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45 Comparing participation in different invasive aquatic plant management programs among recreational users of freshwater lakes in southwest France

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Alien species can have major ecological and socio-economic impacts and so effective management are needed. In this perspective, one increasingly seeks to involve end users, such a recreational users (Shackleton, Adriaens et al. 2019). Recreational users may share valuable knowledge about the ecological ecosystems at stake. They have time, materials and money to afford. In the literature, several studies have looked at factors that increase user involvement highlighting the effect of variables such as e.g. perceptions, information, or education. Nevertheless, these behaviors are often studied separately or, conversely, grouped into a single category called "pro-environmental behaviors" (Halpenny 2010). Without excluding the possibility of common factors affecting these behaviors, we consider that behaviors are not necessarily homogeneous. In particular, the nature of the operations to be carried out may be very important (Niemic, Ardoin et al. 2017, Pagès, Fischer et al. 2019). This is what we study in detail in this paper.

To do so, we conducted an on-site quantitative survey of 323 recreational users on the freshwater lake of Aureilhan (340 Ha), in Southwestern France. The lake is used for many leisure activities with, in particular, two beaches, fishing trails, hunting grounds, boat slips and rings, a sailing club and a nautical stopover. It is invaded by several invasive aquatic plants, including *Ludwigia peploides*, *Lagarosiphon major*, and *Myriophyllum brasiliense*. Management programs for these invasive plants have been applied for several decades

The surveys took place during 3 months in the summer of 2019. To improve the representativeness of the sample, quotas were defined on the geographical origin of the visitors, the sites of practices and the months of the year. In addition to individual information, visitors were asked questions on topics such as their knowledge, perceptions, attitudes towards invasive aquatic plants, their attachment to the lake, and their recreational uses. The three plants listed above were not described as invasive at the beginning of the survey so as not to bias the individual

responses. Five modalities of participation in the management were proposed: changing one's uses on the lake, talking about the plants around one, participating in a digging up, transmitting information to a participative observatory, contributing financially. Three answers were possible: "yes", "no", "I already do it". This design allowed us to compare reported behaviors with intentional behaviors. We conducted bivariate and multivariate statistical analysis (multinomial regressions).

First, our work confirms the influence of recreational practices on the nature of perceptions. For example, anglers are more likely to report that plants can provide positive shelter for fish ($p < 0,05$) and swimmers are more likely to report that plants can increase the risk of drowning ($p < 0,001$), although there is no scientific evidence for either at this time. This directly affects the willingness to participate by following. Overall, 94.69% of respondents said they were willing to participate in one way or another. However, the rates of support vary greatly depending on the proposed operations, with a minimum of 16.72% for the financial contribution and a maximum of 79.54% for the change of uses on the lake. As noted in other works, the supply of financial resources is less important than the supply of time.

The various dimensions of place attachment have different influences on willingness to participate, depending on whether we are looking at reported behaviors or behavioral intentions. Overall, utilitarian values and overall environmental values have a stronger influence on willingness to participate than local place identity variables. Personal knowledge is another important variable. On this point, tourists and residents differ strongly. While residents appear to be more aware of the problem of invasive aquatic plants, relying on their own networks ($p < 0,001$), this is not an explicit reason for tourists to refuse. The first reason for refusal among tourists is "not to live there" ($p < 0,01$). Fewer tourists than residents feel they do not have the time ($p < 0,01$), financial means ($p < 0,01$) or equipments to do so ($p < 0,05$).



In conclusion, our work confirms that recreational users are highly sensitive to the nature of operations before participating in a management program. Often considered as a homogeneous group in invasion science literature, recreational users show very different behaviors and positions. The relationship that these actors have with the natural

environment is far from neutral. It will strongly condition the type of measure that can be applied. This point is still too often neglected by managers in charge of biological invasions. It is however a crucial element to improve the efficiency and organization of volunteer campaigns in the future.