

# The value of eudaimonia for understanding relationships among values and pro-environmental behavior

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## ABSTRACT

Understanding the transactions that occur between humans and their environments requires research focused on phenomena that explain behavioral patterns, particularly values that serve as guiding principles in life. Mounting evidence has suggested that pro-environmental behavior is motivated by the long-term goal of living a meaningful life, as reflected by Aristotle's concept of eudaimonia. However, the relationships among value concepts, particularly eudaimonic values, remains unclear despite the fundamental role that these constructs play in explaining why people make behavioral decisions. We conceptualized eudaimonic values with guidance from Self-Determination Theory to understand how a suite of values affected pro-environmental behavior reported by recreational anglers ( $n = 1,103$ ) across five US states (Wisconsin, Illinois, Michigan, New York, Indiana) in the Great Lakes region. Results from a latent variable path model showed that eudaimonic values were strong predictors of biospheric, altruistic, egoistic, and hedonic values, which in turn, influenced self-reported behavior among recreational anglers who were at risk of spreading aquatic invasive species. These findings suggest that eudaimonic values are an antecedent to values-behavior relationships and can improve the predictive capacity of models being developed to inform management strategies for minimizing human activities that are contributing to the unintentional spread of aquatic invasive species.

## 1. Introduction

Factors that motivate people to act in ways that promote environmental sustainability have received considerable attention among environmental psychologists. Engagement in pro-environmental behavior has been explained by a range of psychological factors such as attitudes, norms, and self-efficacy (Ajzen, 1991; Fishbein & Ajzen, 2011), as well as environmental values and worldviews (Dunlap, Van Liere, Mertig, & Jones, 2000; Stern, Dietz, Abel, Guagnano, & Kalof, 1999). Among these concepts, human values have been positioned as the basis for pro-environmental behavior because they are relatively long-term motivational forces (Vaske & Donnelly, 1999). Values scholarship is underpinned by multiple theoretical lenses that have been used to understand the relationship between values and behavior (Poortinga, Steg, & Vlek, 2004; Schwartz, 1994; Steg, Perlaviciute, van der Werff, & Lurvink, 2014; van Riper, Winkler-Schor, et al., 2019) and their potential for catalyzing societal changes that support transformations toward more sustainable futures (Chan, Gould, & Pascual, 2018; Ives &

Kendal, 2014; Kenter et al., 2019; Rawluk, Ford, Anderson, & Williams, 2019).

Previous research has suggested that pro-environmental behavior is rooted not only in human values but also in motives for happiness and well-being (Sagiv, Roccas, & Oppenheim-Weller, 2015). Researchers from positive psychology have advanced knowledge of how pro-environmental behavior relates to the pursuit of hedonic and eudaimonic well-being (Nisbet, Zelenski, & Murphy, 2011; Venhoeven, Bolderdijk, & Steg, 2013). Although hedonia (i.e., the pursuit of short-term pleasure) has been conceptualized as a type of human value in accordance with the Theory of Basic Human Values (Schwartz, 1992, 1994) and Goal Framing Theory (Lindenberg & Steg, 2007; Steg, Perlaviciute, et al., 2014), eudaimonia (i.e., the pursuit of a meaningful life) has received less attention from value scholars. More recently, research in economics (Spanou, Kenter, & Graziano, 2020) and the conservation sciences (Chan et al., 2016; Knippenberg, de Groot, van den Born, Knights, & Muraca, 2018) has begun to consider how nature-based eudaimonic values can energize behavior change. However, this body

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of work has been largely informed by disciplines such as philosophy (e.g., van den Born et al., 2018) and remained at a conceptual level rather than drawing from a long-standing body of research informed by Self-Determination Theory and the well-being sciences (Ryan & Deci, 2000, 2001; for exception see; Winkler-Schor et al., 2020). Consequently, there is a growing need to connect these lines of research and test theoretically supported hypotheses about how eudaimonic values relate to other drivers of behavior.

### 1.1. Characteristics of pro-environmental behavior

Human concerns for the environment have grown rapidly since the 1970s and paralleled increases in public awareness of the adverse impacts of human activities on ecosystems and resource sustainability (Dietz, 2020). These changes in environmentalism have spawned scholarship focused on understanding “pro-environmental behavior,” defined as actions performed with the intention of minimizing impacts or improving environmental conditions (Kollmuss & Agyeman, 2002; Steg & Vlek, 2009). These actions, ranging from recycling at home to voting for an environmental party, span multiple behavioral domains (Larson, Stedman, Cooper, & Decker, 2015) that may influence the trajectory of human-environment interactions in the future. In light of these complexities, researchers have sought to improve measurement of psychometric scales by identifying the classes of pro-environmental behaviors with similar feasibility (Halpenny, 2010) and ensuring survey items are tailored to specific resource management contexts (van Riper & Kyle, 2014).

An individual’s engagement in pro-environmental behavior is affected by their motivational basis and interactions with the broader context surrounding an action (Gifford & Nilsson, 2014; Schultz & Kaiser, 2012; Stern et al., 1999). Situational factors such as time constraints and financial conditions can mediate the effects of psychological factors on decisions to act in ways that benefit the environment (Corraliza & Berenguer, 2000; Poortinga et al., 2004; Stern, 2000). For instance, an individual might actively work toward saving energy in their home but not attend a public environmental event because it requires time and a financial investment. Hence, pro-environmental behavior should be understood in consideration of both its psychological drivers as well as how it is enabled or constrained by broader contexts.

Previous research has suggested there are multiple dimensions of pro-environmental behavior, depending on the domain and extent of impacts (Steg, Bolderdijk, Keizer, & Perlaviciute, 2014; Stern, 2000). While some researchers have measured pro-environmental behavior using unidimensional typologies (e.g., Kaiser, 1998; van Riper & Kyle, 2014), others have followed Stern’s (2000) classification of behavior including activist and non-activist actions that span public and private spheres. Drawing on this latter perspective, scholars have argued that pro-environmental behavior can be conceptualized in terms of conservation lifestyles, social environmentalism, environmental citizenship, and land stewardship (Larson et al., 2015), as well as public, private, and social stewardship (van Riper, Browning, et al., 2019). We contend that recognizing the multi-dimensional structure of pro-environmental behavior is important for advancing knowledge of how different behaviors are motivated by a range of psychological factors such as values.

### 1.2. Values as a basis for understanding pro-environmental behavior

There is a strong theoretical foundation for arguing that human values predict behavior. Numerous frameworks for classifying and measuring value orientations were proposed through the latter half of the 20th century (Allport, Vernon, & Lindzey, 1960; Fulton, Manfred, & Lipscomb, 1996; Inglehart, 1977, 1995; Rokeach, 1973; Schwartz, 1992). Human values in social psychological terms are commonly defined as prescriptive beliefs and guiding principles oriented toward desirable end-states of existence (e.g., security) or modes of conduct (e.

g., justice) that transcend specific situations or objects (Rokeach, 1973; Schwartz & Bilsky, 1987). The *trans*-situational nature of human values makes them a strong basis for understanding behavior across diverse contexts including public land management settings (Vaske & Donnelly, 1999). Understanding human values can therefore inform efforts to shape behavior relevant to environmental contexts over long time periods (Manfredo et al., 2017; Kenter et al., 2019).

Drawing on Schwartz’s (1992) Theory of Basic Human Values in conjunction with the norm-activation model (Schwartz, 1977), Stern (2000) proposed the Value-Belief-Norm (VBN) Theory of environmentalism, positing that biospheric, altruistic, and egoistic values predict pro-environmental behavior. Biospheric values are based on concern for non-human species or the biosphere (Stern, Dietz, & Kalof, 1993) and emphasize the importance of environmental protection and unity with nature as standards for preferences (Steg, De Groot, Dreijerink, Abrahamse, & Siero, 2011; Stern, Dietz, & Guagnano, 1995). Altruistic values prioritize the well-being of other humans beyond oneself, often reflecting priorities for peace and social justice (Stern et al., 1999). In contrast, egoistic values are motivated by self-centered principles such as authority and personal benefits (de Groot & Steg, 2008; Steg et al., 2011; Stern et al., 1995). Previous research has argued that values can directly predict behaviors that promote environmental sustainability (Karp, 1996; van Riper, Winkler-Schor, et al., 2019) or indirectly affect behavior when mediated by other psychological factors such as personal norms (Han, 2015; Nordlund & Garvill, 2003). This tripartite model of the value basis for explaining pro-environmental behavior has been validated in a wide array of research contexts (Han, 2015; Obeng & Aguilar, 2018; Poortinga et al., 2004; Steg, Perlaviciute, et al., 2014; Steg & Vlek, 2009; van Riper & Kyle, 2014).

Previous studies guided by the VBN theory support the distinction among value types as predictors of pro-environmental behavior. Biospheric values are positively associated with pro-environmental behavior (de Groot & Steg, 2008, 2010; Karp, 1996; Obeng & Aguilar, 2018; Steg et al., 2011; Steg, Bolderdijk, et al., 2014; van der Werff, Steg, & Keizer, 2014; van Riper, Winkler-Schor, et al., 2019), as are altruistic values (Hartmann, Eisend, Apaolaza, & D’Souza, 2017; Jakovcevic & Steg, 2013; López-Mosquera & Sánchez, 2012; Milfont, Sibley, & Duckitt, 2010; Ojea & Loureiro, 2007; Steg, Perlaviciute, et al., 2014). In contrast, egoistic values often negatively correlate with pro-environmental behaviors (de Groot & Steg, 2008; Jakovcevic & Steg, 2013; Steg et al., 2011; Steg, Perlaviciute, et al., 2014; Stern et al., 1995, 1998). However, the effects of egoistic values on pro-environmental behavior should be carefully considered in light of situational factors and behavioral goals (Steg, Bolderdijk, et al., 2014), because egoistic values can encourage pro-environmental behavior when it promotes both personal and environmental benefits (De Dominicis, Schultz, Bonaiuto, Schultz, & Bonaiuto, 2017).

### 1.3. Emerging importance of hedonic and eudaimonic values

Scholars have recently begun to explore how pro-environmental behavior is correlated with different types of psychological well-being, including hedonia and eudaimonia (Steg, Perlaviciute, et al., 2014; van den Born et al., 2018; Winkler-Schor et al., 2020). Hedonia is a form of subjective well-being achieved through experiencing pleasurable feelings over short time periods (Deci & Ryan, 2008; Huta & Waterman, 2014; Ryan & Deci, 2001) and has been operationalized in terms of hedonic values that guide enjoyable lifestyles. Hedonic values are distinguishable predictors of pro-environmental behavior, as posited by Goal Framing Theory (Lindenberg & Steg, 2007; Steg, Perlaviciute, et al., 2014). This body of work has generated evidence indicating that hedonic values are negatively related to intentions to benefit the environment. For example, individuals in the Netherlands with strong hedonic values were less likely to reduce their meat and energy consumption (Steg, Perlaviciute, et al., 2014). Hedonic values also negatively predicted the pro-environmental behaviors of visitors to a

national park in Alaska (van Riper, Winkler-Schor, et al., 2019). However, exceptions to these trends have been detected in leisure contexts, as evidenced by a study indicating that hedonic values were positively correlated with place-based motivations and pro-environmental behavior performed by outdoor recreationists in the southern Sierra Nevada of California (van Riper et al., 2020). These findings indicate that correlations between hedonic values and pro-environmental behavior are contingent on hedonic outcomes such as pleasure and enjoyment generated by the behavior.

Previous studies on human psychological well-being have discussed eudaimonia alongside hedonia to understand competing aspects of happiness. First proposed by Aristotle in the 4th century, eudaimonia was defined as the pursuit of a meaningful and virtuous life (Nagel, 1972; Ryan, Huta, & Deci, 2008). Under the assumptions of Self-Determination Theory (SDT), eudaimonia is driven by basic psychological needs for autonomy, competence, and relatedness, which often accompany intrinsic motivations defined as an inherent tendency to extend and fulfill personal capacities through novelty and challenge (Ryan & Deci, 2000, 2001). In contrast, extrinsic motivations focus on the instrumentality of achieving needs and are partially exemplified by hedonic rewards. Intrinsic motives that contribute to eudaimonia, such as self-expression, promote socially responsible outcomes including pro-environmental lifestyles (Ryan et al., 2008), whereas extrinsic motives such as materialistic desires are likely to conflict with pro-environmental behavior (Hurst, Dittmar, Bond, & Kasser, 2013; Inglehart, 1995; Kasser, 2016). Also, eudaimonic pursuits can meet the psychological need for relatedness through connection to nature (Baxter & Pelletier, 2019; Cleary, Fielding, Bell, Murray, & Roiko, 2017) which forms an affective, cognitive, and experiential basis for pro-environmental behavior (Mayer & Frantz, 2004; Nisbet, Zelenski, & Murphy, 2009). This line of research is informed by SDT and has indicated that the pursuit of eudaimonia can promote pro-environmental behavior as a means to achieve psychological well-being.

While both hedonia and eudaimonia are seemingly driven by similar motives to achieve personal happiness and well-being, they can be conceptually and empirically differentiated (Huta & Ryan, 2010; Waterman et al., 2008). For instance, Waterman (1993) theorized that eudaimonia was obtained through self-expressiveness whereas hedonic enjoyment was promoted by the satisfaction of needs. Other researchers have suggested eudaimonia is a distinct value orientation given its focus on long-term achievements rather than short-term fulfillment of hedonic pleasure and comfort (Winkler-Schor et al., 2020). Although both eudaimonic and hedonic values are self-focused goals that advance well-being, they are likely to conflict with one another. Indeed, previous research has suggested eudaimonic goals that promote living a 'good life' (e.g., reducing consumption) can detract from hedonic pleasure (Kasser, 2016; Waterman et al., 2008). Thus, eudaimonic values may function as antecedents to hedonic values, because they are more likely to be thwarted rather than fostered by pleasurable pursuits and are focused on the achievement of goals over longer rather than shorter time periods.

Recently, conservation scholars have investigated eudaimonia as a human value that affects relationships with nature (Chan et al., 2018, 2016; van den Born et al., 2018; Winkler-Schor et al., 2020). Chan et al. (2016) suggested that eudaimonic values enrich human-nature relationships that contribute to a meaningful life. Through this lens, the inclusion of nature in one's life provides benefits for personal growth (Chan et al., 2018; Knippenberg et al., 2018). Building on this idea, van den Born et al. (2018) posited that active environmentalists had strong connections with nature as well as motivations to act on nature's behalf and support healthy and meaningful human-nature relationships. These findings parallel a body of work suggesting that connectedness to nature (i.e., a subjective sense of one's relationship with nature) and psychological well-being are positively correlated (Mayer & Frantz, 2004; Nisbet et al., 2011; Pensini et al., 2016; Pritchard et al., 2019). Therefore, eudaimonic values may encourage the formation of a strong

relationship with nature, which in turn, energizes environmentalism.

Conceptualizing eudaimonia as a human value offers new insights into the value basis of pro-environmental behavior. Eudaimonic values motivate individuals to live according to a collection of personal values that reflect their true self (Huta, 2012), suggesting that the broad goal of living a meaningful life affects judgments about more specific guiding principles in life. Consequently, we suggest eudaimonia can be operationalized as a higher-order value for living a meaningful life, which is irreducible to other values (Ryan et al., 2008). Previous research has recently begun to explore whether eudaimonic values directly affect participation in pro-environmental behavior. For example, van Riper, Winkler-Schor, et al. (2019) tested the direct effects of multiple values—including a measure of eudaimonic values—on the pro-environmental behaviors reported by visitors in a U.S. protected area. Whereas direct effects were observed for biospheric, altruistic, egoistic, and hedonic values, eudaimonic values did not directly predict pro-environmental behavior. This finding calls into question the role of eudaimonic values as direct predictors of behavior and suggests this construct may function as a more psychologically stable value that precedes other types of human values and pro-environmental behavior.

Drawing on the Theory of Basic Human Values and SDT, we define eudaimonic values as prescriptive beliefs that guide motives for autonomy, human excellence, and personal growth, which help individuals to achieve long-term happiness and well-being conducive to a meaningful life (Ryan & Deci, 2001; Ryan et al., 2008). We argue that eudaimonic values help to explain why other value orientations influence pro-environmental behavior, and therefore hypothesize that the pursuit of a meaningful life (i.e., expression of eudaimonic values) positively predicts guiding principles rooted in the intrinsic values of nature (i.e., biospheric values) and pro-social beliefs (i.e., altruistic values). Also, given eudaimonia's motivational basis for self-expression and subjective well-being, we hypothesize that eudaimonic values give rise to self-focused interests (i.e., egoistic values) and life's pleasures (i.e., hedonic values). In addition, we tested the direct effects of all value concepts on pro-environmental behavior.

#### 1.4. The present study

Our study examined how individual values influenced pro-environmental behavior related to the spread of aquatic invasive species in the Great Lakes. We theorized that values oriented toward eudaimonia logically preceded self-reported pro-environmental behaviors that spanned private (e.g., looking up information), social (e.g., talking to others), and public (e.g., attending a public event) domains. We also quantitatively analyzed the relationships between eudaimonic values and other human values (i.e., biospheric, altruistic, egoistic, and hedonic values). The hypothesized structural relationships among variables in this research are shown in Fig. 1.

## 2. Methods and materials

### 2.1. Study context

Our study focused on U.S. residents who participated in fishing activities in the Laurentian Great Lakes of North America (hereafter called "the Great Lakes"). The Great Lakes are the world's largest freshwater ecosystem providing numerous ecosystem services such as drinking water, pollution control, recreational angling, and social interactions that benefit human health and well-being (Golebie et al., 2021; Steinman et al., 2017; Winkler et al., 2013). However, the Great Lakes have experienced declines in biodiversity and a reduction in ecosystem services in recent decades that are, in part, tied to angler behaviors that unintentionally spread aquatic invasive species (Cole et al., 2019; Hunt et al., 2020; van Riper, Browning, et al., 2019). Therefore, the adverse impacts of aquatic invasive species can be alleviated through the study of angler behaviors that are shaped by a range of psychological

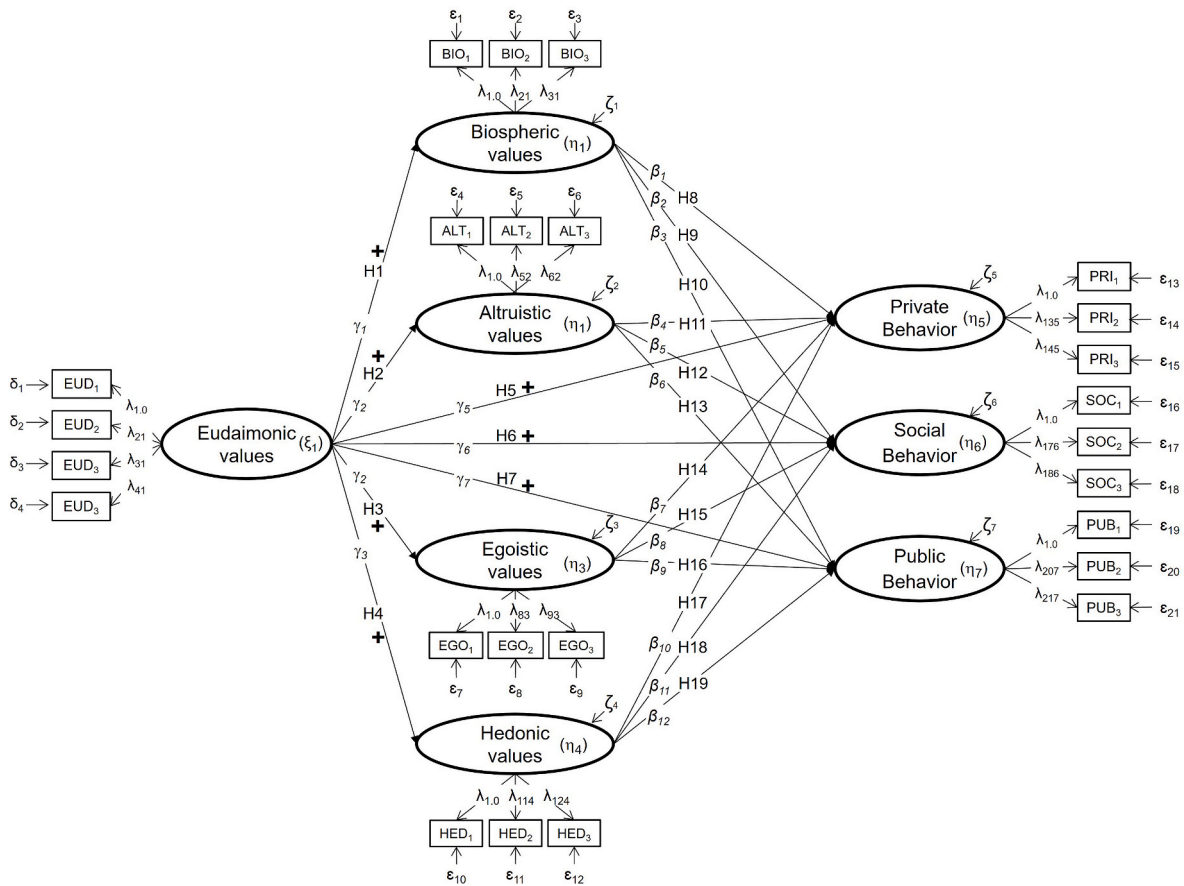


Fig. 1. Hypothesized path model of values and pro-environmental behavior. H1–H19 indicate hypothesized paths with positive (denoted as +) or negative (denoted as -) relationships between variables.

phenomena, particularly human values.

2.2. Data collection

We collected cross-sectional survey data from license holding anglers living in five U.S. states (Wisconsin, Illinois, Michigan, New York, Indiana) from June to August in 2019. Respondents were provided with a cover letter that explained the purpose of our research to learn about the factors that affected angler behavior related to the spread of aquatic invasive species, indicated responses would be kept confidential, and clarified that their participation was voluntary. This study was supported by two universities [identity withheld for blind peer-review] and funded by [identity withheld for blind peer-review]. Using multiple survey modes, we administered a mailback survey that had an online option, in addition to on-site and in-person data collection. In Wisconsin, Illinois, Michigan, and New York, cooperative legal agreements were established with state-based resource management agencies to draw random independent samples of 1,200 individuals who purchased a non-commercial fishing licenses in 2017 and lived in a county directly adjacent to Lake Michigan or Lake Ontario. Following the Tailored Design Method (Dillman et al., 2014), each potential respondent was contacted on multiple occasions to request their participation in the study. The first mailing included a \$1 bill and cover letter that invited respondents to complete the survey online. Next, three waves of the survey questionnaire were mailed with the cover letter, in addition to two reminder postcards. We received 1,120 responses for a 27% response rate. Because license databases were not made available in Indiana, we conducted an on-site survey, whereby anglers at five sampling locations along the shoreline of Lake Michigan, selected in consultation with the Indiana Department of Natural Resources, were

approached by trained survey administrators. Potential respondents were surveyed during two, three-day periods and provided with a postage paid envelope for returning the questionnaire by mail. A total of 363 people agreed to participate (on-site response rate = 85%) and 60 people returned the questionnaire (mailback response rate = 17%). After discarding invalid responses that either skipped questions about values and behavior or that showed non-attentive response patterns (e.g., identical responses to all questions), our final pool of respondents was n = 1,103 (mail-back survey, n = 1,044; on-site survey, n = 59), which was above the minimum threshold of 200 respondents for structural equation modeling outlined by Kline (2015).

2.3. Sample characteristics

Most respondents were male (86.1%) and White (87.5%). On average, they were 55.80 years old with a standard deviation of 15.51. Just over half (59.3%) reported having obtained at least a two-year college degree or higher. Respondents were near the middle-class income bracket, with 58.8% of households earning more than \$60,000 per year.

2.4. Non-response bias

Our survey methods were informed by best practices outlined in Dillman et al. (2014) but still resulted in a relatively low response rate, which necessitated tests for potential non-response bias. First, we compared our sample with previous research conducted in the Great Lakes region. No significant differences in gender ( $\chi^2 = 0.167; p = .682$ ) were found in a comparison with Connelly, Lauber, and Stedman (2014), and days fished ( $t\text{-stat} = 0.260; df = 2,636; p = .795$ ) were



similar to Ready et al. (2012). Next, we assessed non-response bias for the on-site survey of anglers in Indiana. In a comparison between the people who refused to participate and those who agreed across the five sampling locations, no bias was detected on the basis of group size ( $F = 1.498$ ;  $df = 411$ ;  $p = .222$ ) and gender ( $\chi^2 = 0.725$ ;  $p = .395$ ). We also tested for differences between Indiana respondents who agreed to return their questionnaires by mail and those who did not and found that no bias existed on the basis of group size ( $F = 1.488$ ;  $df = 351$ ;  $p = .223$ ) and gender ( $\chi^2 = 0.001$ ;  $p = .969$ ). Although previous research suggests databases could be weighted to account for potential sources of self-selection bias (Stedman et al., 2019), we did not do so given the similarities between our sample and those generated in previous, related studies.

2.5. Survey measures

The questionnaire included items measuring values and three dimensions of pro-environmental behavior (see Table 1), along with socio-demographic questions about age, gender, income, and education. Survey items used to measure biospheric, altruistic, and egoistic values were drawn from Stern et al. (1999) whereas hedonic values were measured using items from Schwartz (1992) and adapted by Steg, Perlaviciute, et al. (2014), with minor changes in wording. Using the same prompt, eudaimonic values were measured by four items (i.e., personal growth, excellence, autonomy, and life satisfaction) that were conceptualized in the Hedonic and Eudaimonic Motives for Activities (HEMA) scale (Bujacz et al., 2014; Huta & Ryan, 2010) and adapted by van Riper, Winkler-Schor, et al. (2019). All value items were measured on a 9-point Likert scale ranging from 1 (opposed to my values) to 9 (of supreme importance) following Schwartz (1992).

To assess self-reported pro-environmental behavior that reduced the spread of aquatic invasive species, survey items were drawn from Landon et al. (2018) to reflect private, social, and public-sphere behaviors. Each behavioral dimension was measured by three items using a 5-point Likert scale ranging from 1 (never) to 5 (very often), alongside a Not Applicable option (NA). The NA response was coded as 1 under the assumption that it indicated non-participation and due to its likeness to never having performed a behavior following Huggins-Manley et al. (2018). This research was approved by the Institutional Review Board at the University of Illinois at Urbana-Champaign.

2.6. Analyses

A two-step approach was taken, including the initial estimation of a measurement model using confirmatory factor analysis (CFA) to test the validity and reliability of our measures, followed by a structural regression model to test whether our data fit the study hypotheses (Anderson & Gerbing, 1988). To understand the structural relationships among the latent variables, direct path coefficients from predictors to dependent variables were evaluated. Also, the products of the direct path coefficients were used to determine possible indirect effects of eudaimonic values on pro-environmental behavior. For fit assessment of the measurement and structural models, Root Mean Square Error of Approximation (RMSEA)  $\leq 0.07$  (Steiger, 2007), Comparative Fit Index (CFI)  $\geq 0.90$  (Bentler, 1990), and Standardized Root Mean Square Residual (SRMR) values  $\leq 0.07$  (Hu & Bentler, 1999) were considered acceptable.

In the initial measurement model, we observed low internal consistency ( $\alpha = 0.53$ ) of the survey items that measured private-sphere behaviors. Consequently, we ran an exploratory factor analysis to refine our hypothesized three-dimensional structure of pro-environmental behavior. Principal axis factoring was used to correct for measurement error and varimax rotation was used to minimize correlation among the latent variables. One survey item (“worked with others to minimize impacts from aquatic invasive species”) under social-sphere behavior was dropped from the model due to a factor loading  $\leq 0.40$  (Hair, Black,

Table 1

Results from a confirmatory factor analysis of survey items measuring values and pro-environmental behavior among survey respondents.

| Variable   | $\alpha$ | CR   | $\lambda$ | M (SD)         |
|--|----------|------|-----------|----------------|
| <i>Biospheric values</i>   | 0.88     | 0.89 |           | 7.23<br>(1.76) |
| Protecting the environment: preserving nature  |          |      | 0.833     | 7.55<br>(1.60) |
| Unity with nature: fitting into nature   |          |      | 0.881     | 7.02<br>(1.82) |
| A world of beauty: beauty of nature and the arts   |          |      | 0.835     | 7.13<br>(1.85) |
| <i>Altruistic values</i>   | 0.86     | 0.86 |           | 7.02<br>(2.10) |
| Equality: equal opportunity for all  |          |      | 0.848     | 7.09<br>(2.02) |
| Social justice: correcting injustice, care for others  |          |      | 0.882     | 6.87<br>(2.13) |
| A world at peace: free of war and conflict   |          |      | 0.728     | 7.10<br>(2.14) |
| <i>Egoistic values</i>   | 0.71     | 0.71 |           | 4.89<br>(2.11) |
| Authority: the right to lead or command  |          |      | 0.734     | 5.91<br>(2.04) |
| Social power: control over others, dominance   |          |      | 0.500     | 3.38<br>(2.24) |
| Influential: having an impact on people and events   |          |      | 0.773     | 5.40<br>(2.06) |
| <i>Hedonic values</i>  | 0.86     | 0.87 |           | 6.97<br>(1.79) |
| Fulfillment of desire: food, fun, pleasure   |          |      | 0.764     | 6.52<br>(1.90) |
| Enjoying life: pursuing hobbies, leisure, socializing  |          |      | 0.892     | 7.29<br>(1.70) |
| Reducing worries: seeking comfort and relaxation   |          |      | .0832     | 7.10<br>(1.77) |
| <i>Eudaimonic values</i>   | 0.87     | 0.88 |           | 7.22<br>(1.74) |
| Personal growth: development of new skills, learning, or gaining insight into something                    |          |      | 0.828     | 7.16<br>(1.73) |
| Pursuit of excellence: attaining a personal ideal in life  |          |      | 0.839     | 6.93<br>(1.84) |
| Autonomy: deciding your own future and doing what you believe in   |          |      | 0.733     | 7.44<br>(1.69) |
| Satisfaction with life: finding meaning, value, and relevance to a broader context                         |          |      | 0.789     | 7.36<br>(1.67) |
| <i>Private sphere behaviors</i>  | 0.63     | 0.61 |           | 2.57<br>(1.43) |
| Looked up information about aquatic invasive species   |          |      | 0.668     | 2.03<br>(1.08) |
| Avoided purchasing products that contribute to the spread of aquatic invasive species                      |          |      | 0.493     | 2.80<br>(1.78) |
| Took measures (e.g., washed boat or equipment) to personally reduce the spread of aquatic invasive species |          |      | 0.408     | 3.21<br>(1.66) |
| Talked to other people in my community about aquatic invasive species                                      |          |      | 0.693     | 2.23<br>(1.25) |
| <i>Public sphere behaviors</i>   | 0.74     | 0.75 |           | 1.49<br>(0.98) |
| Participated in a policy process (e.g., voting) related to aquatic invasive species                        |          |      | 0.664     | 1.72<br>(1.26) |
| Donated money with the intention of reducing impacts from aquatic invasive species                         |          |      | 0.600     | 1.61<br>(1.04) |
| Wrote a letter, sent an email, or signed a petition about aquatic invasive species                         |          |      | 0.662     | 1.29<br>(0.77) |
| Encouraged other people to attend an event related to aquatic invasive species                             |          |      | 0.720     | 1.35<br>(0.83) |

Note. All value items were measured on a Likert scale where 1 = “opposed to my values” and 9 = “of supreme importance”; All self-reported behavior items were measured on a Likert scale where 1 = “Never” and 5 = “Very Often”;  $\alpha$  = Cronbach’s alpha; CR = composite reliability;  $\lambda$  = factor loading; M = mean; SD = standard deviation.

Babin, Anderson, Tatham, 2006). Also, the social-sphere behavior items “talked to other people in my community about aquatic invasive species” and “encouraged other people to attend an event related to aquatic invasive species” were incorporated into private- and public-sphere behavior, respectively. These modifications were made on the basis of loading performance and justified because talking to other people such as friends and family could take place in personal contexts and because encouraging other people to attend events could occur in public contexts. Consequently, we adopted a modified two-factor solution that accounted for 54% of the total variance and showed improvement compared to the initial three-factor behavior model ( $\Delta\chi^2 = 112.36, p < .001$ ). The reliability coefficients of the two behavioral factors were  $\alpha = 0.63$  for private-sphere behavior and  $\alpha = 0.74$  for public-sphere behavior.

We examined potential bias attributed to missing data in our sample, following the guidelines provided by Enders (2010). A full-information maximum likelihood (FIML) procedure was used to account for missing data, but this required that the missing values be missing at random (MAR) or missing completely at random (MCAR) to ensure unbiased parameter estimation (Allison, 2003). The MAR assumption indicates the probability of missing data for the variable of interest are not associated with the variable itself, while MCAR data pattern is completely haphazard (Enders, 2010). We evaluated missingness using Little’s (1988) global test and found that our data were not MCAR ( $p < .05$ ). Given that the majority of our sample (77.8%) provided full responses and that none of the value and behavior questions were sensitive to privacy, we concluded the missing data mechanism was MAR. Consequently, we used the FIML method in our analysis.

We assessed normality of our data by examining the skewness and kurtosis of each variable as well as multivariate data normality using Mardia’s non-normality test (Mardia, 1970). We detected multivariate non-normality based on both multivariate skewness and kurtosis tests indicating  $p$ -values were less than .01. Therefore, we applied the robust maximum likelihood method to statistically correct standard errors and chi-square test statistics (MLR; Satorra & Bentler, 2001). The lavaan package of R version 3.6.1 was used for descriptive analyses as well as structural equation modelling (R Core Team, 2013).

### 3. Results

#### 3.1. Measurement models

Results from a CFA and a correlation matrix of latent variables (see Table 2) showed that the psychometric properties of our survey scales with modified behavioral dimensions were acceptable. The CFA model fit indices showed the data fit the model well ( $\chi^2 = 599.066, df = 231; CFI = 0.961; RMSEA = 0.038; SRMR = 0.035$ ). All factor loadings were

**Table 2**  
Latent factor correlations.

|                            | 1     | 2     | 3     | 4     | 5     | 6     | 7     |
|----------------------------|-------|-------|-------|-------|-------|-------|-------|
| 1. Private-sphere behavior | 1.000 |       |       |       |       |       |       |
| 2. Public-sphere behavior  | 0.748 | 1.000 |       |       |       |       |       |
| 3. Biospheric values       | 0.286 | 0.204 | 1.000 |       |       |       |       |
| 4. Altruistic values       | 0.191 | 0.187 | 0.729 | 1.000 |       |       |       |
| 5. Egoistic values         | 0.155 | 0.209 | 0.457 | 0.520 | 1.000 |       |       |
| 6. Hedonic values          | 0.178 | 0.139 | 0.587 | 0.531 | 0.501 | 1.000 |       |
| 7. Eudaimonic values       | 0.207 | 0.145 | 0.606 | 0.592 | 0.532 | 0.727 | 1.000 |

Note. All correlation coefficients (Pearson’s  $r$ ) are significant at  $p < .001$ .

$\geq 0.40$  and thus retained. All scales showed adequate to excellent reliability with alphas ranging from 0.63 to 0.88 (Hair et al., 2006) and composite reliability ranging from 0.61 to 0.89 (Bagozzi & Yi, 1988). Also, there were no high factor correlations ( $r \geq 0.80$ ) that would indicate significant overlap between the factors (Kline, 2015). Thus, our model was deemed acceptable for measuring the latent constructs examined in this study.

Biospheric values were most important ( $M = 7.23, SD = 1.76$ ) as guiding principles for the respondents, followed by eudaimonic ( $M = 7.22, SD = 1.74$ ), altruistic ( $M = 7.02, SD = 2.10$ ), and hedonic values ( $M = 6.97, SD = 1.79$ ). Egoistic values were less important ( $M = 4.89, SD = 2.11$ ). Respondents reported a low to moderate level of private-sphere behavior ( $M = 2.57, SD = 1.43$ ) and a low level of public-sphere behavior ( $M = 1.49, SD = 0.98$ ) to prevent the spread of aquatic invasive species.

#### 3.2. Structural regression modeling results

We tested our hypothesized path model using structural equation modeling (see Table 3). The model fit the data well ( $\chi^2 = 599.066, df = 231; CFI = 0.961; RMSEA = 0.038; SRMR = 0.035$ ). In addition to examining the direct paths from values to behavior, we also estimated the indirect effects of eudaimonic values on behavior through other individual values.

The hypothesized relationships among variables were partially supported (see Fig. 2). In support of H1–H4, eudaimonic values significantly ( $p < .01$ ) and positively predicted all other individual values, namely biospheric ( $\gamma = .606$ ), altruistic ( $\gamma = .592$ ), egoistic ( $\gamma = .532$ ), and hedonic ( $\gamma = .727$ ) values, explaining 28.3–52.8% of variation ( $R^2$ ) in these dependent variables. In turn, biospheric values were positively related to private-sphere ( $\beta = .291$ ) and public-sphere behaviors ( $\beta = .135$ ) at  $p < .01$ , supporting H8 and H10. However, altruistic values did not significantly predict any dimension of behavior, providing no support for H11 and H13. Contrary to H14 and H16, Egoistic values positively predicted public-sphere behavior ( $\beta = .151$ ) at  $p < .01$  while the path from egoistic values to private-sphere behavior was non-significant. H17

**Table 3**  
Estimates of the structural regression model.

| Dependent variable | Predictor variable | $\gamma$ | $\beta$ | SE   | $t$ -value | $R^2$ |
|--------------------|--------------------|----------|---------|------|------------|-------|
| Private behavior   | Biospheric values  | –        | .291    | .058 | 4.172**    | .086  |
| Private behavior   | Altruistic values  | –        | -.066   | .057 | –0.968     |       |
| Private behavior   | Egoistic values    | –        | .031    | .054 | 0.504      |       |
| Private behavior   | Hedonic values     | –        | -.026   | .047 | –0.390     |       |
| Private behavior   | Eudaimonic values  | .072     | –       | .074 | 1.019      |       |
| Public behavior    | Biospheric values  | –        | .135    | .048 | 2.287*     | .059  |
| Public behavior    | Altruistic values  | –        | .033    | .051 | 0.532      |       |
| Public behavior    | Egoistic values    | –        | .151    | .051 | 2.573*     |       |
| Public behavior    | Hedonic values     | –        | -.013   | .042 | –0.212     |       |
| Public behavior    | Eudaimonic values  | -.028    | –       | .067 | –0.429     |       |
| Biospheric values  | Eudaimonic values  | .606     | –       | .059 | 12.851**   | .367  |
| Altruistic values  | Eudaimonic values  | .592     | –       | .057 | 12.929**   | .350  |
| Egoistic values    | Eudaimonic values  | .532     | –       | .051 | 12.374**   | .283  |
| Hedonic values     | Eudaimonic values  | .727     | –       | .080 | 13.208**   | .528  |

Note.  $\gamma$  = standardized regression coefficients between exogenous and endogenous constructs;  $\beta$  = standardized regression coefficient between endogenous constructs; SE = standard error. \*significant at  $p < .05$ ; \*\*significant at  $p < .01$ .

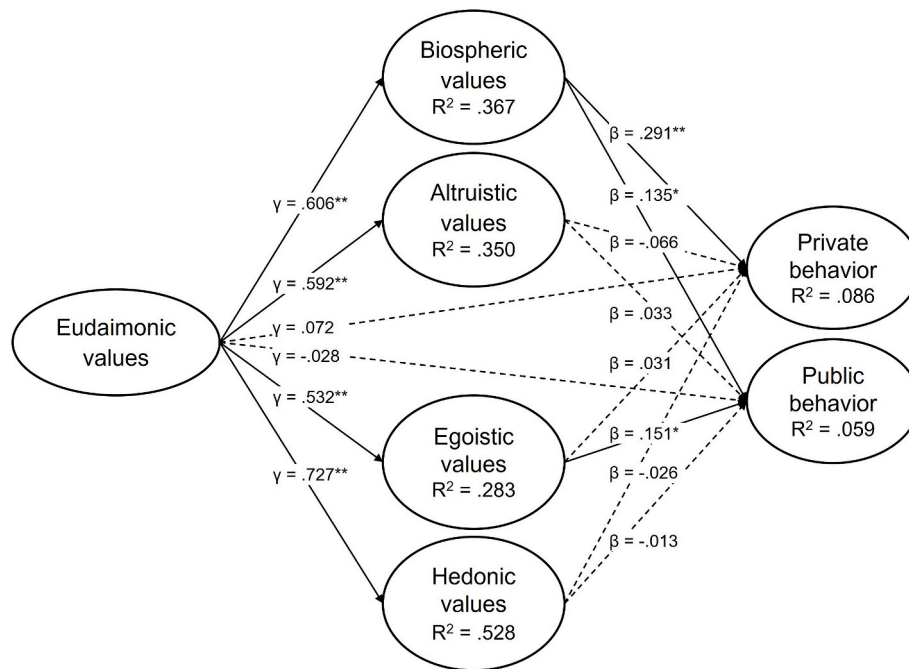


Fig. 2. Results from structural regression model of value-behavior relationships. Non-significant paths are shown using dotted lines. \*significant at  $p < .05$ ; \*\*significant at  $p < .01$ .

and H19 were not supported due to the non-significant path coefficients between hedonic values and behavior. Eudaimonic values did not significantly predict behavior (opposed to H5 and H7), but indirect effects were found through biospheric values (for private-sphere behavior,  $\beta = .202$ ,  $t$ -value = 4.111, 95% confidence interval [CI] = [0.112, 0.315]; for public-sphere behavior,  $\beta = .121$ ,  $t$ -value = 2.838, 95% CI = [0.039, 0.212]) and egoistic values (for public-sphere behavior,  $\beta = .098$ ,  $t$ -value = 2.169, 95% CI = [0.010, 0.193]). The variance of behavior explained by the full effects of the predictor variables ( $R^2$ ) was 8.6% for private-sphere behavior and 5.9% for public-sphere behavior.

#### 4. Discussion

Biological invasions are plaguing freshwater resources that are important for human well-being and quality of life. Given explicit ties between the spread of aquatic invasive species and human behavior, this study tested a series of hypotheses to understand the fundamental role of values in explaining angler behavior using latent variable modeling techniques. Drawing on the Theory of Basic Human Values (Schwartz, 1992, 1994), the VBN theory (Stern, 2000; Stern et al., 1999), Goal Framing Theory (Lindenberg & Steg, 2007) and SDT (Ryan & Deci, 2000), we advanced conceptualization of values as drivers of behaviors that reduce the spread of aquatic invasive species. In particular, we found that eudaimonic values were a strong predictor of other values which in turn accounted for a moderate level of variation in angler behavior. These findings create space for discussion about the role of different human values for engaging in pro-environmental behaviors.

##### 4.1. Values related to pro-environmental behavior

We observed that recreational anglers' self-reported pro-environmental behavior was motivated by human values that correspond to behavioral goals, in line with previous research (e.g., de Groot & Steg, 2009; Nordlund & Garvill, 2003; Poortinga et al., 2004; Schultz & Zelezny, 1999; van Riper, Winkler-Schor, et al., 2019). As expected, biospheric values were positively associated with both private- and public-sphere actions to minimize the spread of aquatic invasive species. This result indicated that strong principles oriented toward the

well-being of other species beyond oneself correspond to the goal of benefiting freshwater ecosystems. Contrary to our expectations and previous research (Hartmann et al., 2017; Steg, Perlaviciute, et al., 2014), altruistic and hedonic values did not significantly predict behavior to prevent the spread of invasive species. It could be that altruistic values are more relevant for behaviors based on humanitarian goals than those based on environmental goals (de Groot & Steg, 2010). In a similar vein, hedonic values were not significantly related to pro-environmental behavior, possibly because behaviors such as cleaning equipment were viewed as a task that might detract from pleasure and enjoyment. This finding is consistent with previous observations that values oriented toward short-term pleasure are unlikely to increase pro-environmental behavior (Steg, Perlaviciute, et al., 2014; van Riper, Winkler-Schor, et al., 2019). Our results suggest that respondents' behavioral goals correspond with motives to protect aquatic ecosystems but not to benefit others or gain hedonic pleasure.

In contrast to our hypotheses, egoistic values positively correlated to public-sphere pro-environmental behavior reported by survey respondents. The reason for this pattern could be two-fold. First, because egoistic values were measured using statements about authority and control over social systems and other people, endorsement of such values might have motivated public-sphere behaviors including political actions and leading others to attend events related to aquatic invasive species. Also, in line with the tenets of the motivational axis of self-enhancement (Schwartz, 1992; Stern, Dietz, & Guagnano, 1998), egoistic values could have aligned with pro-environmental behavior that benefited anglers' own interests in recreational fishing. Several studies have suggested that pro-environmental behavior can be advanced by egoistic values when an action increases one's personal benefits (De Dominicis et al., 2017; Steg, Bolderdijk, et al., 2014; Turaga et al., 2010) and utility from sustainable use of natural resources (Ojea & Loureiro, 2007). Thus, the theoretical assumption that egoistic values conflict with intention to benefit the environment (Stern, 2000; Stern et al., 1999) should not be taken for granted but continue to be explored for specific behavioral goals.

#### 4.2. The role of eudaimonic values in value-behavior relationships

We observed that eudaimonic values did not directly influence respondents' actions to minimize the spread of aquatic invasive species. While this result did not support our hypothesis that eudaimonic values were a direct predictor of pro-environmental behavior, we extended van Riper, Winkler-Schor, et al. (2019) by testing for indirect effects of eudaimonic values on behavior through other values. Our study confirms that eudaimonia can be operationalized as a higher-order value that precedes other values, which guide judgements about an individual's conduct (Huta, 2012; Ryan et al., 2008).

Our findings indicate that eudaimonic values have positive effects on values such as biospheric, altruistic, egoistic, and hedonic. Respondents that endorsed eudaimonic values tended to consider benefits for others, including human and non-human species, as guiding principles in their life. The endorsement of eudaimonic values was also positively related to values rooted in self-centered needs (e.g., desire for social power and control) and achievement of pleasure. Our argument that eudaimonic values help to establish motivations for achieving one's full potential and self-expression was therefore supported. Expression of the true self and acting in full accordance with one's values may lead to eudaimonic well-being (Waterman, 1993), which is a meaningful way of living one's life described in SDT (Ryan & Deci, 2001; Ryan et al., 2008). Therefore, we contend that the motivation for a meaningful life underpins the salient expression of personal values.

The indirect effects in our model suggest that eudaimonic values alone might not motivate the actions needed for recreational anglers to prevent biological invasions, but instead requires endorsement of other values for inducing behavior change. Results indicated that biospheric and egoistic values, in particular, activated the pathway from eudaimonic values to pro-environmental behavior. Specifically, recreational anglers who actively sought a eudaimonic lifestyle were more likely to practice preventive measures against invasive species on the premise of environmental protection. This result is supported by previous research that has indicated eudaimonic well-being is correlated with feeling connected to and concerned about nature (Knippenberg et al., 2018; Nisbet et al., 2011; Pritchard et al., 2019), which is interconnected with biospheric values (Martin & Czellar, 2017). We also observed that as eudaimonic values increased, so too did self-centered needs, which in turn increased engagement in activities in the public domain such as exercising political influence related to invasive species management. These results demonstrate that behavior for environmental protection can be a means for anglers to make their lives more meaningful given that they possess values related to environmental and self-centered goals.

We did not detect that eudaimonic values played an important role in explaining pro-environmental behavior by activating altruistic and hedonic concerns. This may be attributable to the lack of association of altruistic and hedonic values with activities to reduce biological invasions in freshwater environments. Nevertheless, eudaimonic values gave rise to altruistic values, suggesting that consideration of social benefits such as justice and peace are important principles guided by the pursuit of living a meaningful life. In addition, eudaimonic and hedonic values were strongly correlated, aligning with our assumption that both were oriented toward psychological well-being. Yet, eudaimonic and hedonic values were conceptually distinct, in that motives for personal growth and excellence were antecedents to the pursuit of hedonic pleasure and enjoyment. This finding further supports previous research that suggests eudaimonia and hedonia stem from similar needs but are distinguishable (Huta & Waterman, 2014; Venhoeven et al., 2013). Therefore, our results indicate that values oriented toward living a meaningful life positively affect altruistic concerns for other people's benefits and pursuits of hedonic pleasure.

#### 4.3. Implications for future research and decision-making

Our findings extend previous research that has conceptualized the relationships between values and pro-environmental behavior (Rokeach, 1973; Schultz et al., 2005; Schwartz, 1992; Steg, Perlaviciute, et al., 2014; Stern, 2000; van Riper & Kyle, 2014) by incorporating aspects of psychological well-being into the human value system. While the observed structural pattern of values is largely in line with theoretical and empirical knowledge, the low degree of variance in behavior accounted for by values warrants further research attention. Such improvements can be made by adding explanatory factors, in addition to values, which are specifically relevant to the behavioral goals and contexts being studied (Steg, Bolderdijk, et al., 2014). For example, attitudes, norms, connection to nature, and self-efficacy would be important mediating factors that bridge value-behavior relationships (Ajzen, 1991; Fishbein & Ajzen, 2011; Krasny, 2020; Mayer & Frantz, 2004; Stern, 2000).

Our approach to measuring eudaimonic values was inspired by previous research (Bujacz et al., 2014; Huta & Ryan, 2010) and showed relatively strong reliability and construct validity; however, further research should consider incorporating the psychological need of relatedness into this scale given its importance alongside autonomy and competence that were accounted for by asking about personal growth (Ryan et al., 2008). Although relatedness implies having relationships with other people, mounting research has suggested that the need for relatedness can also be met through fostering connection to nature (Baxter & Pelletier, 2019; Cleary et al., 2017). Thus, including relatedness in the definition and scale for eudaimonic values, as well as examining its relationship with connection to nature as a direct predictor of pro-environmental behavior, are promising areas for future research.

Human values should receive more attention from decision-makers seeking behavior change in resource management contexts such as recreational fisheries in the Great Lakes region. Values are considered long-term and stable drivers of behavior as compared to short-term fixes that are often targeted through management interventions. Focusing on short-term solutions such as raising awareness and inducing normative pressures can be limiting insofar as its lasting effects on behavior change, because belief systems are sensitive to changing circumstances (e.g., new information can easily shift unstable beliefs, feelings of guilt or worry may be ephemeral). To encourage more prolonged engagement of anglers in preventing the spread of invasive species in the Great Lakes region, agencies and angler associations would benefit from working to understand, negotiate, and align their actions and messages with more fundamental, and more stable, personal values. This research approach would deepen the current emphasis placed on outreach, education, and information sharing (Cole et al., 2019; Golebie et al., 2021). Fundamentally, without cognitive awareness of environmental impacts of certain behaviors, it is unlikely that behavioral intentions will form, yet these beliefs will be reinforced if agencies also consider and activate values. For instance, communication could stimulate anglers' care for healthy ecosystems, with propositions that stewarding nature will make life more meaningful and self-expressive (Krasny, 2020). Such a value-based approach in resource management would require knowledge of the values held within a given constituency and the ability to align with their guiding principles for longer-term environmental sustainability.

## 5. Conclusion

The study of values is instrumental for understanding human behavior. Various conceptualizations of values call for empirical validation and application of theories to approximate the precise structures of the human mind. This study provides a cross-sectional view of the values of recreational anglers in the Great Lakes region that is faced with threats from aquatic invasive species. We provide evidence that pro-



environmental behavior is a function of multiple human values, particularly eudaimonic values. We contend that principles of a well-lived and meaningful life are the basis for understanding both values and pro-environmental behavior. Particularly in the context of recreational angling, but certainly not limited to it, Aristotle's view that eudaimonia is achieved through leisure pursuits aligns with the goals of environmental sustainability.

### Author contributions

Lead author: Conceptualized the project idea, developed first draft of the manuscript as part of a PhD dissertation, led the analysis, interpreted results, and communicated findings. Second author: Conceptualized the project idea, coordinated data collection and entry, provided guidance on analysis and interpretation of the results, edited the manuscript, and served as Principal Investigator for the grant supporting this work. Third author: Provided guidance on analysis and interpretation of the results, edited the manuscript, and served as co-Principal Investigator for the grant supporting this work. Fourth author: Provided guidance on analysis and interpretation of the results, edited the manuscript, and served as co-Principal Investigator for the grant supporting this work.

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