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Which Fish is A Deviant? The Social Construction of Fish Species in Greater Yellowstone

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Abstract

The reintroduction and protection of native fish species frequently creates conflict with fish management and policy. This study uses the Social Construction Framework to examine anglers' social construction of nine fish species in the Idaho portion of the Greater Yellowstone Ecosystem. This exploratory study uses a sample of 179 anglers to examine perceptions of fish species, and perceived and desired power of fish species. Despite clearly stated support for native species, findings indicate positive and negative constructions of native and non-native fish species. The native Yellowstone Cutthroat and Bonneville Cutthroat are socially constructed as Advantaged (viewed as powerful and positive) in both descriptive and normative social constructions. Whereas the native Mountain Whitefish and Utah Sucker are socially constructed as Deviants (viewed as powerless and negative) in both the descriptive and normative social constructions. We use multiple independent variables to find predictors of support for the various fish species. The implications of our findings are discussed.

Keywords: Social Construction Framework, Greater Yellowstone Ecosystem, Anglers, Native Fish Species, Fish Management

Introduction

"It's a case of trout versus trout, and in the face-off between native Yellowstone cutthroats (Oncorhynchus clarkii bouvieri) and the intruders on the scene, lake trout (Salvelinus namaycush), the judgment handed down is a no-brainer. The lake trout must go" [1]. This National Geographic quote notes the judgment against lake trout is a "no-brainer;" support should go to the native species. It highlights the allure of the native Yellowstone Cutthroat and a fervor to eliminate non-native species. Examining this issue from a political perspective–addressing the issues of power and looking at policies that address species in protected areas, such as National Parks and their larger ecosystems– calls out a topic neglected in political science literature, the political power that humans give some non-human creatures over others. Why are some species favored over others? In this paper we examine this question looking at fish in the Greater Yellowstone ecosystem (GYE)– a region that draws anglers from around the world and thus faces diverse opinions on how to manage native and non-native fish.

In answering the question, literature suggests that conservation plays a role [2], and that people are more inclined to protect species that are: larger in size, physically attractive, have a humanoid appearance, and/or appear to have greater capacity for feeling and cognition [3-8]. When looking at funding, according to Brown and Flesher [9], about half of federal funds spent on endangered and threatened species go toward the recovery of two fish species, Salmon and Steelhead Trout along the West Coast. This funding of iconic or flagship species is common (and has led to a "conundrum" about conservation prioritization [10]) and leaves many species, including most fish, with limited support.

Additional literature suggests three overarching possibilities: native species garner more support than non-natives [11-13]; people value fish when they know more about the species [14]; and knowledge of the role that a species plays in a larger ecosystem explains species advocacy. All of these possibilities can be found to be true at times, but they do not always prove accurate. For example, the native Mountain Whitefish in Montana is a less-supported native fish. In 2016, thousands of Yellowstone River Mountain Whitefish died due to warm water temperatures [15]. A newspaper noted, "Mountain whitefish are native to Montana, but the species has always taken a backseat to the almighty trout. Anglers prefer big browns and rainbows to the snout-nosed whiteys. The hierarchy is evident even in the data Montana's state wildlife agency has collected over the years" [16]. In this example, and countless others, native fish are not given priority. Similarly, Gibbons' [17] work on amphibians, reptiles, and small mammals, reveals an attitude of overall value when 'importance to the ecosystem' is included but Gascon et al. [18] show that people do not always value species, even when they see a connection to the ecosystem. Overall, knowledge of and valuing species, in our case fish species, is not a perfect relationship. For example, many anglers have knowledge of Lake Trout but prefer support for the native Yellowstone Cutthroat.

In this paper, we attempt to address why some fish species are favored over others as an effort to help decision-makers and managers understand the public perspective on species they manage. With this, we hope to shed light on the role human perceptions and social constructions play in native fish management. We do this

through examining the social construction of fish species, utilizing an important political science theory, the Social Construction Framework [19-20]. This framework classifies subjects, in this case fish species, based on social construction and political power, and thus allows us to determine if social construction, or "the virtue ascribed to a subject by the general public" [21], plays a role in policy development and support. More precisely, we look at descriptive and normative constructions, the value the public places on native and non-native fish species, the amount of power the reference to a species affords, and how this relates to the publics' view of management practices. Our research focuses on the Idaho portion of the Greater Yellowstone ecosystem, and places an emphasis on anglers. Four research questions are examined:

1. Do respondents know which fish are native and which fish are non-native in the region?
2. What are respondents' descriptive and normative constructions of fish?
3. What fish species score highest in normative versus descriptive power?
4. What explains variation of respondents' normative and descriptive power appraisals among native fish?

Addressing these questions will give a baseline for understanding how people view fish in the Idaho portion of the GYE, the "reputation" given to various fish species. These insights into public opinion can then be used to help shape future decision-making concerning the management of fish in this region.

Background

The creation of fish or wildlife policy generally does not include deliberate consideration of a species' reputation, or "social construction." However, a dispute over the construction likely occurs. Within these disputes, individuals, both policymakers and the public, construct an image for a species based on a variety of factors, including level of information and data, cognitive bias, and personal connection to nature, and the natural world. First, the more educated individuals are on a topic, the more likely they will support that topic [14]. Or as explained with the deficit model [22], the public's negative attitudes towards science are due to a lack of knowledge, and if individuals have knowledge, they will support policies based on that knowledge. As an example, Hames et al. [23] found educating individuals on native fish species and the ecological benefits from native fish restoration garners support for practices beneficial to native fish. Second, literature suggests that humans are both rational and emotional creatures [24-25], making decisions based on values, beliefs, and perceptions [26] and decision making is full of cognitive biases [27]. Thus, in regard to our topic of interest, a fish may be valued for its beauty, fight in the catch, or because it evokes positive memories based on an individual's life experiences and emotion-based attitudes about the larger environment or a personal environmental worldview. Examining environmental worldviews has, for 30 years, been predominantly measured by identifying environmental attitudes and beliefs with the New Ecological Paradigm (NEP) scale [28-29]. The NEP rates individuals' views on a scale of agreement between extreme anthropocentrism and ecocentrism. For example, eco-centric anglers may want protections and more power for native fish, while anthropocentric anglers might not concern themselves with native versus non-native fish. This is related to the third factor that can impact an individual's construction of a species, personal connection to nature. This factor (more locally based) stands in contrast to the NEP's more abstract measure of worldviews (more globally based). Rural residents, in particular, often have a more concrete and locally-based understanding of how nature works in their region, rather than a global worldview of the environment [30]. This often fosters a locally-based concern for nature and support for locally-based environmental issues [30]. This may impact social construction via support for more policy power to local native fish species.

Overall, it is important for those involved in fish management to consider the logical (information and data based) basis for influencing how people view fish, along with worldviews and connection to nature.

Theoretical Framework

Determining a species' construction can be difficult, as individuals and groups perceive populations differently. For example, in a dispute concerning the siting of an industry, the industry may be positively constructed by some, due to job creation. Others, however, may negatively construct the industry, highlighting pollution and outsourcing of labor. As Schneider and Ingram [19] and Ingram, Schneider, and deLeon [20] argue, such disputes over the "social construction" of populations are the essence of contemporary policy making; we are bombarded with varying narratives naming good-guys and bad-guys. Eventually, one construction wins and policymakers who support this "winning" description reinforce this construction. In other words, if policymakers construct the industry as positive, a job-creator, they will likely give the industry favorable public policy (tax incentives, etc.) and ensure that the industry is described in media and public opinion as "deserving" of favorable public policies. Schneider and Ingram [19], Schneider, Ingram, and deLeon [31], and Ingram, Schneider, and deLeon [20] contend that public policy largely revolves around such social constructions, specifically focused on positive or negative construction and high or low power. Thus, their framework reveals four social constructions (See Figure 1). Two social constructions are constructed in a positive manner, the advantaged and dependent. Of these, the advantaged also has power, thus they are likely to receive favorable public policy because officials believe the public largely supports entities viewed as positive and powerful [20]. The second social construction, dependents, are also viewed positively, but with low power. With less power, dependents are often viewed as innocent victims, a stigma, thus less likely to receive favorable public policy than the advantaged, although they are considered deserving of favorable public policy. The remaining social constructions have negative constructions, and thus are less likely to receive favorable public policy. Contenders have power but are viewed unfavorably; they do not receive favorable policies but their political power keeps them from receiving punishments from the government. Deviants, on the other hand, are negatively constructed and lack power. Deviants are likely to be punished via public policy because elected officials do not fear the group (they lack political power) and the public will not rally to stop punishment against a negatively constructed group [19].

Figure 1 Here

In interdisciplinary work, the Social Construction Framework (SCF) has been applied to both human and non-human species. Czech, Krausman, and Borkhataria [21] surveyed species' perceptions and power by the number of supporting interest groups. They found birds, mammals, and fish were seen positively and well-supported, receiving strong public policy funding. Conversely, reptiles, amphibians, invertebrates, and microorganisms were viewed negatively, lacked support, and received minimal funding. DeMello [32] also used SCF to explore how human societies shape and define animals through cultural and social lenses, highlighting the varied treatment of species. We build on Czech et al. and DeMello's work to apply SCF to fish species in Idaho's portion of the Greater Yellowstone Ecosystem.

Greater Yellowstone Ecosystem

Greater Yellowstone is home to some of the world's most famous and pristine rivers, including the Missouri, Yellowstone, Madison, Firehole, and Snake Rivers. Anglers from around the world come to fish in this renowned area. Native trout species like Yellowstone

Cutthroat, Westslope Cutthroat, and Bonneville Cutthroat are important to the ecosystem and highly prized [33]. Other native fish include Mountain Whitefish, Arctic Grayling (native to the Missouri River basin in Yellowstone but not to Idaho's GYE), Rocky Mountain Sculpin, various minnows, Mountain Sucker, Longnose Sucker, and Utah Sucker. Non-native species in the GYE include Lake Trout, Rainbow Trout, Brown Trout, Eastern Brook Trout, Kokanee, and Lake Chub, all of which harm Yellowstone Cutthroat [34]. The GYE spans parts of Montana, Wyoming, and Idaho. For our study, we focus on the Idaho portion, which includes famous trout rivers like Henry's Fork and the South Fork of the Snake River, as well as significant but lesser-known rivers such as the Bear River, Fall River, Warm River, Portneuf River, and Blackfoot River.

	Positive Construction	Negative Construction
Strong Power	Advantaged	Contenders
Weak Power	Dependents	Deviants

Source: Schneider and Ingram (1993)

Figure 1: The Social Construction Framework

Figure 2 Here

By focusing on a specific section of the ecosystem, we addressed a subset of native and non-native fish species in this part of the GYE, allowing us to distribute a shorter survey. This research aims to refine our techniques and understand how the social construction of fish species might influence public policy. Limiting our study to Idaho's GYE helps test our research design with the goal of expanding to the larger GYE over time.

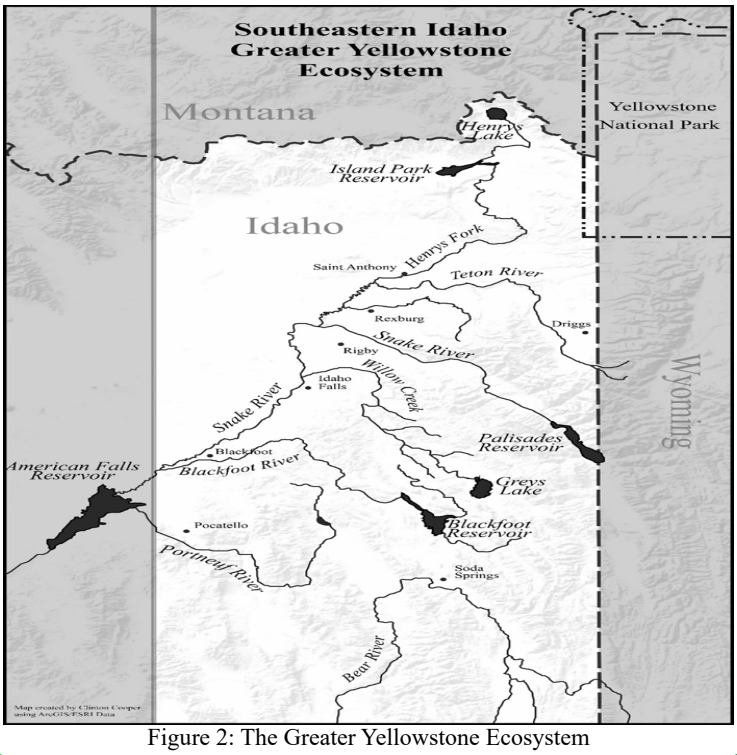

Figure 2: The Greater Yellowstone Ecosystem

The Idaho portion of the GYE has faced fish management disputes. One example is the call to list the Yellowstone Cutthroat as an endangered species, which affects management strategies and can cause conflicts. Idaho developed fish restoration plans to address these varying opinions, including "catch and kill" orders for Rainbow Trout in the South Fork of the Snake River [35], restoration efforts on the upper Henry's Fork [36], and catch-and-release regulations for Yellowstone Cutthroat elsewhere in Idaho [37]. Another dispute involves hybrid "Cuttbows" produced by the reproduction of Yellowstone and Bonneville Cutthroat with Rainbow Trout, which threatens the genetic purity of the native species but is valued by many anglers. Additionally, the Mountain Whitefish, although not as prized by anglers and sometimes mistakenly believed to compete with Yellowstone Cutthroat, co-evolved with them. Idaho allows a bag limit of 25 Mountain Whitefish, despite significant die-offs from parasitic diseases in recent years [38-39]. Lastly, the native Utah Sucker is often considered a "trash fish" by regional anglers, but it co-evolved with Yellowstone Cutthroat and plays a crucial role in the river ecosystem [40]. Fish do not exercise political power like humans, but some species hold more political influence than others. Opinions from individuals and groups like Trout Unlimited give fish a level of political power [41], enabling demands for protection of certain species and reduction of others. Elected officials must balance these opinions to decide which fish to protect [42]. Experts in fish-related agencies use their scientific expertise while reacting to public and official decisions, leading to both conflict and cooperation [43]. Consequently, fish have varying levels of political power, and people can describe which species they think are favored by regulations and which should have power.

In summary, numerous management disagreements in Idaho's GYE are tied to different groups' views on the power of fish species. Anglers play a key role in these discussions, often voicing strong opinions about fish management.

The Case of Anglers and Fish

Many people appreciate fish: watching, catching, eating them. Consequently, understanding how the public views fish is important for understanding management practices. Understanding how anglers, in particular, view fish is even more essential for understanding management practices. Anglers often actively engage with those making the management decisions; they are frequently key contributors for public comments on fish management [44-45]. When addressing fish management issues, anglers are often highly interested both in the fish—maintaining numbers and health of the populations—and in a healthy ecosystem for the fish [45]. Angler support may include native fish restoration, but often anglers focus on supporting the species they like to fish. Thus, at times, anglers even oppose native restoration [44]. Parsing out anglers who support native fish restoration from those who do not can be complex. Arlinghaus and Mehner [44], in an attempt to examine the diverse opinions of anglers, found that anglers who are less consumptive (less likely to keep and eat fish) were more supportive of larger ecological issues including the restoration of native species. Conversely, anglers who are more consumptive in their orientation to fishing were less supportive of these same issues. Accordingly, fly anglers, who tend to be less consumptive in their fishing orientation, are more supportive of ecological issues and restoration practices than bait anglers [46-47]. Supporting this, Bright and Porter [48] and Ropars-Collet, Le Goffe & Lefnatsa [47] show some relationship between fly-fishing and general ecological concern. Furthermore, Bjerke, Thrane, and Kleiven [49] suggest that fly anglers are more supportive of native species than other anglers, although they also find that overall anglers are more environmentally concerned than the general public. Thus, with this research, we focus attention on anglers (fly, bait, and lure), as we examine knowledge and valuing of fish and explore differences that exist in social constructions of fish species. We again suggest furthering this understanding can contribute to better knowledge and practice of native fish management and restoration.

Methods

The goal of this exploratory study is to understand why some fish species are favored over others, how individuals construct fish species, and the impact on public policy. We aim to determine support for policies to restore native fish populations in Idaho's GYE. Understanding how anglers view native and non-native fish can help decision-makers grasp the social and political context of restoring native fish in Greater Yellowstone. Our research questions, focusing on Idaho's GYE, include:

1. Do respondents know which fish are native and which fish are non-native in the region?
2. What are respondents' descriptive and normative constructions of fish?
3. What fish species score highest in normative versus descriptive power?
4. What explains the changes of respondents' normative and descriptive power appraisals among fish species?

To answer these questions, we surveyed self-identified anglers. We developed the email sample by identifying angler groups through media coverage and personal knowledge, then used a snowball sampling technique to gather more stakeholders. This method is suitable for identifying members of a rare population, as fishing license lists are not publicly available in Idaho. Our sample is not representative of all southeastern Idaho anglers but is intended to be exploratory, demonstrating a method of measuring social construction and generating future research questions. After identifying regional fishing and conservation groups and individuals, we sent a SurveyMonkey link and asked recipients to share it with others interested in fish. Media campaigns also promoted the survey and invited public participation. The survey was open for about four weeks. Although anyone could participate, only data from self-identified anglers were used in our results, yielding a sample of 179 respondents.

Our study expands Czech, et al.'s [21] work by asking respondents about their self-perceived general knowledge of fish found in the Idaho portion of the GYE. We then tested respondents' knowledge of native versus non-native fish in the region, asked about the importance of preserving native fish species, and asked about their perceptions (positive or negative) of native and non-native fish species. To determine strong or weak power, we ask respondents the following:

> "Decision makers (elected officials, agency personnel) can influence fish populations through various mechanisms including not stocking certain fish, sterilizing stocked fish, eradicating fish, and reintroducing fish. Using the list of fish species from Greater Yellowstone, indicate the level of support that you think decision makers currently provide in maintaining these fish populations. A high level of support means that you think decision makers spend considerable time and resources trying to maintain a fish population, a low level of support indicates that you believe decision makers do not spend time or resources trying to maintain this fish population."

This question measured how much descriptive power the respondent believed each fish species currently possesses.

To measure how much power the respondents would like to see each fish species possess (normative power), we used this prompt:

> "Once again you are presented with a list of fish species found in southeast Idaho rivers. This time, indicate what level of support you would like to see for decision makers maintaining these fish populations. A high level of support means you would like to see decision makers work to maintain a population of fish. A low level means you don't want decision makers to work to maintain a fish population."

Responses to these survey questions determined the social construction of each fish species. For example, if a respondent

reported a positive view of the Yellowstone Cutthroat, and believes the species has power, the Yellowstone Cutthroat would be advantaged (positive construction, high power). This suggests the species is deserving of favorable public policy in the eye of the respondent. Furthermore, this respondent may want the Yellowstone Cutthroat to have strong political power, so the respondent's normative construction of the species is advantaged.

Independent Variables

We also asked whether a fish species was native to the Idaho region of the GYE, to create a Knowledge Index, and looked at how respondents' worldviews and connection to nature might impact their view of fish. We included the short version of the New Ecological Paradigm (NEP) [29] to measure the respondent's environmental worldview (see Appendix A). Recognizing that the NEP is global and abstract in its application, and that it might not play well with rural individuals whose connection to nature is less abstract [30], we also developed a connection-to-nature-index (Connection Index). This Connection Index asked 14 true or false questions (see Appendix B) about rivers and fish, and mammals, insects, and terrestrials that live along river systems. In addition, we asked standard demographic questions including age, education, gender, political ideology, rural-urban (via size of town the respondent spent the majority of their life in before age 18), along with if they fish and whether they primarily fly-fish, bait fish, or fish with lures. Fly fishing was measured by creating a dummy variable of respondents who fly fish all of the time or most of the time and those who do not do either. The demographic questions, age [50], education [51], gender [52], political ideology [53], and rural-urban [54], are all standard demographic questions that are frequently used and well validated in studies of individual environmental concern. Finally, as discussed earlier, an individual's choice of fishing method (fly fishing, lure, bait) may influence their support of fishery management decisions [49], thus, we included a question about fishing preference and used it as an independent variable. There were some correlations between these variables but a multicollinearity analysis showed VIF statistics all under 1.78 for the independent variables.

Dependent Variable

We use the difference between the respondents' descriptive and normative power ratings for each native fish species as dependent variables. For example, if a respondent evaluated the Mountain Whitefish as having a descriptive power rating of 3 and a normative power rating of 4, the score would be +1. This measure allows us to determine the differences in how much political power each respondent thinks each native fish has (descriptive power) versus how much political power it should have (normative power).

Results

The survey results shed light on our research questions.

Research Question 1: Do respondents know which fish are native and which fish are non-native in the region?s

Table 1 demonstrates a vast majority of respondents correctly identified the Yellowstone Cutthroat (97%), Bonneville Cutthroat (80%), and Mountain Whitefish (73%) as native fish. The Utah Sucker was correctly identified as native 54% of the time. Table 2 shows that non-native fish were less frequently correctly identified: Rainbow Trout were correctly identified as non-native by 64% of the respondents, Brown Trout by 65%, Brook Trout by 60%, Arctic Grayling (again native to Yellowstone National Park but not southeast Idaho) by 51%, and the Kokanee by 59%. The average percentage score on the nine knowledge questions was 6.2, or 68.8% correct.

Bonneville Knowledge		
	N	%
Incorrect	29	16.2%
Correct	144	80.4%
Missing System	6	3.4%

Yellowstone Knowledge		
	N	%
Incorrect	3	1.7%
Correct	173	96.6%
Missing System	3	1.7%

Whitefish Knowledge		
	N	%
Incorrect	39	21.8%
Correct	131	73.2%
Missing System	9	5.0%

Sucker Knowledge		
	N	%
Incorrect	75	41.9%
Correct	96	53.6%
Missing System	8	4.5%

Table 1: Incorrect and Correct Identification of Native Fish

Rainbow Knowledge		
	N	%
Incorrect	61	34.1%
Correct	115	64.2%
Missing System	3	1.7%

Grayling Knowledge		
	N	%
Incorrect	78	43.6%
Correct	91	50.8%
Missing System	10	5.6%

Brook Knowledge		
	N	%
Incorrect	64	35.8%
Correct	108	60.3%
Missing System	7	3.9%

Brown Knowledge		
	N	%
Incorrect	58	32.4%
Correct	117	65.4%
Missing System	4	2.2%

Kokanee Knowledge		
	N	%
Incorrect	64	35.8%
Correct	106	59.3%
Missing System	9	5.0%

Table 2: Incorrect and Correct Identification of Non-Native Fish

Research Question 2: What are respondents' descriptive and normative constructions of fish?

Figure 3 shows the relative rankings (1 to 9) of fish species along the dimensions of perception of fish species (positive to negative) and power the fish species has in terms of management practices and public policy (descriptive power ranked high to low). The species respondents viewed as most positive were the Yellowstone Cutthroat, Bonneville Cutthroat, Rainbow Trout, and Brown Trout. The species viewed as most negative were the Utah Sucker, Mountain Whitefish, Brook Trout, and Arctic Grayling. In terms of power, respondents believed the Yellowstone Cutthroat, Rainbow Trout, Bonneville Cutthroat, and Brown Trout, in that order, had the most power. Overall, the Yellowstone Cutthroat, Bonneville Cutthroat, Rainbow Trout, and Brown Trout were all constructed as advantaged while the Utah Sucker, Mountain Whitefish, and Arctic Grayling were all constructed as deviant. The Kokanee and Brook Trout were both constructed as contenders. Most notably, of the four fish species constructed descriptively as advantaged, two (Rainbow Trout and Brown Trout) were non-native. At the same time, the Utah Sucker and Mountain Whitefish, native fish, were constructed as deviant. This trend, represented by the fact that the data points progress from the upper-left to the lower-right, shows an expected social construction: those species viewed positively are supported with power via policy, while those viewed negatively are not supported with power via policy.

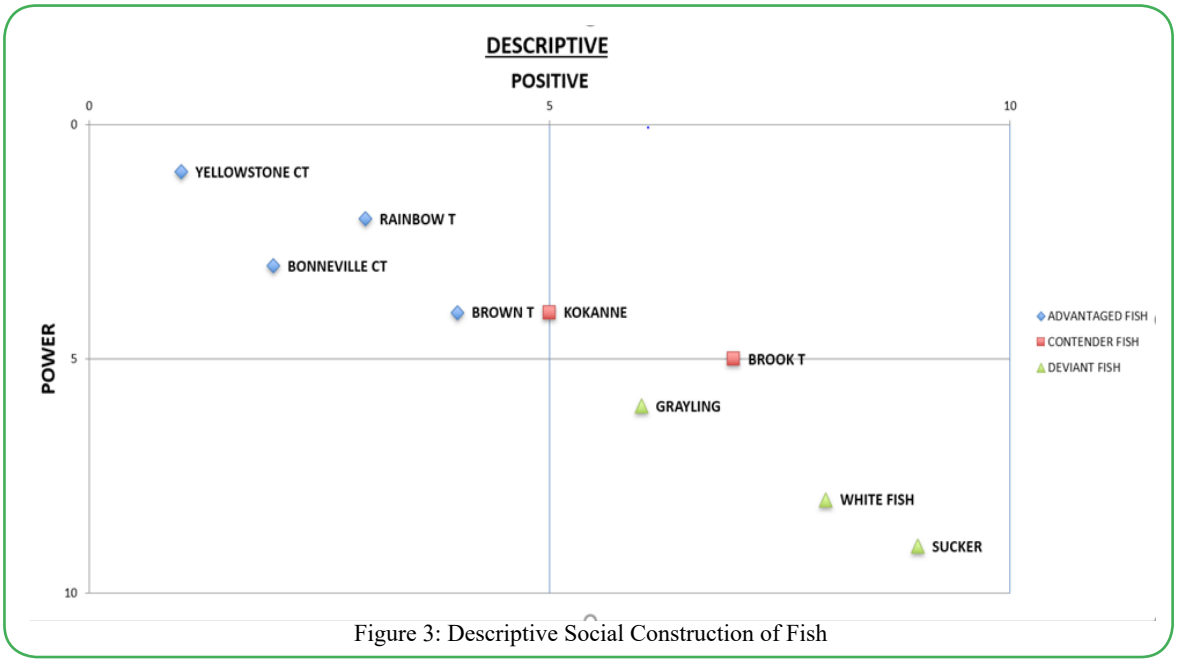

Figure 3: Descriptive Social Construction of Fish

Note. The placement on the grid represents a relative ranking for each fish species on the grid's two dimensions.

Though not presented in a table, 89% of respondents agreed that preserving native species is important to the Southeast Idaho region of Greater Yellowstone. Figure 4 shows rankings of the normative social construction of fish species. There were no obvious changes in the respondents' own perception of the fish, but results of desired power were somewhat different than perceived power. The relative normative power rankings reveal the Yellowstone Cutthroat, Bonneville Cutthroat, Rainbow Trout, and Brown Trout have the most normative power and are categorized as advantaged as they were in the descriptive social construction. The Utah Sucker, Mountain Whitefish, Brook Trout, and Arctic Grayling have the least relative normative power and were constructed normatively as deviant. The Kokanee remained a contender and was nearly in the middle of the 2 x 2 grid. Thus, mirroring the descriptive construction, two of the four species normatively constructed as advantaged are non-native (Rainbow Trout and Brown Trout) and two of the four species normatively constructed as deviant are native (Mountain Whitefish and Utah Sucker).

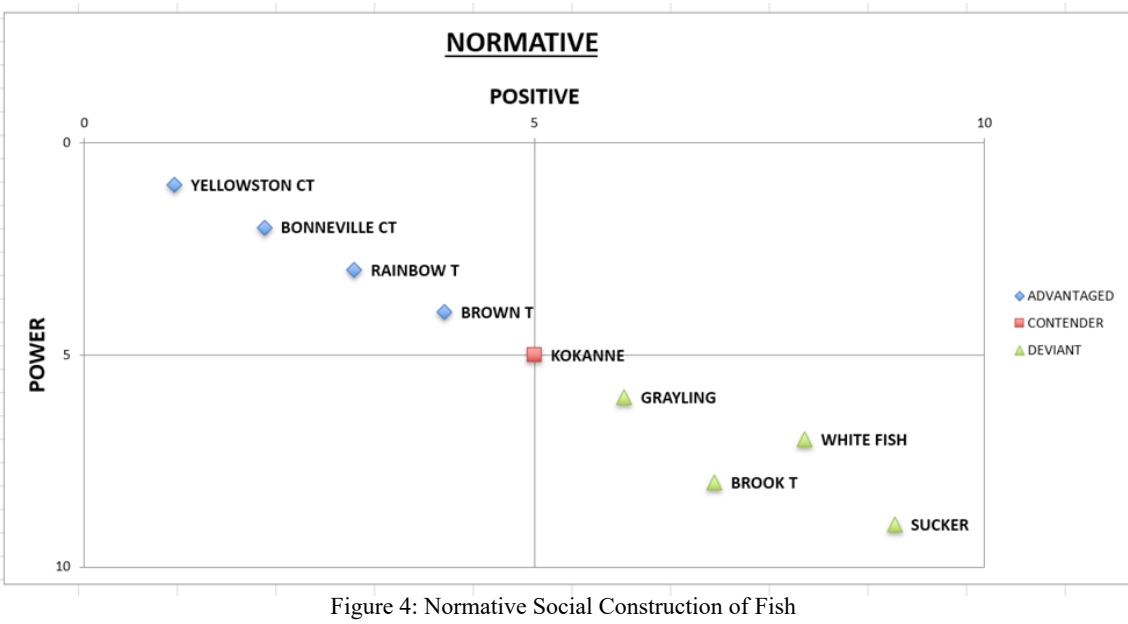

Figure 4: Normative Social Construction of Fish

Research Question 3: What fish species score highest in normative versus descriptive power?

Comparing the rankings of descriptive and normative power of the fish species (Figures 3 and 4), there is some variation. Species that respondents would like to see gain power (move up within the rankings of power) include: Brown Trout, Arctic Grayling, and Mountain Whitefish; one native (Mountain Whitefish) and two non-native species. Conversely, fish that drop in the rankings from descriptiveto normative include the Rainbow Trout, Kokanee, and Brook Trout, all non-native species. Although the figures make it clear that these six species shift in their normative versus descriptive power ranking, only two change in their social constructions. The non-native Kokanee moves from advantaged to deviant and the native Arctic Grayling moves from deviant to dependent. Taking these results a step further, Table 3 utilizes respondents' indications of level of support (very unsupportive to very supportive) from decision-makers for species; specifically comparing mean scores between descriptive power and normative power.

Fish	N	Minimum	Maximum	Mean	Std. Deviation
Mountain Whitefish	171	-5	6	1.24	1.94
Arctic Grayling	170	-3	6	1.02	1.65
Bonneville Cutthroat	172	-4	6	0.78	1.52
Utah Sucker	172	-3	6	0.67	1.73
Yellowstone Cutthroat	171	-6	6	0.58	1.52
Brown Trout	171	-5	5	0.46	1.69
Kokanee	173	-4	6	0.31	1.69
Brook Trout	171	-6	5	-0. 61	1.95
Rainbow Trout	173	-5	6	-0. 64	2.00

Table 3: Power Changes Between Descriptive and Normative Evaluations of Fish Species

The results reveal the degree to which anglers want to see fish species gain or lose power as contrasted with how these anglers perceive the actual power that each species is given by decision-makers. Not surprising, the angler respondents wanted more power for all species but indicated differences in the level of support for these increases. Table 3 demonstrates that the Mountain Whitefish had the largest positive difference between its descriptive to normative rating (+1.24) showing the largest support for an increase in the power. The Mountain Whitefish is followed by the Arctic Grayling (+1.02), Bonneville Cutthroat (+.78), Utah Sucker (+.67), Yellowstone Cutthroat (+.58), Brown Trout (+.46), Kokanee (+.31), Brook Trout (-.61), and Rainbow Trout (-.64). This leads us to Research Question 4 where we attempt to explain the variation in respondents' ratings of normative versus descriptive power for four native fish.

Research Question #4: What explains the changes of respondents' normative and descriptive power appraisals among fish species?

Table 4 shows separate OLS regressions with the power change variable for each of the four native fish species as the dependent variable using the independent variables discussed in the methods section. The NEP Index was a significant independent variable for changes in power between the descriptive and normative power measures for the Bonneville Cutthroat (.112) and the Yellowstone Cutthroat (.113). In regard to the Mountain Whitefish, the Knowledge Index (.256) and NEP Index (.109) are two significant independent variables. Finally, the Knowledge Index (.288) and age (-.022) were significantly related to changes in power for the Utah Sucker. In Table 5, the Connection Index (.279) and Political Ideology (-.448) is significantly related to changes in power for the Rainbow Trout. The Connection Index (.152) and population size (.199) were significantly related to changes in power for the Arctic Grayling. Population size (-.255) was significantly related to power changes for the Brook Trout and the Connection Index (-.172) was significantly related to changes in power for the Kokanee.

Variable	BCT	YCT	MWF	US
Constant	-0.610 (0.908)	0.606 (0.895)	-1.329 (1.063)	-1.120 (0.397)
Konwledge	0.018 (0.103)	0.009 (0.102)	0.256* (0.121)	0.288** (0.106)
Connection	-0.024 (0.086)	-0.058 (0.085)	0.108 (0.101)	0.031 (0.089)
NEP	0.112** (0.039)	0.113** (0.038)	0.109 (0.046)	0.076 (0.040)
Age	0.000 (0.010)	-0.020 (0.010)	-0.018 (0.012)	-0.022* (0.010)
Flyfisher	-0.121 (0.296)	0.385 (0.290)	-0.225 (0.345)	-0.224 (0.303)
Gender	-0.218 (0.330)	-0.013 (0.326)	0.002 (0.387)	0.024 (0.341)
Ideology	0.222 (0.168)	0.048 (0.167)	-0.081 (0.201)	-0.174 (0.173)
Popsize	0.061 (0.093)	-0.049 (0.090)	0.178 (0.108)	0.016 (0.094)
Eduction	0.257 (0.166)	0.251 (0.163)	0.197 (0.197)	0.183 (0.171)

Table 4: Regression Coefficients (S.E.) for Power Change, Native Fish

Note. ** p. <. 01; * p. < .05

Note. Bonneville Cutthroat (BCT), Yellowstone Cutthroat (YCT). Mountain Whitefish (MWF), Utah Sucker (US).

Variable	RB	GY	BT	BR	KOK
Constant	1.779 (1.227)	-1.072 (1.178)	-0.088 (1.345)	0.385 (1.191)	0.384 (1.153)
Konwledge	0.017 (0.116)	0.145 (0.112)	-0.168 (0.127)	0.003 (0.112)	0.157 (0.109)
Connection	0.279* (0.078)	0.152* (0.072)	0.113 (0.085)	-0.088 (0.075)	-0.172* (0.073)
NEP	0.016 (0.045)	0.024 (0.041)	0.095 (0.049)	-0.056 (0.043)	-0.020 (0.042)
Age	-0.006 (0.011)	-0.005 (0.101)	-0.020 (0.013)	0.005 (0.011)	0.002 (0.011)
Flyfisher	-0.090 (0.337)	-0.019 (0.309)	-0.146 (0.373)	0.130 (0.326)	-0.024 (0.317)
Gender	0.374 (0.073)	-0.081 (-0.021)	0.476 (0.421)	-0.090 (0.365)	-0.203 (0.357)
Ideology	-0.448* (0.037)	0.019 (0.179)	0.090 (0.212)	0.085 (0.186)	-0.040 (0.182)
Popsize	0.178 (0.105)	0.199* (0.098)	-0.255*(0.117)	-0.011 (0.101)	0.068 (0.099)
Eduction	-0.101 (0.190)	-0.036 (0.177)	-0.035 (0.210)	0.147 (0.183)	0.185 (0.178)

Table 5. Regression Coefficients (SE) for Power Change, Non-Native Fish

Note. ** p. <. 01; * p. < .05

Note. Rainbow (RB), Arctic Grayling (GY), Brook Trout (BT). Brown Trout (BR), KOK (Kokanee).

Discussion

Our findings shed light on how anglers perceive the power of native and non-native fish in one of the US's key cold-water fisheries. Despite 89% of respondents valuing the preservation of native fish, we did not find clear support favoring natives over non-natives. The negative perception of native Mountain Whitefish and Utah Sucker was expected, given their reputation and perceived lack of beauty among anglers. However, despite being viewed negatively, these species showed support for better policies when comparing descriptive and normative power rankings. All fish, except Rainbow and Brook Trout, scored higher on normative support for policies than on descriptive power, indicating a belief in the need for more protective policies. This also reveals a lack of strong preference for advancing native fish over non-native species. Anglers supported native fish but did not clearly recognize the negative impact of non-native fish on native populations.

Second, looking at the issue of greater/ less support for native species, one possible reason for a lack of findings that native species draw more support than non-native species is the misunderstanding of which species are native. This explanation does not work for species such as the Brown Trout, a non-native that most respondents correctly identified as non-native, yet that is supported as a species that should have more power. However, this may help in explaining results of the Yellowstone Cutthroat and Bonneville Cutthroat, identified as native species by the strong majority of respondents, and which respondents want to have high levels of support from policymakers (high power). Additionally, this can help in explaining a desired increase in power for the non-native Arctic Grayling, as 50% of the respondents incorrectly identified the Arctic Grayling as a native species.

This explanation aligns with the idea that more knowledge about a species increases commitment to policies supporting that species. Our models showed that respondents with greater knowledge of Mountain Whitefish and Utah Sucker were more inclined to support policies boosting their power. While more research is needed, it seems that increased knowledge about native species can lead to greater policy support. Our findings support the science deficit model [22], which suggests that knowledge fosters policy support. However, this is not entirely consistent, as knowledge about native fish increased support for Mountain Whitefish and Utah Sucker but did not affect views on non-native Rainbow Trout and Brown Trout. Therefore, an education plan focusing on native fish might increase support for native fish restoration but would not necessarily reduce support for non-native species. This aligns with studies on fish education programs, which show that while knowledge influences support, other factors also affect how individuals view fish [55-56].

Third, the use of NEP revealed that respondents with a more ecological orientation to the world are supportive of giving three of the four of Idaho's GYE native fish more political power. Overall, the social construction of fish species of the Idaho portion of the GYE highlights some findings that will be of interest for policymakers. Despite Idaho's "catch and kill orders" on Rainbow Trout (on the South Fork of the Snake River), the Rainbow Trout was constructed as advantaged both descriptively and normatively, as was the non-native Brown Trout. Given the anglers' support for native fish, the advantaged constructions of the non-native Rainbow Trout and Brown Trout were somewhat surprising. Rainbow Trout can interbreed with Cutthroat which, over time, could destroy the genetic purity of both the Yellowstone and Bonneville Cutthroat Trout. Furthermore, Brown Trout are aggressive and may outcompete Cutthroat. The fact that these non-native species are perceived as positive and powerful by anglers should be noted by policymakers. If policymakers plan to enact policies which negatively impact the Rainbow Trout and Brown Trout, they will likely need to include an education campaign in order to gain angler support for the policy.

Fourth, it is worth noting that native fish included in the survey ranked as the two most positively perceived and powerful and the two most negatively perceived and least powerful (Figure 4). This appears to suggest that policymakers respond to anglers' reactions to fish species, and/or policies help construct anglers' views of fish species. Again, an educational campaign to help individuals, such as anglers, have a more positive perception of native fish such as the native Mountain Whitefish and Utah Sucker, would be valuable to changing the management of these fish. For policymakers interested in this type of action, the Mountain Whitefish and Utah Sucker, whose normative construction shows a desire to give the fish more power despite a continued negative perception relative to the other species, would be the place to start.

Conclusion

We recognized this research answers some questions, but also fails to explain all aspects of what factors influence people's social construction of fish species. Future research is needed to examine additional factors that influence the social construction of fish species, in particular, how others' opinions impact how a person socially constructs a species. Gozlan et al. [57] suggest perceptions of anglers in the UK were not influenced by the amount of scientific data available or by actual threats posed by non-native species. Instead, these authors argue anglers' perceptions correlated more closely with media interest and the perceived threats presented by media. This suggests that a more direct link to social construction of species comes from what others (such as the media) say, or the manner in which the species is constructed by others. This information suggests that although scientific research is important, so is creating a positive public attitude via stories from the media. Future research should address this angle as it is likely vital to future policy development.

Overall, our findings suggest a disconnect between support for native species and for that which harms the natives. Clearly, how individuals socially construct fish involves values, beliefs, stories, memories of fish, the beauty of the fish species, political ideology and likely a perception of how others socially construct fish. Thus, to fully understand how a study of social construction of fish could help fish managers, more study is needed. This initial study provides a baseline of data, methods, and ideas to help in these efforts and helps political science start to think about how social constructions of non-human species influences fishery policy and other types of environmental and wildlife policies.

Appendix A Questions in the NEP Index (Rated on agreement scale of 1-5)

- The balance of nature is very delicate and easily upset by human activities.
- Humans have the right to modify the natural environment to suit their needs (reverse coded).
- We are approaching the limit of people the earth can support.
- The so-called "ecological crisis" facing humankind has been greatly exaggerated (reverse coded).
- Humans were meant to rule over the rest of nature (reverse coded).

Appendix B: Questions in the Connection Index (True or False)

- On the Snake River, Rainbow Trout are native to Idaho only below Shoshone Falls (True).
- Cutthroat Trout and Rainbow Trout can successfully breed together (True).
- A Brook Trout is a species of trout (False, it is a Char).
- Whitefish compete with trout species and are harmful to trout species (False).
- Yellowstone Cutthroat were originally found only in Yellowstone National Park (False).
- Stoneflies are native to southeast Idaho streams (True).
- The Green Drake hatch occurs in late summer (False).
- Sucker fish are important for southeast Idaho river ecosystems (True).
- Nightcrawlers are native to Idaho (False).
- Grasshoppers are considered an aquatic insect (larval stage occurs in water) (False).
- A stream contributes nutrients to the surrounding terrestrial (on-land) habitat (True).
- Beavers help maintain good stream habitat for trout (True).
- White pelicans are native to Idaho (True).
- In Idaho, Rainbow Trout spawn in the fall and Brown Trout spawn in the spring (False).

References

1. Newman, C. (2013). Lake trout are bad news for Yellowstone Lake. *National Geographic*. January 24.
2. Clark, J. A., & May, R. M. (2002). Taxonomic bias in conservation research. *Science, 297*, 191-192.
3. Kellert, S. R. (1985). Social and perceptual factors in endangered species management. *Journal of Wildlife Management, 49*(2), 528-536.
4. Plous, S. (1993). Psychological mechanisms in the human use of animals. *Journal of Social Issues, 49*(1), 11-52.
5. Metrick, A., & Weitzman, M. L. (1998). Conflicts and choices in biodiversity preservation. *Journal of Economic Perspectives, 12*(3), 21-34.
6. Gunnthorsdottir, A. (2001). Physical attractiveness of an animal species as a decision factor for its preservation. *Anthrozoös, 14*(4), 204-216.
7. Tisdell, C. A. (2014). Human values and biodiversity conservation: The survival of wild species. Edward Elgar Press.
8. Mather, J. A. (2019). Ethics and care: For animals, not just mammals. *Animals, 9*(12), 1018. https://doi.org/10.3390/ani9121018
9. Brown, M., & Flesher, J. (2023, December 29). Most money for endangered species goes to a small number of creatures, leaving others in limbo. *Associated Press*. https://apnews.com/article/endangered-species-spending-extinctions-plants-1ad806de0db9d09a38b7e82f6286c1b5
10. McGowan, J., Brown, E., Villalpando, P., & Hill, J. K. (2020). Conservation prioritization can resolve the flagship species conundrum. *Nature Communications, 11*, 994. https://doi.org/10.1038/s41467-020-14554-z
11. Jacobson, S. K., & Marynowski, S. B. (1997). Public attitudes and knowledge about ecosystem management on Department of Defense land in Florida. *Conservation Biology, 11*(3), 770-781.
12. Bremner, A., & Park, K. (2007). Public attitudes to the management of invasive non-native species in Scotland. *Biological Conservation, 139*(3-4), 306-314.
13. Hettinger, N. (2021). Understanding and defending the preference for native species. In B. Bovenkerk & J. Keulartz (Eds.), Animals in our midst: The challenges of co-existing with animals in the Anthropocene. *The International Library of Environmental, Agricultural and Food Ethics*, vol 33. Springer, Cham. https://doi.org/10.1007/978-3-030-63523-7_22
14. Senior, M. J. M., Brown, E., Villalpando, P., & Hill, J. K. (2015). Increasing the scientific evidence base in the 'High Conservation Value' (HCV) approach for biodiversity conservation in managed tropical landscapes. *Conservation Letters, 8*(5), 361-367.
15. Hutchins, P. R., Sepulveda, A. J., Hartikainen, H., Staigmiller, K. D., Opitz, S. T., Yamamoto, R. M., & Okamura, B. (2021). Exploration of the 2016 Yellowstone River fish kill and proliferative kidney disease in wild fish populations. *Ecosphere, 12*(3), e03436.
16. D'Antuono, H. (2016, October 2). Biologists to measure impact of Yellowstone River fish kill. *Idaho State Journal*.
17. Gibbons, J. W. (1988). The management of amphibians, reptiles and small mammals in North America: The need for an environmental attitude adjustment. US Forest Service. Accessed January 14, 2018. https://www.fs.fed.us/rm/pubs_rm/rm_gtr166/rm_gtr166_004_010.pdf
18. Gascon, C., Brooks, T., Contreras-MacBeath, T., Heard, N., Konstant, W., Lamoreaux, J., Launay, F., Maunder, M., Mittermeier, R., Molur, S., Al Mubarak, R., Parr, M., Rohdin, A., Rylands, A., Soorae, P., Sanderson, J., Vie, J (2015) The Importance and Benefits of Species. *Current Biology, 25*(10), R431-R438.
19. Schneider, A., & Ingram, H. (1993). Social construction of target populations: Implications for politics and policy. *American Political Science Review, 87*(2), 334-347.
20. Ingram, H., Schneider, A. L., & DeLeon, P. (2019). Social construction and policy design. *In Theories of the policy process* (2nd ed., pp. 93-126). Routledge.
21. Czech, B., Krausman, P. R., & Borkhataria, R. (1998). Social construction, political power, and the allocation of benefits to endangered species. *Conservation Biology, 12*(5), 1103-1112.
22. Sturgis, P., & Allum, N. (2004). Science in society: Re-evaluating the deficit model of public attitudes. *Public Understanding of Science, 13*(1), 55-74.
23. Hames, F., Townsend, A., Ringwood, G., Clunie, P., & McPhail, J. (2014). Effective engagement of the native fish strategy is delivered by coordinated and contextual effort. Ecological Management & Restoration, 15, 13-27.

24. Nohria, N., & Gurtler, B. (2004). Note on human behavior: Reason and emotion. *Harvard Business School Case*, 404-104. https://www.hbs.edu/faculty/Pages/item.aspx?num=30848
25. Cian, L., Krishna, A., & Schwarz, N. (2015). Positioning rationality and emotion: Rationality is up and emotion is down. *Journal of Consumer Research, 42*(4), 632-651. https://www.jstor.org/stable/26570234
26. Kollmuss, A., & Agyeman, J. (2002). Mind the gap: Why do people act environmentally and what are the barriers to pro-environmental behavior? *Environmental Education Research, 8*(3), 239-260.
27. Kahneman, D. (2011). Thinking, fast and slow. New York: Macmillan.
28. Catton, W. R., & Dunlap, R. E. (1978). Environmental sociology: A new paradigm. *The American Sociologist, 13*(1), 41-49.
29. Dunlap, R. E., Van Liere, K. D., Mertig, A. G., & Jones, R. E. (2000). New trends in measuring environmental attitudes: Measuring endorsement of the new ecological paradigm: A revised NEP scale. *Journal of Social Issues, 56*, 425-442.
30. McBeth, M. K., & Foster, R. H. (1994). Rural environmental attitudes. *Environmental Management, 18*(3), 401-412.
31. Schneider, A., Ingram, H., & DeLeon, P. (2014). Social construction of target populations. In P. A. Sabatier & C. M. Weible (Eds.), *Theories of the policy process* (pp. 105-150). Westview Press.
32. DeMello, M. (2021). Chapter 3: The social construction of animals. In Animals and society: An introduction to human-animal studies (pp. 57-72). *Columbia University Press*. https://doi.org/10.7312/deme19484-005
33. Leach, M. W. (2014). Grizzlies on my mind: Essays of adventure, love, and heartache from Yellowstone country. WestWinds Press.
34. NPS.gov. (2024). Yellowstone: Fish management. Accessed July 3, 2024. https://www.nps.gov/yell/learn/management/fish.htm#:~:text=Nonnative%20brown%2C%20brook%2C%20and%20rainbow,cutthroat%20trout%2C%20in%20Yellowstone%20Lake
35. Horne, R. (2010, May 12). Bounty offered for rainbow trout on Snake. Teton Valley News.
36. Idaho Department of Fish and Game. (2007). *Management plan for conservation of Yellowstone cutthroat trout in Idaho*. Accessed November 17, 2017. https://idfg.idaho.gov/old-web/docs/fish/planYellowCutthroat
37. Idaho Department of Fish and Game. (2023). Idaho fishing 2022-2024 season and rules. Accessed July 2, 2024. https://idfg.idaho.gov/sites/default/files/seasons-rules-fish-2022-2024.pdf
38. Phillips, R. (2016). Biologists investigate fish kill on South Fork of the Snake River. *Idaho Department of Fish and Game*. Accessed November 17, 2017. https://idfg.idaho.gov/press/biologists-investigate-fish-kill-south-fork-snake-river
39. Hunt, C. (2020, August 20). Don't 'dis' the whitefish that swim next to the trout we love. *Trout Magazine*. https://www.tu.org/magazine/trout-magazine/dont-dis-the-whitefish-that-swim-next-to-the-trout-we-love/
40. Sigler, W. F., & Sigler, J. W. (1996). Fishes of Utah: A natural history. University of Utah Press.
41. Jakus, P. M., Fly, J. M., & Wilson, J. L. (1996). Explaining public support for fisheries management alternatives. *North American Journal of Fisheries Management, 16*(1), 41-48.
42. Chatterton, L., & Chatterton, B. (1981). How much political compromise can fisheries management stand?: Premiums and politics in closed coastal fisheries. *Marine Policy, 5*(2), 114-134.
43. Jenkins, L. D. (2015). From conflict to collaboration: The role of expertise in fisheries management. *Ocean & Coastal Management, 103*, 123-133.
44. Arlinghaus, R., & Mehner, T. (2005). Determinants of management preferences of recreational anglers in Germany: Habitat management versus fish stocking. *Limnologica, 35*, 2-17.
45. NOAA Fisheries. (2024). Access point angler intercept survey at-a-glance. Accessed July 2, 2024. https://www.fisheries.noaa.gov/recreational-fishing-data/access-point-angler-intercept-survey-glance
46. Reynolds, J. (1988). New rules and studies are planned for Connecticut stream: Changes on the Farmington. *Field and Stream, Northeast Edition*, 92-93, 115.
47. Ropars-Collet, C., Le Goffe, P., & Lefnatsa, Q. (2021). Does catch-and-release increase the recreational value of rivers? The case of salmon fishing. *Review of Agricultural, Food and Environmental Studies, 102*, 393-424. https://doi.org/10.1007/s41130-021-00151-1
48. Bright, A. D., & Porter, R. (2001). Wildlife-related recreation, meaning, and environmental concern. *Human Dimensions of Wildlife, 6*(4), 259-276. https://doi.org/10.1080/108712001753473939
49. Bjerke, T., Thrane, C., & Kleiven, J. (2006). Outdoor recreation interests and environmental attitudes in Norway. *Managing Leisure, 11*(2), 116-128.
50. Gray, S. G., Raimi, K. T., Wilson, R., & Arvai, J. (2019). Will millennials save the world? The effect of age and generational differences on environmental concern. *Journal of Environmental Management, 242*, 394-402.
51. Sandell, K., & Öhman, J. (2013). An educational tool for outdoor education and environmental concern. *Journal of Adventure Education & Outdoor Learning, 13*(1), 36-55.
52. McCright, A. M., & Xiao, C. (2014). Gender and environmental concern: Insights from recent work and for future research. *Society & Natural Resources, 27*(10), 1109-1113.
53. Davidovic, D., Harring, N., & Jagers, S. C. (2019). The contingent effects of environmental concern and ideology: Institutional context and people's willingness to pay environmental taxes. *Environmental Politics, 29*(4), 674-696. https://doi.org/10.1080/09644016.2019.1606882
54. Armstrong, A., & Stedman, R. C. (2019). Understanding local environmental concern: The importance of place. *Rural Sociology, 84*(1), 93-122.
55. Siemer, W. F., & Knuth, B. A. (2001). Effects of fishing education programs on antecedents of responsible environmental behavior. *The Journal of Environmental Education, 32*(4), 23-29. https://doi.org/10.1080/00958960109598659
56. Krabbenhoft, C. A., Manente, S., & Kashian, D. R. (2019). Evaluation of an educational campaign to improve the conscious consumption of recreationally caught fish. *Sustainability, 11*(3), 700. https://doi.org/10.3390/su11030700
57. Gozlan, R. E., Burnard, D., Andreou, D., & Britton, J. R. (2013). Understanding the threats posed by non-native species: Public vs. conservation managers. *PLoS One, 8*(1), e354200.