Toward Food Sovereignty for Coastal Communities of Eastern Quebec: Co-Designing A Website to Support Consumption of Edible Resources from the St. Lawrence

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Authors' Contributions

CF, ML, HOW contributed to the design of the study by CF. *Sustenance from our St. Lawrence* contributed to data collection. CF conducted data analysis and interpretation, with the help of HOW's professional contacts. CF and HOW drafted the first version of the article with early revision by ML. All co-authors (in alphabetical order: DD, EP, EF, IC, JB, MM, NP, SP,) critically revised the article and approved the final version for submission for publication. CF, ML and HOW had full access to all the data in the study and had final responsibility for the decision to submit for publication.

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We declare no competing interests.

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Ethics Approval, Consent to Participate and Consent for Publication

This study was approved by CHU de Quebec-Laval University's research ethics committee (approval number no 2018-4171).

Availability of Data and Materials

Raw data are unavailable to share due to ethics committee regulations.

Possible reviewers

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ABSTRACT (249 words/max 250)

Background: Despite the abundance and proximity of edible marine resources, coastal communities along the St. Lawrence in Eastern Quebec rarely consume these resources. Within a community-based food sovereignty project, *Manger notre Saint-Laurent (Sustenance from our St. Lawrence)*, members of participating communities (three non-Indigenous, one Indigenous) identified a need for a web-based decision tool to help make informed consumption choices.

Objective: To co-design a prototype website that facilitates informed choices about consuming local edible marine resources based on seasonal and regional availability, food safety, nutrition, and sustainability.

Method: We co-designed a prototype with community members, regional stakeholders, and experts in user experience design and web development. We conducted 48 interviews with a variety of people over three iterative cycles, assessing the prototype's ease of use with a validated measure, the System Usability Scale.

Results: Community members, regional stakeholders, and other experts identified problematic elements in initial versions of the website; for example, confusing symbols. We resolved issues and added features people identified as useful. The final prototype's usability was rated at "best imaginable" with scores similar across socio-demographic groups.

Conclusion: By co-designing with community members, regional stakeholders, and other experts from the beginning, we were able to integrate communities' priorities and perspectives about edible marine resources into a prototype website adapted to community members' needs. The final prototype includes a tool to explore species, and index cards to regroup accurate evidence about food safety, nutrition, sustainability, regional and seasonal availability, taste properties, and responsible fishing, hunting, picking, and preparation methods.

Keywords

Food sovereignty; St. Lawrence; Eastern Québec; Coastal communities; Risk-benefit assessment; Healthy eating; Edible marine resources; Web design.

MAIN TEXT (7500 / 7500 words)

Introduction

Achieving food sovereignty within a community requires reducing the distance between food providers and consumers and strengthening local food systems (Gordillo & Méndez Jerónimo, 2013; Declaration of Nyéléni, 2007). Edible resources from the St. Lawrence River, Estuary and Gulf used to be central to the food security of coastal communities in Eastern Quebec (Lambert, 2006). However, despite continued physical proximity, accessing edible resources from the St. Lawrence is no longer as easy for consumers in these communities (Côté, 2007).

When prepared and consumed safely, edible resources from the St. Lawrence have many nutritional benefits (Lucas et al., 2010) and contribute to healthy eating habits, namely the consumption of fresh, minimally-processed, nutrient-rich foods (Moubarac et al., 2017; Health Canada, 2019). Their sustainable consumption can also play a major role in the local economy and contribute to the sharing of culinary heritage with younger generations (Fraser et al., 2013; Lavis & Larochelle, 2014; Ministère de l'Agriculture, des Pêcheries et de l'Alimentation du Québec, 2018a, 2018b). However, some of these resources accumulate environmental contaminants (Fraser et al., 2013; Pêches et océans Canada, 1998), presenting a health risk to those consuming them, especially during pregnancy, infancy, and childhood (C. Sheehan et al., 2014; Pirkle et al., 2016). Because of these competing benefits and risks of consuming local foods, people living on the shores of the St. Lawrence could benefit from decision support regarding the consumption of marine resources (Fraser et al., 2013).

Consultations with coastal communities in Eastern Quebec in 2018, conducted as part of the larger project *Manger notre Saint-Laurent (Sustenance from our St. Lawrence)*, underlined communities' need for tailored information. (J. Brousseau, personal communication, June 12, 2020) *Sustenance from our St. Lawrence* aims to promote

sustainable and safe consumption of the edible resources of the St. Lawrence, as well as the food sovereignty of the coastal communities of Eastern Quebec (Manger notre Saint-Laurent, 2018a, 2018b; Réseau Québec Maritime, 2019; Université du Québec à Rimouski, 2018). The four coastal Indigenous and non-Indigenous communities involved in the project are Cap-Chat and Sainte-Thérèse-de-Gaspé (Gaspésie), Magdalen Islands, and Wolastoqiyik Wahsipekuk First Nation (formerly known as the Maliseet of Viger First Nation) (Figure 1).

Figure 1: Screenshot of the hand-drafted map used for the last version of the prototype

Specifically, community members expressed a need for reliable information about St. Lawrence edible resources, their seasonal and regional availability, food safety, nutrition, sustainability, and preparation instructions. Community members also recommended that the information be centralized in one tool, easy to access on the web, easy for community members to understand, and adapted to the St. Lawrence, its species, and the sociocultural characteristics of its communities, such as language preferences, culinary heritage, and geography. (Manger notre Saint-Laurent, 2018a, 2018b)

No existing web tools provided by governmental and non-governmental entities yet meet all these community-identified needs (Agence Canadienne d'Inspection des Aliments, 2019; Blanchet & Dewailly, 2003; Direction de santé publique de la Côte-Nord & Hydro-Québec, 2018; Exploramer, 2020; Hydro-Québec, 2020; Ministère de

l'Agriculture, des Pêcheries et de l'Alimentation du Québec, 2019; Ministère du Développement durable, de l'Environnement et de la Lutte contre les changements climatiques, 2020; Pêches et Océans Canada, 2019). We aimed to fill this gap by co-designing a website prototype to support informed decision making regarding the consumption of edible resources from the St. Lawrence in partnership with the four coastal Indigenous and non-Indigenous communities involved in *Sustenance from our St. Lawrence* and with the regional stakeholders. In this paper, we describe working with community members and project stakeholders from the start and throughout the co-design process.

Methods

Ecosystem approach

Sustenance from our St. Lawrence uses an ecosystem approach to health, with transdisciplinarity, sustainability, equity and community participation from the outset of the project (Webb et al., 2010). Using this approach, activities undertaken in 2018 allowed us to better identify and understand challenges that we needed to address when designing the web-based decision aid for coastal Eastern Quebec communities. With participants and Elders, we deepened our understanding of communities' interest in sharing their culture and culinary heritage. We were able to better understand local economic systems that depend on a sustainable use of the St. Lawrence. As part of the project, we also documented the historical and social context and issues related to the consumption of St. Lawrence resources, allowing a better understanding of the evolution of food security and safety in the region, and the evolution in gender roles from sea to table.

Environment and health

Communities are concerned by species' status; that is, whether a species is extinct, endangered, vulnerable, near threatened, or of least concern (International Union for Conservation of Nature, 2012). Their livelihood relies on sustainable exploitation of edible resources of the St. Lawrence because fishing is an economic driver in these regions. They are also concerned by environmental contaminants; namely, contamination by mercury in fish or by

marine biotoxins in seafood, information which is often unknown, not well known, or possibly mistaken by the general public and consumers (Fraser et al., 2013; Richard & Pivarnik, 2020).

Socioeconomic issues

Food insecurity from low financial or physical access to healthy food is still an important issue in Bas-St-Laurent, Gaspésie and Magdalen Islands (Côté, 2007; Dubé & Parent, 2007; Gravel, 2016a, 2016b; Maisonneuve et al., 2014). Disadvantageous financial status contributes to unequal access to healthy foods (Robitaille & Paquette, 2020), among which marine food. In Gaspésie, part of the area covered in our study, a tenth of the region consists of so-called food swamps and food deserts, where ultra-processed foods of low nutritional quality more commonly dominate (Robitaille & Paquette, 2020). While known important issues, those food insecurity challenges were out of scope for this paper. Members of *Sustenance from our St. Lawrence* are working on the broader issue of food access through related policy work.

For our work within the project, access to internet services, especially in rural communities where population density is low (Lemieux, 2013), was a socioeconomic issue we needed to consider in the co-design process. Communities with poor access to internet services or low speed connexion could have unequal access to the information conveyed by websites and online applications.

Food literacy

Food literacy encompasses the range of skills needed to practice quality eating behaviors (Krause et al., 2018). These skills not only include reading and understanding food information, but also the ability to collect, exchange, use it for healthy food choices and preparation, and reflect on the factors influencing food choices and their impact on their health, society and environment (Krause et al., 2018). Few methods exist to assess food literacy, but general literacy status in Quebec is insufficient to understand health information for 48.6% of the people aged 16 to 65 years old (Toone, 2013). Urban regions show higher literacy status compared to rural regions (Toone, 2013), suggesting that our predominantly rural study population would likely include people with lower literacy skills.

Gender issue

Domestic tasks, including food choices and preparation, still take up more of women's time than men's in Quebec, even if men do participate more and more in meal preparation (Houle et al., 2017; Lacroix, 2013; Lacroix & Boulet, 2013). Along with their offspring, women are also among the most vulnerable to excessive nutrient intakes or environmental contaminants (Fraser et al., 2013; Mozaffarian & Rimm, 2006; Pirkle et al., 2016).

Culinary culture

Culinary heritage from the St. Lawrence changed a lot over the past decades and its knowledge transfer is not easy. The most common species prepared changed over the years and conservation methods benefitted from freezing and vacuuming technologies. Older adults from *Sustenance from our St. Lawrence's* communities are still attached to ancestral culinary knowledge and to other resources commonly consumed before, while popular perception of the St. Lawrence edible resources is a cultural issue in other cases (J. Brousseau, personal communication, June 12, 2020). One striking example is the perception of seal hunting from an animal ethics point of view. Misunderstandings still exist in relation to this hunt and can sometimes stigmatize the profession of seal hunter and the consumption of this meat. Respecting cultural food preferences is essential to food security, acceptability and to the well-being of an individual (Allen & Prosperi, 2016).

Overall methodological process

Our overall process followed the typical steps of user-centered or human-centered design (Figure 2). We conducted user research to understand community members and regional stakeholders' perspectives, developed a prototype website, tested users' interactions with the prototype, interpreted results, and iteratively refined the prototype (Witteman et al., 2015). Under the umbrella of user-centered design, our process was one of co-design, in which community members and stakeholders had equal power to determine the content and design of the intervention (Steen, 2011). To develop a first prototype, the first author (CF) incorporated ideas from other team members, community members, and stakeholders, keeping in mind ecosystem approaches to health, and web design

principles in public health and literacy synthesized from expert's advice and guidelines for professionals (see Appendix 1 for details) (Caldwell et al., 2008; Howard & Brichta, 2013; Lemieux, 2013). We collected and analyzed qualitative and quantitative data to improve the prototype during each of the three iterative cycles. In the third cycle, due to confinement measures associated with the COVID-19 pandemic, the first author (CF) recruited among people comfortable with using video-conferencing software and shared screen functions. The project was approved by the CHU de Québec Ethical Board (Project MP-20-2019-4171 / Modification F1 - 42256).

Figure 1: Adaptation of the user-centered design method from Witteman et al. (2015)

Participants

Communities prioritized reaching current or future parents of young children, and also involving fishers in the overall project. Our inclusion criteria for user testing were therefore: adults over 18 years old who

belonged to the communities involved in *Sustenance from our St. Lawrence* (Cap-Chat and surroundings, Sainte-Thérèse-de-Gaspé and surroundings, Magdalen Islands, Wolastoqiyik Wampanoag First Nation) and/or who were stakeholders in the project (e.g., people working in the maritime food industry, people whose professional role includes promoting local food sustainability in the four included communities), were able to understand at least one of French or English (although it need not be their mother tongue), and able to perceive images and text on paper or on a screen. We aimed to recruit a total sample size of 60 participants (about 5 participants per community per iterative design cycle, across four communities and three iterative cycles) (Faulkner, 2003). Across recruitment efforts, we sought to include community members and stakeholders (participants) with diverse socio-demographic characteristics; for example, people of different age groups, genders, occupations, and languages. While we aimed to consult across all adult ages, our groups of interest were people between the ages of 26 and 50, who were more likely to be parents of young children or adults who might play a role in children's eating habits.

We recruited convenience samples over the three cycles, aiming to gather feedback from people with a range of backgrounds. We allowed people to participate in multiple cycles if they wished, to enable in-depth feedback from repeated participation, but primarily sought new participants in each cycle, as they would better represent potential users of the website encountering it for the first time (Savoy et al., 2009). We also aimed for a variety of occupational classes, approximately equal representation of users and stakeholders, and equal recruitment from the four communities. In addition, although French is the predominant language of *Sustenance from our St. Lawrence's* regions, we sought the perspectives of at least one English-speaking person. A common sample size for this type of work is five people per cycle, which typically approaches saturation of usability problems identified within several cycles (Faulkner, 2003; Nielsen, 1994). We sought a somewhat larger sample size than usual to enable broad representation across communities, aiming for five participants per community (total 20 people per cycle) with a goal of

reaching saturation in people's comments and ensuring that the prototype was of sufficiently high quality from community members' perspectives.

Recruitment

In the first cycle, we recruited participants by posting flyers and posters in the communities and by reaching out through the networks of the *Sustenance from our St. Lawrence* team members (see Appendix 2). We identified recruitment sites with the help of our local partners, both affiliated with *Université du Québec à Rimouski: Centre d'initiation à la recherche et d'aide au développement durable* (CIRADD), a collegial research center, based in Gaspésie-Îles-de-la-Madeleine, that introduces post-secondary students to research and aims to support sustainable development, and *Centre de recherche sur les milieux insulaires et maritimes* (CERMIM), a research center located on the Magdalen Islands, studying maritime and island environments. We visited grocery stores, markets and shopping centers, with the consent of their owners.

In the second cycle, we recruited new participants through project newsletters sent via email or posted on the project's *Facebook* page. We also recruited while participating in other activities of *Sustenance from our St. Lawrence*; for example, when we returned project results and discussed with the communities, and during the annual pow-wow of Wolastoqiyik Wamspekwik First Nation. For the Wolastoqiyik Wamspekwik First Nation, we also collaborated with the Nation's band office to communicate with community members and recruited employees of the office for interviews and co-designing the prototype.

In the third cycle, due to physical distancing restrictions during the Covid-19 pandemic, we conducted interviews through video-conferencing. Our participants needed an internet connection and to be comfortable with using video-conferencing software and shared screen functions so we could observe the interactions with the prototype. We also recruited fewer participants (7 persons) because we made fewer

and more minor modifications in this cycle. With our average System Usability Scale score already high and saturation reached in the comments noted in the second cycle (see Results), the goal of the third cycle was mainly to confirm that the changes made improved the prototype. We therefore conducted the third cycle using methods of standalone critique, which allows conversations between a presenter and critics towards a goal of improving a design. The critics are asked to discuss their perspectives on the prototype without following a particular set of heuristics or checklist. We recruited a set of experts in web design, communication, infographics, and web marketing from our participating communities, and also approached experts from the senior author's (HW) contacts to complete the cycle in a transdisciplinary manner, as suggested by standalone critique principles (Connor & Irizarry, 2015).

Data collection

After having identified communities' needs through consultation activities as described in the Introduction and in a separate article (J. Brousseau, personal communication, June 12, 2020), the first author (CF) created a first prototype and then used it for short (15-30 minutes) user testing sessions. These user testing sessions took the form of semi-structured interviews with the participants (see interview guide in Appendix 2 for details) in French or in English, the main mother tongues of *Sustenance from our St. Lawrence's* member regions (Statistics Canada, 2017). The first author (CF) collected comments, observed interactions as qualitative data regarding the components of the prototype's design and usability, and asked structured questions from a sociodemographic form. She recorded and transcribed the interviews for qualitative analysis of the comments. In the second and third cycles, we also measured the usability (user-friendliness) of the prototype, using a previously translated and validated French version (Lallemant & Gronier, 2015) of the System Usability Scale (Bangor et al., 2009) (see Appendix 3 for details).

Prototype creation

To design the first version of the prototype (Figure 3), we drew on ecosystem approaches to health (Lebel, 2003; Webb et al., 2010), and web design principles in public health and literacy (Caldwell et al., 2008; Howard & Brichta, 2013; Lemieux, 2013). In short, we considered text and font, using a Sans Serif font (Roboto) with minimum font size of 12-14 points, short paragraphs, explicit titles, as well as kerning and line spacing wide enough for pleasant reading. We chose colors that fit well together, and that are contrasted, constant, and simple, using a color palette created for *Sustenance from our St. Lawrence* by an agency specialized in territorial marketing and community development (*Visages régionaux*). We also considered layout principles specifying that a web page should be divided in three parts: the header (including the title, purpose, menus and logo), the footer, and the body, which is centered on the page. Lastly, we considered principles related to web browsing and usability. Namely, websites should be simple, organized, easy to browse, with strategic hyperlinks and a printing option to support potential offline activities such as following recipes or shopping for ingredients. (Caldwell et al., 2008; Howard & Brichta, 2013; Lemieux, 2013) The ability to print for offline use may be especially important in rural areas or among people with lower incomes, who may have less internet access. We used a layout canvas within *Figma* software (San Francisco, United States of America) for all the designing and refining process.

Figure 3: Screenshot of a portion of the first version of the prototype

As we developed the first prototype, we incorporated the needs identified during *Sustenance from our St. Lawrence* consultation activities (Table 1), as well as ideas from other team members, community members, and stakeholders. We printed the first prototype (Figure 3) on legal-sized paper to facilitate a first round of user testing in rural areas in which we might have had difficulty with internet access.

Data analyses

Qualitative data

The first author (CF) developed each component of the first prototype in order to address a need expressed during community consultations in 2018 or to incorporate ideas subsequently expressed by team members, community members, and stakeholders.

We compiled the needs and considerations in Table 1, along with the related components and design features of the prototype. We used the same table to guide the qualitative analysis. We collected

comments on this first version by transcribing interviews and grouping the comments according to which component of the prototype it was related.

We analyzed each grouping of comments and addressed them in a second version of the prototype. We followed the same iterative process for the second and third versions. With additional input from a member of the team (EP) with expertise in interface design, we evaluated which comments or problems needed to be addressed based on the severity of each usability problem.

Table 1: Considerations, components and design features (grouping guide)

Need	Website component addressing the need
Centralized information	Access to species index cards centralizing information. List of species and species categories. "Details" button.
	Species index cards. Print button.
Adapted information	Expectations: Sections of the species index card answering what the participants are expecting in terms of information.
	Website purpose: Presentation of the homepage.
	Index cards will only be about St. Lawrence species.
	Reliability: Do participants view the information as reliable and science-based?
	Language, French, English: Words both in French and English.
Information easily accessible	Exploring (via research bar) Two research bars: bottom of the first picture of the homepage, and left column of the species list. Divided into: species category, season, region.
	Exploring (via images) Drawings representing six species categories: fish, molluscs, crustaceans, algae, seaside plants and marine mammals.
Information easy to understand	Clarity: Is the presentation of the information clear, does it cause confusion or clashes?
	Clarity (three colored points): Colored three points system (red, yellow, green) to emphasize species to consume with caution for their contamination risks.
	Design (font, colors, layout) Dark font adapted for on-screen reading (i.e. sans serif. Here, Roboto). Limited color pallet (i.e. the three colors of the project, HEX codes: 33bce6, 73e0a2, 354047). Aerated layout on a white background.
	Logo and other drawings Official logo of Sustenance from our St. Lawrence. Drawings (pictograms), one by species category.

	Pictures and videos: Pictures (i.e. species and recipes) and videos (i.e. steps of consumption) will be included to facilitate the comprehension. Title examples were put in the prototype.
Information about risks and disadvantages	Contaminants: Section title on index cards: "Recommandations sur les contaminants/Recommendation on contaminants"
	Sustainability: Section not created on the first prototype.
	Fishing, picking, hunting methods: Section title on index cards: "Cueillette ou pêche/Picking or fishing"
Information on benefits and healthy consumption	Excess: Section title on index cards: "Excès/Excess"
	Palatability: Section title on index cards: "Palatabilité/Palatability"
	Nutritional values: Section title on index cards: "Avantages nutritifs/Nutritional benefits"
Information on transformation and consumption	How to prepare: Section not created on the first prototype.
	Recipes: Section at the bottom of each index card: "Recettes valorisantes/Recipes to appreciate". A button was included to suggest recipes.
	Transformation and conservation: Section title on index card: "Transformation"
Information on seasonal availability	Choosing a season with the search bar: Research bars are divided into: species categories, seasons, regions.
Other concerns identified (with prototype 1 interviews only)	Information gap
	Additional suggestions
Available tools and references	Shops and enterprises
	Entourage
	Government
	Books and writings
	Search engine
	Scientific organizations
	Organizations

Quantitative data

We obtained System Usability Scale scores for the second and third versions of the prototype by asking participants to indicate their agreement with 10 statements on a Likert scale rated from 1 (strongly disagree) to 5 (strongly agree) (Appendix 3 for details). We summed the scores to get a global score between 0 and 100 for each participant.

We assessed each global score's validity by using an eleventh statement, according to the method described in Bangor et al. (2009): "Overall, I would rate the user-friendliness of the product as [...]" with

possible answers, “the worst imaginable,” “awful,” “poor,” “OK,” “good,” “excellent,” and “the best imaginable”. This allows researchers to compare a participant’s global score with their answer for this eleventh statement. When a chosen adjective did not match with the global score for a participant in our study, we considered it suggested an inconsistency and their global score was excluded from the statistical analyses.

Statistical analyses

We computed each participant’s global score to calculate the average score of the prototype for the second and third cycles. Scores range from 0 to 100: between 0 and 25 being the worst usability score imaginable, 26 to 39, an awful usability score, 40 to 52, a poor usability score, 53 to 73, a good usability score, 74 to 86, an excellent usability score, and 87 to 100 being the best usability score imaginable (Bangor et al., 2009). We then ran descriptive analyses with R, version 3.6.3 (Vienna, Austria) to assess the distribution of the average scores. We used non-parametric tests to assess differences in global scores by socio-demographic variables ($\alpha = 0.05$). We conducted analyses when we had a minimum of five participants ($n=5$) in each group (Edition, 2009; Gastwirth & Wang, 1987). We used Wilcoxon-Mann-Whitney tests to compare between roles in *Sustenance from our St. Lawrence* (community members and stakeholders), genders (women and men), citizenship categories (Indigenous and non-Indigenous), and age groups (up to 50 years old and over 50). We used a Kruskal-Wallis test to analyse possible differences between communities.

Results

Participants

Socio-demographic characteristics of the participants for all cycles are presented in Table 2. Overall, we met our predetermined inclusivity goals. We had to exclude one participant’s System Usability Scale score from analyses (community member from cycle 2) because their global score for the first 10

statements (0, worst imaginable) did not align with their answer to the eleventh statement (excellent), nor with their qualitative comments, which were positive about the proposed website.

Table 2: Socio-demographic data and mean System Usability Scale (SUS) scores by iterative cycle

	Cycle 1 (user testing; n=20)		Cycle 2 (user testing; n=21 ^a)			Cycle 3 (standalone critique; n=7)		
	n	%	n	%	Mean SUS	n	%	Mean SUS
Mean $\pm$ SD and Median [IQR] out of 100	-	-	-	-	89 $\pm$ 10 93 [13]	-	-	92 $\pm$ 4 93 [4]
Gender								
Woman	14	70%	14	67%	88 $\pm$ 10	6	86%	92 $\pm$ 4
Man	6	30%	7	33%	92 $\pm$ 8	1	14%	95
Non-binary and other	0	0%	0	0%	-	0	0%	-
Age								
18-25 yrs	2	10%	4	19%	91 $\pm$ 4	2	29%	90 $\pm$ 7
26-35 yrs	7	35%	3	14%	90 $\pm$ 13	2	29%	93 $\pm$ 0
36-50 yrs	5	25%	8	38%	91 $\pm$ 12	2	29%	95 $\pm$ 0
51-65 yrs	5	25%	5	24%	86 $\pm$ 9	1	14%	90
66 yrs and more	1	5%	1	5%	83	0	0%	-
Role^b								
Community members	12	60%	13	62%	89 $\pm$ 9	0	0%	-
Stakeholders	8	40%	8	38%	89 $\pm$ 11	7	100%	92 $\pm$ 4
Occupation^c								
Retired, student, etc.	4	20%	3	14%	93 $\pm$ 3	0	0%	-
Manager	3	15%	4	19%	89 $\pm$ 12	1	14%	95
Professionals	5	25%	8	38%	90 $\pm$ 8	6	86%	92 $\pm$ 4
Technicians and associate professionals	3	15%	2	10%	83 $\pm$ 0	0	0%	-
Clerical support workers	2	10%	2	10%	83 $\pm$ 21	0	0%	-
Service and sales workers	3	15%	2	10%	100	0	0%	-
Others	0	0%	0	0%	-	0	0%	-
Languages								
French	20	100%	20	95%	89 $\pm$ 10)	7	100%	92 $\pm$ 4
English	0	0%	1	5%	95	0	0%	-
Communities^d								
Gaspésie (Cap-Chat)	4	20%	5	24%	78 $\pm$ 13	1	20%	95
Gaspésie (Ste-Thérèse-de-Gaspé)	4	20%	5	24%	94 $\pm$ 7	0	0%	-

Magdalen Islands	6	30%	4	19%	91 ± 4	2	40%	89 ± 5
Bas-St-Laurent	6	30%	7	33%	91 ± 7	2	40%	91 ± 2
Other	0	0%	0	0%	-	2	40%	95 ± 0
Citizenship category ^e								
Indigenous	5	25%	5	24%	89 ± 6	1	14%	90
Non-Indigenous	15	75%	16	76%	89 ± 11	6	86%	93 ± 4

SD: Standard deviation

IQR: Interquartile Range

Note: We ran nonparametric statistical analysis using Wilcoxon-Mann-Whitney or Kruskal-Wallis tests when $n \geq 5$ in each group: * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

^a We excluded one participant from the analysis because of an invalid rating.

^b Users (meaning community members who might use the web-based decision support) and stakeholders (meaning people with a specific interest or input in the project).

^c Classes of the International Standard Classification of Occupations (International Labour Office, 2012).

^d Part of three Eastern Quebec regions: Gaspésie (Cap-Chat and surroundings, or Sainte-Thérèse-de-Gaspé and surroundings), Magdalen Islands, or Bas-Saint-Laurent (Wolastoqiyik Wampanoag First Nation). Participants might also represent other regions since members of the Wolastoqiyik Wampanoag First Nation are spread across various regions of Quebec and Ontario Provinces, as well as Maine, in the United States (Maliseet Viger First Nation, 2020).

^e We also considered citizenship categories when collecting the socio-demographic data: Indigenous origins (Wolastoqiyik Wampanoag First Nation) or other non-Indigenous origins.

Iterative Cycle 1

We summarized participants' comments and grouped them according to which component of the prototype it referred, then made modifications to refine the prototype accordingly (see [Appendix 4](#) for details).

The type of comments provided differed somewhat by socio-demographic characteristics (age and occupation). Older community members had a different understanding of the purpose of the website in general. Participants with a background in marketing or web design had more specific comments and a more accurate understanding of the prototype. For instance, regarding the purpose of the website:

“[...] for sure, regarding fishes, there are less and less. I'm with the impression that there are, that this website will tell us if fishes are endangered, or those who are mistreated, those to avoid. I don't know.

Pollution. Problem with water. Water, we don't know what we eat. Maybe it's better that way. I don't know.” (translation, retired participant, 65 years old)

“Only to contextualize where you are, at first glance. Because a person will spend three seconds. The first three seconds are decisive to stay on a website or not.” (translation, stakeholder participant, 29 years old)

We noted various severe problems regarding comprehension and usability of the first version of the prototype. The three-color point system (red, yellow, green) to emphasize contamination risks was not understood or the red had too strong a meaning. From the three suggestions noted, we moved the color system from the homepage to the species' information for index cards. Also, to avoid the alarming red colors and having a detailed legend, we considered other symbols: a magnifying glass or yellow triangle with an exclamation point (see Figure 4).

Figure 4: Screenshot of a portion of the first and second versions of the prototype
Top-right - Homepage version 1, with colored points for contaminant information

Top-left - Index card version 1, with colored points for contaminant information
Bottom-right - Index card version 2, with magnifying glass for precaution information
Bottom-left - Index card version 2 with triangle for precaution information

Many participants made negative comments about the word “palatabilité” (palatability). Some suggested the words “propriétés gustatives” (taste properties) instead. We also changed the first sentence seen on the homepage to better describe the website’s purpose.

Participants understood the pictograms representing the six species categories, but the section’s name and titles were not well understood. We changed those titles from “espèces en saison” (species in season) to “catégories d’espèces” (species categories).

Many participants used “Qualité de la ressource” (resource quality) to talk about the safety of the edible resources, more than the word “contaminants”. We changed the section on contaminants for “Qualité de la ressource et contaminants” (resource quality and contaminants). We kept the word “contaminants” because we noted that public health departments, researchers and communities are concerned by food safety and health risks of environmental contaminants.

Although they expressed them in various ways, all participants had concerns regarding resources’ and environmental sustainability, many pointing out the importance of considering resources’ status and environmental impacts for responsible fishing, picking, and hunting methods. Some also mentioned the resource status as being an ecological and economical preoccupation. We created a new section to discuss resource status and we added the word “responsable” (responsible) to the section on fishing, picking, and hunting methods to reflect the importance of sustainability.

Participants were interested in learning about health issues related to some nutrients found in the resources. We created a “nutrition” section to cover both health benefits and what constitutes an excessive

intake. We planned on using claims like “rich in” or “poor in” (based on *Canadian Food Inspection Agency*’s labelling regulation) and not the actual nutritional facts table, which requires higher numeracy and literacy skills (Howard & Brichta, 2013).

Participants showed interest in seeing a section on safe ways to handle, preserve and cook the resources, other than simply providing recipes. We changed the title of the transformation section of the index card for “comment on l’apprête?” (how to prepare?) and added three subtitles: “préparation” (preparing), “cuisson” (cooking), “conservation” (conserving).

The star system used to evaluate the recipes was not understood by all. We replaced it by the name of the Chef who created or adapted the recipe. One participant also suggested having a storytelling section to promote the recipes.

In the species list, we replaced the contaminants indication by regions and seasons because some thought it was a strong word for the first page of the website, and few understood that they could use the exploration bar to find species in season. We also added colored letters next to species photos to indicate the seasons in which the species are available.

Some participants also made suggestions regarding browsing and the general user experience. A number of participants expressed an interest in a search option. We added this function accordingly.

There were no major comments on design, pictures, or videos, but participants suggested making the pictures bigger and repeating the logo more often. We also added circles indicating a potential carousel of photos for the picture of the homepage. Taking this participant’s suggestion further, we added the same feature to the smaller pictures of the website (i.e., pictures for the categories and the index card).

Iterative Cycle 2

In addition to the modifications described above, we modified the prototype to make it more usable on an electronic tablet. Based on comments made during the first cycle, we refined the prototype to create a second version (see Figure 5).

Figure 5: Screenshot of a portion of the second version of the prototype

We summarized again participants' comments and grouped them according to which component of the prototype it referred before making modifications to refine the prototype (see [Appendix 5](#) for details).

Again, the type of comment did not differ by most socio-demographic characteristics, with the exception of age. Older community members were more hesitant but still able to access the information and understand the sections:

“Easy to use, yes, it’s relatively easy. I would not need any technical support, I don’t think. Even despite my great ignorance. I’m showing humility there, eh?” (translation, participant, 72 years old)

For this second version, community members offered fewer comments and, compared to the first cycle, we observed fewer critical issues that needed to be addressed to improve the comprehension and usability of the second prototype.

Modifications made to the homepage descriptive sentence and the exploration tool helped participants better understand the purpose of the website. This was true even for those less used to web browsing. Two persons suggested it would make more sense to put the project description before presenting the communities in the “About us” section.

The participants who already knew about *Fourchette bleue* understood the logo without looking for the explanation, but others rarely saw the explanation at the bottom of the page. We therefore created a “pop-up” bubble where the explanation appears when clicking on the *Fourchette bleue* logo. *Fourchette bleue* is an ecoguide created by the scientific museum *Exploramer* in Sainte-Anne-des-Monts, Gaspésie, that aims to valorize the sustainable exploitation of the edible resources from the St. Lawrence (Exploramer, 2020).

The word "category" instead of a more official taxonomic word was questioned by one person. Since the most common word “category” was understood by the majority of participants, we kept it this way. Three people also asked about the difference between "harvesting" and "picking". We preferred the word “picking” over the word “harvesting”, both in French and English, when comparing the definitions in Antidote 9 dictionary (Druide, 2018). “Harvesting” is to pick and/or collect (a crop, a grain or other plant

product grown in large quantities, usually as food). “Picking” is to remove (a flower, fruit, nut, etc.) from a plant, or to remove (something small) from a place by pinching or poking it with (fingers, a tool, etc.).

All participants preferred the yellow triangle with the exclamation point to the magnifying glass to represent precaution. However, the understanding of the word “precaution” varied slightly from one person to another, and some participants found the word threatening. With the advice of our web design specialist (EP), we changed the symbol to a black circle with a white exclamation point, and changed the legend to a pop-up bubble reading, “Pay special attention to this section for healthy, sustainable, and safe consumption of the resource.”

The majority of participants did not understand that they could scroll down the page, although nobody had a problem accessing the index cards or browsing the prototype by other means. We moved the exploration tool a little higher on the page to allow users to notice the lower section at first glance.

Participants needed time to understand the colors and one-letter abbreviations for the seasonality indication. We therefore changed the letters and colors to black and white symbols more commonly representing the seasons in Quebec: a snowflake for winter, a flower for spring, a sun for summer, and a leaf for fall.

The participants did not always notice the storytelling portion of the recipe card. One person suggested also adding the recipe's purpose (i.e., if it is a meal, an appetizer, etc.). We made the storytelling portion more visible and added the recipe's purpose, although it was not a major issue for safe, sustainable, and healthy consumption of the resources.

In this second cycle, we also identified keywords that participants were likely to use in their search engine to find information about St. Lawrence edible resources, namely “[Species name]” and “recipe”.

We finally calculated System Usability Scale scores, for an average of 89.1 (best imaginable) for this second version, and varying from 72.5 (good) to 100 (best imaginable). We examined score differences between socio-demographic groups. We ran Wilcoxon-Mann-Whitney tests for gender ($p\text{-value} = 0.42$), role in the project ($p\text{-value} = 0.61$), citizenship category ($p\text{-value} = 0.60$), and age groups ($p\text{-value} = 0.15$), and Kruskal-Wallis rank sum test for communities ($p\text{-value} = 0.25$), although it should be used with caution. We did not find significant differences or stochastically dominant scores.

Iterative Cycle 3

Based on comments from the second cycle, we refined the prototype to create a third version (see Figure 6).

Figure 6: Screenshot of a portion of the third version of the prototype

After completing the third cycle of interviews, a standalone critique with experts as participants, we transcribed their comments, then grouped them according to which component of the prototype it referred before making modifications (see Appendix 6 for details). As in other iterative cycles, the lead author identified participants' desired modifications from their comments and reviewed these with other team members. Given the small sample of participants recruited, we did not evaluate whether the type of comments differed according to the socio-demographic characteristics.

We found only minor issues for this version. The main problem we noted was with the symbols for season identification in the species list. They were not quickly understood by all. Three people thought the symbols should not be next to the picture because it overloads the webpage. They suggested placing them

horizontally under the regions, or to keep them only for species index cards. We moved the symbols under the regions in the species list and added a pop-up legend.

“Like, not on the [species] picture, but maybe underneath [the regions]. But not in the picture. It looks like it’s hiding the product.” (translation, professional participant, 25 years old)

We noted comments regarding the layout and some wording as well. Two participants suggested using an action verb and cutting the first sentence of the homepage because it is too long. Also on the homepage, participants suggested using more space for the layout and using buttons as big as the species categories’ images. The menu bar was not seen immediately and one participant suggested having it floating when the user scrolls down the page. We made this change, noting that such functionality helps usability and allows the menu bar to be more visible. One person suggested that the picture carousel of the species categories be controlled by the user. When the pointer passes above it, the picture would switch to another and the other categories would be darkened. This avoids having too much movement on the homepage, which may confuse or distract the user.

On the index card, two people suggested laying out the sections in a logical order, from fishing to plate, and one person suggested following the same layout as the videos and recipes, in three columns. For the "About us" section, three participants suggested laying out the information in two columns and to put the references in a separate tab. For the recipe cards, the only comment was to further emphasize the storytelling section and to use texture to better differentiate the recipe and its Chef’s origin from locations where the central resource of the recipe can be found.

Regarding the wording, two people suggested having catchier titles for the sections. Two people also alerted us to a few spelling mistakes.

We calculated System Usability Scale scores to explore whether the changes made after the second cycle improved the prototype. We calculated an average of 92.1 (best imaginable), which varied from 85.0 to 95.0. We noticed that one participant had an incongruent answer to the second affirmation of the scale, a double negative sentence, but it did not invalidate the rating as the eleventh statement (excellent) still matched the calculated score (best imaginable).

Final version of prototype

From those third cycle’s comments, we finished the final version of the prototype, with a few minor modifications (see Figure 7).

Figure 7: Screenshot of a portion of the final version of the prototype

Discussion

Main takeaways: Co-design and communities' involvement

In this study, we co-designed a user-friendly prototype website about consuming edible resources from the St. Lawrence in partnership with members of four coastal communities in Eastern Quebec and regional stakeholders. It is a unique tool for decision-making regarding the safe, sustainable, and healthy consumption of the edible resources from the St. Lawrence, integrating health, environment, cooking skills, and taste appreciation. It aligns with the suggestion of Fraser et al. (2013) and Richard and Pivarnik (2020) to develop a decisional tool to meet community members' information and decision support needs about consuming marine resources.

Co-design processes can be explained as efforts to facilitate creative cooperation between different people with a variety of abilities and challenges: researchers, users, and designers. As participants to the co-design process, everyone brings their expert point of view based on their experience and perspectives, as well as an equal power to determine the design and the type of content the tool would have (Steen, 2011). In our study, the cooperation of community members and partners, stakeholders and design experts was essential to better meet the needs of community members through a co-design process. By including every participant in a process, we can capture a diversity of point of views and address their comments appropriately (De Weger et al., 2018).

We started our co-design process by drawing a portrait of environmental, health, social, economic, and cultural challenges with the help of our study participants and available references (see Conceptual Framework). These challenges are important dimensions of an ecosystem approach to health (Webb et al., 2010), including the perspectives of a variety of socio-demographic groups while also considering web design principles and public health issues (Lemieux, 2013). By addressing them, we aimed to ensure that

we were promoting food system sustainability which means having little impact on the environment, contributing to food and nutrition security as well as healthy living for present and future generations, protecting and respecting biodiversity and ecosystems while being culturally acceptable, economically fair and accessible, and encouraging of local production and distribution networks (Allen & Prosperi, 2016; Food and Agriculture Organization, 2010, 2014; Story et al., 2009).

We involved people from different age and occupation groups to ensure a variety of perspectives. Despite differences across these socio-demographic groups, we did not observe significant between-group differences in global System Usability Scale scores. We interpreted this finding as an indication that our prototype may be suited for users of different backgrounds, at least in our study regions.

Limitations

This study had three main limitations. First, we achieved our recruitment goals regarding inclusivity and recruited more participants than are typically necessary for a website usability study (Faulkner, 2003; Nielsen, 1994, 2000), we may still have missed key differences. Our sample sizes were smaller than might be required to be able to detect differences in System Usability Scale scores between socio-demographic groups. Second, while we explicitly considered the needs of users who might have lower education, literacy, and numeracy during our co-creation process, we did not formally assess these characteristics during user testing cycles. Measuring education and ability may cause people to feel like they are being tested, rather than evaluating a prototype website. Further studies could determine the extent to which the final website is usable by people with lower levels of education, literacy, and numeracy. Third and finally, we did not aim to directly address food insecurity in Eastern Quebec. In addition to the barriers to edible marine resource consumption addressed in this study, food insecurity remains an important health and social issue in the geographic area of our study (Côté, 2007; Dubé & Parent, 2007; Gravel, 2016a, 2016b; Maisonneuve et al., 2014). We hope that our website can help to promote the consumption of locally-

produced foods to support food sovereignty in the communities, which may promote healthier food environments and enhance food accessibility and availability, key pillars of food security (Food and Agriculture Organization, 2008; Pageau, 2008).

Conclusion

The ecosystem approach and the user-centered method we used require a great deal of thinking, time and flexibility. By working as part of a greater project, *Sustenance from our St. Lawrence*, and participating in its research activities, we were able to capitalize on the financial and human resources available and better understand environmental, health, social, economic, and cultural challenges. We were able to build on our collaborations with the four communities of Eastern Quebec coastal regions from the beginning, integrating our common understanding of those challenges with their comments and web design principles throughout the co-design process to propose a prototype website which better fits their perspectives for an informed consumption of edible resources from the St. Lawrence.

Project members and stakeholders' involvement in an ecosystem approach helps to get a global understanding of a problem, and to see how a tool can be used for initiatives aiming to reduce inequalities and strengthen local capacities (Allen & Prosperi, 2016; Webb et al., 2010). In future work, we aim to mobilize and transfer the knowledge to a publicly accessible online interface, as part of *Sustenance from our St. Lawrence* project and determine to what extent this resource might encourage healthy, sustainable consumption of maritime resources. With this unique interface, we hope to contribute to a better informed consumption of St. Lawrence resources in Quebec, and ultimately, to foster food sovereignty, food security, coastal communities' health, and marine food system sustainability.

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APPENDICES

Appendix A. Web design recommendations in public health and literacy

(Caldwell et al., 2008; Howard & Brichta, 2013; Lemieux, 2013)

	Recommendations
Text and font	Font adapted for the web: sans serif (like Arial or Tahoma) and of at least 12-14 points.
	Only 2-3 different fonts.
	Wide enough spacing for a pleasant reading.
	Text divided with titles and subtitles, self-explaining and short (about four words). Icons can also be helpful to illustrate sections and categories. Visual elements like images, pictures, drawings, videos, icons, are often treated by the eyes before text.
	Information divided into short paragraphs with only one idea each. (Low literacy level users are less prone to jump paragraphs if they contain about three sentences.)
	Prioritize alphabetical order.
Colors	Constant color palette that is contrasted and fit well together (RVB or HEX codes ideally). Three colors is enough.
	For the content, few colors. Dark text on a pale background, black on white ideally.
	For browsing elements like buttons, large forms and contrasted colors.
Disposition	Web page should be divided in three parts: the header, the footer, the body
	Header: it is the first seen on the page. Normally contains the title, the website purpose (who, what, when, where, why), browsing menus and the logo.
	Footer: contains a recall of the menu, the rights and legal notice, the sitemap, a quick description, contact information, page partners, etc.
	Body: where the content is. Should have an idea of the content before beginning the design. Important information at the top of the page to avoid having to scroll down (few users scroll down to the bottom of web pages, especially users with lower literacy levels), and centered instead of on the sides.
Web browsing and ergonomics	Think well how the site is going to be organized. Simplify the browsing and ergonomics to facilitate access to information and its comprehension.
	Respecting web design conventions helps the user to self-orient on the website.
	Provide many different ways to access the information while browsing the website.
	Provide a breadcrumb trail, meaning a way for users to self-locate on the website. Often found at the top of the page.
	Avoid information that needs to be remembered between pages.
	Use few hyperlinks, and in a strategic manner. Avoid “Click here”.

	Users with lower literacy levels are more at risk to lose themselves on a website. Use browsing tools like browsing arrows or consult elements on the sides.
	Allow printing and consider internet speed.
	Use a layout canvas.

Appendix B. Interview guide

Main page

1.Presentation of the main page of the tool (showing page 1 of the prototype):

- Can you describe what you first saw on the page?
- What do you think it represents?

Are there any details given that were hard to understand or not clearly presented?

2.The main page is part of a website (still showing page 1 of the prototype, not yet the others):

- What information do you expect to find?
- Where would you click or look to find out what the site is for? Please give me your first impressions and tell me why you would click at that spot.
- Which section appears to be the most useful in helping you understand the purpose of this site?

3.The objective of this website is to gather, facilitate access to knowledge on edible products of the St. Lawrence.

- Do you have any concerns about the consumption of Quebec seafood products?
- What information would be to be most useful?
- Do you know of other tools that provide the same type of information?

Let's do a think aloud exercise (one, two or three, depending on the time remaining and the availability of the participant)

4.You'd like to know what seafood products in your region are in season. (Showing page 1 of the prototype.)

- Where would you currently find information to answer that question?

- Let's say that this website could help you answer that question. What do you do? Tell me what crosses your mind and what you need to do on the main page.

5. You have received or purchased sea lettuce and razor clams from Quebec. You wonder if there are guidelines on how to consume them, if it's a sustainable resource and how to prepare them. (Showing page 1 of the prototype.)

- Where would you currently find information to answer that question?
- Let's say that this website could help you answer that question. What do you do? Tell me what crosses your mind and what you need to do on the main page.

6. You are thinking of participating in a local food market. You would like to have information and materials that would help you promote Quebec seafood products. (The question should be adapted to the occupation of the person: teaching, fishing and gathering, health professions, food business, municipal or ministerial, commerce, etc.) (Showing page 1 of the prototype.)

- Where would you currently find information to answer that question?
- Let's say that this website could help you answer that question. What do you do? Tell me what crosses your mind and what you need to do on the main page.

7. Would you be interested in seeing the final version of the website?

Appendix C. System Usability Scale

Answer the following statements with an X (strongly agree [5], strongly disagree [1]):

Statements	1 = Strongly disagree 5 = Strongly agree				
	1	2	3	4	5
1. I think that I would like to use this website frequently.	☐	☐	☐	☐	☐
2. I found the website unnecessarily complex.	☐	☐	☐	☐	☐
3. I thought the website was easy to use.	☐	☐	☐	☐	☐
4. I think that I would need the support of a technical person to be able to use this website.	☐	☐	☐	☐	☐
5. I found the various functions in the website were well integrated.	☐	☐	☐	☐	☐

6. I thought there was too much inconsistency in this website.	☐	☐	☐	☐	☐
7. I imagine that most people would learn to use this website very quickly.	☐	☐	☐	☐	☐
8. I found the website very awkward to use.	☐	☐	☐	☐	☐
9. I felt very confident using the website.	☐	☐	☐	☐	☐
10. I needed to learn a lot of things before I could get going with this website.	☐	☐	☐	☐	☐

Statement	11. Overall, I would rate the user-friendliness of this website as:					
The worst imaginable ☐	Awful ☐	Poor ☐	OK ☐	Good ☐	Excellent ☐	The best imaginable ☐

French version:

Affirmations	1 = Strongly disagree 5 = Strongly agree				
	1	2	3	4	5
1. Je pense que j'aimerais utiliser ce site web fréquemment.	☐	☐	☐	☐	☐
2. J'ai trouvé ce site web inutilement complexe.	☐	☐	☐	☐	☐
3. J'ai trouvé ce site web facile à utiliser.	☐	☐	☐	☐	☐
4. Je pense que j'aurais besoin d'un support technique pour être capable d'utiliser ce site web.	☐	☐	☐	☐	☐
5. J'ai trouvé que les différentes fonctions de ce site web étaient bien intégrées.	☐	☐	☐	☐	☐
6. J'ai trouvé qu'il y avait trop d'incohérence dans ce site web.	☐	☐	☐	☐	☐
7. Je suppose que la plupart des gens apprendraient très rapidement à utiliser ce site web.	☐	☐	☐	☐	☐
8. J'ai trouvé ce site web très contraignant (inconfortable) à utiliser.	☐	☐	☐	☐	☐
9. Je me suis senti.e très confiant.e en utilisant ce site web.	☐	☐	☐	☐	☐
10. J'ai dû apprendre beaucoup de choses avant de me sentir familiarisé.e avec ce site web.	☐	☐	☐	☐	☐

Affirmation	11. En général, je dirais que la convivialité (user-friendliness) de ce site web est :					
La pire imaginable ☐	Terrible ☐	Mauvaise ☐	Ok ☐	Bien ☐	Excellente ☐	La meilleure imaginable ☐

Appendix D. First summary of comments and modifications

Need	Website component addressing the need	Participants' comments	Changes to be made
Centralized information			
1	List of species and species categories. "Details" button.	15 out of 20 times, participants access the card by clicking on "details", no matter the socio-demographic characteristic. One participant said she would use Google to access the card. She had web design experience.	No changes needed. Button is understood. To be verified: keywords used in Google. Cycle 2.
2	Species index cards. Print button.	Majority of participants: well detailed, interesting, well identified, well presented, happy to see all in one place. No matter the socio-demographic characteristic. One person: subtitles could be reviewed to be better understood. The participant was used to popularization in the fisheries sector. Print button: five would use it, one no, the others did not mention it.	Subtitles to be reviewed (see Language component). No modification to the print button needed.
Adapted information			
3	Sections of the species index card answering what the participants are expecting in terms of information.	What does the species look like, at different stages (natural habit, fresh, cooked). Warnings, if necessary. Respectful picking, fishing and hunting methods. Latin names. Benefits, nutritional values and properties. Information on water pollution and contamination of the species. Species status (extinction, sustainability). Available edible species. How to prepare. Recipes. Who is Sustenance from our St. Lawrence. Where to find local marine products, according to seasons. Educational material.	The index card's sections already answer a majority of the expectations, asking the question before showing the index card. Latin made to be added. How to get to "who is Sustenance from our St. Lawrence" needs to be clearer.

4	Presentation of the homepage.	The sentence at the bottom of the homepage picture could be more descriptive of the purpose and the photo should reflect that.	Change the sentence.
5	Index cards will only be about St. Lawrence species.	Participants understand that the website will only be about St. Lawrence edible species, animals and plants. Question about where we got our species list.	Mentioning where we get our list: using the Fourchette bleue symbol (Exploramer) and explaining in the "about us" section.
6	Do participants view the information as reliable and science-based?	The project being carried out by a group of researchers is reassuring for participants. But would like to know exactly where the information comes from.	Add where the information comes from and who is involved in Sustenance from our St. Lawrence.
7	Words both in French and English.	Word "palatabilité" not well understood by a majority. Suggestion of a participant: using words from the TV show "Les Chefs" for taste properties. Having the common name first is appreciated by most.	Changing the word "palatabilité" for words used in Quebec TV's culinary scene.
Information easily accessible			
8	Two research bars: bottom of the first picture of the homepage, and left column of the species list. Divided into: species category, season, region.	Homepage research bar: participants that used it, understood it and saw it as useful. One thought it looked like a search bar for plane tickets. Species list's research bar: well seen and understood by a majority,	Homepage research bar could take up more space.
9	Drawings representing six species categories: fish, molluscs, crustaceans, algae, seaside plants and marine mammals.	More participants used the species categories drawings as a way to research and explore, instead of the research bar, on the homepage. The subtitles "petite suggestion d'espèces en saison" and "species name" were not well understood.	Changing the subtitles for "catégories d'espèce" and "nos [species category]".
Information easy to understand			
10	Is the presentation of the information clear, does it cause confusion or clashes?	A lot of participants had a problem with the use of the word "contaminant" on the homepage.	Information regarding contaminants should be kept for the index cards only.

11	Colored three points system (red, yellow, green) to emphasize species to consume with caution for their contamination risks.	<p>Colored system not well understood.</p> <p>For many, the red color has too strong of a danger meaning, contradicting the idea of encouraging the consumption of edible resources from the St. Lawrence.</p> <p>For many, their concerns were not only for contaminants. Mainly: sustainability, preparation, fishing, hunting and harvesting methods.</p> <p>Three suggestions :</p> <p>1- Adding a legend to explain the system and keeping it on the homepage.</p> <p>2- Adding a legend to explain the system and keeping the system only for the index cards.</p> <p>3- Changing the system because red has too strong of a danger meaning.</p>	<p>Changing the system and keeping it for the index cards only. The yellow triangle with an exclamation point or the magnifying glass symbols are considered.</p> <p>Symbols to be placed for other sections of the index cards when there is a special concern.</p>
12	<p>Dark font adapted for on-screen reading (i.e. sans serif. Here, Roboto).</p> <p>Limited color pallet (i.e. the three colors of the project, HEX codes: 33bce6, 73e0a2, 354047).</p> <p>Aerated layout on a white background.</p>	<p>Official colors and font Sustenance from our St. Lawrence were appreciated by all. Tabs and simplicity were other strengths of the design.</p> <p>One participant said to keep in mind: explaining in a few words and few paragraphs, keeping a pale background, repeating Sustenance from our St. Lawrence's logo.</p>	Sustenance from our St. Lawrence's logo could be repeated more often.
13	<p>Official logo of Sustenance from our St. Lawrence.</p> <p>Drawings (pictograms), one by species category.</p>	<p>Official logo appreciated by all. First component to be seen. One participant was able, without asking, to understand its exact signification.</p> <p>Species drawings well understood by all and appreciated. Some questioned the necessity of using them for the recipes.</p>	No changes, but the drawings should be reviewed since they are currently from an open access source.

14	Pictures (i.e. species and recipes) and videos (i.e. steps of consumption) will be included to facilitate the comprehension. Title examples were put in the prototype.	<p>All loved the idea of having pictures and videos. One participant (specialised in web design) even suggested giving more space for the pictures on the homepage.</p> <p>For the first picture of the homepage, two suggestions: 1- Representative picture carousel 2- A representative short video (+/- 10 sec.), with or without sound</p>	Give more space for pictures on the homepage and use a picture carousel. Would be interesting to have mini-carousel for species index cards.
Information about risks and disadvantages			
15	Section title on index card: "Recommandations sur les contaminants/Recommendation on contaminants"	<p>All found the section interesting but some thought having the word "contaminants" at the beginning of the card had a negative connotation.</p> <p>"Qualité de la ressource" (resource quality) have been used by many.</p> <p>Mercury was also named, but principal concerns were about molluscs and bivalves.</p>	Changing the section name for "Qualité de la ressource et contaminants/Resource quality and contaminants" and putting it in second.
16	Section not created on the first prototype.	Many concerns about sustainability, mainly for responsible fishing, harvesting and hunting methods. Stock status was also mentioned, for ecological and economic reasons.	Add a section to the index card.
17	Section title on index card: "Récolte, cueillette ou pêche/Harvest or fishing"	<p>Section useful to people that want to know about responsible methods, although there were some comments on the section's name. It should change depending on the species.</p> <p>Also, hunting was forgotten from the title.</p>	Changing for "Méthodes de [pêche, récolte, cueillette, chasse] responsables/Responsible [fishing, harvesting, picking, hunting] methods".
Information on benefits and healthy consumption			
18	Section title on index card: "Excès/Excess"	Appreciated but not always noticed. One participant suggested putting a bigger emphasis on the resource's qualities.	Moving the section to have it with the others.
19	Section title on index card: "Palatabilité/Palatability"	Appreciated but the word "palatabilité" was not well understood. "Propriétés gustatives" was suggested by many.	Changing for "Propriétés gustatives/ Taste property". "Odeur/smell" to be removed.

		Also, it was suggested removing "odeur/smell" since it's hardly describable.	
20	Section title on index card: "Avantages nutritifs/Nutritional benefits"	Appreciated. Some participants would like to know what the benefits of each nutrient are. One participant showed interest in a nutrition fact table.	Presenting health benefits in opposition to excess in a "nutrition" section, for main nutrients present in the resource.
Information on transformation and consumption			
21	Section not created on the first prototype.	Participants showed interest to have a section on safe ways to prepare the resources, apart from having recipes. Would like to know what not to do and what to do, how to cook well.	Changing the "transformation" section for "Comment l'apprêter?/How to prepare?" section that would include the following subtitles: "préparation/preparing", "cuisson/cooking", "conservation/conserving".
22	Section at the bottom of each index card: "Recettes valorisantes/Recipes to appreciate" A button was included to suggest recipes.	While appreciated by many, the button to suggest a recipe was pointed out as a complicated function to maintain. The star system to evaluate recipes was also pointed out as complicated, even risky at the beginning of a project. Some did not understand the star system. Suggestions: changing the star system for the name of the Chef who wrote the recipe. Other suggestions: adding a "storytelling" section for recipes and changing the title "Recettes valorisantes/Recipes to appreciate" for simply "Recettes/Recipes". Having only three suggested recipes at the bottom of an index card was understood and the possibility to see more was appreciated.	Star system to be replaced by Chef's name. New section to be added on recipes' card.
23	Section title on index card: "Transformation"	Appreciated but participants want to know more about preparing and cooking.	See changes for "How to prepare"
Information on seasonal availability			
24	Research bars are divided into: species category, season, region.	Few understood that they could use the research bar to select a season. Suggestion: instead of having the contaminants	For the homepage species categories, only "explorer la catégorie/explore category"

		presented from the beginning, changing it for the seasonal availability.	to be kept under the pictures and pictograms. For species list, contaminants to be replaced by region and season.
Other concerns identified (with prototype 1 interviews only)			
25	n/a	<p>One participant was concerned that some consumers might not know that there are seasons for marine food, just like there are for fruits and vegetables.</p> <p>The origin, traceability, is a concern. For instance, if the species are wild or farmed, local or imported.</p>	<p>For seasonality, adding the seasons next to each species should address the issue. Would be interesting to create a calendar, printable from the website.</p> <p>For traceability, Fourchette bleue logo, with a hyperlink to their list of certified fish shops and restaurants, could address the issue for some species.</p>
26	n/a	<p>1- Two participants showed interest in a map of the project's regions and the species local to each of them.</p> <p>2- Three participants showed interest in a research bar where to write the exact name of a resource.</p> <p>3- One participant thought it would be interesting to even present the species that are not edible or available for consumption, to inform the population.</p> <p>4- One participant suggested adding "colors" to the taste properties (fresh vs cooked).</p> <p>5- One participant suggested adding a section to the index cards for what can replace the resource if not available or not in season.</p>	<p>1- Adding an interactive map with the project's regions in the "à propos/about us" tab.</p> <p>2- Adding a research bar to write a specific resource name.</p> <p>3- It would be impossible to present all St. Lawrence species, edible or not.</p> <p>4- Instead of writing the color, the resource picture would show its appearance. A mini-carrousel would allow it to show various appearances: natural habitat, fresh, cooked.</p> <p>5- A section for "remplace bien/good substitute for" to be added.</p>
Available tools and references			
27	n/a	<p>Gourmande de nature (îles-de-la-Madeleine)</p> <p>La Buvette (îles-de-la-Madeleine)</p> <p>Fish shops</p> <p>Les Jardins de la mer (Bas-St-Laurent)</p>	n/a (Useful for <i>Sustenance from our St. Lawrence's</i> progress and to identify stakeholders and key players when it comes to edible local resources and food security.)
28		Neighbors, family, fishermen, fisherwomen, reference people in the community	

29	Canada Parks MAPAQ
30	Book Attention fragiles Recipe books from farmer circles ("Cercles de fermières") or others Hélène Raymond's articles
31	Google
32	Merinov Fourchette bleue and Exploramer Maritime school in Rimouski
33	Attention fragiles Comités ZIP Bon goût frais des îles Mon Homard.ca Aliments du Québec Marine Stewardship Council Gaspésie Gourmande Un Océan de saveurs Varech farest Caribou Association québécoise de l'industrie de la pêche Ocean Wise

Appendix E. Second summary of comments and modifications

Need	Website component addressing the need	Participants' comments	Changes to be made
Centralized information			
1	List of species and species categories. "Details" button.	All accessed the index card without problem by clicking mainly on the "details" button or simply on the species picture. Only one person questioned the necessity of the button. However, since a majority used it, it is not to be changed.	None
2	Species index cards (with reviewed subtitles) Print button.	Many noticed the print button and appreciated it.	None
Adapted information			
3	Sections of the species index card answering what the participants are expecting in terms of information. (With Latin names added and a better "about us" access.)	Expectations were identified twice before the second cycle. Saturation of the comments was reached, so the question was not asked again in the second cycle.	None
4	Presentation of the homepage (with changed sentence)	Modifications in the sentence and the research bar (exploration) helped participants to better see the purpose of the website. All participants understood well, even those less used to web tools. All accessed the "About us" section without issue. Two persons suggested putting project description before communities' presentation to make more sense.	Project description will be put before communities' presentation.
5	Index cards will only be about St. Lawrence species. (with Fourchette bleue reference added)	Participants said the name of the project shows well that it is about St. Lawrence species.	One species category might be missing for sea cucumber, sea urchins, etc.
6	Do participants view the information as reliable and science-based? (with added information about Sustenance from our St. Lawrence team and references)	Fourchette bleue logo was understood by those who knew what Fourchette bleue was. For others, the	The explanation to be moved to the top of the page and the asterisk changed from blue to black.

		explanation at the bottom of the page was rarely seen.	
7	Words both in French and English (with "palatability" changed)	No problem noticed regarding words. Only question was about the use of the word "category" instead of maybe "kingdom", "class", "order", "family", "genus". Same for "harvesting" vs "picking".	Vocabulary verification. More common culinary and fishing words are preferred. "Category" will be kept. For "harvesting": to cut and collect crops when they are ready (Cambridge Dictionary) For "picking": if you pick flowers, fruit, etc., you take them off a tree or out of the ground. "Picking" would thus be preferred.
Information easily accessible			
8	Two research bars: bottom of the first picture of the homepage, and left column of the species list. Divided into: species category, season, region. (bigger research bar)	All saw the bar and understood how to use it. However, many focused more on the tabs at the top of the page and used those instead of the bar or instead of scrolling down (see design need).	None.
9	Drawings representing six species categories: fish, molluscs, crustaceans, algae, seaside plants and marine mammals. (with changed subtitles for "species category" and "our [species]")	Understood, once the possibility of scrolling down is understood.	None. (See design need and St. Lawrence species)
Information easy to understand			
10	Is the presentation of the information clear, does it cause confusion or clashes? (contaminants kept for the index cards only)	None. (see sections less understood [i.e. seasons, recipes, reliability, ...])	None
11	Three colors points system (red, yellow, green) to emphasize species to consume with caution for their contamination risks. (system changed for either the yellow triangle or the magnifying glass, and kept for index cards)	All preferred the yellow triangle, not the magnifying glass. However, the understanding varies slightly from one person to another when they see the word "precaution".	Since the one word is not enough, a pop-up bubble has been added to better explain and replace the single word.
12	Dark font adapted for on-screen reading (i.e. sans serif. Here, Roboto). Limited color pallet (i.e. the three colors of the project, HEX codes: 33bce6, 73e0a2, 354047). Aerated layout on a white background. (repeating Sustenance from our St. Lawrence logo)	The majority of the participants did not understand they could scroll down the page.	The page seems to be finished after the main picture. Moving it up to show a part of the first subtitle.

13	Official logo of Sustenance from our St. Lawrence. Drawings (pictograms), one by species category.	The logo is appreciated and rapidly noticed. Pictograms for species categories were also understood and appreciated.	None
14	Pictures (i.e. species and recipes) and videos (i.e. steps of consumption) will be included to facilitate the comprehension. Title examples were put in the prototype. (more space given to pictures)	Pictures helped understanding the website's purpose, especially the homepage picture. The possibility of consulting videos was also appreciated.	None
Information about risks and disadvantages			
15	Section title on index card: "Recommandations sur les contaminants/Recommendation on contaminants" (changed for "Qualité de la ressource et contaminants/Resource quality and contaminants" and put in second)	None	None
16	Section not created on the first prototype. (section added to index cards)	None	None
17	Section title on index card: "Récolte, cueillette ou pêche/Harvest or fishing" (changed for "Méthodes de [pêche, récolte, cueillette, chasse] responsables/Responsible [fishing, harvesting, picking, hunting] methods")	None	None
Information on benefits and healthy consumption			
18	Section title on index card: "Excès/Excess" (section moved)	None	None
19	Section title on index card: "Palatabilité/Palatability" (changed for "Propriétés gustatives/Taste property", "Odeur/smell" removed)	None	None
20	Section title on index card: "Avantages nutritifs/Nutritional benefits" (changed for a "nutrition" section with benefits and excess information)	Only one person was interested in having nutritional values of the species. However, it was from a marketing point of view.	None
Information on transformation and consumption			
21	Section title on index card: "Transformation" (changed for "Comment l'apprêter?/How to prepare?", with divisions for "préparation/preparing", "cuisson/cooking", "préparation/preparing")	None	None

22	<p>Section at the bottom of each index card: "Recettes valorisantes/Recipes to appreciate" (changed for "Recettes/Recipe")</p> <p>A button was included to suggest recipes. (Star system replaced by Chef's name and suggestion button removed. Added a new section for storytelling for the recipe.)</p>	<p>The possibility to sort recipes by time or Chef's name did not get negative comments. The storytelling portion of the recipe card was not always seen. It was suggested by one person to change its presentation.</p> <p>One person had a problem with reading the recipe ingredients. It was suggested presenting the ingredients more as a table. One person also suggested adding the recipe's purpose, i.e. if it is a meal, an appetizer, etc.</p>	<p>The storytelling portion will be more visible although it is not a major issue for safe, sustainable and healthy consumption of the resources. The purpose of the recipe will be specified in the storytelling.</p> <p>Ingredients' presentation will be changed to be more easily readable.</p>
Information on seasonal availability			
23	<p>Research bars are divided into: species category, season, region. ("region" and "season" replacing "contaminants" next to the species' name. Homepage only has "explore the category", no other information.)</p>	<p>Participants were taking a certain time to understand the colors and abbreviations for the season's indication.</p>	<p>Letters and colors to be changed for symbols more common for season representation in Quebec Province. Legend would then be less necessary. (discuter avec Elizabeth)</p>
Other concerns identified (with prototype 1 interviews only)			
24	n/a	<p>Contrary to the first cycle, the second cycle was not meant to again identify needs (see Expectations). Three persons still suggested the following, without the question being asked:</p> <ol style="list-style-type: none"> 1. Criteria to indicate a precaution or not; 2. Newsletter archives of Sustenance from our St. Lawrence; 3. Selling points and member companies. 	<ol style="list-style-type: none"> 1. Criteria could be added as pop-up bubbles when the user is interested and click the precaution symbol. Since it is one specific comment, this should answer his or her suggestion. 2. Newsletter archives would rather be useful on the Facebook page of the project, since it is used for Sustenance from our St. Lawrence communications. A hyperlink could be simply added to refer to the archives so as not to overload the website. 3. For the selling points, it needs to be discussed...
25	<ol style="list-style-type: none"> 1. Interactive map with the project's regions in the "à propos/about us" tab. 2. Research bar to write a specific resource name. 3. The resource picture shows its appearance. A mini-carrousel to allow it to show various appearances: natural habitat, fresh, cooked. 4. Section for "remplace bien/good substitute for" added. 	<ol style="list-style-type: none"> 1. Appreciated but needs to be refined. 2. Appreciated but not always used. 3. None 4. None 	<ol style="list-style-type: none"> 1. Refine the map with the help of a geographer, member of Sustenance from our St. Lawrence. 2. Research bar should be more visible, and the little triangle should change for a magnifying glass (error in design). 3. None 4. None

Available tools and references			
26	n/a	None	Book identified: "Produire et consommer chez nous" Keywords identified: [species name] + recipe
27		None	
28		None	
29		"Produire et consommer chez nous"	
30		Google	
31		None	
32		None	

Appendix F. Third summary of comments and modifications

Need	Website component addressing the need	Participants' comments	Changes made
Centralized information			
1	List of species and species categories. "Details" button.	One participant suggested putting a hyperlink for the website on the page of the First Nation.	None
2	Species index cards (with reviewed subtitles) Print button.	Two people suggested laying out the sections in a logical order, from fishing to plate. One person suggested following the same equal columns as the layout of the videos and recipes.	Slightly changing columns width and order.
Adapted information			
3	Sections of the species index card answering what the participants are expecting in terms of information. (With Latin names added and a better "about us" access.)	None	None
4	Presentation of the homepage (with changed sentence)	Two participants suggested using an action verb and cut the homepage first sentence because it is too long.	Changing the sentence for a shorter and more active than passive one.
5	Index cards will only be about St. Lawrence species. (with Fourchette bleue reference added)	None	None
6	Do participants view the information as reliable and science-based? (with added information about Sustenance from our St. Lawrence team and references)	None	None
7	Words both in French and English (with "palatability" changed)	Careful with the family name and First Nation's spelling.	Spelling check.
Information easily accessible			
8	Two research bars: bottom of the first picture of the homepage, and left column of the species list. Divided into: species category, season, region. (bigger research bar)	One person suggested having to scroll down lists instead of scrolling up lists for the research bar of the homepage.	Since only one person commented on this and since it does not affect the usability for other participants, no changes were made.
9	Drawings representing six species categories: fish, molluscs, crustaceans, algae, seaside plants and marine mammals. (with changed subtitles for "species category" and "our [species]")	None	None
Information easy to understand			

10	Is the presentation of the information clear, does it cause confusion or clashes? (contaminants kept for the index cards only)	None	None
11	Three colors points system (red, yellow, green) to emphasize species to consume with caution for their contamination risks (system changed for either the yellow triangle or the magnifying glass, kept for index cards)	None	None
12	Dark font adapted for on-screen reading (i.e. sans serif. Here, Roboto). Limited color pallet (i.e. the three colors of the project, HEX codes: 33bce6, 73e0a2, 354047). Aerated layout on a white background. (repeating MSL logo)	Participants suggested using more space for the layout, to use buttons as big as the images for the homepage, to layout the "About us" section in two columns and to put the references in a separate tab. Also, the menu bar is not seen immediately.	Using space for the layout, enlarging the elements of the menu bar and making it floating, and changing the layout of the "About us" section.
13	Official logo of Sustenance from our St. Lawrence. Drawings (pictograms), one by species category.	One person suggested that the menu bar float to stay visible even when scrolling down the page.	Since it helps usability and allows the menu bar to be more visible, the change was made.
14	Pictures (i.e. species and recipes) and videos (i.e. steps of consumption) will be included to facilitate the comprehension. Title examples were put in the prototype. (more space given to pictures)	Two people suggested having more catchy titles for the sections. One person suggested that, for the species categories, the picture carousel be controlled by the user and when the pointer passes above it, the picture changes and other categories are darkened.	Comments had to do with a more marketing side of the website than its usability. However, the comment on the carrousel being more controllable would avoid having too much movement on the homepage.
Information about risks and disadvantages			
15	Section title on index card: "Recommandations sur les contaminants/Recommendation on contaminants" (changed for "Qualité de la ressource et contaminants/Resource quality and contaminants" and put in second)	None	None
16	Section not created on the first prototype. (section added to index cards)	None	None
17	Section title on index card: "Récolte, cueillette ou pêche/Harvest or fishing" (changed for "Méthodes de [pêche, récolte, cueillette, chasse] responsables/Responsible [fishing, harvesting, picking, hunting] methods")	None	None
Information on benefits and healthy consumption			
18	Section title on index card: "Excès/Excess" (section moved)	None	None
19	Section title on index card: "Palatabilité/Palatability" (changed for	None	None

	"Propriétés gustatives/Taste property", "Odeur/smell" removed)		
20	Section title on index card: "Avantages nutritifs/Nutritional benefits" (changed for a "nutrition" section with benefits and excess information)	None	None
Information on transformation and consumption			
21	Section title on index card: "Transformation" (changed for "Comment l'apprêter?/How to prepare?", with divisions for "préparation/preparing", "cuisson/cooking", "préparation/preparing")	None	None
22	Section at the bottom of each index card: "Recettes valorisantes/Recipes to appreciate" (changed for "Recettes/Recipe") A button was included to suggest recipes. (Star system replaced by Chef's name and suggestion button removed. New section for storytelling for the recipe.)	The only comment was to texturize more the "storytelling" column. Also, the Chef's community and places where the resource can be found are not well visible.	We added texture for the "storytelling" and used it to better divide the recipe and Chef's origin from the places where the resource can be found.
Information on seasonal availability			
23	Research bars are divided into: species category, season, region. ("region" and "season" replacing "contaminants" next to the species' name. Homepage only has "explore the category", no other information.)	Symbols for season identification were not quickly understood by all. Three people thought the symbols should not be next to the picture because it overloads the webpage. They suggested putting them horizontally under the regions, with a pop-up legend or not to have them in the species list since they also are on species index cards.	Symbols were moved under the regions and pop-up legend was added.
Other concerns identified (with prototype 1 interviews only)			
24	n/a	None	None
25	1. Interactive map with the project's regions in the "à propos/about us" tab. 2. Research bar to write a specific resource name. 3. The resource picture shows its appearance. A mini-carrousel to allow it to show various appearances: natural habitat, fresh, cooked. 4. Section for "remplace bien/good substitute for" added.	There are some concerns related to the hosting of the website in the future.	None
Available tools and references			
26	n/a	None	n/a
27		None	
28		None	
29		None	

30		Identified keywords: [species name] + nutrition	
31		None	
32		None	

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