taken from bootstrapped mediation analysis using the MEDIATE macro provided by Preacher & Hayes (2004; 2008) using SPSS. Model summaries provided are for all independent variables predicting the dependent variable within the specific model. Sustainable Behaviour = the number of fish left in the lake at the end of the Little Gull Lake Task. Significant beta coefficients have been bolded for ease of identification.

focus on the health of the resource (i.e., keeping the population of fish sustained or growing), the less they focus on extrinsic rewards, and through these effects, they are more pro-environmental in their behaviour in the resource dilemma. In contrast, NSDM directly predicted acting unsustainably. Moreover, the more a person pursued extrinsic goals or simply reacted to what their partner was doing, the less pro-environmental they were in task. In sum, the overall results of the mediation analysis demonstrate the value of the application of Self-Determination Theory to resource dilemmas, and the importance of considering quality of intraindividual motivation in understanding co-operative, sustainable behaviour.

3. Study 2

In Study 2, we introduced a centralized sanction system into the Little Gull Lake Task. In this system, participants were fined from their in-task cumulative earnings for each round in which they did not throw back enough fish (i.e., for throwing back less than 15 fish), or monetarily rewarded for throwing back more than a sustainable amount of fish (i.e., for throwing back 25 or more fish). Each participant saw both versions of the task in two blocks of trials, with order counterbalanced across 2 groups, creating a 2[order of presentation: sanction system first (SSF) vs. no-sanctions first (NSF)] x2(sanctions vs. no-sanctions) mixed-factorial design, with repeated measures on the second factor. The overall aim of Study 2 was to systematically examine the impact of a centralized sanctioning system on quality of individual motivation, goal content, and behaviour in a resource dilemma, and to determine if changes in motivation and goals could predict changes in behaviour when a centralized sanctioning system is added/removed.

3.1. Method

3.1.1. Participants and procedure

A sample of first-year university students from a Canadian university enrolled in an introductory psychology course participated in this lab-based study in exchange for a course credit (sample size $N = 69$). Mean age of participants was 19.45 ($SD = 1.79$) with a range from 18 to 27. The majority of participants were female (n = 46), with 20 male participants. With respect to ethnicity, participants were Asian (n = 20), Caucasian (n = 28), Hispanic (n = 1), African-American (n = 6), Arabic (n = 6) or 'Other' (n = 7). There was missing demographic data for gender and ethnicity for 3 participants, and missing data for age for 5 participants.

A power analysis using G*Power 3 showed that a sample size of $N = 68$ would be sufficient for power at .80 in detecting effect sizes of $\eta_p^2 \geq 0.11$ (using the option to estimate effect sizes as done in SPSS, as this was the statistical software used for the analyses, and not doing so essentially "double counts" the correlation among repeated measures) for the repeated measures ANOVA with a within-between interaction in Study 2.

On arrival, participants were explained the parameters and requirements of the experiment and given a consent form to sign before proceeding. Participants were randomly assigned to two groups, which would determine the order of presentation of the two version of the Little Gull Lake Task. As such, one group was called the No-Sanction First (NSF) group, which saw the sanction-free version of the Little Gull

Table 3
Bootstrapped mediation results for indirect effects for study 1.

Model	Independent Variable	Mediator	Indirect Effects		
			Effect Coefficient	LLCI	ULCI
Indirect Effects of Xs on Y through Ms	SD Motivation	Extrinsic Goals	9.82	1.59	22.27
		Reactive Goals	10.79	1.81	25.81
		Intrinsic Goal	18.58	6.24	36.52
	NSD Motivation	Extrinsic Goals	−7.31	−23.50	6.68
		Reactive Goals	1.16	−8.83	14.77
		Intrinsic Goal	3.24	−13.57	6.93

Note. Statistics are taken from a bootstrapped mediation analysis using the MEDIATE macro provided by Preacher & Hayes (2004; 2008) using SPSS. Statistics shown are indirect effects of the independent variables (Xs) on the dependent variable (Y; the number of fish left in the lake at the end of the task) through the mediators (Ms). Effect coefficients that have an LLCI and an ULCI that contain zero (i.e., that have a 95% confidence interval that contains zero effect) are considered non-significant. LLCI = lower limit confidence interval, UCLI = upper limit confidence interval, based on 95% confidence intervals of the effect coefficient. Significant beta coefficients have been bolded for ease of identification.

Table 4
Descriptive statistics and correlations between variables for study 2 for the sanction and No-Sanction conditions.

Variable	No Sanctions		Sanctions						
	M	*SD*	*M*	*SD*	1	2	3	4	5
1. SB in LGLT	136.12	*72.11*	172.19	*76.03*	–	.41**	.56**	-.01	-.57**
2. SD Task Motivation	4.86	*.98*	4.90	*.95*	.30*	–	.36**	.29*	-.28*
3. Intrinsic Goal	3.15	*1.62*	3.17	*1.71*	.45**	.29*	–	.11	-.38**
4. NSD Task Motivation	3.06	*.85*	3.39	*.90*	-.29**	.08	-.13	–	.05
5. Extrinsic Goals	3.12	*1.67*	3.42	*1.73*	-.54**	-.27*	-.44**	.53**	–

Note. SB = sustainable behaviour, measured by the number of fish left in the lake at the end of the task, LGLT = Little Gull Lake Task, SD = Self-Determined, NSD = Non-Self-Determined. Bivariate correlations shown above the diagonal represent the correlations for the no-sanctions condition, whereas bivariate correlations shown below the diagonal represent the correlations for the sanction condition. *$p < .05$, **$p < .01$.

Lake Task in Block 1, and the sanction-present version of the Little Gull Lake Task in Block 2. Conversely, the other group was called the Sanction System First (SSF) group, which saw the sanction-present version of the Little Gull Lake Task in Block 1 and the sanction-free version of the Little Gull Lake Task in Block 2. This was done in order to counter-balance the order of presentation of the two task versions. The same deception was used in this study as was used in Study 1.

Participants first completed the Motivation Toward the Environment Scale on their own. Afterwards, they did 12 practice trials of the Little Gull Lake Task by themselves in order to get oriented with the task, as was done in Study 1. Following this, participants began Block 1, in which they first completed 30 rounds of the Little Gull Lake Task with their simulated partner, with the version of the task used in Block 1 dependent on their group membership. Following the first block of trials in the Little Gull Lake Task, participants completed the Task Motivation Scale, the Strategy Choice in Little Gull Lake Task Scale, and the Task Aptitude Scale. Once all of these measures were filled out, participants then moved on to Block 2, where the same procedure was repeated except for the change in task version for the Little Gull Lake Task (participants that saw the sanction-free version would then see the sanction-present version, and vice versa). When participants had finished completing the experimental measures (the same measures repeated from Block 1) for Block 2, they were debriefed and questioned about their belief in the genuineness of their simulated partner. Any participants that answered that they did not believe the presence of their 'partner' during the debriefing would not have their data included in subsequent analyses; however, no participants were excluded on this basis.

3.1.2. Measures

Motivation Toward Environmental Behaviours. Participants' overall motivation to perform pro-environmental behaviour in the context of their general lives was assessed using the same scale as was used in Study 1 (Pelletier et al., 1998).

Task Motivation. Participants' levels of self-determined and non-self-determined motivation within the specific context of the Little Gull Late Task were assessed using an adapted version of the questions on the Motivation Toward the Environment Scale to be context-specific to the Little Gull Lake Task. The scale begins with the stem, "I chose to act the way I did during the task because …" to which participants give their responses to the items on a Likert rating scale ranging from 1(Does Not Correspond at All) to 7(Corresponds Exactly). The no-sanction version of the Task Motivation Scale consisted of 18 items, with three items each reflecting the six motivational subscales of Self-Determination Theory. An example of an intrinsic item is "Because I enjoyed seeing the lake flourish"; an example of an integrated item is "I felt like acting that way was consistent with who I am"; an example of an identified item is "I value the health of the environment, so I wanted to act as sustainably as I could in the task"; an example of an introjected item is "I would have been ashamed of myself if I did not throw back enough fish"; an example of an external regulation item is "I felt it was expected of me to act that way"; and finally, an example of an amotivated item is "I don't really know; I didn't really see the point to any of it". The version of the scale created for the Little Gull Lake Task with sanctions present had two additional items, namely "I wanted to get as many of the rewards as I could" and "I wanted to avoid as many punishments as possible", which were used to supplant the item "the money was quite important to me", which was instead removed for the sanctions version of the questionnaire in order to keep the relative balance of the number of items per subscale as even as possible for both versions. For both the no-sanction and sanction versions of the scale, items corresponding to the intrinsic, integrated and identified motivational subtypes were averaged to form a SDM index, while items corresponding to the introjected, external regulation and amotivation motivational subtypes were averaged to form a NSDM index. For the sanction-free version of the scale, the reliability (as evidenced by Cronbach's Alpha) for the SDM index was $\alpha = .83$. The reliability for the NSDM index was $\alpha = 0.73$. For the sanction-present version of the scale, the reliability for the SDM index was $\alpha = 0.82$, while the reliability for the NSDM index was $\alpha = 0.76$.

Goals. Participants' goals during the Little Gull Lake Task were assessed using the same scale as was used in Study 1, namely the Strategy Choice in the Little Gull Lake Task Scale. The same goal composites that were used in Study 1 were also replicated in Study 2 (see Table 4). However, in Study 2, our hypotheses only dealt with the extrinsic goals and the intrinsic goal.

Aptitude. Participants' feelings of mastery surrounding the Little Gull Lake Task were assessed using a scale that consists of 9 items. Five positively worded items were used "I knew what I was doing", "I was able to accomplish the goals that I wanted to accomplish", "I understood the task well", "If there was something I did not understand at first, I could figure it out for myself", and "I mastered the task by the time it was finished"; and four negatively worded items were used "I was not able to achieve the goals I wanted during the task", "I did not feel like I was very good at the task", "I was confused during most of the task", and "I did not really grasp the rules/guidelines of the task as much as I wanted to". Participants gave their responses using a 1(Does Not Correspond at All) to 7(Corresponds Exactly) Likert rating scale. All items were averaged to create an index of participants' feelings of personal competence. The overall reliability for the scale for Block 1 was $\alpha = 0.78$ and for Block 2 was $\alpha = 0.74$.

3.2. Results

3.2.1. Correlations and descriptives

Means, standard deviations, and inter-variable correlations for all variables for the no-sanctions and the sanction conditions data are presented in Table 4. All variables were checked and cleaned for normality, univariate outliers, and multivariate outliers ($n = 1$) according to the recommendations of Tabachnick and Fidell (2007) using the same procedures outlined in Study 1.

3.2.2. Control checks

Before moving into hypothesis testing, we examined whether participants were able to understand and master the Little Gull Lake Task by measuring participants' self-reported aptitude with respect to the task. The mean for aptitude in the no-sanction condition was $M = 5.97$ ($SD = 0.70$), while the mean for the sanction condition was $M = 6.05$ ($SD = 0.64$). Moreover, there was no significant difference between conditions on participants' ratings of aptitude, $t(63) = 1.13$, $p = .262$.

Another control check that was performed was to make sure that the two groups (SSF vs. NSF) were not different from each other with respect to general environmental motivation prior to beginning the experiment. The results of the *t*-test examining means for general environmental SDM found no significant difference between the SSF and NSF groups, $t(63) = 0.31$, $p = .758$. Likewise, the results of the *t*-test examining means for general environmental NSDM found no significant difference between the two groups, $t(63) = 1.32$, $p = .191$. Thus, the two groups were equal in their general environmental motivation.

We also checked whether scores on the Task Motivation Scale correlated appropriately with scores on the Motivation Toward the Environment Scale, as a means of providing some construct validity to the Task Motivation Scale via a convergent validity test between the two scales. Thus, we created individual SDM and NSDM indices for both scales. Results showed that the general environmental SDM index for the Motivation Toward the Environment Scale correlated positively and significantly with the task-specific SDM index of the no-sanctions version of the Task Motivation Scale ($r = 0.61, p < .01$) and the sanctions version ($r = 0.52, p < .01$), but did not correlate with the task-specific NSDM index for the no-sanctions ($r = 0.07$, $p = .577$) or sanctions version ($r = 0.06$, $p = .629$). Similarly, the general environmental NSDM index from the Motivation Toward the Environment Scale correlated positively and significantly with the task-specific NSDM index of the no-sanctions version of the Task Motivation Scale ($r = 0.41$, $p = .001$) and the sanctions version ($r = 0.39$, $p = .001$), but did not correlate significantly with the task-specific SDM index from either the no-sanctions ($r = 0.17$, $p = .163$) or the sanctions version ($r = 0.12$, $p = .358$) of the Task Motivation Scale. Thus, we considered that the test of convergent validity was successful.

3.2.3. Inference tests

Information regarding cell means for all of the inference tests can be found in Table 5. Visualizations of the means, including 95% confidence interval error bars, for the sanction and no-sanction conditions for each of the dependent variables is provided in Figs. 2–6 in order to help with interpretation of the main repeated-measures effects for all analyses.

Pro-environmental Behaviour in the Little Gull Lake Task. The first set of hypotheses surrounded the effect that the centralized sanction system would have on participants' sustainable behaviour. Since the main objectives of this study were to examine the effect of condition (sanction vs. no-sanction) on various outcomes, we first collapsed the data so that all participants had 'sanction condition' and 'no-sanction condition' data on all relevant variables. Following this, we conducted a 2(condition) x 2(group) mixed-factorial ANOVA with condition

Table 5
Cell means for each group by condition for study 2.

Variable	Group	Condition	
		Sanctions	No-Sanctions
Sustainable behaviour in Little Gull Lake Task	SSF	153.5(*67.71*)	136.5(*60.44*)
	NSF	195.87(*80.42*)	135.63(*85.76*)
SD Motivation	SSF	4.82(*.95*)	4.98(*1.06*)
	NSF	5.00(*.95*)	4.71(*.86*)
NSD Motivation	SSF	3.56(*.85*)	3.08(*.85*)
	NSF	3.18(*.93*)	3.03(*.86*)
Intrinsic Goal	SSF	2.69(*1.35*)	3.14(*1.42*)
	NSF	3.76(*1.94*)	3.17(*1.87*)
Extrinsic Goals	SSF	4.04(*1.47*)	3.40(*1.51*)
	NSF	2.66(*1.74*)	2.78(*1.82*)

Note. Information presented in reg. font represents the means, while information presented in italics in parentheses represent the standard deviations.

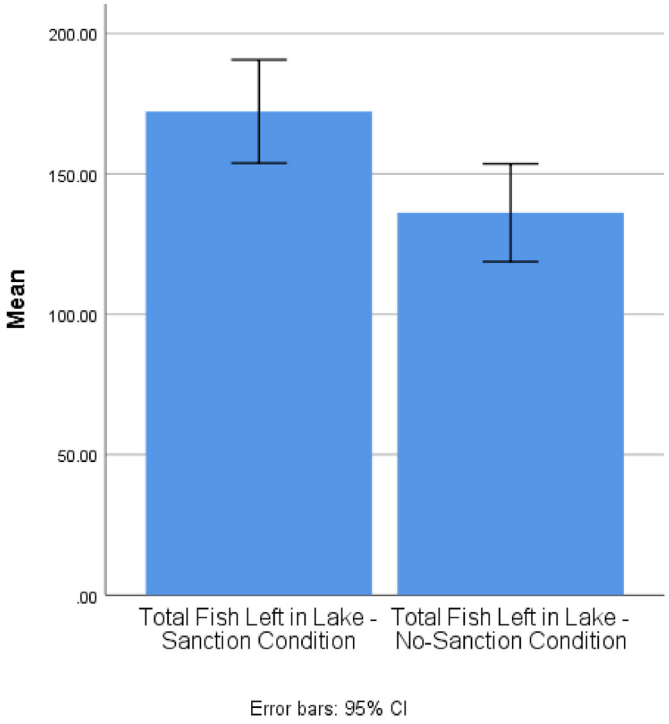

Fig. 2. Mean Number of Fish Left in Lake by Condition – Study 2. Fig. 2. Bar graph with 95% confidence interval error bars showing the mean number of fish left in the lake at the end of the task in Study 2.

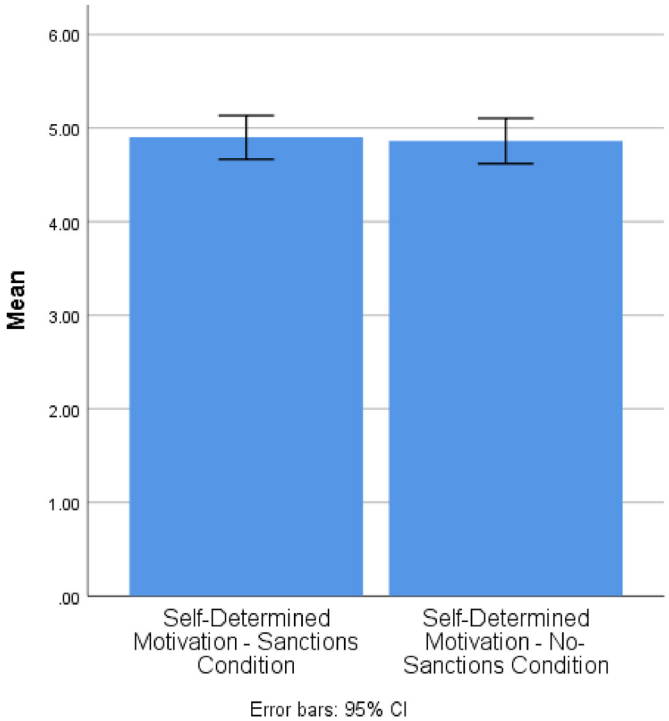

Fig. 3. Means for Self-Determined Motivation by Condition – Study 2. Fig. 3. Bar graph with 95% confidence interval error bars representing the means for each condition for Self-Determined motivation in Study 2.

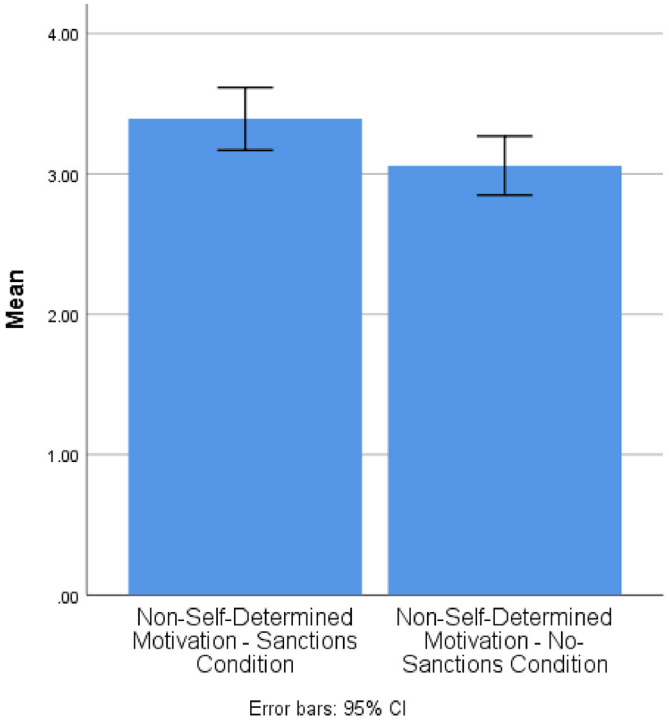

Fig. 4. Means for Non-Self-Determined Motivation by Condition – Study 2. Fig. 4. Bar graph showing with 95% confidence interval error bar showing the means for non-self-determined motivation for each condition in Study 2.

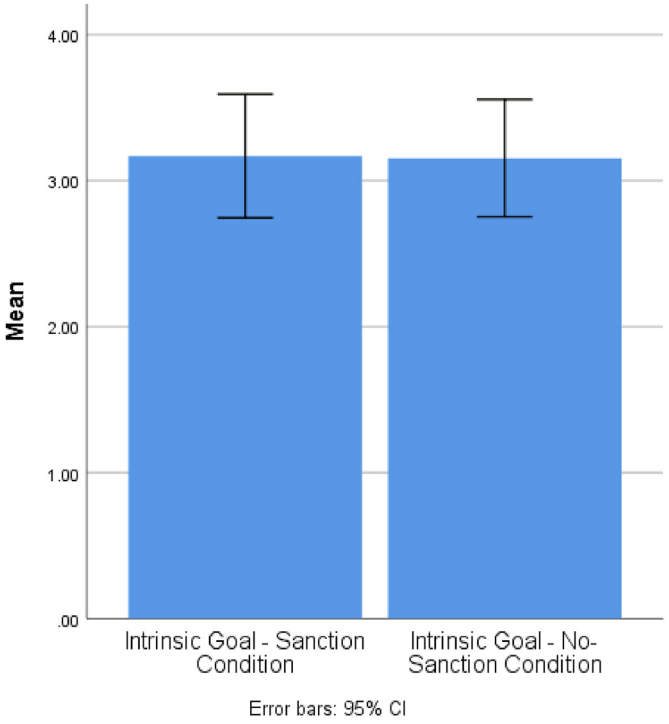

Fig. 5. Means for Intrinsic Goal by Condition – Study 2. Fig. 5. Bar graph with 95% confidence interval error bars showing means for intrinsic goal strength for each condition in Study 2.

(sanction vs. no-sanction) as the within-subjects factor and order of presentation [sanction-system-first (SSF) group and no-sanction-first (NSF) group] as the between-subjects factor. Any significant interaction would demonstrate that order of presentation had a significant impact on the effect of condition on the dependent variable. The number of fish

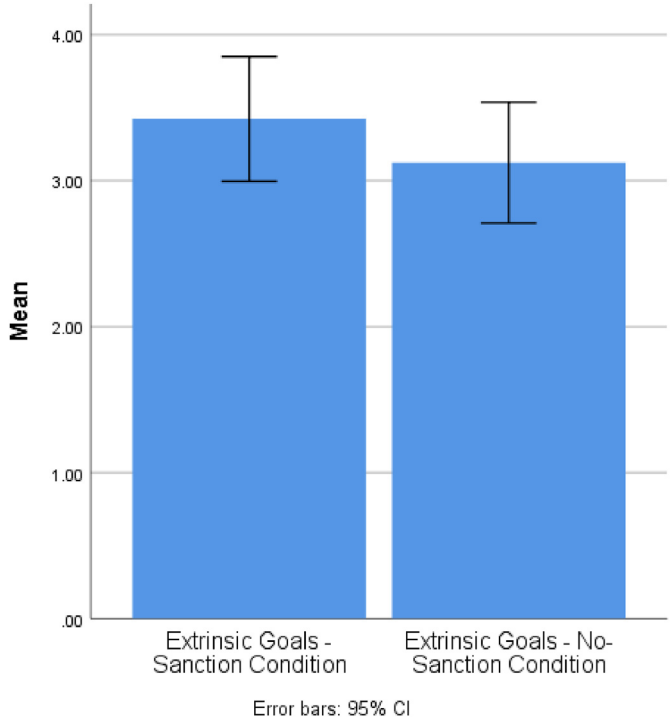

Fig. 6. Means for Extrinsic Goals by Condition – Study 2. Fig. 6. Bar graph with 95% confidence interval error bars showing means for extrinsic goal strength for each condition in Study 2.

left in the lake at the end of the task was used as the dependent variable and was taken to demonstrate participants' level of sustainable behaviour. The results showed a significant interaction between condition and group, $F(1,66) = 18.57$, $p < .0005$, $\eta_p^2 = 0.22$. The main effect of condition was also significant, $F(1,66) = 59.25$, $p < .0005$, $\eta_p^2 = 0.47$; however, the main effect of group was not significant, $F(1,66) = 1.47$, $p = .230$, $\eta_p^2 = 0.02$. With respect to the simple effects for the between-subjects contrasts, the results showed that, in the sanction condition, there was a significant difference for the order of presentation, mean difference = 42.37, 95% CI [6.50, 78.24], $p = .021$, Cohen's $d = 0.57$ (effect sizes for post-hoc tests calculated from Lenhard & Lenhard, 2016), with a lower mean for the SSF group ($M = 153.5$, $SD = 67.71$) than the NSF group ($M = 195.87$, $SD = 80.42$). There was no significant difference between the SSF group ($M = 136.5$, $SD = 60.44$) and the NSF group ($M = 135.63$, $SD = 85.76$) in the no-sanction condition, mean difference = 0.87, 95% CI [-34.57, 36.30], $d = 0.01$. With respect to the simple effects for the within-subjects contrasts, the results showed that, for the NSF group, there was a significant increase in sustainable behaviour from the no-sanction to the sanction condition, mean difference = 60.23, 95% CI [45.26, 75.21], $p < .0005$, $d = 0.73$. For the SSF group, there was a significant decrease from the sanction to the no-sanction condition, mean difference = 17.0, 95% CI [3.70, 30.31], $p = .013$, $d = 27$. Thus, *hypotheses 4a* and *hypothesis 4b* were supported by the data. The addition of the sanction system led to a higher mean number of fish left in the lake at the end of the task in the sanction condition compared to the no-sanction condition for the NSF group (*Hyp. 4a*), while the removal of the sanction system led to a decrease in the mean number of fish left in the lake at the end of the task in the no-sanction condition compared to the sanction condition for the SSF group (*Hyp. 4b*).

Personal Motivation and Goals. The next hypotheses dealt with the effect of sanctions on personal motivation. To test these hypotheses, we conducted a series of mixed-factorial ANOVAs identical to the one used to test *hypotheses 4a-4b*, though with different dependent variables. The first interaction test used the task-specific SDM index as the dependent

variable. The results showed a significant interaction between condition and order of presentation, $F(1,63) = 11.37$, $p = .001$, $\eta_p^2 = 0.15$. Results showed no significant main effect of condition, $F(1,63) = 0.83$, $p = .365$, $\eta_p^2 = 0.01$, and no main effect of group, $F(1,63) = 0.03$, $p = .858$, $\eta_p^2 = 0.001$. Examination of the simple effects for the between-subjects contrasts showed that, in the sanction condition, there was no significant difference between the SSF group ($M = 4.82$, $SD = 0.95$) and the NSF group ($M = 5.00$, $SD = 0.94$), mean difference = 0.19, 95% CI [-0.66, 0.28], $p = .427$, $d = 0.20$; similarly, in the no-sanction condition, there was no significant difference between the SSF group ($M = 4.98$, $SD = 1.06$) and the NSF group ($M = 4.71$, $SD = 0.86$), mean difference = 0.27, 95% CI [-0.22, 0.76], $p = .269$, $d = 0.28$. With respect to the simple effects for the within-subjects contrasts, results showed that, for the SSF group, the change between the sanction and no-sanction conditions was non-significant, mean difference = .17, 95% CI [-0.02, 0.35], $p = .071$, $d = 0.17$; for the NSF group, the results showed a significant increase in task-specific SDM between the sanction and no-sanction condition, mean difference = .29, 95% CI [0.09, 0.50], $p = .005$, $d = 0.32$.

Examination of the direction of the within-subjects differences for the SSF and NSF group in combination with the lack of between-subjects differences in the simple effects contrasts suggested a main effect of Time, as the no-sanction condition for the NSF group would have occurred at Time 1 while the sanction condition would have occurred at Time 2, and vice versa for the SSF group. Thus, a post-hoc test was done in order to corroborate this hypothesis. Another mixed-factorial ANOVA was conducted using Time (Block 1 vs. Block 2) as the within-subjects factor instead of condition. The results of this analysis showed a significant main effect of Time, $F(1,63) = 11.35$, $p = .001$, though no significant interaction or main effect of group was found. Thus, *hypothesis 5a* was not supported by the data. Instead, SDM increased across time as a function of the repetition of the Little Gull Lake Task.

For *hypothesis 5b*, we conducted another 2(condition: sanction vs. no-sanction) x 2(order of presentation: SSF vs. NSF) mixed-factorial ANOVA using the task-specific NSDM index as the dependent variable. The results of this analysis showed no significant interaction between condition and order of presentation, $F(1,63) = 3.68$, $p = .06$, $\eta_p^2 = 0.06$. Examination of the main effects showed a significant main effect of condition on task-specific NSDM, $F(1,63) = 13.79$, $p < .0005$, $\eta_p^2 = 0.18$, with the mean in the sanction condition ($M = 3.39$, $SD = 0.92$) being higher than the mean in the no-sanction condition ($M = 3.06$, $SD = 0.85$). No significant main effect of order of presentation emerged, $F(1,63) = 1.15$, $p = .287$, $\eta_p^2 = 0.02$. Thus, *hypothesis 5b* was supported by the data.

The next hypotheses surrounded the effect of condition on personal goals in the Little Gull Lake Task. Another mixed-factorial ANOVA identical to the ones previously conducted was used to test this hypothesis, with participants' self-reported ratings of their strength of pursuit of the intrinsic goal as the dependent variable. The results showed a significant interaction between condition and order of presentation, $F(1,63) = 11.95$, $p = .001$, $\eta_p^2 = 0.16$. There were no main effects for condition, $F(1,63) = 0.23$, $p = .636$, $\eta_p^2 = 0.004$, or for order of presentation, $F(1,63) = 2.09$, $p = .154$, $\eta_p^2 = 0.03$. With respect to the simple effects for the between-subjects contrast, the results showed a significant difference between the SSF group ($M = 2.69$, $SD = 1.35$) and the NSF group ($M = 3.76$, $SD = 1.94$) in the sanction condition, mean difference = 1.06, 95% CI [0.25, 1.88], $p = .011$, $d = 0.64$; however, there was no significant difference between the SSF group ($M = 3.14$, $SD = 1.42$) and the NSF group ($M = 3.17$, $SD = 1.87$) with respect to the no-sanction condition, mean difference = 0.03, 95% CI [-0.78, 0.85], $p = .935$, $d = 0.02$. For the simple effects for the within-subjects contrasts, the results showed that, for the SSF group, there was a significant increase in intrinsic goal pursuit between the sanction and no-sanction condition, mean difference = .44, 95% CI [0.05, 0.84], $p = .029$, $d = 0.33$. Moreover, for the NSF group, there was a significant increase between no-sanction and sanction conditions, mean difference = .59, 95% CI [0.14, 1.03], $p = .010$, $d = 0.31$. Thus, *hypothesis 6a* was partially supported by the data, though the expected relationship depended on the order of presentation. The pursuit of an intrinsic goal was stronger in the no-sanction condition compared to the sanction condition for the SSF group, which was in line with our expectations; however, pursuit of an intrinsic goal was lower in the no-sanction condition compared to the sanction condition for the NSF group (see Table 5 for cell means and standard deviations). Moreover, participants who saw the sanction condition in Block 2 had stronger intrinsic goal pursuit in the sanction condition than participants who saw this condition in Block 1.

For *hypothesis 6b*, we conducted an identical mixed-factorial ANOVA using participants' pursuit of extrinsic goals as the dependent variable. The results of this analysis showed a significant interaction between condition and order of presentation, $F(1,63) = 12.52$, $p = .001$, $\eta_p^2 = 0.17$. For the main effects, the results showed a significant main effect of condition on extrinsic goal pursuit, $F(1,63) = 4.12$, $p = .046$, $\eta_p^2 = 0.09$, with a higher mean for the sanction condition ($M = 3.42$, $SD = 1.73$) compared to the no-sanction condition ($M = 3.12$, $SD = 1.67$). The main effect of group was also significant, $F(1,63) = 6.65$, $p = .012$, $\eta_p^2 = 0.10$, with a higher overall mean for the SSF group ($M = 3.72$, $SD = 1.49$) than the NSF group ($M = 2.72$, $SD = 1.78$). With respect to the simple effects for the between-subjects contrasts, the results showed a significant difference between the SSF group ($M = 4.04$, $SD = 1.47$) and the NSF group ($M = 2.66$, $SD = 1.74$) in the sanction condition, mean difference = 1.39, 95% CI [0.59, 2.18], $p = .001$, d = 0.86; however, there was no significant difference between the SSF group ($M = 3.40$, $SD = 1.51$) and the NSF group ($M = 2.78$, $SD = 1.82$) in the no-sanction condition, mean difference = 0.63, 95% CI [-0.20, 1.45], $p = .134$, $d = 0.37$. For the simple effects for the within-subjects contrasts, the results showed that, for the SSF group, there was a significant decrease in extrinsic goal pursuit between the sanctions and no-sanction conditions, mean difference = .64, 95% CI [0.35, 0.93], $p < .001$, $d = 0.43$; conversely, there was no significant difference between conditions for the NSF group, mean difference = .12, 95% CI [-0.2, 0.44], $p = .453$, $d = 0.07$. Thus, *hypothesis 6b* was supported by the data.

Hypothesis 7 dealt with explaining the change in behaviour in the Little Gull Lake Task across conditions by using corresponding changes in individual task motivation and goals as predictors. To test this, we created difference scores by subtracting each participants' no-sanction condition data from their sanction condition data on each of the relevant variables (number of fish left in the lake at the end of the task, task SDM, task NSDM, intrinsic goal pursuit and extrinsic goal pursuit). The change scores for SD task motivation, NSD task motivation, intrinsic and extrinsic goal pursuit were used as predictors, while the change score in the number of fish left in the lake at the end of the task was used as the dependent variable in a multiple linear regression. The omnibus ANOVA was significant, $F(4,60) = 2.62$, $p = .043$, $R^2 = 0.15$. With respect to the individual predictors, change in intrinsic goal pursuit strength was the only significant predictor when controlling for all other variables, $b = 9.92$, $\beta = 0.30$, $t = 2.48$, $p = .016$; 95% CI for b [1.91, 17.92]. Thus, the larger the change in intrinsic goal pursuit strength between the conditions, the larger the change in behaviour, such that the larger the drop in strength of participants' pursuit of an intrinsic goal, the larger the drop in the number of fish left in the lake from the sanction to the no-sanction conditions, and vice versa. Thus, *Hypothesis 7* was supported by the data, as 15% (a moderate effect size) of the variance in participants' change in behaviour between conditions can be significantly explained by corresponding changes in intrinsic goal pursuit.

3.3. Discussion

In Study 2, we examined the effect of a centralized sanction system on sustainable behaviour, individual task motivation and goal content in the Little Gull Lake Task. Overall, the presence of a centralized sanction system initially had a positive effect on participants' sustainable behaviour when examining within-subjects effects, as indicated by a 26.5% increase in the number of fish left in the lake in the sanction condition compared to the no-sanction condition. We found that adding the centralized sanction system increased sustainable behaviour, while removing the centralized sanction system decreased sustainable behaviour, with the latter corroborating previous studies (e.g., Chen et al., 2009; Mulder et al., 2006). By examining the simple effects in more detail than previous studies, we were able to uncover additional trends that have not been identified before, namely, that the positive effect of the presence of a centralized sanction system may depend on the timing in which is it presented. The largest positive effect of a centralized sanction system seems to occur when participants are first allowed to conduct the resource dilemma without the centralized sanction system included, and then have the centralized sanction system subsequently added, as indicated by the fact that, in the sanction condition, the NSF group had a significantly higher mean than the SSF group. Interestingly, however, in the no-sanction condition, the means of the two groups were almost identical in this study, showing that behaviour in the no-sanction condition was the same regardless of the order of presentation. Moreover, this shows that the effect of sanctions did not last beyond the presence of the centralized sanction system, with resource consumption returning to baseline when sanctions were removed. Thus, it appears that it is important to first allow participants the chance to understand the task, and internalize their motivation, allowing for more intrinsic goal pursuit before introducing a system of control into the dilemma; when this is done, the addition of the centralized sanction system is significantly more amplified. A likely explanation is that this order of presentation leads to an increase in overall motivation in terms of allowing a self-determined motivation to develop, therefore increasing overall sustainable behaviour in the task.

The competition between the hypotheses of the dominant economic, ego-incentive model and the Self-Determination Theory model showed that a blending of the two approaches seems best. Sanctions can increase sustainable behaviour, but only after participants have been able to experience the task autonomously first without a centralized sanction system present. Also, in general, intrinsic goal pursuit increased over time as a function of repetition of the task; however, in the sanction condition the NSF participants had a higher mean than the SSF participants, showing that, if first allowed to conduct the task autonomously without external incentives, the addition of a centralized sanction system can have a differentially positive impact on intrinsic goal pursuit above and beyond the effect of time alone. In line with this, and with Self-Determination Theory in general, the larger the increase in intrinsic goal pursuit, the larger the increase in sustainable behaviour across conditions as well, as the only significant predictor of change in behaviour across conditions was change in participants' intrinsic goal pursuit.

We also conducted several analyses to uncover the nature of the effect of a centralized sanction system on task SDM and NSDM, as well as goal content and goal pursuit. The results showed that task SDM was unaffected by the centralized sanction system, regardless of overall condition or order of presentation. In contrast, changes in the external context significantly affected task NSDM. In this case, the presence of a centralized sanction system can have a detrimental effect by increasing task NSDM and extrinsic goal pursuit, which, as was shown in Study 1, are not positive predictors of sustainable behaviour in a resource dilemma.

4. General discussion

The overarching aim of the research presented herein was to examine the role of motivation and goals as defined by Self-Determination Theory, when attempting to understand the factors that promote or inhibit cooperative, sustainable behaviour in managing natural resources. The study of resource dilemma provides an excellent avenue for examining the issue of resource management. In the case of the research presented herein, the focus was on recreational fishing and how this activity can be managed sustainably.

The present research uncovered the significant predictive utility of self-determined (compared to non-self-determined) motivation, as well as goal content with respect to sustainable behaviour in a resource dilemma. Where past research has tended to confound these two constructs, the present research points out that motivation and personal goal content can be separated when using Self-Determination Theory as a guiding theoretical framework. Together, motivation and goal content, can explain a large portion of the variance in cooperative behaviour, and may represent important constructs to improve the effectiveness of future interventions surrounding natural resource management.

We also provided evidence of the influence that a centralized sanction system can exert on participants' behaviour, motivation and goals. By using a mixed-factorial design, we were able to uncover nuances in the effect of external incentives on cooperative behaviour in a resource dilemma. To begin with, the efficacy of the centralized sanction system in increasing sustainable behaviour was quite largely affected by the order of presentation. The significant effect of the centralized sanction system was, essentially, seen in the NSF group, showing that participants do best when allowed to first experience the task autonomously, and then to have the sanctions added afterwards. However, the results from the SSF group in Study 2 demonstrated that the positive effect of a centralized sanction system does not extend beyond the presence of that system, such that if the system is removed, sustainable behaviour will decrease and, at best, return back to baseline. Considering the costs of implementing and enforcing such systems in the real world, the question of what has truly been gained by using such becomes a valid concern.

From a theoretical standpoint, specifically relating to Self-Determination Theory, the findings from Study 2 with respect to motivation and goals point to the importance of the order of presentation. The NSF group did not necessarily show any deleterious effect of having the sanctions added after first being given the opportunity to experience the task autonomously. It is probable that, when people are first given an opportunity to act autonomously, this allows them to set a more self-determined course for their motivation and goals. Thus, when sanctions are added, it is not derogatory of the SDM of an individual, nor is it deleterious to the target behaviour. This is in line with a small body of research that has shown that having a profile of motivation that includes equal strengths of SDM and NSDM may not necessarily be a negative motivational state. In education and sports, for example, having mixed-motivations can be useful with regards to some outcomes (Boiché, Sarrazin, Grouzet, Pelletier, & Chanal, 2008; Ratelle, Guay, Vallerand, Larose, & Senécal, 2007). However, when examining the SSF group, we see that the centralized sanction system does have an effect on NSDM and extrinsic goal focus, such that extrinsic goal pursuit is higher, and NSDM is higher. Moreover, the size of the increase in sustainable behaviour for the SSF group in the sanction condition in Block 1 was much smaller than the increase seen in the sanction condition for the NSF group in Block 2. Thus, when participants first perform the task with external incentives present, it seems that this sets an individual on a more externally-oriented course with respect to personal motivation and goals, which will manifest as an overall reduction in behaviour since the important positive driving forces of sustainable behaviour, as seen in Study 1, were SDM and intrinsic goals. Therefore, regardless of any effect of incentives on behaviour, positive or negative, focus should

never be lost on the fact that it may be better to cultivate SDM and intrinsic goal content. Overall, it was the hope of this research that the provision of this knowledge will lead to new and interesting research questions on the role of motivation, as well as goal content when trying to predict cooperative behaviour in a resource dilemma, and a better understanding of the intraindividual effects of utilizing centralized sanctions to induce cooperation over finite natural resources.

4.1. Limitations and future directions

A main limitation that runs through both experiments is the nature of the resource dilemma employed as the experimental task. Although our results provide interesting insights on the possible causal role that motivation, goals and sanctioning systems could have on sustainable behaviour in the context of resource dilemma in a laboratory experiment, the significance of these variables in a natural resource dilemma should be further examined in future research. The Little Gull Lake Task used a 2-person stranger experimental design. While this helps to create good internal validity by reducing the normative influence that an *N*-person design may have on the participant and by increasing the level of confidence in the causal relationships between the variables that were examined, it nevertheless somewhat lessens the generalizability. That is, resource dilemmas in the real world tend to involve many individuals, with the number of confederates sometimes known to the person, and sometimes not. Thus, some caution must be applied to overgeneralizing the findings of the present studies, relative to the actual design of the resource dilemma that was employed. Also, recreational fishing may provide a practical context to test our hypotheses regarding a resource dilemma but it may not be a representative activity for all resource dilemmas or a resource dilemma that is meaningful to all participants. In other words, it may have limited external validity. It may be interesting to see whether our results could be replicated in other contexts important for the population in general because of their significance as a natural resource (ex., access to pure water) or because they may be considered important for our economy (ex., fossil fuels).

Another limitation was the somewhat small sample sizes used our studies. Because this was a lab-based experiment with a relatively long testing time (especially in Study 2), large sample sizes were difficult to achieve. For the regressions in Study 1, the third part of the analysis in which Xs and Ms predicted Y, our sample size did not exceed the general rule of thumb of '$N \geq 50+8m$' (Green, 1991; see also; Tabachnick & Fidell, 2007), where 'm' is the number of predictors; however, the results of this analysis showed a large proportion of statistically significant results, and so further testing was not required within this particular research in order to further boost statistical power beyond what was already achieved. For Study 2, our inference testing could have been underpowered in detecting small effect sizes, particularly for main effects of the between-subjects factor (order of presentation alone, without the within-between interaction). Thus, any future research based on replicating/expanding the results found herein would benefit by utilizing a large sample size in order to overcome this limitation.

While the present studies focused on a resource dilemma, another area of viable exploration would be to examine the same relationships in the context of public goods dilemmas. In a public goods dilemma, participants must decide how much to *contribute* toward a common resource, rather than *harvest* from it. Such research would also have somewhat different implications toward environmental psychology, such as the application of the knowledge generated thereof toward behaviours such as cleaning of public parks, replanting of forested areas, individual contributions to collective pollution such as air pollution from personal automobiles, compared to harvesting behaviours relevant to more traditional resource dilemmas, such as recreational fishing, commercial harvesting of wild species, and foresting.

It may also be interesting to examine the impact of a centralized sanction system on other dependent variables, such as environmental awareness, environmental concern, and quality of life (i.e., well-being). The present research demonstrates that it is important to understand the potential negative effects and practical limitations to the use of centralized sanction in trying to increase cooperative behaviour. However, an important compliment to these findings in the future is addressing the question of how such effects and limitations may be overcome, if possible.

In sum, mismanagement of natural resources constitutes a large part of the problems facing the natural environment in the contemporary world. To date, not much research has examined individual motivation in this context and its importance in determining cooperation of finite resources, with the focus heavily being on interpersonal constructs and processes. However, the present research has shown the importance of separating motivation and goals, and hopefully opened investigative curiosity into the potential for other related constructs, especially those involving internalization to be examined. It is our hope that further research continues to be done in this vein, as it is probable that without such, endeavours to abate the tragedy of the commons are designing interventions with only half the picture in mind.

CRediT authorship contribution statement

Daniel Baxter: Conceptualization, Methodology, Validation, Formal analysis, Investigation, Resources, Data curation, Writing - original draft, Writing - review & editing, Project administration, Visualization. **Luc G. Pelletier:** Conceptualization, Methodology, Resources, Writing - review & editing, Supervision, Project administration, Funding acquisition.

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