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# What determines the behavioral intention of local-level fisheries managers to alter fish stocking practices in freshwater recreational fisheries of two European countries?

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ABSTRACT

Angling clubs in central Europe regularly use fish stocking to maintain or enhance stocks. Our objective was to understand the behavioral intention of club decision makers to alter stocking practices. To that end, we conducted a survey among a random sample of fisheries managers in angling clubs in Germany ($n$ = 1222) and France ($n$ = 587). We report four key findings. First, the intention to decrease stocking was better predicted than the intention to increase stocking, suggesting that the decision to increase stocking is under less psychological control. Second, differing psychological constructs predicted the intentions to alter three distinct stocking practices (stocking amount in general, stocking of fry and juvenile fish, stocking of harvestable fishes), indicating that no universal set of psychological predictors for stocking decision making exists. Third, the perception of the socio-economic situation of the club and of the status of the club's waters had consistent explanatory significance, while the predictive power of basic sociopsychological characteristics related to stocking (attitude, norms etc.) was low. However, the clubs' past stocking measures (club typology) moderated the impact of the attitude, norms and beliefs, thereby revealing that the effect of the psychological disposition of the decision maker on intended future stocking behavior depended on the club's ecological and social context. Similarly and finally, beliefs about stocking-related ecological and genetic risks did not exert strong influence on the intention to alter stocking practices, but their explanatory power increased when the club typology was taken into account. We conclude (i) that contextual (social and ecological) factors, not psychological dispositions per se, inform stocking intentions and (ii) that intended stocking regime alterations depend on the interaction of the psychological disposition with the contextual frame within which stocking decisions are made.

## 1. Introduction

Fish stocking is a frequently used, and often abused, management tool in freshwater recreational fisheries (Arlinghaus et al., 2002, 2016; Cowx, 1994). Objectives for stocking range from species conservation to fisheries enhancement (Arlinghaus et al., 2016; Cowx, 1994; Lorenzen et al., 2012). Stocking regimes can broadly be classified into those that are culture-based (i.e., stocking of species that do not naturally recruit, thereby maintaining a catchable stock) and stock enhancing (i.e., stocking into recruiting populations to maintain or increase abundance over natural limits; Lorenzen et al., 2012). Stocking can produce fisheries benefits by maintaining or elevating fish stocks, which is particularly well documented in culture-based fisheries (Arlinghaus et al., 2015; Lorenzen et al., 2012). Culture-based stocking programs may involve nonnative fishes (e.g., rainbow trout, *Onchorhynchus mykiss*, in Europe), but may also involve native species when natural recruitment is strongly impaired or lacking (e.g., eel, *Anguilla anguilla*, in standing water bodies). Stock enhancements are usually directed at native species, but there is the risk of genetically polluting wild populations in the recipient ecosystems depending on the source of the stocking material and the intensity of stocking (Lorenzen et al., 2012). Stock enhancements may also occur with feral nonnative fishes that have established recruiting populations (e.g., with Pacific salmonids in the Great Lakes).

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In many western and central European countries (e.g., France, Austria, Germany), the owner of a water body also owns the fishing rights (Daedlow et al., 2011). Fishing rights can subsequently be leased to other parties, such as angling clubs or commercial fisheries. Leasing out fishing rights to angler communities is very common in countries such as Germany, when the fishing rights belong to the government. The entire bundle of fishing rights includes the duty and the right to organize management activities, such as fish stocking, largely independently of other actors or organizations (Arlinghaus, 2006; Arlinghaus et al., 2015; Daedlow et al., 2011). Fishing rights owners are entitled to sell angling tickets; the angler as a ticket holder is then only allowed to fish with rod and line, while the management right continues to belong to the fishing rights owner. In countries such as Germany, angling clubs are by far the dominant decision-making bodies in relation to fish stocking, which is conducted largely independently of fisheries agencies or scientists (Arlinghaus, 2006; Arlinghaus et al., 2015). Key decisions about stocking are made by the clubs' management boards, which include elected members of the angling club that are trained in fisheries management issues by angler associations or agencies (Arlinghaus et al., 2015).

Although the benefits of successful stocking for fish conservation and fisheries are undisputed in some situations (Lorenzen et al., 2012), there is an increasing discussion that indiscriminate stocking may negatively affect biodiversity and ecosystem functioning (Eby et al., 2006; Johnson et al., 2009; Laikre et al., 2010; van Poorten et al., 2011). In addition, many stock enhancements fail to generate additive effects on stock size and can thus be economically wasteful (Arlinghaus et al., 2015; Hühn et al., 2014; Lorenzen, 2014), but these failures may not be perceived by the angler communities due to a lack of proper assessment of the outcomes of past stocking measures (Hühn et al., 2014; Lorenzen et al., 2012; Post et al., 2002). Lack of ability to discriminate stocked from wild fishes, ecological stochasticity and the resulting variation in angler successes, social pressure by anglers on managers to reinvest license fees into stocking, path dependencies, lack of alternative management tools and humans' general disposition to avoid future losses or regrets are likely mechanisms involved in explaining why stocking has evolved as a panacea in the management of freshwater recreational fisheries in angling clubs and associations (Anderson, 2003; Arlinghaus et al., 2015; van Poorten et al., 2011)

Fisheries management is as much about people management as it is about fish stock management (e.g., Arlinghaus et al., 2016). In this context, there is a need to better understand the social (i.e., the human) dimension of fisheries management including the drivers of stocking decisions made in angling clubs. Most of the existing research on understanding determinants of stocking-related preferences and attitudes in recreational fisheries has been devoted to the study of individual anglers (e.g., Arlinghaus and Mehner, 2005; von Lindern and Mosler, 2014) rather than decision makers. Studies targeting the people who actually make the stocking decisions in angling communities are rare and have mainly employed qualitative research techniques (Eden and Bear, 2011a,b, 2012; van Poorten et al., 2011; Sandström, 2010, 2011). Such research has revealed that decision makers engage in stocking according to their primary management goals (e.g., environmental vs. fishery management; Knuth et al., 1995), in accordance with their personal mental models and beliefs about how stock-enhanced ecosystems function (von Lindern 2010), and in response to social norms by the recreational angler constituency in light of budgetary constraints (Jackson et al., 2004; van Poorten et al., 2011). Moreover, when studying ordinary anglers, von Lindern and Mosler (2014) showed that the probability to contribute to stocking behaviors was a function of an angler's expectations of stocking outcomes, beliefs about stocking-related risks, the attitude toward stocking and the perceived control over actually participating in stocking behavior. Relatedly, anglers' preference for stocking over alternative management tools was found to be affected by environmental beliefs, attitudes, consumptive orientation and the general avidity level of the angler (Arlinghaus and Mehner, 2005). Although these studies focused on anglers rather than on stocking decision makers, they suggest that a number of psychological characteristics (e.g., beliefs, norms, attitudes) may be strong determinants of the stocking decisions made by fisheries managers in angler communities as well. Ultimately, the latter are ordinary anglers that had been elected as angling club members into their club's management board and thus became stocking decision makers. The objective of the present study was to use a quantitative survey-based approach in two European countries (Germany and France) to understand the systematic influence of the psychological disposition of these local-level decision makers on their intentions to modify stocking in the future. In addition to psychological characteristics, we included contextual information about the club's past stocking activities and accounted for the club's socio-cultural environment by testing the model in these two countries.

## 2. Theoretical background

### 2.1. Sociopsychological theory and behavioral model

The theory of planned behavior (TPB; Ajzen, 2005; Fishbein and Ajzen, 2010) and the value-belief-norm theory (VBN; Stern, 2000) have been widely used to explain human pro-environmental behaviors (Kaiser et al., 2005; Klöckner, 2013; Steg and Vlek, 2009), particularly in conservation contexts (Cooke et al., 2009; Decker et al., 2012; Milner-Gulland, 2012). Because both theories focus on the behavior of individual actors, they may help understand the psychological processes underlying stocking decisions made in angling clubs, which is considered pro-environmental behavior by local-level fisheries managers. Both theories assume a hierarchy of psychological constructs that exert influence on one another and ultimately inform conservation behavior. The TPB asserts that performing a certain behavior depends on an individual's intention to perform that behavior. This intention increases with an increase in the subjective, or social, norm (i.e., the experience of social pressure to perform the behavior), an increase in an individual's attitude toward the behavior (i.e., a positive evaluation of the behavior), and with an increase in perceived behavioral control (i.e., the belief that the behavior is under one's volitional control; Ajzen, 2005). The attitude toward a behavior is in turn influenced by beliefs about the consequences of that behavior (e.g., whether fish stocking is considered an effective management tool or whether it entails ecological risks). Behavioral beliefs are again influenced by other factors such as human personality traits (Ajzen, 2005). von Lindern and Mosler (2014) applied the TPB to the individual stocking-related behavior of Swiss anglers, who made decisions about their own participation in stocking activities conducted by their angling clubs (e.g., helping with releasing fishes). These respondents were, however, not stocking decision makers as in the present study (i.e., the person who decides which fish species and how many individual fish to release). They found that behavioral beliefs about ecological risks of stocking measures and about the success of these measures explained 58% of the variance in Swiss anglers' attitude toward stocking. The attitude, together with perceived behavioral control, in turn, explained 23% of the variance in the intention to participate in stocking activities, which again accounted for 53% of the variance in actual participation (von Lindern and Mosler, 2014). The study by von Lindern and Mosler (2014) thus supports the assumption that the TPB may be well suited for modeling the impact of psychological constructs on stocking behavior performed by decision makers in angling clubs.

Similar to the TPB, the VBN consists of a causal chain of psychological constructs that inform pro-environmental behavior. According to the VBN, the proximal determinant of a behavior is the personal (rather than social) norm. This is defined as a moral obligation felt by an individual to engage in a pro-environmental way. For example, if decision makers believe that stocking is a pro-environmental behavior aimed at keeping fish stocks in good shape and if they feel responsible for attaining this goal, they will feel obliged to stock fish. The ascription of responsibility in turn is influenced by the decision makers' awareness of consequences if not acting pro-environmentally (Steg and Nordlund, 2013; Stern, 2000). Previous research has revealed that personal norms were positively related to pro-environmental behaviors such as