

Complexity of public interest in ethical analysis of genomics: Ethical reflections on salmon genomics/aquaculture

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1 Introduction

This paper describes the use of focus groups to support ethical analysis of public interests related to genomics and biotechnology. This work represents one “stream” of the research encompassed by the Genome Canada funded project, *Democracy, Ethics and Genomics: Consultation, Deliberation and Modeling*.

The objectives of the paper are to describe the moral dimensions and perspectives of the issues raised by focus group participants, to assess the information required to support informed dialogue about issues, and to describe some necessary components of ethical analysis of these issues. As such, the paper presents a sample analysis which the reader can compare with the other empirical approach in the project, Norms Evolving in Response to Dilemmas (NERD) (see [Ahmad et al., 2006](#)).

The purpose of this comparison is to evaluate the relative strengths and weaknesses of two approaches for assessing public input on common topics—in this case, salmon genomics and aquaculture—a surprisingly rare activity ([Abelson et al., 2003](#)).

The topics were selected on the basis that the prospective evaluation of an emerging cluster of salmon genomic scientific studies and technologies¹ provides a good representation of the range of interests raised in earlier focus groups on genomics ([Burgess, 2004, 2005](#))². Although ethical debate and the social

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¹While much of this research is already underway, it has yet to be translated into technological applications and has not been the focus of significant controversy.

²Biobanking was also evaluated as part of this project using similar methods but is discussed elsewhere.

issues raised by research and technology cannot be separated from the specific context, salmon genomics and aquaculture were used in this project primarily to illustrate an approach to ethical analysis of policy and social issues that involved qualitative public consultation methods (i.e., focus groups).

2 Theoretical Background

Keulartz et al. (2004) lament the ‘technology blindness’ of ethics that results from the focus of the discipline on people and the regulation of their actions: ethicists traditionally focus on the values, norms and principles that hold society together. In contrast, Keulartz et al. argue that the moral order is influenced just as much by material objects in the form of technologies that enable social action. It is their view that:

... applied ethics has insufficient insight into the moral significance of technological artifacts and systems and that it therefore cannot cope adequately with the dynamic character of our technological culture. (Keulartz et al., 2004, p. 25)

To put it briefly, (medical) ethics is dominated by either a neutral or a negative vision of technology.

While Keulartz and his colleagues make a convincing case for the need for a broader approach to the evaluation of new technologies, Zoloth (2001) focuses on the timing of the evaluation of novel technologies. In the context of stem cell research Zoloth insists that:

Moral vision has to precede research or we will be constantly in a reactive legal position, seeking to justify what is already unfolding, or struggling to find a political move or linguistic turn to allow political peace. (Zoloth, 2001, p. 236)

Zoloth proposes that Applied Ethics needs to embrace exotic thinking, that it needs to look “beyond the horizons that keep appearing before us as science develops” (Zoloth, 2001, p. 233). In practical terms, these arguments suggest that, in contrast to a focus on statistical representation and the methodological requirement to use preconceived categories, applied ethicists need to use approaches that enrich the range of moral perspectives. This requires research to identify and test methodologies capable of evaluating emerging technologies and must be able to provide a thicker description of the social context of technologies than has traditionally been possible³.

Despite the tradition in ethics of considering all logically possible alternatives, critiques of narrow analysis of ethical issues demonstrate that it is necessary to engage in empirical study and dialogue to identify novel and ethically

³Keulartz et al. (2004) suggest that both moderate and radical variants of Science and Technology Studies achieve a richer description of context, but also suggest that STS remains agnostic about the technologies it describes. The case they make is that ethics informed by the pragmatic tradition may be more fruitful.

relevant perspectives (cf., [Kelly, 2003](#)). Given unequal access to policy debates and other forms of the political influence, a central problem is how to adequately represent the full diversity of views or interests in ethical issue definition and analysis. Justice theorists writing in *From Chance to Choice: Genetics and Justice* have identified the first problem of justice as the question of how to be sufficiently inclusive in who participates in the process of defining the public interest ([Buchanan et al., 2000](#), p. 263). Reflecting a growing concern among feminists, social scientists, and public interest groups, [Sherwin \(2001\)](#), has argued that "...when approaching complex policy matters, we should actively seek out moral perspectives that help to identify and explore as many moral dimensions of the problem as possible" ([Sherwin, 2001](#), pp. 18, 30). Otherwise, ethical analysis may merely engage the views of those with dominant or vested interests, neglecting the interests of others not because they do not bear on the issues, but because the relevance of these interests are hidden by the methods used to articulate the range of relevant perspectives. The practical failure is that the influence of ethical analyses on public discourse and policy will be to reify the framing of issues that ethical analyses should be deconstructing.

The objective of engaging public participants in ethics related discussions is to articulate for consideration the full breadth of interests among citizens rather than seeking demographic or statistical representation ([Burgess, 2004](#)): the point is to understand under-represented or unarticulated perspectives, not to assign frequencies to well-articulated or pre-conceived perspectives. This form of representation in ethics requires substantive engagement with the values and meanings that may not readily be represented in the market or dominant culture, or in many approaches to public consultation or education. Important clarification may come from perspectives that are widespread in a population but are unarticulated in mainstream discourse.

The ethical and political assumption of this research is that the range of interests relevant to determining the public interest in genome research and biotechnology must be described with sufficient inclusiveness before the nature and scope of policy decisions can be determined. The inclusiveness requirement is best served by an approach that is exploratory in its recruitment and method. The objective is to identify the range of interests a diverse set of participants consider relevant to defining the public interest in genomics and biotechnology. This will in turn support the identification of additional participants and issues that are important to an informed and inclusive analysis.

3 Methods

If we are to make a case for methods that allow for greater representativeness and inclusiveness in the ethical evaluation of technologies, then the results of our work need to be compared to a reasonable benchmark. The benchmark was derived from a literature review conducted prior to the focus groups and a comparison to the NERD approach.

In order to provide rich context for this study our team prepared background

documents on salmon genomics and aquaculture. The salmon genomics paper included a summary review of the ethical dimensions of salmon genomics, with the intent of establishing a broad scope of issues to be considered. The paper, “Lots of Fish in the Sea: Salmon aquaculture, genomics and ethics” (Power, 2003), reviews literature on the cultural and economic importance of salmon, the state of aquaculture and salmon genomics internationally, assessments of effects on the environment and wild stocks, local, national and transnational governance, and public attitudes. Based on that literature review the following ethical issues were identified:

- harms to the natural environment and wild fish stocks relating to farm escapes;
- harms to the natural environment, wild fish stocks, and fisheries due to disease;
- food security;
- respect for boundaries, specifically, respecting cultural and other ‘in principle’ objections for example those based on a belief in the integrity of the organism or respect for First Nations’ objections to the perceived violation of a cultural icon;
- respect for individual choice;
- safety for human consumption; and
- lost opportunities (including related trade-offs).

The rich contextual description provided by the literature provided a benchmark against which our results could be evaluated.

The second comparison is to an online survey and computer modeling approach to salmon genomics, characterized as “Norms Evolving in Response to Dilemmas (NERD)” and described in another paper in this special issue (Ahmad et al., 2006).

3.1 Focus groups

Focus groups are unique social events whose analysis cannot be generalized to a population. Yet how topics are organized in relation to each other, particularly across different focus groups, reflects a wider social discourse and the expertise of the participants in their roles as citizens as well as consumers (Kerr et al., 1998a,b).

Focus groups provide an opportunity for participants to stimulate each other’s participation, thereby reducing the risk that information introduced by the moderator will direct the discussion. Focus groups encourage participants to interact on a topic, shaping the resulting dialogue and stimulating each other to clarify meaning rather than merely reporting static opinions or presuming that they use words and phrases in the same way. The structure of the discussion and

the topics raised reflect how the participants think and feel about the topic, permitting participation without requiring participants to justify their views to such an extent that they feel inhibited. Only open-ended methods like focus groups are able to capture this structuring, since more formalized methods tend to provide the structure for the discussion or responses. By focusing on the notion of interests as perceptions of entitlements and emphasizing that both hopes and concerns are to be described, participants are encouraged to state their views openly.

There are several features of communication that can inhibit unrestricted expression of interests. For instance, if the distribution of technical knowledge between participants is uneven, participants may hesitate to identify interests that would demonstrate their superficial understanding or ignorance. For this reason the participants were organized into groups that had a common background: disinterested randomly recruited, non-governmental agency members, and researchers and funders with connections to salmon genomics.

Recruiting for the purpose of generating diversity of perspectives suggested consideration of at least two issues. First recruitment needs to involve people who are not typically engaged in the debates related to the policy issues. Second, recruitment must involve people who may have interests, but are often excluded from voicing or promoting interests in policy debates.

The study design involved five focus groups, each composed of participants drawn from common backgrounds. The first segment was composed of two groups (Random1 and Random2) who were randomly recruited by a consulting firm using random digit dialling. The second segment recruited participants with a direct professional interest in the area of salmon genomics; three groups were recruited using targeted research into the relevant organisations and by soliciting recommendations from individuals known to the research team. The first of these groups was made up of individuals recruited from a mix of non-governmental organisations (NGOs). The second group was individuals who work for funding organisations and researchers (Fund/Res) directly involved in salmon genomics. The third group was composed of academics and regulators (Reg/Acad) with a direct professional connection to salmon genomics⁴. The focus groups were moderated by professional facilitators using a moderator's guide. The meetings were recorded, transcribed and coded by one of the facilitators using QSR N6. One of the authors (JT) checked for consistency.

Following a brief introduction to genomics, the facilitators provided the participants with the following explanation of the task; hopes and concerns related to the technology were addressed separately, the facilitators substituting “concerns” for “hopes” in the following text.

⁴Focus groups or other forms of consultation are sometimes unacceptable for a group to express its interests. For example, the ongoing negotiation of political interests creates a broad distrust of activities related in any way to fisheries among B.C. First Nations communities. We had to cease attempts to set up a focus group or other methods of seeking First Nations input, instead interviewing members of a public commission representing First Nations fishing interests to develop an understanding of both resistance to dialogue and the perspectives of First Nations people toward salmon genomics.

Now what we'd like to switch to is spending a bit of time thinking first about the hopes or potential benefits the salmon genomics might have to society ...so what I'd like you to do is just spend a few minutes thinking quietly to yourself. There's some paper and pencils there for you to just jot down a few thoughts that you might have, and then we'll go around the room and see what everybody comes up with. So what do you think might be some of the potential benefits? What would you hope to see coming from this?

4 Themes

Analysis of the focus group transcripts revealed that a number of themes appeared to varying degrees across the five groups. In this analysis we focus on the themes relevant to three questions⁵:

1. What novel interests or issues are identified?
2. What information is important to a well-informed discussion of the novel interests and issues?
3. What groups or individuals need to participate to represent their interests?

We will return in the discussion to consider the implications of the analysis of the themes for the organization of ethical analysis.

The following analysis captures articulations of participants' perceptions of entitlements (interests) or issues (points of contention). While it is unlikely that groups will raise wholly original interests or issues, the perception that they are relevant to salmon genomics may be novel, or may indicate the importance of including perspectives and information that relate to these issues, whether through public dialogue, further research, or ethical and policy analysis. It is also interesting that these results support the conclusions of other studies that, to some extent, all the focus groups generated a fairly complex and sophisticated depiction of the issue (Bates et al., 2005, p. 340–341; Kerr et al., 1998b). The themes are organized under eight headings. The themes are described in much greater detail in a separate report.

1. Commercial influence on research
2. Technological imperative
3. Foreign ownership
4. Impacts on culture and society
5. Negative public perception & NGOs as an “industry”
6. Salmon as food “tainted by association”

⁵The full report of the focus groups will be published elsewhere.

- 7. Welfare of salmon
- 8. Environmental concerns and benefits

4.1 Commercial influence on research

One member of the random group asked the moderator to distinguish between genomic research and genomic modification in the form of new commercial products:

- V1** Now the ethical question we're asking, was whether it's useful to do research genomics, or was it whether it's useful to actually change the genomic make-up of fish? Because I think that there's nothing wrong with the research, but there's quite a lot wrong with the practice.

The practices associated with commercial activities appear to be the problem, not genomics per se, particularly where the practice is driven by a profit motive.

Participants in the one random group questioned the motives behind current research and the political favours it involves. The people in control may have narrower interests that mean they do not consider the wider public good. Corporate interests may make judgements about the risks that are a problem: the example of Firestone's choices about whether to recall car tires was used. The NGO group made a similar point about the motives of corporations. Other participants argued that there is too much hysteria in the press about the impacts of research.

Members of one of the expert groups suggested that there have been changes in the way research occurs so that scientists have to try and make profitable applications quickly:

- V3** But I think that that has been systematically cut by the need, and this is where the motivation comes in, to find a product that you can market and make profit from, and jump from the smallest level of understanding to implementation as quickly as humanly possible.

Genetics is considered a classic example of this phenomenon; new products are created while the research is still underway. The research environment is much more competitive today so there is less collaboration and nobody is looking at the aggregated effects. Research is done with the end in mind:

- V5** Because they already have the end in mind. We want you to do research to get us here. The end is defined. And if you don't do that we're not funding you, because this is what we want the end product to be. You get us there.

The profit motive is creating a society that is "out of control" and is driving the development of aquaculture (NGO group). This raises wider concerns

Table 1: Commercial Influence on Research

Group	# Lines
Random1	14
Random2	20
NGOs	50
Res/Promo	14
Reg./Acad.	16

about whether governments are under the control of corporations. Both the Res/Promo and the Reg/Acad groups expressed similar views about the commercial funding of basic research, although one participant in the latter group thought that the predominance of public funding was sufficient to ensure that wider interests were considered.

Although this data cannot support quantitative analysis, a simple count of the numbers of “lines” spent on a topic does give a general sense of how much time each group spent discussing this theme. Although the NGO group spent the largest amount of time, the commercial influence theme was raised in all other groups. These other groups spent a similar number of lines on the topic (see [Table 1](#)).

4.2 Technological imperative: conflating genomics and transgenics

There was a tendency among the Random and Researcher/Funder groups to evaluate genomics on the basis of the effects of transgenic salmon⁶. While a number of participants in these groups questioned whether in many cases specific examples counted as genomics, participants described many of their hopes and concerns about the field by drawing on examples of transgenic applications. In these cases a subset of the class of activities involving transgenic applications was conflated with the entire class of genomic research. The Random1, Random2, NGO and Res/Promo groups all manifested this tendency, although it was weaker in the Reg/Acad group.

4.3 Foreign ownership

A concern identified by both the random and the NGO groups related to foreign control of fish farms. Participants were concerned that foreign firms have narrower interests and that the economic benefits generated by the farms are exported. Specifically, participants felt that British and Norwegian companies dominate aquaculture in B.C. and use the province as a laboratory. The view was expressed that these companies were kicked out of Europe because of the

⁶A detailed analysis of the segments of transcripts on this topic is available elsewhere ([Tansey & Burgess, Submitted](#)).

effects of aquaculture and now they threaten provincial sport fishing. The participants felt that this affects the broader context within which any commercial salmon genomics applications would be used:

- V1** So taking this into genetics is just one more step, so this resentment builds with this foreign interest in aquaculture.

It was argued that foreign ownership limits control over fish farming activities:

- V3** It takes away our local control. I mean all we can do is create laws. We can't necessarily have social impact on it when, you know, the ownership isn't B.C. bred.

Further, the concerned groups felt that if the business model for delivering new genomic technologies follows Monsanto's lead (i.e., involves contracts for sterile organisms), local operators will become even more dependent.

In a closely related theme—unequal access to benefits and resources—participants in the random groups discussed wider distributional issues. For example, there is a need for equal access to fishing sites in commercial fishing; however, in the current licensing regime fish belong to a limited number of people. Similarly, the same participant emphasized the need to ensure that the benefits that come from salmon genomics, such as enhanced nutritional value, are equally accessible to all. It was also felt that, because money is invested within B.C., local residents should benefit before Americans. Moreover, participants across the groups suggested that information about the benefits of genomic and other health research should be made more accessible than it is now.

The Res/Promo group recognized that aquaculture relies on the privatization of common property (i.e., water, fish stocks). For instance, fish farms are established on common property and at least generate localized effects on the environment such as the local build-up of food waste and faeces. This raised wider concerns about the claims of fishing interests over wild stocks:

- V4** And it really is an ethical question, who owns it and who gets the benefit from it. I mean it's the same question as genomics. Who owns them and who gets the benefit? They're a natural resource. Are they a natural resource? Are they a private resource?

There are related issues about who owns the products of genomic research under the current system and one respondent in the Res/Promo group asks if genomic research should be treated like prospecting for gold where the finder may keep what he or she owns and pay a royalty into the public purse.

4.4 Impacts on culture and society: First Nations and commercial fishers

Both the NGO and the Reg/Acad groups raised concerns about the effect of fish farming and genomics on First Nations. Direct instrumental effects were

thought to include the harvesting of feed fish, which may affect First Nations access to those stocks over time, changing their culture, society and economic base.

Other cultural concerns were also raised. It was felt that creating a “Frankenfish” may diminish what are considered by some to be the “magical” or mythical properties associated with salmon. Salmon are critical to the spiritual well being of B.C. first nations, so harm to the fish will harm the community as a whole (although it was recognized that some First Nations have established joint ventures with aquaculture companies).

Participants argued that fish farming may provide employment, although the participants debated whether this was relevant to genomics. On the other hand, it was recognised that genomic research directly employs people and that increases in economic growth through farming may offset losses in the fishing sector. Work in genomics should be higher paid because it requires higher educational levels, although there was a concern that the transition to new kinds of work will not provide employment for fishermen. In addition, it was argued that aquaculture may make more fish available for sport fishing, creating more jobs in the service sector that are more stable than commercial fishing although it was questioned whether the jobs would be accessible to fishermen.

A participant in the Res/Fund group argued that aquaculture, supported possibly by genomics, will help create new coastal communities in B.C. that are less transient than communities supported by logging and fishing. More stable communities could lead to a reduction in divorce rates, improved infrastructure, etc.; stable communities create responsibility and ownership and help build community. The participant used the example of the Norwegian government’s support for aquaculture as a way to underpin communities. There was a lengthy discussion in the Res/Fund group about the extent to which commercial fishing supports only transient workers both in the Alaskan and the B.C. fisheries. Participants argued that stable communities create responsibility and ownership and help build community.

4.5 Negative public perception and NGOs as an “industry”

One Random group expressed concerns about negative public perceptions of salmon genomics, drawing on an analogy with the “hysterical” public perception of AIDS when it first appeared. Other groups pointed to the complexity of genomics and the limited understanding the public has of the field. The Res/Promo group pointed out that even experts in the field have a hard time understanding all of the developments, so the public is going to find it especially difficult. The Reg/Acad group suggested that the lack of public understanding of the field makes the area susceptible to spin.

In one discussion, participants in the Reg/Acad group discussed the special status accorded to salmon in Canada and the fact that there is an NGO “industry” focused on the species.

V5 The NGOs are an industry because they all draw pretty decent salaries being anti-aquaculture, because salmon is a religion here, they can make a lot of money by—

V1 It has an emotional component that makes it suitable for this.

M What do you think makes it a religion?

V5 On this coast it's always been the wild—this incredible Walt Disney sort of picture of the mighty salmon forging its way up our pristine rivers, you know. And it's just this whole—

V1 Myth.

V5 — myth. Yeah, Disneyesque sort of view of salmon on the West Coast.

M And how does that play into this conversation?

V5 Because the aquaculture is the antithesis of that. It's a caged domestic animal. It's not a wild free salmon. It's not “organic.”

Negative public perceptions focus on genetic drift and displacement of native species. These perceptions have a negative effect on the marketability of the product. Because of a lack of science in the policy and regulatory process one participant in the Reg/Acad group argued that:

V5 People are going to go with their emotions.

In other cases, the Reg/Acad group suggested, there is active fear-mongering about “Frankenfoods.” This discussion considered that although citizens lack an understanding of the science of risks, it is not clear that, even if the science was completely understood, decisions would not still be political.

4.6 Salmon as food “tainted by association”

One participant in the Reg/Acad group argued that a whole class of genomic technologies could be tainted by association with negative perceptions of genetically modified organisms⁷:

V2 if the public viewpoint is that genetically modified organisms are bad, and by association the salmon aquaculture industry uses genetically modified organisms, then it spreads to aquaculture products and in fact even into other salmon products.

⁷In a separate paper (Tansey & Burgess, Submitted) we found that many participants conflated transgenic applications with the broader class of genomic technologies. In this case though, the participant explicitly recognizes the problems caused by this association.

This could result in a decline in all areas associated with salmon production. In addition, misperceptions that farmed salmon are constantly fed antibiotics could scare people towards other meat sources where animals are fed antibiotics in much higher volumes.

Broader food controversies (e.g., BSE) also create real distrust of genetic modification, but it was also noted (again in the Reg/Acad group) that the science is incomplete and that this very incompleteness creates distrust of scientists:

V3 And I think because of the European trauma, you know, they're still suffering from the post-traumatic syndrome of BSE and all these things, I can understand if I'm a European I'm suspicious of government and I'm suspicious of scientists, you know, the government scientists.

Participants in the Reg/Acad group were concerned that negative perceptions of genetically modified salmon could spread to other technologies and to other production systems:

V2 Wild fishery, everything. You'd see decline and everything and it's like being tainted, you know, the entire thing. And certainly, I mean, V5 could speak better to this. I mean, the minute that any health concerns come up for any seafood product, they all take a nosedive in terms of consumption. It just spreads among. The general public is—you know, views seafood as essentially one product.

This statement indicates both the sensitivity of the public to salmon genomics and also gives some indication of one scientist's understanding of the public. In this case, the public is perceived to have only one taxonomic category that applies to all seafood products. Participants added that the B.C. government says public perception is not their concern and expects industry to address the issue.

4.7 Welfare of salmon as organisms or species

The Reg/Acad groups suggested that the welfare of research animals is becoming a concern:

V2 So, no, welfare of fish is definitely becoming a much greater topic. Killing, you used to kill the fish however you want, and now in Europe there are set standards for how you cull fish, and those standards are coming to Canada as well.

These welfare concerns could extend to whether it is acceptable to modify fish physiologically.

V3 So the ethics is there. I think scientists don't have the right to do or generate any monsters or Frankenfish. We do not have the right, I think.

According to this group, the process of inserting genes is still random and creates large quantities of deformed fish. While it is similar to breeding processes, “there’s more chance that you create monsters,” which are not seen outside the laboratories. The concern expressed here is that there is no right to create monsters in the process of producing a viable line. Another participant pointed out that lots of unviable fish are created in selective breeding and are “trashed.”

It was felt that cloning in particular could alter salmon’s natural instincts so that they may no longer be able to breed in freshwater, if at all; tampering with nature is unnatural and could create food that is dangerous to human health, as well as to the modified species. An excerpt from a random group is illustrative:

V4 It’s unnatural.

M And what are some of the potential risks, do you think, of tampering with nature?

V4 Well, the food could be dangerous to human health. Changing nature risks upsetting the balance among species. Lack of certainty and the moral concerns are strongly intertwined. We might not know about the impacts of changes for hundreds of years. You can’t then put the ‘genie back in the bottle’

Examples for past dangers of human intervention included germ warfare that resulted from biological research. There was also a question of whether lessons have been learned from early cases. The example given here was the (possible) negative effect of gene modified corn on migrating Monarch butterflies.

This view was also expressed in one random group as a lack of respect for living organisms:

V5 I believe that every living thing is there for a reason and we don’t have the right to go and change it. It’s just we have to learn—you have to understand that they have rights too, like we need to respect that right. I don’t know.

NGO participants also focused on the right of organisms to have their genetic integrity respected. The discussion of “rights” was framed in relative terms; humans see themselves as being on the top of a hierarchy and as having the right to manipulate other organisms, even those that have been here longer than humans. NGO participants questioned this hierarchy arguing that given that there are restrictions on modifying humans, why is it possible to modify organisms that cannot provide consent?

Others argued that genomic research involving salmon may be of less concern than research involving sheep, since the former are less sentient:

V3 I think it’s significantly important. When they talk about whales what’s the first thing they mention? How intelligent they are. When they want you to—when they anthropomorphize a whale, the first thing they do is

they give it a level of intelligence. If you start with salmon, where do you stop?

A similar implicit taxonomy was expressed as the view that salmon are not as aesthetically attractive as other animals, although the participant tempered this view:

V4 They may be under the radar as far as “Oh, well, it’s only a salmon, it’s not cute, I don’t really care.”

There was a negative perception across a number of the groups of activities that modify salmon for research purposes. This research may have an immediate good in mind but is accompanied by unknown long-term effects. This code, closely related to “Improved food quality and yield,” focused on interventions that could improve the resistance of salmon to a range of illnesses and parasites, but also to human influences and climate change. The discussion referred to both wild and farmed salmon: participants felt that wild stocks and species could benefit from salmon genomics and aquaculture as a result of the reduced pressure that might result from getting farms out of the oceans.

V3 Well, yeah, they could let the natural salmon go out and feed the whales and whatever else, they can eat that, and we can eat the farm fish.

Participants in the Res/Fund group felt that fish farming may be more effective than fisheries closures for protecting wild stocks. One participant argued that because fish farming has reduced the cost of salmon it has relieved poaching pressure on wild salmon stocks that existed when a stolen fish could sell for up to \$200. Genomics could ensure that if a limited gene pool makes salmon in farms vulnerable to attack, that there are resistant strains ready to replace them. In the words of one of the Reg/Acad participants:

V2 And again I think that links into the diversification. I think we have the ability to create or at least to recognize different groups of populations to be able to make sure that they’re banked for the future. And we can’t do that without having genomic information. We need to be able to profile all the different fish out there so that we can create a nice bank for, you know, future disasters. (Res/Promo group)

If escaped salmon breed with wild salmon, this loss of natural instincts could cause natural runs to collapse.

4.8 Environmental concerns and benefits

Participants in one Random group argued that fish farming that is on land “doesn’t seem natural,” although it was suggested that land tanks are meant to avoid pollution in the ocean. On the other hand, salmon could end up harbouring a disease in this unhealthy environment where you have the possibility

of “mad salmon.” Diseases spread because the environment is not natural for the salmon and if there is no natural selection in a fish farm then the diseased salmon mix with the healthy ones. One participant drew on an analogy with caribou runs that are attacked by wolves: the healthy survive.

Participants from all groups except the NGO group suggested that salmon genomics and aquaculture might have broader environmental benefits. For instance “modification” could produce environmental benefits if fish farms could be concentrated into smaller areas or moved onto land, thereby reducing pollution. Others argued that fish farming is a more efficient way of producing food that is less wasteful than commercial fishing which involves by-catch (including both other fish and marine mammals such as dolphins). In addition, the effects of pollution from fishing boats could be avoided and fish farming allows for more control over production and less waste. Participants in the Random groups argued that salmon left for sport fishing and recreation generate much more economic value. The broader benefits noted included reducing pressure on wild stocks and freeing up more wild fish for feeding bears.

Participants identified a range of other related environmental concerns associated with genomics and aquaculture, including:

- “visual” pollution or offensive odours from fish farms when they are introduced that may reduce the value of properties or result in conflict with people who had moved into the area for aesthetic reasons;
- genetically modified material “getting out” through predators who consume salmon;
- effects of fish farm owners shooting seals, sea lions and birds that feed on farmed salmon;
- modified salmon may result in altered disease vectors; and
- the environmental effects of using fish meal from south America for salmon farms.

Potential environmental benefits from salmon genomics were also identified, including:

- using genomics to create low cost or non-animal proteins might make salmon farming more acceptable and take the pressure off wild stocks;
- applications of genomics to ensure that farmed salmon are sterile (this would address some concerns about escapement); and
- the possibility that the feedstock fishery was being used sustainably and that if it was not used for salmon, it would be used for something else.

These environmental themes identify a range of interests and issues, as well as stakeholders, which are important to analysis or discussion of the interests and issues raised by the participants.

Table 2: Issues and Interests identified in literature review and focus groups

Literature review	Focus Groups
Food security	Commercial Influence
Harms to environment	Technological Imperative
Harms to wild fish stocks	Genomics conflated with transgenics
Lost opportunities	Foreign ownership
Safety for human consumption	Impacts on culture/society
Respect for boundaries (moral and cultural)	Negative public perception and NGOs as an “industry”
	Salmon “tainted by association”
	Salmon welfare (individual & species)

A comparison of the issues and interest identified through the literature review conducted prior to the focus groups to the focus group analysis is summarised in [Table 2](#)⁸.

5 Discussion

5.1 Novel interests or issues

In mapping out an ethical framework informed by pragmatism, Keulartz and colleagues suggest that ethicists must develop methods “to handle deep-seated value conflicts if the possibilities for consensus and compromise are eliminated.” (Keulartz et al., 2004, p. 22). The focus groups support such an approach by scoping in broad terms the range of issues that would need to be addressed. These issues will inevitably require a context that supports ongoing evaluation of tension between, for example, commercial investment in research and the direction of research to serve the public interest; encouraging investment and innovation while promoting access and research that serves commercial needs.

The issues raised by the focus groups emphasize the importance of recognizing that these problems involve moral conflict that may be irresolvable. This scenario requires approaches that support ongoing dialogue about proportionate respect for difference and iterative evaluation, not forced consensus or resolution by power. Consultations seeking consensus or dialogue on specific policy questions make it difficult for participants to raise the broader issues that are part of the larger context for policy formation and implementation. For example,

⁸Recognizing the problem that a priori ethical analysis often inadequately characterizes the range of relevant interests and issues, Kaiser & Forsber (2001) use Mephram (2000)’s re-characterisation of principles of bioethics to develop an ethical matrix for improved a priori identification of the issues relevant to fisheries management (Beauchamy & Childress, 1994). The matrix does identify issues related to the interests of fishing industry, workers and communities as well as animal welfare, but it did not identify issues of commercial influence on research, the technological imperative, and effects on culture and society which were identified in the focus group analysis.

how will the evolving knowledge and uses of salmon genomics shape responsibilities related to consumer choice and their relationship to civic responsibility and the environmental commons? Will developing genomic knowledge that can improve the economic viability of salmon aquaculture and availability of salmon strengthen the responsibility to make that technology and product available, rather than to develop alternatives? Will the opportunities to meet needs for human health and survival through salmon genomics and perhaps aquaculture make it more difficult to attend to other concerns, such as environment or respect for cultural aspects? For example, the concern that the welfare and interests of First Nations and commercial fishers be considered suggests that serious attention must be paid to how these groups' interests can be understood (the involvement of particular groups is discussed below). Yet the emphasis on fair deliberation and decision-making must avoid both extremes of attributing moral primacy to the interests of these groups, or simply dismissing them as too self-interested or strategically weighted. The focus group model simply draws attention to the broad ways in which a range of groups might be affected, facilitating recognition that these interests need to be explicitly considered and fairly assessed.

5.2 Information important to a well-informed discussion

There are several types of information that are important to a well-informed analysis or dialogue about the issues and interests characterized above. Some of the information is obvious—for example, research on environmental effects and the food safety of transgenic salmon and aquaculture—but some may be less obvious, including:

- the effects of aquaculture on cultures and societies;
- the effects of genome research and transgenic applications on individual salmon and the species' welfare;
- the possible use of genomic research to benefit salmon and the environment;
- the influence of commercialization on research; and
- the effects of cultural prestige on and financial investment in NGOs on their influence and activities.

A public dialogue that respects the range of interests related to salmon genomics must present information necessary to understand and evaluate competing claims. Emphasizing the need for technical information draws attention away from the local knowledge and expertise arising from the experiences of citizens, consumers and workers. As [Bates et al. \(2005\)](#) argued, participants in public discussions of science consider whether claims made by different participants are “warranted.” Evaluating whether beliefs or claims are warranted requires public dialogue that is informed by the expertise and experience on

which different moral perspectives and interests are based. Substantive understanding of the different moral perspectives and interests held in a society must inform the definition of policy issues that can then be studied or assessed using quantitative deliberative methods.

This type of public dialogue—one that describes the range of interests that different groups see as relevant to the science—is very different from the kind of dialogue that emphasizes notions of the demographic constituency of the population through statistical representation (Burgess, 2004). A statistical exercise divides the sample into established categories. This risks forcing greater diversity of opinion into restricted choices. Focus groups encourage participants to suggest their own categories, and may even elicit or create a more diverse or deeper set of responses.⁹ Of course, once identified, it is sometimes useful to find out how frequent a perspective is in a population, although normative force in a moral discussion is not a simple matter of high frequency.

The larger range of issues and interests arising in focus groups may frustrate decision makers involved in policy analysis who would prefer a narrower framing of the issue. Many of the interests and issues raised may not be within the responsibility of the policy makers or resolvable by a policy. For example, the concern about commercial influence on research raises issues related to the source and nature of research funding, intellectual property regimes, and the effects of these policies on research. It is unlikely that any salmon genomics policy would be able to compensate for the lack of trust in the broader context. Identification of broader issues as sources of resistance is important for negotiating appropriate policy by allowing participants to focus on conclusions about policy while acknowledging the broader problems as important but not within the scope of policy (Burgess, 2004).

5.3 Participants important to an inclusive analysis and dialogue

Where there are perspectives or interests that are difficult to understand, it is inadequate to merely provide substantive descriptions and then have participants evaluate whether claims are warranted. Perspectives such as these will often require nuanced descriptions that should be presented by articulate participants who are able to ensure that their perspectives are understood.

There are several groups who are clearly important participants in policy discussions related to salmon genomics and aquaculture because they have special entitlement to the interests identified and therefore should participate in dialogue and analysis that attempt to assign relative weight to these interests. Some, such as First Nation and perhaps commercial fishers, require special approaches in order to be engaged. Other interests—such as interests in the welfare of salmon, and long-term environmental effects for future generations—inevitably require surrogates.

⁹The authors are grateful to David Castle and an anonymous reviewer for clarifying this point.

6 Conclusion

The analysis of focus groups identifies interests and issues that tend to be overlooked in policy and literature-based discussions of salmon genomics and aquaculture: the perspectives of participants are shaped by dialogue with participants with similar background knowledge leading to accounts of interests and issues that are a more inclusive starting point for ethical analysis and policy framing. Ethical assessment of the issues involved in salmon genomics, or any other area, requires consideration of the full range of interests related to the area and influenced by policy. Ethical analysis that merely facilitates narrow policy discussions legitimates neglect of these broader interests.

The focus groups that took part in this research were facilitated to raise the widest possible range of issues and interests rather than limit the discussion to ones that could be warranted. While this process may provide insight into how each group negotiates this evaluation, or specific patterns of reasoning that might be novel, when there are trade-offs between interests that must be made for a policy or other decision, focus groups do not provide either the accountability for reasonableness nor the democratic representativeness claimed by other methods (cf., Daniels & Sabin, 1997; Fishkin, 2006). As the need to establish frequencies of interests in a wider population or the legitimacy of decisions to an informed and representative group increase, the usefulness of focus groups decreases.

That said, the process of selecting the criteria for what aspects of the population should be represented in a public dialogue, and the breadth of policy and related information to be presented requires an approach to identifying the relevant range of interests and issues. Focus groups provide just this kind of knowledge based on the social construction in the groups of the participants' shared expertise and experiences.

7 Bibliography

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