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The pitchfork or the fishhook: a multi-stakeholder perspective towards intensive farming in floodplains

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When conservation conflicts occur, the recognition of a plurality of perspectives among the stakeholders makes it possible to better understand the divergences and convergences between the parties. In this research, Q methodology was used to explore different stakeholder views on management issues surrounding intensive farming in the floodplain of Lac Saint-Pierre (Quebec, Canada), a UNESCO biosphere reserve and a RAMSAR conservation site. In recent decades, Lac Saint-Pierre has undergone many changes in its floodplain, notably through the conversion of perennial crops to more intensive annual crops considered incompatible with aquatic life by the conservation community and current agri-environmental laws. This research highlighted three perspectives related to the standing of intensive farming in Lac Saint-Pierre's floodplain: pro-conservation, pro-agriculture and conflict between agriculture and conservation in the floodplains. This research illustrates the socio-ecological complexity behind intensive farming in floodplains and the need for representativeness of the main perspectives during negotiations between the parties.

Keywords: agri-environment; conservation conflict; Q methodology; Lac Saint-Pierre; common-pool resource

1. Introduction

The pitchfork or the fishhook exemplifies a choice in floodplain land use between farming activities and biodiversity conservation. As fertile land, floodplains have been cultivated for centuries around the globe. With the need to feed the growing world population and the mounting awareness regarding wetland protection, the presence of intensive farming in the floodplains is an important dilemma for society (Pardoe, Penning-Rowsell, and Tunstall 2011). How and why this type of ecosystem is used depends partially on the individual perception that users have of it (Berestovoy 2006). For each individual, the perception of a resource is different because of personal experiences, social and cultural backgrounds, and their interactions with the resource (Lepage 1999). In a conservation context, each stakeholder has a preference regarding how a natural resource should be used, conserved or developed (Adams *et al.* 2003), thus creating dynamic and complex socioecological interactions (Liu *et al.* 2007).

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Moving toward negotiated solutions to complex and potentially conflictual resource management issues requires the engagement of all parties, in full recognition of their perspective and how it may be compatible or otherwise with potential courses of action (Reed *et al.* 2009).

In a natural environment subjected to various pressures, the coexistence between agricultural activities and those dedicated to conservation can be complex, or even conflictual (Madden and McQuinn 2014). Thus, a land-use conflict emerges not only from competition between different users, but also from the meanings people attribute to a place and the expectations they have of it (Cheng, Kruger, and Daniels 2003; Torre 2006). Therefore, conservation conflicts occur when some stakeholders oppose the conservation objectives or one party's interests are imposed at the cost of another party's (Redpath *et al.* 2013).

There are different levels of conflict that intensify as the conflict becomes more complex (Madden and McQuinn 2014; Torre 2006). This can start with tensions between different parties, a verbal confrontation, and even end with a recourse to the courts (Torre 2006). According to the Canadian Institute for Conflict Resolution (CICR), there are three levels of conflict: 1) disputes, 2) underlying conflict, and 3) identity-based/deep-rooted conflicts (Madden and McQuinn 2014). When analyzing a conservation conflict, an understanding of the different points of view of the stakeholders involved in it is essential to reduce their negative impacts during future negotiations (White *et al.* 2009). Whatever the level, conflict resolution using land-use allocation attempts to identify the underlying causes of the divergence (Crespin and Simonetti 2018).

This study aims to provide a better understanding of conservation conflicts related to intensive farming in floodplains. It seeks to highlight the different perspectives attached to a unique ecosystem in Canada, the floodplain of Lac Saint-Pierre (LSP), where there is opposition from the agricultural sector to conservation objectives supported by a large part of the community. As such, large parts of the community favour the return of a permanent vegetative cover suitable to aquatic fauna in the floodplains, which goes against current agricultural practices. Despite its uniqueness, LSP is not the only place in the world where there are conservation conflicts related to intensive farming (Perrotton *et al.* 2018; Porras, Stringer, and Quinn 2018; Horowitz 2018). Thus, this study wants to contribute to this growing literature by providing an in-depth look.

Numerous studies have been conducted to characterize the current state of LSP and the changes in its floodplain in the last fifty years (Carignan and Lorrain 2000; Hudon and Carignan 2008; Mailhot *et al.* 2015). However, none of them looked at the social perspectives surrounding the coexistence of agricultural uses and conservation goals. As part of this research, Q methodology was used to explore stakeholder perspectives on current management issues related to intensive farming in the floodplains. Through its quantitative and qualitative approaches, the Q methodology is particularly useful in highlighting the different discourses within a group of respondents in relation to controversial environmental issues (Cotton 2015). In recent years, this method has gained a lot of popularity among researchers who wish to better capture stakeholder perceptions of various conservation issues (Zabala, Sandbrook, and Mukherjee 2018) and to understand divergences among a set of respondents (Gänsbauer, Bechtold, and Wilfing 2016; Loring and Hinzman 2018). Q method can therefore help to render explicit the different perspectives of stakeholders, such as the interests and beliefs surrounding the controversy (Durning 2006). Thus, this method makes it possible to highlight the

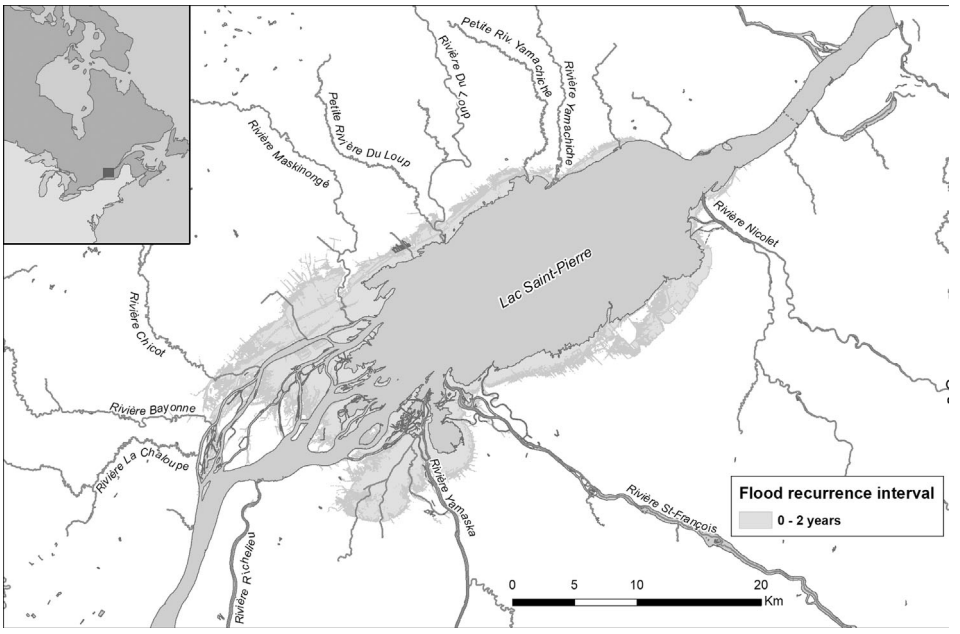

Figure 1. The study area: the floodplain of Lac Saint-Pierre, Quebec, Canada.

different definitions of the problem under study within a group, and the solutions considered possible among the respondents.

2. Methodology

2.1. Study site: the shoreline of Lac Saint-Pierre and its islands, a valuable territory

Located in the heart of the St. Lawrence River valley, halfway between Quebec and Montreal, Lac Saint-Pierre (318 km^2) and its archipelago (63 km^2 excluding its islands) has its source in the Great Lakes-St. Lawrence watershed (Figure 1). With its vast wetlands, LSP was designated a RAMSAR site in 1998 under an international treaty on the conservation and sustainable management of wetlands, and recognized as a biosphere reserve by UNESCO in 2000. In the last few decades, the lake's floodplains have undergone a deep transformation due to land use change (Dauphin and Jobin 2016). Formerly dominant perennial crops have been largely abandoned in favour of annual crops such as soybeans and corn (De la Chenelière, Brodeur, and Mingelbier 2014). In addition to increasing the sediment load in the lake, thereby reducing access to spawning sites upriver, this type of agriculture is poorly suited to the biological needs of fish due to the absence of vegetation on the ground during spawning and nursery periods. Furthermore, these farming practices are currently inconsistent with existing environmental regulations and policies. There is, thus, no consensus within the Québec government regarding this type of activity in the floodplain.

Each spring, the floodplain of LSP covers nearly 14,000 ha for a period ranging from five to nine weeks (De la Chenelière, Brodeur, and Mingelbier 2014). During this period, this vast body of water is visited by thousands of migrating waterfowl (Reed, Chapdelaine, and Dupuis 1977). The flooded area is also frequented by about 40 species

of fish, including yellow perch (*Perca flavescens*). Commercial fishing for yellow perch has been practised since the 19th century on this body of water. This species was very abundant in the 1960s, but has declined in recent decades to the point that the authorities decided to introduce a moratorium in 2012 (Mailhot *et al.* 2015). Several factors are linked to the collapse of the stocks, but the deterioration of its habitats, particularly the breeding and nursery areas located on the floodplains due to intensive agricultural practices, remains an important factor (De la Chenelière, Brodeur, and Mingelbier 2014). Its moratorium was, in a way, the spark plug for the conservation conflict under study.

In addition to the change in land use on its floodplain, LSP's current imbalance is caused by numerous cumulative impacts that have been occurring for several years (Hudon and Carignan 2008). Indeed, LSP has suffered various disturbances, including several dredging operations to establish and maintain the St. Lawrence Seaway (Carignan and Lorrain 2000). The lake was also used as a military testing site for several years, and until 2000, projectiles (estimated at 300,000 in total) were fired into the lake (La Violette 2004). The arrival of Highway 40 in the 1970s also led to changes in the ecosystem, including the installation of drainage pipes, 102 of which provide access to fish breeding areas north of the highway (Le Pichon *et al.* 2018). During this decade, 559 ha of agricultural land was dammed to serve the dual functions of controlling water levels to create resting places for waterfowl and of draining farmland (De la Chenelière, Brodeur, and Mingelbier 2014). Because of its proximity to large urban centers and areas of intensive agricultural activity, LSP's water contains residual bacteriological pollutants on the North Shore, as well as high levels of sediments and agricultural inputs from upland farm drainage that flows into it (Simoneau 2017). All of these factors, combined with climate change, the arrival of invasive species, recreational boating and shoreline development, make this unique environment highly disturbed.

Since the implementation of the moratorium on yellow perch, the government has increased dialogue with stakeholders to identify actions to protect and restore LSP, including a drastic change in agricultural practices that the farming sector opposes. Although this initiative has fostered the emergence of collective action on the territory, it is not unanimous among stakeholders which type of activity is directly responsible for the limited success of conservation actions.

2.2. Choice of Q methodology

Q methodology asks researchers to develop a list of subject-related statements that respondents will be asked to rank according to how well it represents their viewpoint and to give reasons for their respective rankings (Watts and Stenner 2012). The objective of this methodology is to reduce the range of viewpoints to a limited number of archetypal groupings that capture key variations across the set of individual rankings (Davies 2017). These archetypal groupings represent the different perspectives present among the respondents surveyed and allow identification of key values, as well as areas of divergence and convergence, in order to provide a better understanding of values and interests within a group of stakeholders (Zabala, Sandbrook, and Mukherjee 2018).

2.3. Selection of statements (Q sample)

The choice of the statements to be presented to the respondents must reflect the entire field of subjectivity (Brown 1993; Stephenson 1953). To achieve this, a media review

of the various uses and issues present at LSP was conducted for a period of 25 years, from 1992 to 2017. The media selected during the documentary search included six local newspapers, three national newspapers and a specialized newspaper in agriculture. A literature review was also conducted through the gray literature, including briefs, reports, minutes of meetings and conference proceedings for the organizations working on LSP issues. To obtain the most representative Q Sample, four themes associated with the subject were developed to structure the collected data: 1) coexistence of uses; 2) collective actions supporting the LSP ecosystem; 3) agricultural and agri-environmental practices; and 4) policy and regulations related to agriculture and natural resource conservation. The four themes were selected by using the constant comparison method peculiar to the grounded theory approach (Paillé 1994). First, the data are coded and then grouped into categories. This allows us to develop four main themes that express the content of each of the identified categories as the analysis progressed (Guillemette 2006).

Each statement selected within the resulting structure of the data came directly from the literature under review. Once the exercise was completed, a reduction in the number of statements was made to facilitate ranking for the respondents. The redundancy in the statements was reduced while capturing the essence of the study subject as a whole. A total of 39 statements were created and a pretest was conducted with four individuals to ensure the quality of the Q Sample. The four individuals selected were a social scientist, an agronomist, a biologist and a member of the Waban-Aki Nation. Their contribution at this stage of the research allowed us to clarify the statements to increase understanding among the stakeholders under study.

2.4. Selection of respondents

A non-probability sampling technique was used for the selection of the respondents. Therefore, an exhaustive list of stakeholders revolving around LSP issues was drawn up: 1) elected officials and municipal employees; 2) farmers and agronomists; 3) researchers from governments and universities; 4) government employees; 5) members of the Waban-Aki First Nation; 6) members of conservation organizations; and 7) hunters and fishermen. Subsequently, four subgroups were developed based on the categories of selected actors: 1) agricultural sector; 2) government/municipal sector; 3) conservation sector; and 4) hunting and fishing sector. The number of interviews per subgroup was determined by the theoretical saturation point. The theoretical saturation point is reached when the information is repeated and where all the perspectives seem to have been sufficiently documented (Guillemette 2006). To recruit respondents, invitations were sent to individuals with the desired profile. To achieve this, a search was conducted to develop an exhaustive list of potential respondents. In the absence of a response from the targeted individuals, we used the snowball sampling technique to add respondents from the recommendations made by initial participants (Noy 2008).

2.5. Collection of data (Q sort)

A total of 58 people were interviewed individually and 57 of them completed the entire interview. For each of the subgroups, about fifteen people were sought for a good representation of the entire territory under study. Each interview consisted of briefly presenting the context of the research project to the respondent and giving

Table 1. Distribution of the responses on the scale.

Scale of appreciation	−4	−3	−2	−1	0	1	2	3	4
Number of statements	2	3	5	6	7	6	5	3	2

them the instructions to follow in order to achieve the ranking of the statements (Q Sort). Respondents were asked to rank each of the statements according to their degree of agreement in a grid (Table 1) with a predetermined number of responses per score according to a normal distribution. While optional, forced distribution facilitates the ranking process and encourages respondents to think about where to place each of the statements in the answer grid (Brown 1993). At the end their Q Sort, the respondents answered a few questions for a better understanding of their rankings and their views on the conservation conflict under study. We asked each participant what they thought the solutions were to the problem with the yellow perch and the role of agriculture in the conflict.

2.6. Analysis and results interpretation

All statistical processing was done using the free software PQMethod version 2.11 (Schmolck 2002). First, each individual Q Sort was correlated with the entire set of Q Sorts collected. The differences among the responses between all possible respondent pairs were calculated to generate a correlation matrix (Watts and Stenner 2012). A principal component analysis was then conducted to find the most significant axes according to the eigenvalues (greater than 1.0). The first three factors were retained using Horne's parallel analysis technique as a decision tool (Watts and Stenner 2012).

Subsequently, a centroid factor analysis was performed to find the strongest correlations among the different Q Sorts. This allowed the data to be restructured to increase possible correlations (Ramlo 2016). For each factor extracted, a portion of the variation present in the data was captured. Thus, subsequent factors took another portion of the correlations explained by this factor and so on (Davies 2017). Once the extraction of the factors was complete, a varimax rotation was carried out. Factor rotation makes it possible to change the distribution of the variances explained by the factors and to analyze them from different angles to arrive at factors, each comprising a set of strongly correlated individual points of view (Brown 1993). Qualitative and quantitative criteria were used to select the final factors that became the different social perspectives present among the respondents (Ramlo and Newman 2011). Qualitatively, selection of final factors was based on their distinctive characteristics, their consistency and their relevance to the field of study (Brown 1980). At a quantitative level, several elements were taken into consideration, including the Kaiser-Guttman criterion (greater than 1.0), the Horne's parallel analysis technique, the variance percentage explained, and the *P*-value of 0.01 if it exceeds a factorial saturation of ± 0.41 (Brown 1980; Watts and Stenner 2012).

3. Results

We identified three archetypal perspectives of respondents toward conservation conflicts in LSP: the pro-conservation, the pro-agriculture and conflicts between

agriculture and conservation in the floodplains. They account for 48% of the explained variance and encompass all 57 Q Sorts made by respondents. An explained variance of between 35-40% and above is considered satisfactory for this methodology (Watts and Stenner 2012).

3.1. *Perspective 1: pro-conservation in the floodplains*

This perspective explains 27% of the variability and mainly represents the point of view of researchers, fishermen, elected officials and professionals working for conservation organizations and government agencies.

As can be seen in Table 2, the pro-conservation discourse is convinced that the moratorium on yellow perch is essential to protect current stocks. For them, this moratorium has also made it possible to highlight all the issues surrounding the LSP and to mobilize the stakeholders. For these stakeholders, the wetlands of LSP are extremely rich. They also want to increase the protected areas in LSP. For them, if there were sufficient protected areas to preserve wetlands and fish habitats, the yellow perch population would be in a better state. According to them, the establishment of a farmland buyback system to preserve certain sensitive areas would be an avenue to explore.

For these respondents, the two actual challenges of LSP are: 1) yellow perch breeding and rearing habitats and 2) water quality. Intensive agriculture is currently

Table 2. Statement in the Q sample that received the most disagree (−3 and −4) and the most agree (+3 and +4) score for perspective 1.

Very agree (+4)	18: Intensive agriculture is the biggest threat to preserving the integrity of LSP.
	21: LSP is very fragile, the status quo in agriculture is no longer an option.
Agree (+3)	9: LSP's agriculture must incorporate agricultural development and practices that are favourable to several species (fish, wild birds, amphibians, insects, etc.).
	15: A system of farmland repurchases by the government should be put in place to preserve sensitive areas of LSP.
	23: To improve water quality in LSP, work should be done on the upstream watersheds that flow into it.
Very disagree (−4)	14: In my opinion, wetlands are bug holes that are detrimental to the economic development of the region. 35: The moratorium on yellow perch in LSP is useless.
Disagree (−3)	2: The width of the current riparian buffers of cultivated land (3 meters) is sufficient to protect agricultural streams that discharge into LSP.
	8: The complete drainage of agricultural land helps to preserve the quality of watercourses around LSP.
	22: There are enough protected areas on LSP to protect species.

the greatest threat to the integrity of LSP, and as a result, the status quo in agriculture is no longer an option. They deplore the current lack of linkage between the various ministries concerning water management and the conservation of natural environments in agricultural areas.

In order to continue farm activities around LSP, farming must incorporate practices compatible with the floodplain ecosystem. It is also necessary to work with the farmland watersheds upstream of LSP to reduce sediment and agricultural inputs such as fertilizers and pesticides. The current width of the riparian strips is clearly insufficient. If existing regulations were respected by all farmers, that would already be a good start.

3.2. Perspective 2: pro-farming in the floodplains

This second factor explains 12% of the variability and brings together the point of view of eight farmers and four agronomists, but also of one fisherman, one elected official and one conservationist.

Table 3. Statement in the Q sample that received the most disagree (−3 and −4) and the most agree (+3 and +4) score for perspective 2.

Very agree (+4)	10: It will take more research to develop wildlife-friendly farming in LSP.
	34: Innovation to restore some of the ecological functions of farmland in the floodplain takes time and the input of agricultural producers.
Agree (+3)	26: The cumbersome and complex current ministerial procedures prevent the implementation of measures to preserve and improve LSP's condition.
	31: In addition to a change in farming practices, several projects can be carried out to improve fish distribution on farmlands, including the reconfiguration of culverts and the removal of plant plugs or sediments from ditches and streams.
Agree : other distinguishing statement	37: It is important to continue the concertation initiative begun several years ago at LSP.
Very disagree (−4)	3: To preserve LSP, agriculture should be prohibited in the floodplain (recurrence 0–2 years).
	14: In my opinion, wetlands are bug holes that are detrimental to the economic development of the region.
Disagree (−3)	16: With the damage done by waterfowl and spring floods, the current crops in the floodplain of LSP are not profitable for anyone.
	17: The main goal of farmers in the area is to make money irrespective of the condition of LSP.
	18: Intensive agriculture is the biggest threat to preserving the integrity of LSP.
Disagree: other distinguishing statement	35: The moratorium on yellow perch in LSP is useless.

As can be seen in Table 3, this group is aware of the fragility of the environment. It also recognizes the essential role of wetlands in the LSP ecosystem and the importance of maintaining the moratorium on yellow perch. To restore their habitat, the pro-farming group understands that it is necessary to find crops or cultural practices to avoid bare soils in the floodplain, at least in the spring, to increase the number of spawning sites for yellow perch. Despite herbaceous cover in the spring, some of the respondents are concerned that the water will not stay above the shoreline long enough for the fish. They want agriculture to continue in the floodplain, because it is part of their heritage, the soils are fertile, and the current crop production is profitable despite the floods and the presence of waterfowl in the spring.

For these stakeholders, agriculture is not the only pressure responsible for the decline of the yellow perch, instead they blame the entire set of land-use issues. In their opinion, it would then be more constructive to tackle the problem as a whole instead of targeting only the agricultural sector. The pro-farming discourse finds that the current ministerial procedures are cumbersome and prevent the implementation of measures to preserve and improve LSP's condition. For example, the cleaning of waterways and the reconfiguration of culverts would increase the free flow of water and fish, but obtaining a permit can take several years. Similarly, obtaining an authorization for habitat restoration work in the floodplain is a complex process.

The pro-farming discourse portrays agricultural producers as people who care about the state of LSP and recognize the effort put in place by the government to increase dialogue among parties over several years. For these respondents, the key ingredient for developing an innovative agriculture that is compatible with the specificities of LSP is research conducted with committed, actively participating agricultural producers. In addition, an increase in the representation of the agricultural sector in consultative bodies would be desirable for several of its respondents.

3.3. Perspective 3: conflicts between agriculture and conservation in the floodplains

This third perspective explains 9% of the variability and represents exclusively the point of view of farmers located near wetlands and manmade waterfowl habitats. All of them suffer damage in their agricultural fields from the increased presence of the greater snow goose (*Chen caerulescens atlantica*).

As can be seen in Table 4, these respondents clearly feel the conflicts surrounding issues of coexistence of agricultural and conservation uses in LSP. For these farmers, there is a lack of political cohesion at the governmental level regarding the place of agriculture in LSP. The farmers believe that they are already making their environmental contribution by respecting the laws and regulations in force. Environmental standards make their work more difficult near streams, rivers and in the floodplain. The obstruction of watercourses downstream of the watersheds is a major stressor for all of the respondents.

According to them, the status quo in agriculture is possible because their annual production is profitable for the most part and compatible with the changes in water levels. As farmers, they have adapted to floods for generations. They are open to changing their farming practices for the benefit of LSP if there is monetary compensation and if the proposed changes will have a real impact on the yellow perch population. They are also open to collaboration in finding solutions because they know the

Table 4. Statement in the Q sample that received the most disagree (−3 and −4) and the most agree (+3 and +4) score for perspective 3.

Very agree (+4)	28: Right now, every government ministry is doing what they want at LSP. It's fragmented and incoherent management.
	32: With the laws and regulations in force, it is increasingly difficult to farm in the floodplain or where there is a watercourse.
Agree (+3)	1: It takes more financial incentives to change the way farmers do business on LSP.
	33: Each area has its challenges. It is impossible to apply the same solutions everywhere to preserve LSP.
	38: LSP is an area of conflicts.
Agree : other distinguishing statement	22: There are enough protected areas on LSP to protect species.
Very disagree (−4)	3: To preserve LSP, agriculture should be prohibited in the floodplain (recurrence 0–2 years).
	15: A system of farmland repurchases by the government should be put in place to preserve sensitive areas of LSP.
Disagree (−3)	16: With the damage done by waterfowl and spring floods, the current crops in the floodplain of LSP are not profitable for anyone.
	17: The main goal of farmers in the area is to make money irrespective of the condition of LSP.
	21: LSP is very fragile, the status quo in agriculture is no longer an option.

particularities of the soils. However, they feel far away and disconnected from the decision-making processes. Some of them would like to be more informed about the measures and studies undertaken on LSP over the past several years.

For these farmers, there are enough protected areas in the LSP region. Man-made wildlife habitats dedicated to waterfowl cause problems for both the fishing and agricultural sector. Damned areas that support waterfowl during the springtime flooding are eventually drained for agriculture, and spawning fish populations are stranded on the wrong side of the dams. The purchase of farmland by the government is not an option for them because agriculture is not only a question of profit. They feel close to nature, connected to their territory and view themselves as stewards of the land. For them, each area has its own challenges. The territories surrounding LSP are very different and it is impossible to apply the same regulations everywhere.

3.4. Consensual areas, convergence and divergence

Data analysis reveals that there are no significant consensus statements among the three emerging social perspectives. However, it is relevant to point out that there seems to be a common agreement among the stakeholders surveyed. Indeed, all the actors agreed that intensive farming in the floodplains is not the only activity responsible for the reduction of yellow perch. They were also aware that this problem came not only from the farms near the lake but also from the various watersheds upstream.

3.4.1. Perspectives 1 and 2: convergence and divergence

These two perspectives agree on the importance of preserving wetlands. Although they make development more complex for some, wetlands carry out many ecological services. Water filtration, sediment retention, ecological richness and aesthetics were the most cited ecological services among respondents. The two perspectives also share the same opinion on the importance of the moratorium on yellow perch, whether it is to maintain current stocks, to support the food chain of other species, to explain the collapse of stocks or to highlight all the environmental issues of LSP. This moratorium has also helped to create movement at the political level through the deployment of various financial aids for research, for cooperation among the parties, for the improvement of water quality, for the restoration of wildlife habitats or for existing human-man waterfowl habitat improvement. Many of the respondents are using scientific studies as sources to comment on the yellow perch issues. Some respondents question the method of sampling stocks used by researchers and the possible causes of declining stocks (sedimentation, invasive species, various predatory migratory birds, earlier overfishing, poaching, bank erosion, lack of underwater grass beds, loss of, and access to, breeding sites and habitat fragmentation).

However, these two perspectives do not share the same point of view on the main cause of the current problems in LSP. For perspective 1, intensive farming is currently the biggest threat. Growing annual crops in the floodplain does not provide spawning and nursery habitats for fish due to the absence of vegetation on the ground during the spawning and nursery periods in the spring. In addition, agricultural drains are too effective. Water does not have time to filter, causing a deterioration in water quality and in the meadows and spawning grounds (including access to them) by the massive accumulation of sediment over the last two decades.

For perspective 2, the stakes for LSP are multiple. Marine transportation, recreational boating, water-level control, climate change, highway 40, abuse of fisheries in the past, double-crested cormorant (*Phalacrocorax auritus*) pressure, invasive species, clogged waterways, sewage spills and ice jam removal to maintain the St. Lawrence Seaway are all pressures other than agriculture that were raised during the interviews. Some respondents from the farming sector questioned the use of the term “intensive agriculture” and the negative cultural connotations associated with the word “intensive”. They specified that there are different crop management practices specific to cereal crops. They are open to doing their part if each of the sectors involved do theirs. Many respondents even see the current challenges of LSP as opportunities for innovation.

3.4.2. Perspectives 2 and 3: convergence

These two social perspectives are both opposed to the idea of removing agriculture from the floodplain. For them, agricultural activities have a right to exist acquired through generations. Flooded farmland is not what it used to be, and going back to the past farming practices is not an option. Water control for maritime transportation and flood control have facilitated the establishment of annual crops in the floodplain. Current farming practices are no longer compatible with grazing and grass production on the shoreline is of poor quality. The hay smells of fish which the animals do not like. They must then rely on low impact agricultural practices for the soil and for aquatic ecosystems. Some farmers use a different crop management system when

growing in the floodplain, such as reduced tillage and the establishment of narrower and shallower ditches.

According to these two social perspectives, farming in the floodplain is profitable. With few exceptions, good yields can be obtained in the area around LSP. The increased presence of greater snow geese in the spring is a negative factor for all respondents in the agricultural sector. They pull out the seedlings in the spring and compact the soil where there is poor drainage, reducing the annual yield. These two perspectives deplore the negative image of intensive agriculture in the media and feel unjustly blamed for all the problems of LSP.

3.4.3. Perspectives 1 and 3: divergence

Social perspectives 1 and 3 share no common statements. These two social perspectives differ significantly on the possible option of implementing a farmland purchase system at LSP. Some respondents doubt that the government is the best body to acquire and manage these lands. Land management at the local and decentralized level would be the preferred option for them. Other alternatives for generating ecological gains in LSP have been identified by some of the stakeholders, including conservation easements and integrated land management.

Perspective 3 strongly believes that a government farmland purchase program would increase the price of neighbouring farmland and send a negative message to the public about agricultural production. According to them, the lands currently owned by government and conservation agencies are poorly maintained and managed, so additional areas under conservation would be undesirable. For some of them, this type of program destroys the social fabric of the environment and forever creates emotional scars in the territory.

Social Perspective 3 questions whether the protected areas and fallows around LSP actually offer a suitable fish habitat. These farmers do not like to see farmland go fallow or mature silver maples rot due to stagnant water caused by the obstruction of watercourses or the creation of dams or dykes for manmade waterfowl habitats. Social perspective 1 suggests that the type of protection in place at LSP is inadequate or insufficient, and for the most part has no legal weight. It also deplores the excessive speed of boats and the presence of certain types of boat close to islands. These boats are damaging the underwater grass beds and the banks of the islands, as well as being incompatible with the use of non-motorized boats such as canoes and kayaks in the LSP archipelago. Several respondents feel that the UNESCO's biosphere reserve status is poorly valued. They see this designation as an image with no real impact on the territory due to lack of funding and lack of community involvement. On the other hand, some pro-conservation respondents associated this status with diplomatic action, in which the country is committed to maintaining the reserve status on behalf of the international community.

5. Discussion

Conservation conflicts are the result of different viewpoints (Young *et al.* 2010). By its exploratory nature, the Q methodology has made it possible to better understand not only the different social perspectives with regard to the agriculture-conservation

issues present in LSP, but also to identify the different levels of conflict present among the stakeholders (Madden and McQuinn 2014).

Recognition of the views and values of all stakeholders is an important step forward when there is a conservation conflict (Gutiérrez *et al.* 2016). In the case of LSP, the divergence is mainly at the dispute level, with the desire of the pro-conservation groups to bring about a rapid change in the agricultural sector concerning farming practices, ultimately to restore the yellow perch habitat and improve water quality. Underlying conflicts and identity-based conflict are also present in LSP among some of the stakeholders. For the commercial and sport fishing sector, the pressure of double-crested cormorants on perch stocks in the fall and the government's current inaction in controlling the bird population during migration also appears to represent an element of tension for some of the fishermen surveyed. For the agricultural sector, there are several conflicts underlying the current ones that will greatly complicate the process of addressing these different conflicts.

The perspective 3 is in opposition with conservation agencies and the government because man-made waterfowl habitats are slowing down the drainage of water from agricultural fields in the spring. They experience severe damage from the greater snow geese, resulting in considerable yield losses in their fields. In addition, the current high-water mark for the government does not make sense for some farmers. Others are very attached to their location and a possible government farmland purchase program disturbs them enormously and threatens their fundamental identity. The latter are challenging the possibility that their lands could be used for conservation purposes, because they have been cultivating them for generations, since well before the enactment of the various regulations that are applied to LSP. They believe that it is thanks to their hard work that the landscape has been maintained. These reasons for the disputes are thus anchored in the place (Holmes 2007). Therefore, people from the Social Perspective 3 fit well with the place-based principles (attachment, identity and dependence) that come from environmental psychology (Jorgensen and Stedman 2006).

Some of these areas seem more conflictual than others around LSP, depending on their history, their social dynamics, relevant standards and regulations, and uses specific to each area. The possibility of conservation and other uses to coexist depends partly on the willingness of stakeholders to recognize the problems as shared and to be able to discuss them collaboratively (Redpath *et al.* 2013). At this time, the non-uniform application of standards and regulations at LSP causes a feeling of injustice within groups of stakeholders and amplifies problems for both the agricultural and the conservation sectors. However, strict and inflexible laws can reduce the number of possible solutions or even increase existing conservation conflicts (Redpath *et al.* 2013). In order for all uses to continue, each of the stakeholders will have to take responsibility for their own uses and agree to compromise in favour of the collective interest in LSP. Such compromises will be effective or not dependant on the social perspective into which each individual fits (Game *et al.* 2014). By knowing the beliefs and interests for each of the perspectives, it is possible to achieve better representation during negotiations (Durning 2006). Given their geographical position, farmers who are cultivating in the floodplain are the ones most likely to adapt their practices to the current context. These farms are downstream of large tributaries highly disturbed by various anthropogenic pressures and are also under pressure from the various uses present in the LSP. It would then be interesting to explore the various possible mechanisms of compensation to promote equity between agricultural enterprises upstream and downstream of the LSP and the different uses present within the lake.

Public participation in natural resource management can reduce the conflicts among parties and the legal costs to resolve the conflicts (Daniels and Walker 1997). This research revealed that agricultural sector stakeholders want to be more involved in the decision-making process of LSP environmental planning and management, especially considering their land-use practices are the main focus of upcoming policies and regulations. The information collected from the Q methodology can be useful in designing a discussion session to foster dialogue between the parties and the deliberation of the conflicts among the stakeholders (Cuppen *et al.* 2010). It can be used as a negotiation technique to find compromises or maximize the adherence of stakeholders to the proposed solutions by taking into account the preferences of a greater plurality of viewpoints, thus making it more attractive for all stakeholders (Durning 2006). Q methodology can also serve as an alternative approach to selecting people in focus groups not only according to specific interests but to improve the representation of perspectives (Cuppen *et al.* 2010).

6. Conclusion

The pitchfork or the fishhook? Do agricultural activities have a place on the shores of LSP? For the two thirds of the respondents interviewed, it is possible that current uses could coexist despite the poor condition of the LSP ecosystem. For the majority of respondents surveyed, it is not the presence of agriculture that is the actual problem, but the type of agriculture practised. This research has also demonstrated the importance of addressing all the issues in search of solutions to agriculture-conservation conflicts at the LSP. Thereby, this study converges with other ones in suggesting that widening the field of interests could help in resolving conflicts (de Bruijn, ten Heuvelhof, and In ‘t Veld 2010). The stakeholders in LSP face difficult challenges where there are no simple solutions. The integration of values and different opinions within a community are critical to the success of desired conservation measures (Zabala, Sandbrook, and Mukherjee 2018). A better understanding of different stakeholder positions improves efficiency and transparency in negotiations between opposing parties (Adams *et al.* 2003; Durning 2006). Thus, transparency among the actors can promote compromise (Van Den Hone 2006).

Instead of perceiving them negatively, conservation conflicts can become an opportunity to identify problems, increase the understanding of stakeholders and promote the creation of sustainable solutions among them (Young *et al.* 2005). This study provides a novel contribution about how people perceive intensive farming in floodplains. Q methodology brought out the elements of contention, showing that it is not possible to isolate a problem from other issues. It allowed us to contextualize the problem and to identify the beliefs and interests underlying stakeholders’ positions toward intensive farming in the floodplains. This study demonstrated the social complexity behind the agricultural activity in the floodplains and the need to include a diversity of perspectives during further negotiations among the stakeholders involved in this issue.

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