



Research article

Implementing participatory monitoring in river management: The role of stakeholders' perspectives and incentives



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ABSTRACT

Involving local stakeholders in monitoring has the potential to stimulate learning and improve management responses. However, there is limited understanding about factors which influence implementation and success. This paper reviews local stakeholders' perceptions with respect to the construction of longitudinal dams in the Dutch river Waal, and explores their incentives to be involved in monitoring the effects of this intervention. Interviews with key stakeholders showed that concerns and (dis)trust are important incentives for participating in monitoring. Surveys of local residents, recreational anglers and boaters, and shipping professionals mapped their level of trust, attachment to the river landscape and evaluation of the effects of the longitudinal dams. Our case study shows that incentives for participation differ between stakeholder groups, and that research into their perceptions of the local environment can inform water managers on how to involve these groups in participatory monitoring.

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1. Introduction

Climate change and societal pressures create challenges for sustainable and multifunctional use of rivers. This has led to a transition towards collaborative and integrative approaches in water management (Emerson and Gerlak, 2014; Hill Clarvis and Engle, 2013; Pahl-Wostl, 2006) by moving away from hierarchical and top-down government structures towards less formalized governance based on networks of stakeholders (e.g. Huitema and Meijerink, 2014). In this new governance mode, stakeholders play an active role in both decision making as well as policy planning and implementation. There are several potential benefits of active participation of stakeholders, including more public support for policy decisions, higher quality of the decision-making process, and empowerment of stakeholders (Mostert, 2003; Reed, 2008; Stringer et al., 2006). Public participation has become mandatory in many water management policies, yet the level of participation and the influence of these participatory processes remain limited and require further study (Newig et al., 2014; Van der Heijden and Ten Heuvelhof, 2012; Wehn et al., 2015).

Participatory monitoring refers to the active involvement of local stakeholders in the systematic collection of information (Villaseñor et al., 2016). Several authors have illustrated the potential role participatory monitoring can play in data collection, in fields as diverse as anglers monitoring their catch (Eden, 2012), or citizens monitoring the quality of air (Snik et al., 2014), water (Buytaert et al., 2014; Fore et al., 2001) or soil (Bone et al., 2012).

Decisions made in the planning phase of a participatory monitoring project are crucial for its successful implementation and projected outcomes. One such important decision in project design is the selection of participants. Stakeholders perceive their environment and its resources differently, which in part determines how they define the focal problems and appropriate solutions. As such, it is important to take these different stakeholder perceptions into consideration (De Groot et al., 2013; Luyet et al., 2012). Successful recruitment and engagement of volunteer monitors also requires an understanding of their incentives for participating (Measham and Barnett, 2008; Wright et al., 2015). In practice, however, the amount of time and resources invested in studying public perceptions when planning participatory processes is limited (EEA, 2014). This paper addresses this gap between research and practice by studying public perceptions of a major intervention in the Dutch river landscape, and stakeholder incentives to participate in monitoring the effects of this intervention.

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1.1. Research aims

The aim of this paper is to investigate the perceptions of local stakeholders (i.e. citizens, recreational anglers, recreational boaters and shipping professionals) and their incentives for participating in monitoring a new engineering project in the river Waal, The Netherlands. Subsequently, we discuss the importance of these perceptions and incentives when implementing participatory monitoring. The main research questions addressed in this study are:

1. What incentives do local stakeholders have to participate in monitoring the effects of the planned engineering project?
2. How do local stakeholders perceive the planned engineering project and the expected changes to the river landscape?
3. How do local stakeholders' incentives and perceptions inform the implementation of participatory monitoring?

To provide the necessary background, we will first discuss relevant literature on participatory monitoring, incentives for participation, and the importance of landscape perceptions and trust. Next, the case study is introduced by describing the study area and the participatory process leading to a monitoring plan. The main part of the paper reviews stakeholders' incentives for their involvement in monitoring, and survey data on public perceptions. Finally, we reflect on the outcomes and highlight lessons for practitioners.

1.2. Participatory monitoring in practice

The importance of public involvement in local monitoring was first recognized in developing countries, with the aim to empower local communities and improve management of natural resources (Danielsen et al., 2005; Estrella and Gaventa, 2000). In recent years, participatory monitoring has been increasingly adopted in Europe and North America, which entails a broader vision regarding involvement of citizens in monitoring. For example, Fernandez-Gimenez et al. (2008) define collaborative or participatory monitoring as “involv[ing] multiple individuals or organizations with different interests and forms of expertise in the design and implementation of monitoring” (p. 1). Literature on participatory monitoring has described a diverse range of case studies which differ in scale, aims and level of participation (Danielsen et al., 2009; Villaseñor et al., 2016). This includes local projects mostly aimed at building trust and relations between stakeholders, and large-scale projects with an emphasis on substantial data collection. Villaseñor et al. (2016) distinguished between participatory monitoring projects aimed at collaborative learning, and more evidence-based approaches that are used to improve management efficiency, although these can sometimes overlap. Alender (2016) and Gouveia et al. (2004) have also noted that participatory monitoring may serve both scientific and management goals while also providing opportunities for learning and collaboration among the involved stakeholders. For instance, Overdeest et al. (2004) showed how participation in volunteer stream monitoring increased citizens' social capital, which in turn could increase participation in combating local environmental problems. While there is increasing recognition that involving local stakeholders in monitoring enhances management responses, we still have a limited understanding about the factors that influence implementation and success.

1.3. Incentives for taking part in participatory monitoring

Incentives for stakeholders to engage in participatory

monitoring are diverse and range from value-oriented incentives, such as protecting the local environment, to social incentives, such as working together in a group. A number of studies have looked at the incentives for environmental volunteers to take part in participatory monitoring. For instance, Gooch (2005) found in her study of catchment volunteers that stewardship of the catchment was an important incentive, but so were the social opportunities and the chance to be empowered in resource management. In the field of citizen science most work has focused on biodiversity recorders; for instance, Hobbs and White (2012) found that an existing interest in wildlife and an opportunity to contribute to its conservation were the main incentives to get involved in biological monitoring, while Bell et al. (2008) showed the importance of bonding with like-minded people. Since there is limited empirical data on incentives for joining river-based participatory monitoring, one aim of this paper is to gain more insight into why different stakeholders might participate in monitoring the effects of a planned river engineering project.

1.4. The role of landscape perceptions

An important aspect when dealing with landscape change is sense of place, or the way people perceive and bond with places and the local environment (Cheng et al., 2003; Davenport and Anderson, 2005; Vorkinn and Riese, 2001). Not only does attachment to nature and place play a role in evaluating landscape change (e.g. Jacobs and Buijs, 2011), it may also motivate people to take part in citizen science (Haywood, 2014). Farnum et al. (2005) note that “when people with a strong investment in a place feel the area is jeopardized or is endangered, these feelings of dissatisfaction may catalyze people into action” (p. 26–27). This argument resonates with other authors who have empirically demonstrated correlations between sense of place dimensions and engagement in different place-oriented civic actions, from donations and volunteer work to oppositional behavior such as protesting place change (Anton and Lawrence, 2016; Devine-Wright and Howes, 2010; Payton et al., 2005; Walker and Ryan, 2008). In addition, participatory monitoring has the potential to further strengthen the bond between participants and their physical and natural environment (Haywood et al., 2016). For instance, Jones (2013) reported improvements in long-term citizen science participants regarding their connection to nature and valuation of local green spaces.

1.5. The role of trust

Like other participatory processes, participatory monitoring requires a certain level of trust among the participating citizens, researchers and institutions (De Vente et al., 2016). Haklay (2013) has argued that citizens are often “as capable as the best researchers” (p. 115), but he also noted that, despite evidence to the contrary, data collected by citizen scientists are not always considered trustworthy. Resnik et al. (2015) extend this importance of trust to personal and organizational trust: it is vital to prevent both citizen scientists and data users from feeling like they are being taken advantage of. As such, gaining more insights into the level of trust between citizens and institutions is also an important step for facilitating civic action (Payton et al., 2005).

2. Case study: longitudinal training dams in the waal river

Our case study concerns the construction of longitudinal training dams on a 10 km stretch of the Dutch river Waal between Tiel and Ophemert (Fig. 1A and B). In this pilot engineering project, the traditional groynes (which are placed perpendicular to the river) are partly substituted by three dams situated parallel to the

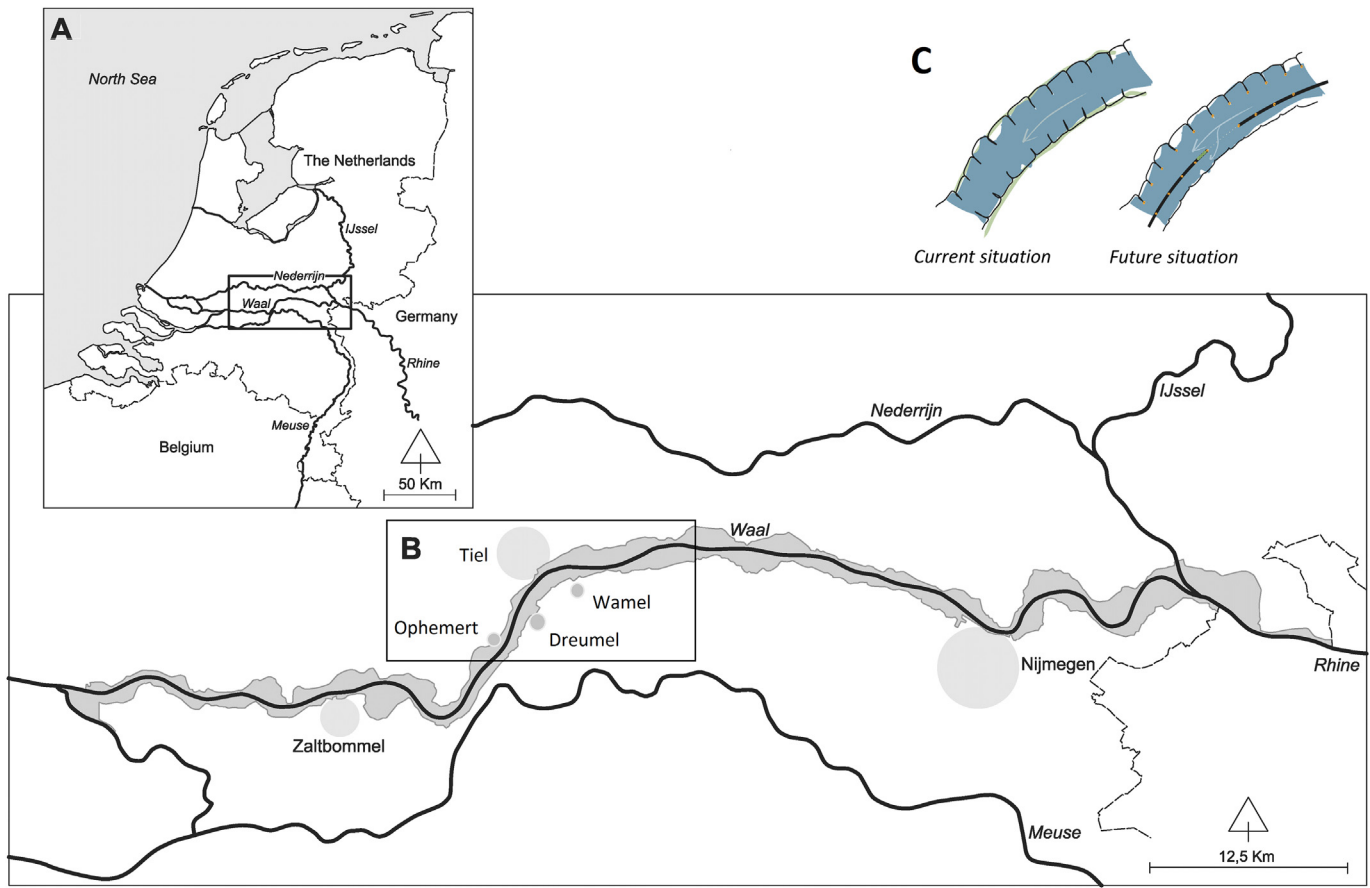


Fig. 1. Map of the Netherlands (A) and study area (B) comprising a 10 km stretch of the river Waal (km 911.5 tot 922) in the Netherlands (adapted from Fliervoet et al., 2013) and a schematic overview (C) of the current and new situation (Source: Rijkswaterstaat).

river bank (Fig. 1C). The dams are placed in the inner bends of the river and differ in length. The first and second dam are situated on the left riverbank and are three and 4 km long respectively. The third dam is 3 km in length and situated on the right riverbank near the village of Ophemert. In the new situation, the river will consist of a main channel (width of 230 m) and a secondary channel (average width of 90 m). Altogether, this intervention represents a major change in the Dutch fluvial landscape.

The goals of the longitudinal training dams come together in the concept *WaalSamen* (WaalTogether) which promotes sustainable and integrated river management by combining improvements for flood safety, inland shipping, nature development, discharge capacity, maintenance (costs) and public engagement in water management (Eerden, 2013). For example, the intervention will change sediment flows, which is also aimed at reducing maintenance costs relating to dredging and creating a river system that keeps itself navigable (Van Vuren et al., 2015). The construction of the dams was initiated by Rijkswaterstaat and started at the end of August 2014. Rijkswaterstaat is the executive agency of the Ministry of Infrastructure and Environment and responsible for the design, construction, management and maintenance of the Dutch waterways. The first part of the dam near Ophemert was finished in November 2014, while the construction works for the whole trajectory were completed in December 2015.

Because of the novelty and complexity of the intervention and its impact on the Dutch river landscape, Rijkswaterstaat initiated a participatory process in 2011 to integrate bottom-up initiatives into a monitoring plan. In this participatory process the role of

Rijkswaterstaat was twofold: firstly, they were the responsible organization for the construction of the dams and the design and implementation of the monitoring program, and secondly, they were the facilitator of stakeholder meetings. In the first stage, a diverse group of stakeholder representatives, including public and private partners, were invited by Rijkswaterstaat to share their concerns and to discuss opportunities for collaboration in monitoring. They were also asked whether they wanted to play an active role in co-designing the monitoring plan for evaluating the hydrological, ecological and socio-economic effects of the longitudinal dams. Citizens were not involved in the meetings.

In the next step of the participatory process, closed stakeholder meetings were organized with the aim to explore opportunities, risks and uncertainties when monitoring the effects of the longitudinal training dams. These meetings were attended by representatives of Rijkswaterstaat, Royal BLN-Schuttevaer, Royal Dutch Angling Association and research institutes. Royal BLN-Schuttevaer represents the professional interests of the inland shipping sector. The Royal Dutch Angling Association represents the interests of recreational fishermen, and also aims to build up knowledge and expertise on fish stock management, including fish monitoring. The role of research institutes was primarily focused on monitoring tasks to be carried out for Rijkswaterstaat and will not be further discussed. During these meetings it was also discussed how the monitoring outcomes will be used to evaluate the effects of the intervention in relation to the goals that were set. The intentions for collaboration in the monitoring activities were formally established in a partnership agreement in June 2015 and signed by all

stakeholders. This agreement helps achieve a collaborative mindset, ongoing commitment and a coordinated approach when carrying out the monitoring activities. In addition, it contains a description of specific partner contributions in terms of data collection, data sharing and coordination.

3. Material and methods

We used a two-tiered approach aimed at eliciting perspectives from both organized stakeholder groups and individuals. In order to gain insights into stakeholders' incentives for participation in monitoring, we conducted three semi-structured interviews with representatives from Rijkswaterstaat, Royal BLN-Schuttevaer and the Royal Dutch Angling Association. These interviews took place between 22 and 26 September 2014 (about one month after the start of the construction works). The interviews had three main topics: the concerns the interviewees had regarding the construction of the longitudinal training dams, their incentives to participate in the monitoring program, and their view on their role in the monitoring activities. The interviews were recorded and a summary report was written, which was checked by the interviewees to ensure correct interpretations. Interview data were analyzed by a qualitative and comparative assessment of the main topics.

Data on perceptions of local residents, recreational anglers and boaters, and shipping professionals were elicited through questionnaires. In addition to recreational anglers and shipping professionals, the survey also targeted local residents and recreational boaters, who will also be impacted by the intervention but are not represented in the partnership agreement. The surveys for local residents and recreationists were held between December 2013 and May 2014 (i.e. before the planned construction works). Data collection from shipping professionals took place between October 2014 and January 2015 when the construction works had just started. Shipping professionals and recreationists were asked to participate in an online survey for which a link was distributed via newsletters and advertisements in (online) magazines. A postal survey was sent to inhabitants of the city of Tiel ($N = 2000$) and the villages of Wamel ($N = 1043$), Dreumel ($N = 1472$) and Ophemert ($N = 678$), which yielded 1102 questionnaires that could be used for analysis.

The survey addressed three main themes: attachment to place, trust in Rijkswaterstaat, and expectations of the construction of the longitudinal training dams. The questionnaire included two visual elements: a map of the study area and an impression of the new landscape with longitudinal training dams (including a short description). Surveys were adapted to match the background and

interests of stakeholder groups. The number of items included in each survey is presented in Table 1. Trust was measured with one item on whether respondents feel they trust Rijkswaterstaat to protect them against floods. This item was broadened for shipping professionals in order to include nautical safety. For place attachment, we made a distinction between place identity (emotional and symbolic ties to a place) and place dependence (functional dependencies on a place) (e.g. Kyle et al., 2004). Social bonding (feelings of belonging to a group or community) was included as a third dimension in the survey for local residents and recreational anglers and boaters. In addition, local residents were asked about the cultural-historical values, while for recreational anglers and boaters we included nature bonding as a fourth dimension. For each dimension of place attachment we included three to five statements. Place attachment items were adapted to fit the context of the stakeholder group (e.g. "Fishing/Boating in this river area says a lot about who I am"). An overview of the items per group is available in the Supplementary Material. For each dimension, we calculated the average scores to allow for ranking of dimensions and comparisons between groups. Finally, respondents rated the expected impact of the longitudinal training dams on the landscape in terms of beauty, naturalness, accessibility, suitability for navigation or fishing purposes, and flood safety. We also asked for an overall rating of the intervention. All items in the questionnaire were measured on a five-point Likert scale from 1 to 5. Independent samples t-tests were performed (using SPSS Statistics 21) to compare scores between two groups.

4. Results

4.1. Incentives for participation in monitoring activities

The representatives of the Royal Dutch Angling Association expressed concerns about the consequences of the longitudinal training dams for the availability and diversity of fish, and the availability and accessibility of fishing spots. Despite these concerns, they also expressed a moderately positive attitude towards the proposed intervention. The current intervention provides an alternative for earlier types of construction works carried out by Rijkswaterstaat (i.e. lowering the groynes) which impacted the ecology of the river system, and the association representatives expected the longitudinal training dams to provide a more sustainable solution. However, we also found that negative experiences during these earlier interventions played an important role in shaping their perception of the longitudinal training dams. These negative experiences originated from a perceived poor quality of

Table 1

Overview of the variables included in the survey for the three stakeholder groups. Numbers between brackets indicate the number of statements used to measure this variable.

	Place attachment	Trust	Expectations regarding longitudinal training dams ^a
Local residents ($N = 1102$)	Place identity (4) Place dependence (4) Social bonding (4) Narrative bonding (4)	Trust in Rijkswaterstaat with regards to flood protection	...more natural ...more beautiful ...more accessible ...safer with regards to floods
Recreational anglers and boaters ($N = 75$)	Place identity (5) Place dependence (4) Social bonding (5) Nature bonding (5)	Trust in Rijkswaterstaat with regards to flood protection	...more natural ...more beautiful ...more accessible ...more suitable for boating/fishing ...safer with regards to floods
Shipping professionals ($N = 88$)	Place identity (4) Place dependence (4)	Trust in Rijkswaterstaat ^b	...more natural ...more beautiful ...more suitable for boating ...safer ^b

^a This question was formulated as follows: "In my opinion, the placement of longitudinal training dams will make the landscape...".

^b These statements were formulated more generally to acknowledge the importance of nautical safety for this group.

monitoring and lack of feedback about the outcomes of the monitoring that took place. These concerns were transferred to this new collaborative setting and increased their current interest in working together on monitoring the ecological effects, in order to ensure anglers' interests were sufficiently represented. Their perceived role was to perform fish monitoring, participate in meetings and actively communicate with their members.

On the one hand, Royal BLN-Schuttevaer (the representative group for inland shipping) expressed concerns about possible increases in travel time and fuel usage, as well as the consequences for river depth and safety risks due to changing traffic conditions near the crossing at Tiel. On the other hand, they acknowledged the potential benefits of the longitudinal training dams, such as maintaining a constant depth of the fairway. Their perceived role was to give input during meetings and being active in communicating new developments to their members.

Incentives to participate in actual monitoring activities touched upon different motivations. For Rijkswaterstaat, participatory monitoring is a means to create a shared vision among directly involved stakeholders and to actively involve them in the evaluation of the intervention. In addition, it would provide additional measurements that can be used as an early warning system. On a strategic level it will promote the use of innovative methods for facilitating participatory processes within the organization itself. Both representative organizations felt it was important to be included in the project as equal partners. Some differences could also be noted between the two: additional incentives for the Royal Dutch Angling Association were centered on mutual learning, i.e. learning from other involved organizations, and gaining knowledge about fish populations and pressing research topics (e.g. the occurrence of invasive fish species). The interviewee also pointed out that recreational anglers are already quite active in reporting their catches to fishing community networks, biodiversity databases, or as part of scientific research in a specific area. In contrast, Royal BLN-Schuttevaer is not involved in any research activities and is primarily focused on promoting sectoral interests. Therefore, they have less intrinsic motivation to participate in monitoring activities, but did so largely to maintain and strengthen the established reciprocal trust and good social relationship with Rijkswaterstaat. Inland shipping is an economically important stakeholder and therefore has close ties to Rijkswaterstaat with regard to maintenance of the fairway and traffic and safety procedures. The interviewee explicitly mentioned the high value they

place on maintaining well-established lines of communication with Rijkswaterstaat, and that this formed the basis for their decision to perform monitoring activities, together with their concerns regarding the impact of the intervention for inland shipping. For instance, upon the request of Rijkswaterstaat, two bargemen performed baseline measurements of their fuel usage along the monitoring trajectory before the construction of the dams.

4.2. Inventory of public perceptions

4.2.1. Recreational anglers and boaters

Recreational anglers and boaters are two main groups of recreationists who make use of the Waal area for leisure and relaxation. Two distinct differences between these groups are that anglers are often based locally and frequently return to specific locations (e.g. groynes), while boaters also come from other regions and are less dependent on specific spots. These group characteristics are clearly visible in their responses to the place attachment survey, with higher average scores for recreational anglers regarding social bonding (3.73 vs. 3.42), nature bonding (4.45 vs. 3.67), place identity (4.06 vs. 3.31) and especially for place dependence (3.85 vs. 2.69) (Table S1 Suppl. Material). Two-thirds (67%) of the total group trusted Rijkswaterstaat with regards to flood protection (while only 5% reported not to), with no differences between the two groups. Compared to recreational boaters, anglers had a much more negative view on the construction of the longitudinal training dams, especially with regards to accessibility of the area and suitability for fishing and boating (Fig. 2). This led to more negative overall evaluations from recreational anglers (2.28 ± 1.14) compared to recreational boaters (3.02 ± 1.11) ($p < 0.05$). This can be explained by the concerns that were raised in respondents' remarks. Groynes are highly valued as fishing spots and their removal is perceived by anglers as a loss of recreational value in the area which could force relocation. Other points of concern raised by this group were the impacts on fish and spawning populations due to the construction works or changes in sedimentation processes, and doubts regarding the accessibility of the area. Although boaters expressed some concerns and questions about safety issues and navigation routes (i.e. regulating traffic on the river), they had overall positive expectations, particularly regarding flood protection and the opportunities for recreation in the secondary channel. The Waal is regarded as a rather dangerous river to navigate, and splitting professional and recreational traffic

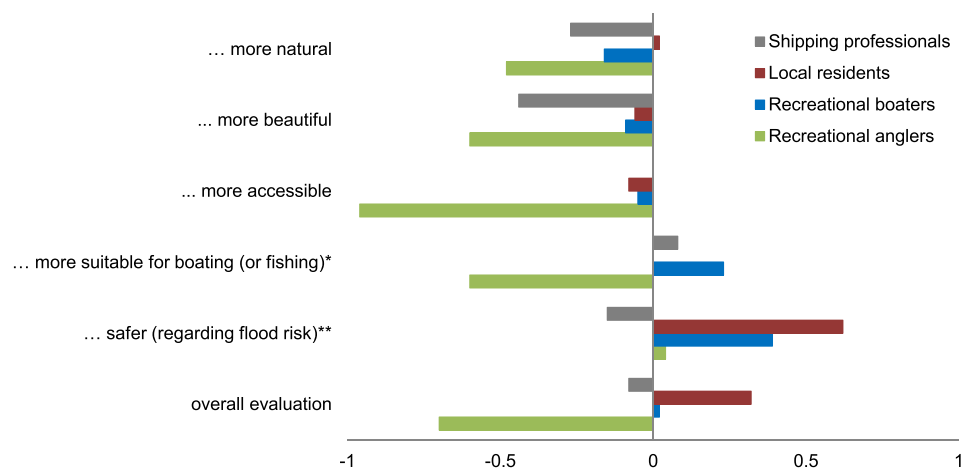


Fig. 2. Responses of stakeholder groups to the following statements: "In my opinion, the placement of longitudinal training dams will make the landscape...". For visual clarity, the scale was recoded to a 5-point scale running from -2 to 2. * Not included in the questionnaire for local residents. ** For shipping professionals this statement was formulated in a general way to acknowledge the importance of nautical safety for this group.

was perceived as a benefit.

4.2.2. Professional shipping

Regarding place attachment, shipping professionals generally neither agreed nor disagreed with the place identity statements (average score of 3.03). For place dependence slightly lower scores were reported (average score of 2.60), indicating that they do not favor the Waal more than other waterways (Table S2 Suppl. Material). We found that about one-third of the shipping professionals (36%) expressed low levels of trust in Rijkswaterstaat, with almost equally large groups being neutral (35%) or positive (29%) in this respect. Their opinions on the effects of the construction of the longitudinal training dams on the landscape were divided, with expected negative impacts on naturalness, beauty and safety, and a slightly positive score for suitability for navigation (Fig. 2). However, in all cases a large proportion of respondents (between 45 and 52%) reported neutral views, indicating they are unsure what the effects will be. Altogether, this results in a neutral overall evaluation (2.92 ± 1.04). Expressed concerns were often related to safety issues and possible increases in time and fuel use. One shipping professional put it as follows: “*My main concern is that the fairway will become more narrow. And this means that, without proper beaconing, larger ships will keep more distance*”. As a result of keeping more distance, the journey will take more time, impacting profits. This particular quote also shows that shipping professionals perceive the new situation as a reduced width of the fairway, even though the formal dimensions of the fairway (maintained by Rijkswaterstaat) remain the same. In addition, the reduced visibility of the fairway, lack of space for maneuvering, and possible suction effects close to the dam were mentioned in regard to safety.

4.2.3. Local residents

Surveyed residents included 1102 people living in residential areas adjacent to the River Waal: the city of Tiel and the villages of Wamel, Dreumel and Ophemert (Fig. 1B). Residents of all areas reported strong personal bonds to the area, with above average scores for place identity (4.03), place dependence (3.27), social bonding (3.32) and narrative bonding (3.18). The strong connectedness to the river landscape was largely based on a feeling of being at home (4.39 ± 0.71) and familiarity (4.36 ± 0.70). In addition, there were some noteworthy differences in perceptions between the four residential areas. Respondents living in the rural villages were more attached to the area compared to residents from the city of Tiel (Table S3 Suppl. Material). As in other studies among Dutch citizens (e.g. Baan and Klijn, 2004), we found that local residents of the four residential areas reported a high level of trust in Rijkswaterstaat regarding flood risk protection (86% agreed with this statement). Overall, local residents had a slightly positive evaluation of the construction of the longitudinal training dams (3.30 ± 0.92). This was mainly based on positive expectations for flood safety, compared to other intended outcomes such as nature restoration (Fig. 2).

5. Discussion

5.1. General reflection on the case study

This paper reviewed local stakeholder perceptions with respect to the construction of longitudinal dams in the Dutch river Waal, and explores their incentives to be involved in monitoring the effects of this intervention. Knowledge of stakeholder incentives to participate in monitoring is important for identifying and selecting both participants and relevant monitoring indicators. We found that a combination of incentives motivated representative organizations to collaborate in monitoring activities. These incentives

emerged from initial working relations, levels of concerns regarding their interests, learning goals, and in some cases originated from previous experience. In the case of inland shipping representatives, reciprocal trust formed the basis for cooperation with Rijkswaterstaat and in their decision to collect data on the impact of the longitudinal dams for shipping. Recreational anglers reported negative experiences in earlier projects which led to an erosion of trust. While this can have major consequences for participatory processes, possibly resulting in discontinuation of the cooperation (e.g. Van Bommel et al., 2009), here it actually became an incentive to be included in the partnership agreement.

In contrast to their representative organization, the level of trust in Rijkswaterstaat among individual shipping professionals seemed considerably lower. They might be unaware of the dialogue and partnership established by their representative organization, or might not feel closely affiliated with it. These results show that trust can be established on different levels: in addition to the institutional level, participatory monitoring also requires fostering trust among individual members, as they are key players. Responses to a call from Royal BLN-Schuttevaer, as well as initiatives from individual shipping professionals, suggest an interest in becoming more actively involved in participatory monitoring activities. Bonaiuto et al. (2002) showed that perceptions of land use change are influenced by economic ties to the area. Shipping professionals may thus also have employment-related incentives to monitor environmental changes.

The monitored perceptions of local stakeholders provided Rijkswaterstaat with useful information on the longitudinal training dams' possible impact, which is of importance when deciding whether to construct longitudinal training dams elsewhere in the Netherlands. Opinions on the longitudinal training dams appear divided, and there exists significant uncertainty among all surveyed groups about the purpose of the dams and their effects on landscape, nature and (nautical) safety. Local residents and recreational boaters are more positive about the planned intervention than recreational anglers and shipping professionals (Fig. 2). Residents and boaters emphasize the advantages for flood safety, while boaters also see opportunities for recreation in the secondary channel. This lack of major concerns is likely the reason for the low interest in this topic by the representatives from yachting and water sports associations, who were briefly involved in the preparation phase but not part of the discussions and final partnership agreement. Especially recreational anglers expressed fears that the interventions would negatively affect their ability to fish in the area. An additional explanation for their opposition lies in their appreciation of the natural landscape and the fact that the new dams would block the characteristic view on the river, which in turn may affect their personal attachment to it. This is in line with Haywood (2014) who stresses the need for further study of the role of place attachment in people's motivations to participate in scientific research.

The results of this study also played a role in further planning and implementation of the participatory monitoring activities. The concerns and trust issues among the shipping professionals and recreational anglers appeared to be sufficient incentives for actively involving them in monitoring the effects of the longitudinal training dam, especially regarding issues of importance to them, i.e. impacts on ecology (anglers) and nautical safety (shipping professionals). After completion of the baseline measurements, we initiated two participatory monitoring pilot projects, in close collaboration with the Royal Dutch Angler Association and Royal BLN-Schuttevaer, Rijkswaterstaat and research partners. First, a group of volunteer anglers is participating in fish monitoring by reporting their catches in the study area. Second, a number of shipping professionals is involved in measuring fuel usage, travel

time and safety aspects on the trajectory. As a group, local residents were judged to be less suitable for participation in monitoring because of the diffuse nature of the group and lack of any major concerns. As such, they are not actively engaged in participatory monitoring despite their strong attachment to the area.

5.2. Lessons learned

Our case study illustrates that incentives for participation differ between stakeholder groups, and that research into their perceptions of the local environment can inform water managers on how to involve these groups in participatory monitoring. In this paper we presented a single case study, and therefore the results have to be interpreted with care. Also, when comparing the results from the different stakeholder groups it is important to note the large differences in number of respondents. This case study was also restricted to stakeholders which took part in the partnership agreement or were surveyed as part of the exploration of public perceptions. This does not mean that there is no potential interest from other groups to participate. For example, birdwatchers who are active in the area may be interested in the effects of the longitudinal training dams on avian biodiversity.

With regard to setting up a participatory monitoring project, we note that cooperation with (local) interest groups is crucial for establishing effective communication with and recruitment of participants in monitoring activities. This means that organizations which are not part of the dialogue may be more difficult to involve. For this reason, the lack of concerns of the recreational boating sector (who were not represented in the partnership agreement) may become an impediment for recruiting boaters in participatory monitoring, even though they could provide valuable insights. It is also important to realize that volunteers differ in their experience with participation in scientific research. Recreational anglers often document their catches, sometimes even within an institutionalized setting (Eden, 2012), which makes it easier to involve them in participatory monitoring projects.

Stakeholders have different incentives for participating, but organizers also have different reasons for initiating such a project. It is important that these two elements match. In this case study, the alignment of expectations and wishes of stakeholders in a formal setting provided a solid basis for initiating and sustaining the participatory process. Even though a partnership agreement is based upon equality and trust, this does not erase all dimensions of power in cooperative processes. Each stakeholder is limited in their ability to act based on the availability of resources and responsibilities. For example, Rijkswaterstaat is responsible for the construction of the longitudinal dams and the safety on Dutch waterways, and is also the convener for the monitoring activities. Fliervoet et al. (2016) show that governmental bodies can use their regulatory powers to pursue different objectives, i.e. to implement their own policy strategies, to coordinate and facilitate, or to initiate collaboration in a rather top-down manner. In our case study Rijkswaterstaat took on the important role of facilitator and coordinator. While they stimulate collaboration in the monitoring activities as much as possible, these are embedded in the institutional and regulatory boundaries of their organization. This power imbalance has both advantages and disadvantages: participatory processes initiated or facilitated by government bodies are more likely to be accepted and implemented but may also lead to lower levels of trusts and learning among participants (De Vente et al., 2016). This highlights the importance of identifying which parts of the decision-making process are open to debate and which are more enclosed by rules and laws, and of being transparent about this early on in the cooperation.

Heldt et al. (2016) have shown that insights into the attitudes of

local communities at different implementation stages of a project helps to understand the dynamics of public acceptance in relation to participation processes. Follow-up studies among these stakeholder groups will allow for assessments of how their perceptions may change after the dams have been constructed. Finally, we stress the importance of collecting data on public perceptions when monitoring landscape interventions, especially when the intervention is local, novel and has an impact on landscape and place-based values.

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Appendix A. Supplementary data

Supplementary data related to this article can be found at <http://dx.doi.org/10.1016/j.jenvman.2016.11.035>.

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