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Explaining Anti-Angling Sentiments in the General Population of Germany: An Application of the Cognitive Hierarchy Model

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A cognitive hierarchy framework was used for understanding the impact of two wildlife value orientations (WVO), domination and mutualism, on anti-angling sentiments in Germany. We also explored anthropomorphism (i.e., attribution of sentience and pain perception to animals), attitudes toward animal rights, and attitudes toward recreational and catch-and-release angling as constructs that might mediate the influence of WVO on the support for a ban on recreational angling. Data from 1,043 randomly selected persons were analyzed using structural equation modeling. Results supported the suitability of WVO to explain the moral acceptability of recreational fishing mediated by animal rights ideology. We found little effect of anthropomorphism on attitudes toward recreational fishing. We conclude that convincingly answering the question of whether or not fish feel pain is unlikely to alter the social climate related to recreational fishing. By contrast, an increase of mutualism WVO in Germany is likely to elevate negative resentment to recreational fishing.

Keywords animal liberation, animal rights, anthropomorphism, catch-and-release, fish pain, recreational fishing, wildlife value orientations

Introduction

Recreational angling has come under moral and subsequently legal pressure in several industrialized countries due to rising concerns about the welfare status of individual animals in harmful human–animal interactions (Arlinghaus, Schwab, Riepe, & Teel, 2012). This development is assumed to be driven, in part, by an intergenerational shift in societal values that is tied to increasing affluence and shifting need structures in industrialized countries (Inglehart, 1997; Manfredo, Teel, & Bright, 2003; Manfredo, Teel, & Henry, 2009). In relation to fisheries, there seems to be growing unease in many industrialized nations over the potential capacity of fish to feel pain and suffer in the process of recreational angling (Arlinghaus, Schwab, Cooke, & Cowx, 2009). Clearly, however, one can also hold anti-angling attitudes for reasons that are not contingent on sentience of fish. For example,

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some people might morally object to recreational fishing because it is perceived as interfering with their conception of wilderness, or because the use of animals per se is seen as unethical and unnecessary (Arlinghaus & Schwab, 2011).

Any changes in societal values have the potential to affect animal-related legislation, in particular when effective lobbying by anti-angling lobby groups meets with limited political support for recreational fishing interests (Arlinghaus et al., 2012). Germany may serve as one example. The first clause of the German Animal Protection Act (§1 Tierschutzgesetz, 2013) specifies that nobody is allowed to inflict pain, suffering, or damage on a vertebrate animal without a reasonable purpose. Various court cases in the 1980s and 1990s against critical angling practices, such as voluntary catch-and-release fishing of legally harvestable fish or competitive fishing, have helped clarify that the German society tolerates recreational fishing only if the actor's intention is to harvest fish for personal consumption (Arlinghaus, 2007; Arlinghaus et al., 2009) or to help maintain ecological balance (Meinelt, Arlinghaus, & Jendrusch, 2008). Once popular angling practices where the actor's intention is primarily something other than the consumption of fish, such as fishing competitions or total catch-and-release fishing, have consequently been restricted or entirely banned in Germany (Arlinghaus, 2007; Arlinghaus et al., 2009; Meinelt et al., 2008). Similar developments have recently happened in Switzerland and other countries where the ethical burden on some recreational fishing practices such as catch-and-release fishing is on the rise (Arlinghaus et al., 2012).

Surveys in selected industrialized countries have shown that about one quarter of the general population in some western nations perceives recreational angling, or some of its practices such as voluntary catch-and-release angling, as cruel (Arlinghaus et al., 2012). Fundamental to the cruelty charge is the assumed sentience of fishes (de Leeuw, 1996). From a biophysical science perspective, there is considerable scientific uncertainty as to whether fish are actually capable of feeling pain and to suffer (Braithwaite, 2010; Rose et al., 2014). However, what matters for the ethical judgment by people is likely the subjective ascription of negative mental states to fish, regardless of whether such attributions are scientifically justified. In a recent survey among the general population in New Zealand, Muir, Keown, Adams, and Farnworth (2013) found that the majority of respondents believed that fish were able to feel pain and that catch-and-release angling causes pain to fish. At the same time, two-thirds of respondents considered this particular angling practice acceptable, but those who deemed it unacceptable were more concerned with pain in fish than those who found it to be acceptable.

Academically, concerns about the potential maltreatment of fishes by anglers can originate from three different moral philosophical backgrounds, all of which focus on the impact of humans on the individual animal (Arlinghaus, Cooke, Schwab, & Cowx, 2007; Arlinghaus et al., 2009). First, animal *welfare* describes a position that basically permits human use of animals provided that their well-being is taken into account and any impacts are minimized. Although welfare thinking applied to fish does not strictly center on fish pain (Arlinghaus et al., 2007), some academics prefer defining fish welfare by the "absence of suffering" (Huntingford et al., 2006, 2007). Second, fish pain is also central to animal *liberation*, a philosophical tradition that judges the consequences of actions and how they interfere with the preferences and interests of both humans and non-human animals (Singer, 2009). According to this stream of thought, sentient animals are assumed to have preferences and interests entitling them to be protected against misuse by humans (Singer, 2009). Animal liberation claims that an action is permissible if the benefits received by humans through their use of animals outweigh the costs in terms of reduced well-being of the animals. In practice, however, animal liberationists typically oppose recreational fishing

because the pleasure received by the angler is not perceived as important enough to outbalance the suffering-related costs imposed on fishes (Arlinghaus et al., 2009). Finally, according to animal *rights* philosophy, not only humans possess an inherent value, but also some animals do, in particular those possessing beliefs, desires, emotions, the ability to feel pain, and a sense of psychophysical identity. Humans and all animals sharing these qualities are so-called "subjects-of-a-life," and every subject-of-a-life has the right not to be harmed (Regan, 2004). Recreational angling is, therefore, morally not permissible. In fact, animal rights proponents oppose every form of human use of animals with characteristics of a subject-of-a-life.

Differences among these three animal-related ideologies are relatively clear-cut from an academic perspective. However, average citizens are likely to hold a mixture of perspectives when morally assessing certain human practices in relation to animals (Arlinghaus et al., 2007, 2012), typically falling somewhere along a continuum ranging from the more moderate animal welfare views to the stronger protectionist convictions related to animal rights or liberation reasoning (Hutchins, 2007; Signal & Taylor, 2006). In the United States, the general population is more willing to endorse the more liberal animal welfare than the rights position (Responsive Management, 2008). It is not clear whether these findings hold true for other industrialized nations such as Germany, which has previously been reported to host people with a different value system compared to the United States and Japan (Kellert, 1993).

Given the complexity of the animal welfare concept, it is unclear how beliefs, attitudes, and other cognitions that humans may hold toward animals relate to anti-angling sentiments and to what degree, if at all, the attribution of sentience to fishes plays a role. The objective of our study was to describe and model some driving forces behind anti-angling sentiments in the general population in Germany at the micro level of individual cognitions and behavioral intentions related to recreational angling. We focused particularly on understanding how wildlife value orientations, attitudes toward animal rights, and beliefs about sentience in animals were linked to attitudes toward recreational angling in general and voluntary catch-and-release in particular as one of its most debated fisheries practices from a moral perspective (Arlinghaus, 2007; Arlinghaus et al., 2009, 2012).

Theoretical Background, Conceptual Model, and Hypotheses

Postindustrialization, urbanization, and increasing affluence are assumed to alter values held by a society in relation to the use of animals (Manfredo, 2008). Facilitated by a reduction of direct experience with wildlife and nature in urban societies, emphasis on materialist values (related to economic and physical security) declines, whereas postmaterialist values (such as self-expression and belongingness, which includes concern for the environment and animals) gain in importance (Inglehart, 1997; Manfredo et al., 2009; Oesterdiekhoff & Jegelka, 2001). Values are enduring beliefs held by members of a society. Values constitute an internal moral compass for an individual (Manfredo, 2008), but they are so general in nature that they supply unspecific behavioral guidance in a given situation. To improve predictive ability, Manfredo and colleagues (e.g., Fulton, Manfredo, & Lipscomb, 1996; Manfredo, 2008; Manfredo et al., 2009; Teel, Dayer, Manfredo, & Bright, 2005) developed the concept of wildlife value orientations (WVO), which are cognitive networks of interrelated beliefs that refer to basic values and supply them with contextual meaning in relation to wildlife. WVO have been found to affect specific attitudes and behavioral intentions of individuals targeted at wildlife-related activities such as fishing (Bruskotter & Fulton 2008; Fulton et al., 1996).

Two key WVO are domination (formerly named utilitarian) and mutualism (Fulton et al., 1996; Manfredo et al., 2009; Teel et al., 2005). Individuals scoring high on domination tend to hold the view that human well-being should take priority over the welfare of fish and wildlife, and that species should be managed and used for human benefit. Such individuals have also been found to engage in hunting or fishing more often than those with a strong mutualism orientation (Fulton et al., 1996; Hrubes, Ajzen, & Daigle, 2001; Manfredo et al., 2009). People with a high score on the mutualism dimension view wildlife and fish as capable of relationships of trust with humans and deserving rights similar to humans. These individuals are more likely to perform behaviors that enhance the welfare of animals and are less likely to support harmful or lethal activities toward animals (Manfredo, 2008; Manfredo et al., 2009; Teel et al., 2005). Mutualists are also more likely to attribute human properties such as emotions, personality traits, or mental abilities to fish and wildlife; that is, they tend to anthropomorphize animals (Manfredo, 2008; Manfredo et al., 2009).

Paralleling the enduring shift in societal values, a change in WVO has been hypothesized to occur entailing an increase of the share of people holding mutualist views toward wildlife and a decrease of those adhering to the domination orientation (Manfredo et al., 2009; Teel et al., 2005). As a consequence, the societal tolerance of recreational hunting and fishing is expected to decrease on moral grounds (Manfredo, 2008). Little research exists, however, on how WVO and specific animal-related cognitions, such as the support for animal rights or anthropomorphism, interrelate to jointly influence anti-angling attitudes and behaviors.

The cognitive hierarchy model (Fulton et al., 1996) constitutes a theoretical framework that can be used for studying anti-angling sentiments as a function of underlying WVO and other attitudes and beliefs related to animals. This model builds on the value-attitude-behavior hierarchy proposed by Homer and Kahle (1988). Fulton et al. (1996) elaborated this model in relation to WVO assuming a multi-stage hierarchy of psychological attributes that exert influences on one another in a cascade-like fashion to affect behavioral intentions and ultimately behavior in relation to hunting and fishing (see Figure 1 for a model variant that we used here). According to Fulton et al. (1996), the model starts with broad constructs such as values or value orientations, which then shape general attitudes and beliefs, which, in turn, inform more specific attitudes and beliefs that are woven around a particular

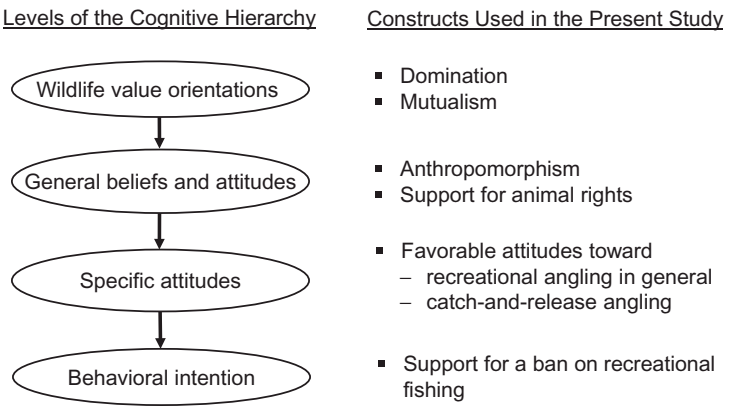

Figure 1. Hypothesized cognitive hierarchy of influences on anti-angling behavior.

behavioral domain. These domain-specific attributes are then thought to be the antecedents of behavioral intentions, which are considered to be good predictors of actual behaviors (Ajzen, 2005).

A number of studies have found good predictive ability of the WVO construct. Fulton et al. (1996) used the cognitive hierarchy approach to model the impact of WVO on the attitude toward hunting and fishing, and subsequently this attitude's effect on the intention to participate in hunting and fishing. Manfredo et al. (2009) reported that the domination WVO was positively correlated with hunting participation and support for lethal control of bears as a tool for human–wildlife conflict management (which served as an attitudinal measure), whereas mutualism was negatively associated with both of these factors. Bruskotter and Fulton (2008) demonstrated that fisheries-related value orientations predicted anglers' stewardship norms, and Hrubes et al. (2001) found that WVO were correlated with hunting behavior.

A substantial part of research on WVO has been conducted in the United States. Lately, some research has also been carried out in European countries (Teel et al., 2010). Hermann, Voß, and Menzel (2013), for example, used Manfredo et al.'s (2009) set of items to measure WVO to explain the intention of supporting the reintroduction of large terrestrial mammals (wolves, bisons) to Germany. They found domination to be negatively correlated with the intention to support the reintroduction of both species, and mutualism to be positively correlated with support. Yet, the authors did not measure attitudes or beliefs that might potentially mediate the relationship between WVO and behavioral intentions, such as the attitude toward animal rights or the degree of anthropomorphic thinking.

Figure 1 summarizes our study concept, which draws on the approach suggested by Fulton et al. (1996). Starting at the bottom of the hierarchy, we sought to explain between-subject variation in the approval of the abolishment of recreational angling and the intention to actually support such a ban. We expected this anti-angling intention to be driven by attitudes toward the moral acceptability of recreational angling in general and of catch-and-release angling in particular as specific behavioral domains. We further hypothesized that the less that individuals approve of recreational angling, the more likely they are to support anti-angling activities. The specific practice of catch-and-release was included as a sub-dimension because it is among the most critically viewed angling practices from a fish welfare perspective, possibly because it is viewed as a visible sign of nonharvest-oriented fishing intentions (Arlinghaus et al., 2009).

According to the multi-stage cognitive hierarchy model, specific attitudes may be informed by more general beliefs such as the degree that individuals anthropomorphize animals by attributing the capability to experience negative emotions such as pain, fear, or suffering to them. Specific attitudes may also be influenced by general attitudes toward animals such as supporting the idea that the moral rights of animals should not be violated by using them for food, clothing, or fur. The former construct relates to animal liberation (Singer, 2009) and taps the concept of animal sentience, whereas both aspects refer to central concepts of animal rights philosophy (Regan, 2004). We hypothesized that the stronger individuals anthropomorphize animals and the more they tend to concede moral rights to them, the less favorable their attitude will be toward recreational angling.

Finally, on top of the hierarchy, we followed Teel et al. (2005) in measuring domination and mutualism as WVO because these concepts promised to have explanatory power in the context of the moral acceptability of recreational fisheries. We hypothesized that the higher individuals score on domination, the more they approve of recreational angling, whereas with increasing scores on mutualism they express more disapproval of this activity.

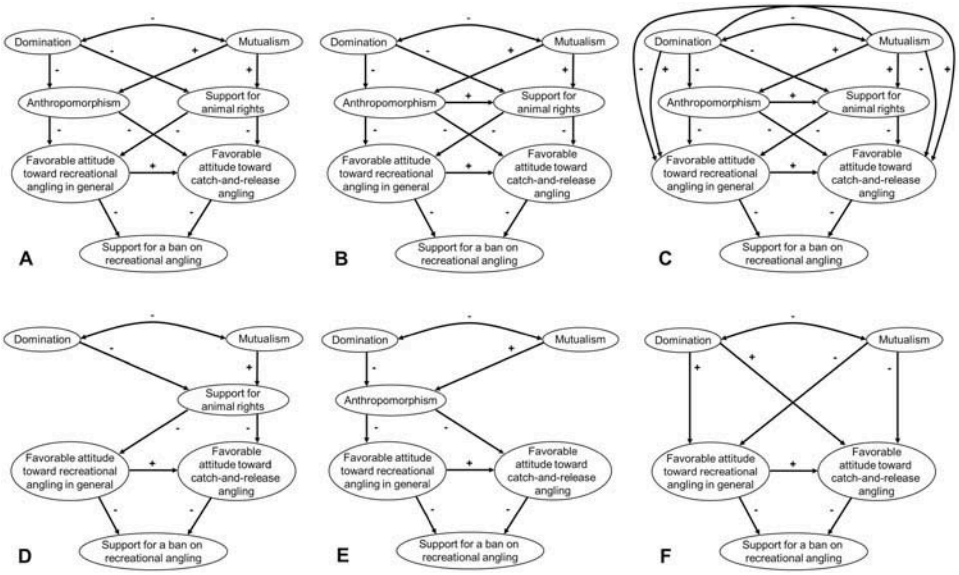

Figure 2. Candidate models with hypothesized direction of effects between components of the cognitive hierarchy model. Domination = Appropriate Use Beliefs subscale; Mutualism = Social Affiliation Beliefs subscale; Support for animal rights = Animal Use subscale of the Animal Rights Scale. A: Base model. B: Base model with additional path at the level of general beliefs and attitudes. C: Same as B but with direct effects of wildlife value orientations on specific attitudes toward angling. D: Base model with anthropomorphism omitted. E: Base model with support for animal rights omitted. F: Base model with both anthropomorphism and support for animal rights omitted.

We further expected the influence of WVO on the acceptability of recreational angling to be mediated by anthropomorphism and the attitude toward animal rights.

To identify the most parsimonious model, we postulated and tested six candidate models (Models A to F, Figure 2). The arrows between the constructs in Figure 2 symbolize the hypothesized flow of cognitive processing and the algebraic signs indicate our hypotheses about the direction of influence. We assumed two constructs to be involved at each of the hierarchical levels preceding behavioral intention. At the top level in Model A, the two WVO were hypothesized to correlate with each other (Teel et al., 2005) and to affect both constructs at the subsequent level of general beliefs and attitudes toward animals, which, in turn, should influence the attitudes toward angling in general and toward catch-and-release angling in particular. As the latter is a sub-construct of the former, we expected the broader fishing construct to inform the more specific attitude toward catch-and-release angling. Both of these attitudes should have an influence on the degree that people are willing to support a ban on recreational angling.

Models B to F were variations of Model A at the level of general beliefs and attitudes to explore their adequate positioning in the hierarchy. In Model B, we assumed an additional relationship between anthropomorphism and the conviction that animals should be conceded moral rights. At the core of the concept, anthropomorphism is about beliefs people hold about psychological abilities that animals might have, and beliefs can be conceptualized as the informational foundation of an attitude (Ajzen, 2005) such as the attitude toward animal rights. Also, anthropomorphic thinking is a person-related trait with a presumably genetic basis, which is assumed to have evolved because it provided superior hunting

abilities (Manfredo, 2008), and thus seems to historically precede the emergence of the idea that animals should be legally protected and eventually granted rights similar to those of humans (Lawrence, 2008). Therefore, the hypothesized direction of the influence from anthropomorphism to the support for animal rights seems theoretically justified and is supported by earlier research (Herzog & Galvin, 1997; Wuensch, Poteat, & Jernigan, 1991). In Model C, we sought to establish whether allowing for an additional direct impact of the WVO on attitudes toward angling would improve Model B. As both anthropomorphism and support for animal rights have not yet been incorporated into a cognitive hierarchy approach, we finally tested whether either of them (Models D and E) or both (Model F) may be omitted without reducing model fit.

Methods

Sample and Survey Procedure

Data were collected as part of a survey among the general population of Germany that was intended to generate representative information about the current state of value orientations, beliefs, and attitudes related to recreational angling in the context of fish welfare. The study was designed cross-sectionally and was based on a random sample of $n = 1{,}043$ individuals (72% response rate). The population was defined as German-speaking persons aged 14 years or older who lived in private households at their principal place of residence in the territory of the Federal Republic of Germany. The sample was generated according to the three-stage ADM (Arbeitskreis Deutscher Markt- und Sozialforschungsinstitute) sampling system (Bortz & Döring, 2006), consisting of: (a) a random area sample, (b) a selection of private households along a random route from a starting point within the sampled areas (i.e., sampling points), and (c) a random selection of interviewees within a household according to a Kish selection grid. Data were collected in 131 sampling points by means of an extensively pretested paper-and-pencil questionnaire administered face-to-face by interviewers in respondent homes. Mean interview length was 53.1 minutes ($SD = 12.8$). Data were collected in October and November 2008 by a professional polling institute (BIK Marplan Intermedia GmbH, Offenbach, Germany).

Measures

The questionnaire included items and scales that we hypothesized a priori to be potential indicators of the constructs of the cognitive hierarchy model.[1] Two subscales have been published for the measurement of each of the two WVO (Manfredo et al., 2009; Teel et al., 2005): (a) the Appropriate Use Beliefs and the Hunting Beliefs subscales of the domination value orientation, which was originally named as the utilitarian value orientation by Teel et al. (2005), and (b) the Social Affiliation Beliefs and the Caring Beliefs subscales of the mutualism value orientation. By running confirmatory factor analyses, Teel et al. (2005) found that the Appropriate Use Beliefs subscale (they called the Utilitarian Belief dimension) had a higher loading on the domination factor compared to the Hunting Beliefs subscale. Likewise, the Social Affiliation Beliefs subscale (they called the Mutualism Belief dimension) exhibited a higher loading on the mutualism factor than did the Caring Beliefs subscale. Given our target activity (i.e., recreational fishing, not hunting), the original labels of the WVO and their subscales that Teel et al. (2005) used, and the pattern of loadings that was revealed in confirmatory factor analyses, we decided to omit the Hunting and the Caring Beliefs subscales in our study to save questionnaire space and reduce respondent

burden. Despite this reduction in information obtained, we were confident to tap the core meaning of both WVO and consequently named the concepts we were measuring as domination and mutualism WVO. We administered five of the six items in the Appropriate Use Beliefs subscale of the domination value orientation (e.g., "humans should manage fish and wildlife populations so that humans benefit;" Manfredo et al., 2009). We used three of the four items in the Social Affiliation Beliefs subscale of the mutualism value orientation (e.g., "I view all living things as part of one big family;" Manfredo et al., 2009). We omitted Item 6 of the Appropriate Use Beliefs subscale and Item 3 of the Social Affiliation Beliefs subscale (Manfredo et al., 2009, p. 417) because keeping them would have led to an overlap of item contents with items used for the measurement of the support for animal rights.

For the measurement of the latter concept, we drew on the Animal Rights Scale (Wuensch, Jenkins, & Poteat, 2002) that consists of two subscales: Animal Use and Animal Research. Given that we did not expect the Animal Research subscale to contribute relevant information to our understanding of the public perception of recreational angling, which lacks obvious relationships with research activities, we disregarded all items belonging uniquely to this subscale. We administered 14 of the 18 items of the Animal Use subscale omitting Items 13, 14, 15, and 24 because they were either redundant, made reference to animal research, were outdated, or overlapped with one of the scales measuring WVO. The remaining 14 items were used for measuring respondent support for animal rights and opposition to using animals for food, clothing, and fur (e.g., "animals should be granted the same rights as humans," "it is wrong to wear leather jackets and pants"). By administering only some items of the Animal Use subscale, we reduced the information that was generated compared to the application of the full Animal Rights Scale. However, we were convinced to tap a key aspect that is measured by means of the Animal Rights Scale, which is the support for animal rights including the opposition to using animals for human purposes other than research. We therefore named the concept that we were targeting support for animal rights as measured by the Animal Use subscale of the Animal Rights Scale.

Respondents answered items of both WVO and support for animal rights on a 5-point scale from 1 (*strongly disagree*) to 5 (*strongly agree*). Given that the measurement of the three constructs was grounded in previous research, we summed the scores of all items belonging to each of the three according to the specifications given by the previous authors, and used the composite scores in all subsequent analyses.

We adopted Herzog and Galvin's (1997) Attributions Questionnaire to obtain a measure of anthropomorphic thinking. We presented respondents with a list of nine animal species (chimpanzee, house cat, duck, tortoise, frog, trout, house fly, oyster, shrimp) to which we added "preschool child." Question wording was used for clearly differentiating the child, which served as a human base construct, from the nonhuman animals. The interviewer read out 12 properties rooted in human psychology to the respondents, and their task was to indicate to which species, including the preschool child, they were applicable (e.g., "which of these animals are able to feel pain?"). This process resulted in 120 dichotomous variables (i.e., 0 *does not apply to* vs. 1 *applies to*). The properties that we considered to be relevant for the measurement of animal sentience (Singer, 2009) were the assumed capabilities to feel pain, fear, and suffering. For each of these, we summed the number of animals, including the child, to which a respondent attributed a capability. This summation resulted in three scores that we used as indicators of a person's disposition to attribute sentience-related characteristics to animals in general. We used the dichotomous attributions of pain, fear, and suffering to trout at the species level to explore separately the interplay of fish-related anthropomorphic thinking with the other constructs in the cognitive hierarchy. The

three resulting binary variables could take on the values of 0 (*does not apply to trout*) and 1 (*applies to trout*).

An attitude refers to a cognitive representation that summarizes a person's evaluation of an object (Smith & Mackie, 2007). We used five ad hoc questions and items with clear evaluative contents to measure the two specific attitudes related to recreational angling (Table 1). The two questions by which we measured the attitude toward recreational angling in general covered both currently accepted reasonable reasons to fish recreationally in Germany (i.e., to harvest fish for food and to maintain the ecological balance). Participants answered three questions on a 5-point scale from 1 (*morally very reprehensible*) to 5 (*morally very acceptable*) and responded to two items on a different 5-point scale from 1

Table 1
Relative frequency distributions (%), means, and standard deviations of indicators of specific attitudes and behavioral intention

	Scale points (%)				
Construct/Measures	1, 2	3	4, 5	*M*	*SD*
Favorable attitude toward recreational angling in general					
How do you morally evaluate recreational angling if anglers catch fish for food?[a]	12.3	25.9	61.8	3.77	1.11
How do you morally evaluate recreational angling if anglers catch fish with the intention to manage fish stocks so that the ecological balance is restored?[a]	8.1	24.5	67.5	3.95	1.03
Favorable attitude toward catch-and-release angling					
How do you morally evaluate recreational angling if the anglers decide at their own discretion which fish to retain and which to release?[a]	20.9	28.5	50.6	3.44	1.11
It is cruel to catch fish and release them again into the water body.[bc]	41.3	25.0	33.7	2.86	1.28
It is an act of unnecessary cruelty to animals if anglers catch fish and release them alive into the water body.[bc]	40.9	23.1	36.1	2.92	1.29
Support for a ban on recreational angling					
Recreational angling should be banned because it results in many water bodies being overfished.[c]	53.7	24.9	21.4	2.47	1.20
Recreational angling should be banned because it means unnecessarily torturing animals.[c]	57.1	23.5	19.4	2.39	1.22

$n = 1{,}006$ with complete data.
[a]Scale from 1 (*morally very reprehensible*) to 5 (*morally very acceptable*).
[b]Codes were reversed prior to final analyses to facilitate model interpretation.
[c]Scale from 1 (*strongly disagree*) to 5 (*strongly agree*).

(*strongly disagree*) to 5 (*strongly agree*). The support for a ban on recreational angling was operationalized by one item targeting behavioral intention, which asked for the perceived likelihood of the respondent signing a petition calling for a ban on recreational angling in the near future (scale from 1 *extremely unlikely* to 6 *extremely likely*), and by two items asking for the degree of approval of such a ban (5-point scale from 1 *strongly disagree* to 5 *strongly agree*; Table 1).

Data Analysis

We performed structural equation analyses to test the appropriateness of the six candidate Models (Figure 2) based on all respondents for whom complete data were available (n = 1,006). We treated the theoretical constructs of the cognitive hierarchy as latent variables for which the items and scales of the questionnaire provided the manifest indicator variables. Codes of two items were reversed prior to analyses to make the interpretation of path coefficients more intuitive (Table 1). Analyses were based on correlations among the indicator variables. Using correlations resulted in fully standardized path models where both manifest and latent variables have unit variance. Parameters were obtained by running preliminary generalized least squares estimation followed by maximum likelihood estimation.

We evaluated overall model fit using four indices: (a) the standardized root mean square residual (SRMR), (b) the root mean square error of approximation (RMSEA), (c) the normed fit index (NFI), and (d) the comparative fit index (CFI). According to the recommendations given by Schermelleh-Engel, Moosbrugger, and Müller (2003), we considered a model to fit well (acceptably in parentheses) if SRMR, RMSEA, NFI, and CFI indices were $\leq .05$ ($\leq .10$), $\leq .05$ ($\leq .08$), $\geq .95$ ($\geq .90$), and $\geq .97$ ($\geq .95$), respectively.

Although fit indices reveal the compatibility of the estimated parameters of a given model with the empirical data, they are less useful for comparing competing systems of a priori hypotheses and deciding between models that are theoretically equally plausible. To that end, we used the bias-corrected Akaike information criterion (AIC_C) and its underlying information-theoretic approach to decide which of our six Models A to F was the best in terms of losing the relatively least amount of expected Kullback-Leibler information when approximating full reality, given the empirical data (Anderson, 2008). The AIC_C links information theory with the maximum likelihood statistic such that the model yielding the smallest AIC_C value in a given set of models is the one that minimizes information loss (Anderson, 2008).[2] The models in a set were evaluated by their distances from the model with the relatively lowest AIC_C value (ΔAIC_C) such that the likelihood of a model, given the data, is proportional to $\exp(-0.5 \times \Delta AIC_C)$. Division of each model's likelihood by the sum of the likelihoods of all models in a set results in Akaike weights w_i that can be interpreted as a model's probability of being the relatively best of all models in terms of losing least expected Kullback-Leibler information (Anderson, 2008). We used three types of results to assess the adequacy of Models A to F: (a) fit indices, (b) AIC_C values and Akaike weights w_i, and (c) the size of the path coefficients of the structural path models together with the explained variances of the endogeneous constructs.

Results

Descriptive Data and Reliability

The unweighted sample consisted of 55% women and 45% men, whose mean age was 49.6 years (SD = 17.8 years; range from 14 to 92 years). One third of respondents (34%)

Table 2
Psychometric properties of indicators of wildlife value orientations and general beliefs and attitudes

Construct/Measures	Min	Max	*M*	*SD*	α[a]
Wildlife value orientations					
Domination (Appropriate Use Beliefs subscale, 5 items)[b]	5	25	17.06	3.55	.695
Mutualism (Social Affiliation Beliefs subscale, 3 items)[b]	3	15	9.50	2.35	.631
Support for animal rights					
Animal Rights Scale (Animal Use subscale, 14 items)[b]	14	62	33.34	8.09	.806
Anthropomorphism (aggregated across all 10 animals)					
Pain[c]	0	10	7.25	2.75	
Fear[c]	0	10	6.00	2.99	
Suffering[c]	0	10	6.17	3.16	

$n = 1{,}006$ with complete data.
[a]Cronbach's α based on the total sample ($N = 1{,}043$).
[b]Scale from 1 (*strongly disagree*) to 5 (*strongly agree*).
[c]Sum of attributions (0 *does not apply to* vs. 1 *applies to*) across the list of animals.

was living in cities with more than 100,000 inhabitants, 24% in small cities (population between 20,000 and less than 100,000), and 43% in smaller towns or villages.

On average, respondents viewed recreational angling, including catch-and-release angling, as morally acceptable while being undecided as to whether catch-and-release angling constitutes an act of cruelty. Also, respondents tended to disagree with the opinion that angling should be prohibited (Table 1). The vast majority (85%) was unlikely to sign a petition for a ban on recreational angling ($M = 2.03$, $SD = 1.31$; scale from 1 = *extremely unlikely* to 6 = *extremely likely*). Pain perception was attributed to more animals than the capabilities to experience fear or suffering (Table 2), which was reflected in the shares of participants ascribing these properties specifically to trout (pain: 66%; fear: 45%; suffering: 48%). Reliability (Table 2) of the Appropriate Use Beliefs subscale of the domination WVO was acceptable (Cronbach's $\alpha = .70$), of the Social Affiliation Beliefs subscale of the mutualism WVO slightly low ($\alpha = .63$), and of the Animal Use subscale of the Animal Rights Scale high ($\alpha = .81$).

Structural Equation Models

All significant structural path coefficients in Models A to F fully confirmed our hypotheses about the direction of relationships among constructs in the cognitive hierarchy (Figure 2). Indices of global model fit revealed acceptable fit for most models (Table 3) except for Model E, which failed to meet minimum requirements in SRMR and CFI when anthropomorphism was measured using composite scores (left columns in Table 3). No differences in fit indices were found among models using composite-score measures of

Table 3
Fit indices of candidate models A to F

	All animals[a]				Trout[b]			
Model	SRMR	RMSEA	NFI	CFI	SRMR	RMSEA	NFI	CFI
A	.049	.063	.949	.958	.047	.063	.948	.958
B	.047	.063	.950	.960	.046	.062	.950	.959
C	.046	.065	.951	.960	.045	.064	.951	.960
D	.055	.081	.947	.953				
E	.113	.071	.935	.944	.102	.068	.938	.947
F	.045	.072	.963	.968				

SRMR = standardized root mean square residual; RMSEA = root mean square error of approximation; NFI = normed fit index; CFI = comparative fit index.
[a]Attributions of the capacity to feel pain, fear, and suffering were aggregated across all 10 animals and used as indicators of anthropomorphism.
[b]Attributions to trout only were used as item-level indicators of anthropomorphism in Models A, B, C, and E.

anthropomorphism across all 10 animals and models using the dichotomous attributions to trout only as manifest indicators (Table 3).

Determining Akaike weights for all models that involved anthropomorphism (Models A, B, C, E) revealed that Model B was comparatively most adequate for representing the true process that has generated the data regardless of how anthropomorphism was operationalized (4-model set in Table 4). In Model B (Figure 3), the WVO were negatively correlated with each other. Here, the domination WVO exerted a negative influence on anthropomorphism and support for animal rights, whereas the mutualism WVO had a positive impact on both. In turn, the more supportive participants were of animal rights, the less favorable their attitude was toward angling in general and toward catch-and-release angling in particular. A positive attitude toward the currently accepted reasons to fish recreationally in Germany had a positive impact on the attitude towards catch-and-release angling. Both these favorable attitudes exhibited substantial negative influence on the support for the abolition of recreational angling with the strength of this influence being slightly higher for catch-and-release angling than for angling in general. Ultimately, 78% of the error-free variance of the support for a ban was explained in Model B (i.e., 1 – Z; Figure 3), and 37% of the variance of the general attitude toward angling, and 46% of the variance in the attitude toward catch-and-release angling were explained. Path coefficients among latent variables and their manifest indicators (i.e., factor loadings) were in the range of about .70 and above (not displayed) meaning that latent constructs explained around 50% or more of the variance of their indicators (i.e., indicator reliabilities $\geq .7^2$).

Although no substantial differences emerged among path coefficients of the two variants of Model B where anthropomorphism was operationalized differently (Figure 3), anthropomorphism appeared to play only a minor role as a construct in the cognitive hierarchy in two respects. First, the explanatory impact of WVO on anthropomorphism was smaller than the influence they exerted on the support for animal rights, which had the effect that some 90% of the variance of anthropomorphism remained unaccounted for (Figure 3). Second, the ability of anthropomorphism to explain favorable attitudes toward angling was much smaller in terms of path coefficients than the explanatory power of

Table 4
Information-theoretic criteria of candidate models A to F

		All animals[a]				Trout[b]			
Model	K	LL	AIC_c	ΔAIC_c	w_i	LL	AIC_c	ΔAIC_c	w_i
4-model set[c]									
A	35	−181.0	434.7	8.4	.013	−179.4	431.5	11.0	.003
B	36	−175.8	426.3	0.0	.888	−172.8	420.4	0.0	.855
C	40	−173.6	430.6	4.4	.099	−170.3	424.0	3.6	.142
E	30	−205.2	472.2	46.0	<.001	−189.7	441.4	21.0	<.001
6-model set[d]									
A	35	−181.0	434.7	189.2	<.001	−179,4	431,5	186,0	<.001
B	36	−175.8	426.3	180.8	<.001	−172,8	420,4	175,0	<.001
C	40	−173.6	430.6	185.2	<.001	−170,3	424,0	178,5	<.001
D	25	−161.0	373.3	127.8	<.001	−161,0	373,3	127,8	<.001
E	30	−205.2	472.2	226.8	<.001	−189,7	441,4	195,9	<.001
F	24	−98.1	245.5	0.0	1	−98,1	245,5	0,0	1

K = number of free parameters; LL = log likelihood; AIC_c = corrected Akaike information criterion; ΔAIC_c = difference in AIC_c from model with relatively lowest AIC_c; w_i = AIC_c weight.

[a]Attributions of the capacity to feel pain, fear, and suffering were aggregated across all 10 animals and used as indicators of anthropomorphism.

[b]Attributions to trout only were used as item-level indicators of anthropomorphism in Models A, B, C, and E.

[c]All 4 models involving anthropomorphism.

[d]All 6 models.

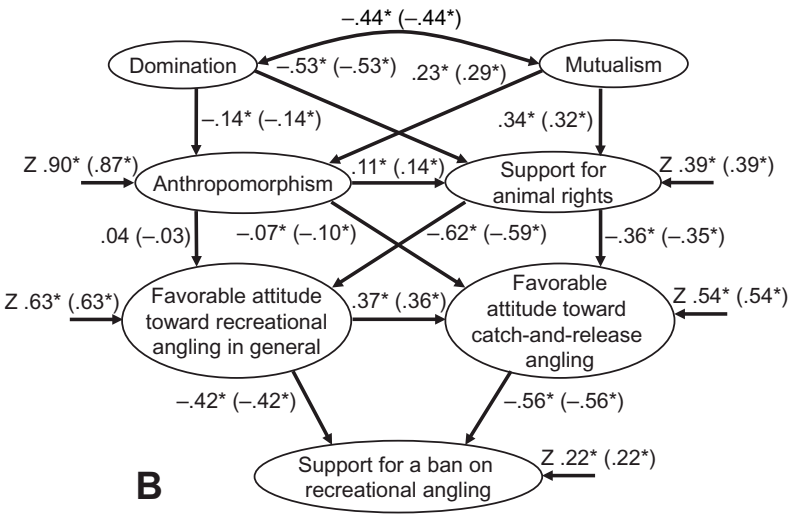

Figure 3. Standardized path coefficients for Model B when indicators of anthropomorphism were aggregated across all 10 animals (coefficients based on item-level attributions to trout only in parentheses). Z = Residual s^2. Domination = Appropriate Use Beliefs subscale; Mutualism = Social Affiliation Beliefs subscale; Support for animal rights = Animal Use subscale of the Animal Rights Scale. $^*p < .05$.

the support for animal rights (Figure 3). As with Models A and C (not displayed) and in contrast to expectations, there was no significant influence of anthropomorphism on the attitude toward angling in general. Also, anthropomorphism had only negligible, but still significant, impacts on the support for animal rights and the attitude toward catch-and-release angling. Therefore, Model E, where the influence of WVO was exclusively mediated by anthropomorphism, performed worst of the four models involving this construct in terms of both model fit (Table 3) and AIC_C-based assessment (Table 4) although here path coefficients between anthropomorphism and both subsequent angling attitudes became significant (not displayed).

When assessing Akaike weights for the full set of six models, we found support for Model F as best ranking model (Table 4), where both anthropomorphism and support for animal rights were omitted and WVO were assumed to have a direct effect on angling attitudes. This model also performed very well in terms of fit indices, except for RMSEA (Table 3). However, the impact of the WVO on the angling attitudes in Model F (Figure 4) was weaker than their impact on anthropomorphism and support for animal rights in Model B (Figure 3). Moreover, the explained variances of the general attitude toward angling (22%), attitude toward catch-and-release angling (41%), and support for a ban (75%) were lower in Model F than in Model B. This finding suggests that Model B, though less parsimonious in terms of estimated parameters than Model F, described and explained the driving forces behind anti-angling sentiments in a psychologically more meaningful way with regard to the hypothetical underlying multi-stage cognitive hierarchy. This conclusion is corroborated by the results of Model C (not displayed), which showed that the additional direct paths from WVO to the angling attitudes (Figure 2) were insignificant. This finding indicates that the influence of WVO on the favorable attitudes toward angling can best be modeled as mediated by anthropomorphism and support for animal rights.

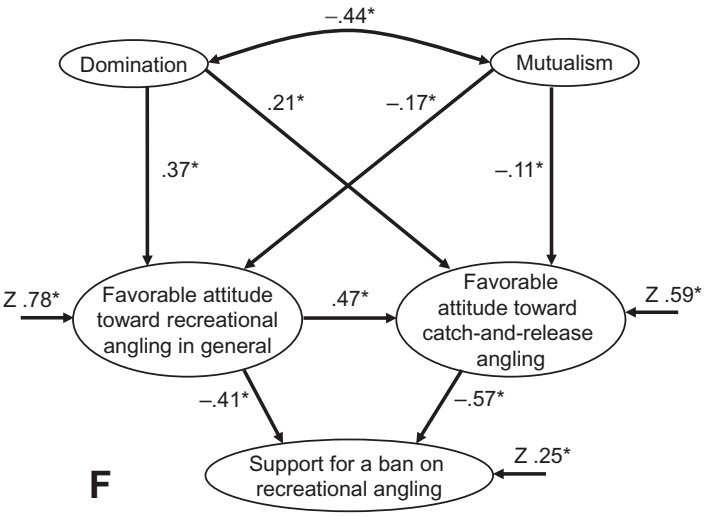

Figure 4. Standardized path coefficients for Model F. Z = Residual s^2. Domination = Appropriate Use Beliefs subscale; Mutualism = Social Affiliation Beliefs subscale. $^*p < .05$.

Discussion

We used a cognitive hierarchy approach to understand the mental processes that drive an individual's intention to view angling critically and to support a ban. We tested six variants of a hypothesized model interrelating psychological attributes that we deemed relevant at four hierarchical levels. All significant path coefficients confirmed the hypothesized direction of relationships among the constructs and supported the cognitive hierarchy as a viable approach to the explanation of drivers of anti-angling sentiments at the micro level of the individual. In line with expectations, we identified favorable attitudes toward angling in general and toward catch-and-release angling in particular as interrelated proximal determinants (specific attitudes) of the intention to act against recreational fishing or to support action against it: the less participants deemed angling as morally acceptable and the more they thought catch-and-release angling is cruel, the more likely they were to support the abolition of recreational angling. This finding is consistent with foundational social psychological conceptions of the relationships between attitudes and behavior (e.g., Ajzen, 2005; Smith & Mackie, 2007).

Similarly, the position and function of both WVO in the cognitive hierarchy as more distal determinants of behavioral intentions, which exerted their influence indirectly mediated by domain-specific attitudes toward fishing, was consistent with earlier studies using the cognitive hierarchy in wildlife and fisheries contexts (Fulton et al., 1996; Hrubes et al., 2001). We can thus conclude that WVO as "expressions of fundamental values" (Teel et al., 2005, p. 5) are concepts crucial to the understanding of anti-angling sentiments in Germany and that the cognitive hierarchy is a useful framework for understanding attitudes and behavioral intentions of the public toward recreational fishing. Our study underscores earlier cross-cultural work that concluded that WVO as a cognitive basis for individual thought and action toward wildlife appear to be universally present (Teel et al., 2010; Teel, Manfredo, & Stinchfield, 2007). This finding is noteworthy because the WVO construct was developed in the United States and is not necessarily transferable to other cultures. Having said this, it should be noted that we based the measurement of both WVO on only one scale per construct (out of two available) and that both of these scales were reduced by one item. Although we believe that we tapped the key meaning of both WVO, further research with the full set of items is needed before we can unambiguously conclude that WVO are related to anti-angling sentiments at least in Germany.

One aim was to understand whether moral philosophical concepts jointly or individually influence anti-angling sentiments among the German public. We assumed that anthropomorphism (central to animal liberation philosophy) and support for animal rights (central to animal rights philosophy) would mediate the effect of WVO on the domain-specific attitudes toward angling, and obtained mixed results. Unexpectedly, we found little influence of WVO on anthropomorphism and of anthropomorphism on attitudes toward recreational fishing. Also, there was little difference between the estimated parameters of models where anthropomorphism was measured by attributions of the capability to experience pain, fear, and suffering to all animals as opposed to models using binary attributions to trout only as a model fish species. Although it is known from past studies that fish do not prompt anthropomorphic thinking to the same degree as other animals do (Herzog & Galvin, 1997; Phillips & McCulloch, 2005), Muir and colleagues (2013) found that people who did not consider catch-and-release angling to be acceptable were more concerned with pain in fish than people who found it acceptable. Thus, in our study, the lack of variance in favorable attitudes toward fishing explained by variation in the degree to which negative mental states were attributed to trout was surprising.

By contrast, we found the support for animal rights well represented in our hypothesized cognitive hierarchy. Support for animal rights can be modeled as being driven and explained by WVO while exerting substantial influence on the moral acceptability of angling within the scope of the currently legally accepted reasons in Germany and, though to a lesser degree, on the acceptability of catch-and-release angling. Removing anthropomorphism from the cognitive hierarchy and inserting the support for animal rights as the only construct at the level of general beliefs and attitudes, as we did in Model D, did, however, not result in superior fit indices or AIC_C values, suggesting that anthropomorphism was only slightly contributing to model performance. We can, however, conclude that the ideology of animal rights pervasively drives anti-angling sentiments. By contrast, animal liberation reasoning (which negotiates the benefits of animal use accruing to humans versus the suffering costs to the animal) appeared of little importance for determining the moral views of the public. A word of caution is in order here. Similar to the measurement of WVO, we did not make use of the full Animal Rights Scale published by Wuensch et al. (2002), but administered only its Animal Use subscale with 14 instead of all 18 items to measure support for animal rights. Given the large number of items used and in light of their wording, we are still confident that the information we obtained is sufficient to support our conclusions.

The ability of fishes to feel pain and suffer is an often-used criterion to distinguish legally relevant from legally irrelevant animals; that is, animals that deserve to be protected against human maltreatment from those that ethically and legally do not matter (e.g., German Animal Protection Act). Hence, the assumed ability of animals and fishes to feel pain affects the actions of some animal welfare lobbyists, lawmakers, prosecutors, and judges in Germany, and there is also a lively scientific debate on this issue (Braithwaite, 2010; Rose et al., 2014). By contrast, in our study the assumed capability of animals in general, or trout in particular, to experience human-like emotions such as pain did not substantially drive the moral acceptability of recreational angling in the general population of Germany. Instead, negative attitudes toward fishing were more strongly affected by an animal-rights construct and underlying WVO, all of which strictly speaking are not contingent on sentience in fishes. Therefore, resolution of the current scientific uncertainty as to the ability of fishes to feel pain (Rose et al., 2014) is unlikely to affect the moral acceptability of recreational fishing in the German society. Nevertheless, the question of sentience in fishes is still important to resolve in a legal context because it affects the type and degree of fines that recreational anglers may face when fishing in Germany for recreation without a good reason (Jendrusch & Arlinghaus, 2005).

We also tested the effect of omitting both anthropomorphism and support for animal rights as mediating factors in the cognitive hierarchy (Model F). Results favored the reduced Model F from an information-theoretic perspective. In the model, however, the average impact of the WVO on the subordinate constructs decreased, and so did the explained variances in the angling attitudes in Model F compared to Model B. This finding indicated that in the reduced Model F, the psychological distance between the explaining and explained constructs was increased, analogously to the increased spatial distance in Figure 4. Also, the additional paths in Model C, which linked the WVO directly with the angling attitudes, were not significant. Both findings emphasized the importance of the jointly mediating function of anthropomorphism and support for animal rights on angling attitudes. We contend that Model F, despite its simplicity and the fewer path coefficients that need to be estimated for it (which work as model penalties in the information-theoretic approach), is not necessarily the best approximation to the psychologically relevant reality. Our aim was not to determine the optimal prediction of behavioral intentions of the German

public with the least possible number of estimated parameters, but to unveil the cognitive decision-making processes underlying and preceding behavioral intentions. We thus favor the existence of a level in the cognitive hierarchy that mediates the impact of WVO on the domain-specific attitudes.

In terms of methodological issues, respondents utilized the full scale range of nearly all manifest indicator variables. Reliability estimates of the three published scales that we used indicated different psychometric qualities, but all were within the ranges reported by other authors. Our Cronbach's α (.70) for the Appropriate Use Beliefs subscale of the domination WVO compares very well with reference values ranging from .27 at the lowest (Teel et al., 2010) to a maximum of .78 (Manfredo et al., 2009). Our coefficient α (.63) for the Social Affiliation Beliefs subscale of the mutualism WVO is also within the range (.62 to .83) reported by Hermann et al. (2013), Manfredo et al. (2009), and Teel et al. (2010). Our Cronbach's α (.81) for the Animal Use subscale of the Animal Rights Scale was close to .86 and .89 reported by Wuensch (2013) for this subscale and to .87 that was obtained by DeLeeuw, Galen, Aebersold, and Stanton (2007) for the total Animal Rights Scale. Hermann et al. (2013) is the only known and available study where the scales for the measurement of the WVO (Manfredo et al., 2009) were administered in Germany. It may serve as a benchmark to discuss the suitability of the WVO items when used in a translated version. Contrary to the present study, Hermann et al. (2013) omitted the word *fish* from all items where it appeared on the original list of items and translated only the verbal reference to *wildlife* (i.e., they did not translate "fish and wildlife" as "Fische und Wildtiere," as we did). The cognitive frame of reference they created for their respondents was, therefore, different from the one we intended in our study. Hermann et al. (2013) also administered the WVO scales to a sample of students, not to a random sample of the general population, and they did not include attitudinal constructs that might mediate the impact of WVO on behavioral intention. Yet, they managed to replicate the factorial structure of the original WVO developed by Manfredo and his colleagues (Manfredo et al., 2009; Teel et al., 2005) and concluded that their results supported the applicability of WVO in Germany (Hermann et al., 2013). Our study joins this conclusion despite the limitation that we used only two of the four original subscales.

Our results implicate that forces of increasing modernization, which might elevate the fraction of mutualists and animal rights supporters in society, could increase the moral pressure exerted on recreational fishing. However, postindustrialization, urbanization, and increasing affluence with their accompanying shift in values, WVO, attitudes, and beliefs constitute but one driving force that influences the actual context and societal conditions under which recreational anglers pursue their activity. We cannot be certain that further modernization will necessarily increase anti-angling sentiments within society because public opinion, legislation, and lobbying at the macro level will all exert influence on individuals at the micro level and affect their beliefs and attitudes (Arlinghaus et al., 2012). All of these issues are subject to change under the influence of complex communication processes within society including, for instance, media reports, stakeholder campaigns, and the actions of interest groups to affect political activities. Messages communicated by these means and political decisions taken might not mirror the current majorities in the population. Therefore, even though recreational angling is judged as morally acceptable, on average, by the contemporary general population in Germany reflecting the fact that recreational fishing is presently tolerated in Germany, the legal pressure on anglers on moral grounds can still be high as witnessed by the many constraints placed on fishing. It is important to realize that our study was designed to explain the decision-making process and the relationships among cognitions and the behavioral intention to constrain

recreational fisheries. We outlined the thought processes within individuals. This perspective needs to be separated from political and legal decisions made in a given country, which do not always follow the same logic as the one followed by the citizens despite often being within democracies.

To conclude, we found the cognitive hierarchy model to be appropriate for describing, predicting, and explaining anti-angling sentiments. However, we also found that the ability of fishes or other animals to feel pain or to suffer does not strongly affect the moral acceptability of recreational angling as perceived by the German public. Instead, support for animal rights and underlying WVO were found to be strong contributors to the morality of fishing. This suggests that the minority of people who dislike recreational fishing in this country do so based on ideological grounds of animal rights and not based on the concept of sentience in fishes and corresponding animal liberation philosophy. Based on our results, we can draw the implication that shifts in societal values as well as in WVO, which may entail an increase of mutualist views and a decrease of people holding domination-oriented positions (Inglehart, 1997; Manfredo, 2008; Manfredo et al., 2003, 2009; Teel et al., 2005), will elevate the moral concerns over the welfare and well-being of fishes and other animals in the future (Arlinghaus et al., 2012). We predict the societal tolerance of recreational fishing will presumably decrease further in the future in Germany, but processes at the macro level or political processes may lead to outcomes other than constraints or even banning the activity.

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Notes

1. German wordings of all items used in the present context are available from the corresponding author.
2. We are grateful to James H. Steiger for detailed comments that helped us apply the information-theoretic approach to the AIC-related output of the modeling software that we used (SEPATH). Details can be requested from the corresponding author.

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