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# Involving citizens in monitoring river interventions: Lessons learned from a river Waal case study

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## Introduction

Adequate monitoring and evaluation of large-scale river interventions is vital for successful adaptation to environmental and social change. Participatory monitoring refers to the active involvement of local stakeholders in the systematic collection of information (Villaseñor et al., 2016). Intended outcomes of stakeholder inclusion in monitoring are both process and outcome related, including (1) increased public support, (2) increased levels of trust between participants, (3) integration of lay and expert knowledge facilitating (social) learning, or (4) more or better data (Breman et al., 2014).

This case study concerns the substitution of traditional groynes by longitudinal training dams (LTDs) in a 10 kilometre stretch of the Waal river (the main Rhine branch in The Netherlands), dividing the river in a main channel and secondary channel. The main objectives of this intervention are: (1) to improve conditions for navigation during low water levels, (2) to increase discharge capacity for improved flood safety, (3) to protect hydraulic infrastructure and river dikes from potential ice damage, (4) to reduce dredging costs, and 5) to improve ecological conditions in the secondary channels (Eerden, 2013). The completion of the LTDs in December 2015 marked the beginning of an intensive monitoring program (2016-2019) in which governmental, societal and research partners collaborate (Verbrugge et al., 2017; Van den Heuvel et al., this issue).

The monitoring results facilitate adaptive management, i.e. adjusting to the changing conditions in the (physical) environment. Citizen observatories have the potential to contribute to the evaluation of LTDs, in terms of their impacts on recreational and ecological values. For example, with the removal of groynes, local recreational anglers lose one of their favourite fishing spots, which may force

them to relocate. On the other hand, the creation of a more protected side channel may create more opportunities for nature development and may sustain a more diverse fish population.

In a previous paper, we reported on the incentives of organized stakeholders to actively participate in monitoring the effects of the LTDs, as well as on the outcomes of pre-intervention surveys among local residents, recreational anglers and boaters, and shipping professionals (Verbrugge et al., 2017). These results fed into the design of a participatory monitoring pilot project involving recreational anglers, based on their concerns for negative impacts on fish habitats and a lack of trust that sufficient monitoring would be carried out (resulting from previous experiences, i.e. lowering of the groynes). Here, we describe the design, implementation and outcomes of this participatory project during the first two years (2016-2017). Finally, we present the lessons learned and our next steps in research.

## Methods

A group of volunteer anglers was involved in the monitoring activities in two ways:

- (1) By reporting their catches in the study area in the period April-October of 2016 and 2017, using an (online) form documenting date and time, location (GPS-coordinates), species name and fish size (in cm).
- (2) By participating in online surveys asking questions about the accessibility and suitability of locations, their level of satisfaction regarding catches, and their appreciation of the landscape during an angling session (on a 5-point scale).

In addition, a number of (outreach) activities were organized (Table 1) in close collaboration with the Royal Dutch Angler Association (and its regional division). At the end of 2016, an evaluation survey was conducted.

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Table 1. Overview of (outreach) activities.

Activities	Frequency
Competitions	2-4 times a year
Meetings	Once or twice a year
Newsletters	Monthly in the period April - November
Facebook website	From spring 2017 onwards
Email	At regular intervals

### Results

In 2016 and 2017, respectively 44 and 118 catches were reported by volunteers, representing 11 fish species (Table 2). Fish size was reported for 72% (in 2016) and 65% (in 2017) of the reported catches, of which approximately half were at least 30 cm in length. In 2016, volunteers reported one species not caught during research monitoring (i.e. Gibel carp).

Table 2. Overview of fish species caught by volunteers.

Year	Species
2016	Kessler's goby ( <i>Neogobius kesslerii</i> ), Perch ( <i>Perca fluviatilis</i> ), Ide ( <i>Leuciscus idus</i> ), Pike perch ( <i>Sander lucioperca</i> ), Eel ( <i>Anguilla anguilla</i> ), Barbel ( <i>Barbus barbus</i> ), Flounder ( <i>Platichthys flesus</i> ), Bream ( <i>Abramis brama</i> ), Gibel carp ( <i>Carassius auratus gibelio</i> ), Asp ( <i>Aspius aspius</i> ), Roach ( <i>Rutilus rutilus</i> )
2017 <sup>a</sup>	(+) Vimba ( <i>Vimba vimba</i> ), White bream ( <i>Blicca bjoerkna</i> ), Wels ( <i>Silurus glanis</i> ). (-) Flounder, Gibel carp, Asp

<sup>a</sup> compared to 2016

Results from online surveys show above average scores for the accessibility of fishing locations and the appreciation of the landscape.

Open-ended questions reveal that respondents saw little influence of the LTDs on these two aspects. The lower scores given to suitability and satisfaction were explained by high flow velocity in the secondary channel and the frequent loss of fishing gear due to debris and irregularities in the riverbed profile.

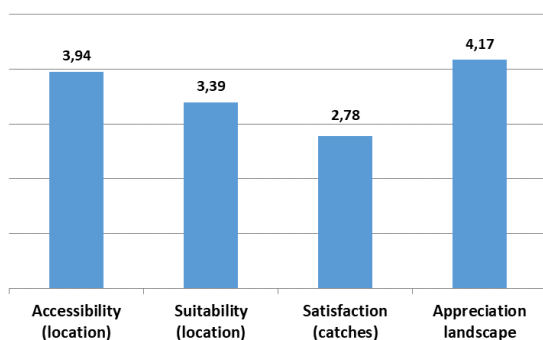


Figure 2. Average scores for anglers' experiences while fishing, measured on a 5-point scale (n = 18).

### Lessons learned

- Additional data on presence of adult fish is valuable for ecological monitoring and complements traditional monitoring techniques applied in formal research (Collas et al., 2017).
- The outcomes provide an informational basis for improving management, public engagement and communication practices.
- Cooperation with (local) stakeholder groups is crucial for establishing effective communication with and recruitment of participants in monitoring activities.
- Follow-up perception studies among recreational anglers showed more positive evaluations of the LTDs in 2016 compared to 2014 (unpublished results), possibly due to a positive influence of participatory processes.

### Next steps

Recognizing the benefits of citizen science is important but these should also be evaluated. A next step in this research is to compare species diversities resulting from different datasets (e.g. university research and citizen observatories) which will inform us on the complementarity of these sources. This project is continued in 2018 and 2019. This will allow for a temporal assessment of the contribution of volunteers to biodiversity monitoring, as well as of the impacts of participation on social learning.

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