

FishEthoBase Stakeholder Dialogue on Short Profiles

Feedbacks, abbreviated and thematically ordered

15 April 2017

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Note: The following summary contains all parts of feedbacks which we took down as points to look at properly and/or to be answered personally later. We do not report here the many lauding words which we appreciate of course. Almost all stakeholders participating expressed a generally positive perception of our work, regardless of how critical their feedback might be on certain issues.

General statements

- I find the content and purpose irrelevant. (farmer and consultant, DK)
- As we have only a limited understanding about the well-being of the underwater animal, I don't see why we are this over critical. (Aquac. expert, CH)
- "Dignity" and some other terms create confusion with a high potential to dilute or distract from your greater message. Explore alternative words that won't fuel judgmental reaction from a large sector that human behavior or "rights" are erroneously superimposed on animals. (CSR director of a company of the branch, ASC board, USA)
- Discrepancies between short and full profiles: the section headings (and thus some of the information) in the short profile and in the recommendations differ. This unfortunately makes both seem less authoritative than they should – and creates a situation where it is not clear which is definitive. The general remarks in the short profile need to very closely match/paraphrase the main points made in the summary and recommendations in the full profile. (Ethologist, UK)
- Certification: approach the ASC to explore ways of incorporating "measurable indicators" or referring to other animal welfare standards that the ASC standard could incor-

porate to address this issue more broadly. (CSR director of a company of the branch, ASC board, USA)

- Species-appropriate systems: Looking for a good way to grow each species, I would expect that not all species would be cultivated in the same way. A type of cage should be developed, for each species, as well as the management of the same conditions of light or shade, depth, even to have the presence of other species to reduce the stress. (Researcher, BR)
- I would also suggest that, in the case of sea-based aquaculture, these are public resources in public commons, so government also has the burden of proof. (Marine ecologist and science advisor of a fishermen NGO, USA)
- To put, in the summary, a graphical tool or a table, that would highlight the minimum and ideal condition for each point studied in the short profile. (ethologist/neuroscientist, France)
- To build an interactive graphical tool in which a user of your website could enter some data (the name of the species he wants to have in the same aquarium, the size of his aquarium, etc.) and the tool would answer him about the possibility/viability of his project.
- Some species had only a "short profile", while others had additionally "findings" and "recommendations" – why this difference? (Fish veterinary scientist, Switzerland)

Comments on website design

- Website is not appealing, confusing, not intuitive (CCMAR, PT)
- Ethologist/neuroscientist, FR:
 - put the short profile right under the summary and not in another page; it could be confusing to have to click several times to get the searched info.
 - put the "Likelihood" column on the right rather than on the left for a better readability.
 - put, in the summary, a graphical tool or a table, that would highlight the minimum and ideal condition for each point studied in the short profile.

Fish welfare

- Marine ecologist and science advisor of a fishermen NGO, USA:
Does FishEthoBase's understanding of fish welfare embrace also:
 - wild fish affected by farming? You have applied it to forage fish, so I would urge you to do it for all affected wild fish – e.g. concerning diseases spread from open water farms; pollution effluent from fish farms; interbreeding with farm escapees; degradation or occupation of breeding, feeding, or migrating habitat essential to the wellbeing of wild fish; etc.
 - Natural predators are also a concern in open aquaculture. How do the farming operations deal with predators? It most often is not humane or ecologically viable.

- Open water systems are more likely to affect wild fish populations; but closed systems are often harder on farmed fish. (Marine ecologist and science advisor of a fishermen NGO, USA)
- It is entirely possible to experience high welfare in an unnatural setting. For this reason, I'd like this question to be on our radar: Can farming conditions allow for the majority of behaviors resulting in positive effect? (Ethologist, animal welfare NGO, USA)

Farmability (index)

- Many captive species have been demonstrated to have high welfare in the absence of natural habitats. It would be beneficial to attempt to uncover which natural behaviors produce positive affect, and hence, will contribute to higher welfare. This focus will allow for higher welfare outcomes in traditional aquaculture facilities. This means that more research. In the interim, use a modified farmability index that focuses primarily on physical welfare outcomes, with requirements to utilize husbandry practices and facilities that allow for and encourage natural behaviors of positive affect. (Ethologist, animal welfare NGO, USA)
- My first impression of the short profiles for the two primary species we farm here - rainbow trout and arctic charr - is one of surprise. Our impression of the farmability of these species, from the perspective of animal welfare is that they would score high because of the careful care that is exercised when farming and preparing these fish for market. (Aquaculture specialist officer, USA)
- You could also consider in some cases that there is a potential for greater farmability. E.g. humane protocols for feeding without forage fish are possible for all species in due course and likely for some sooner, eg Tilapia. (Biologist, animal welfare NGO, UK)
- Farmability index: I was confused: does 1 mean the species is "good" or not? (Researcher, USA)
- Improvements: Some of your issues (such as escapes, disease, use of feeds with minimal fish meal, etc.) are constantly being addressed through research and have improved dramatically in recent years. (Researcher, USA)
- In the case of some species for which it seems impossible to make the farming conditions match the species needs in the wild, you are concerned but do not recommend ending the farming of that species. And you also do not seem to recommend breeding programs that would change some of those traits. Perhaps stronger recommendations for action would be desirable.
- Even on the same database, I would come up with a different farmability classification of rainbow trout than the FishEthobase – regardless whether we use each criterion at equal weight or whether we weight them. The question behind this: how much does the welfare concept used by the evaluator influence the outcome? I am not saying which concept has to be used, but I am saying it needs to be highlighted very clearly which concept is used by FishEthobase. My impression is that the evaluation of the farmability relies largely on a "nature-based" concept, i.e. a farmed animal should be allowed to express its natural behavior. But if we apply such strict rules, I wonder if there is any species that can be cultured. In my view, if we

overdo concerning welfare requirements, we will not achieve anything because then we set the standards that high that farming is basically no longer possible.
(Fish veterinary scientist, Switzerland)

- The maximum index achieved by a species is 5 (of 12 max), most species stay at 1. In other words: none of these species is really fit for farming. The consequence of this can only be: stop fish farming. Is it this what we want? Or should the outcome of the FishEthobase not be: "good candidate – but point x, y and z need more information/ need improvement" and "poor candidate – better no culture, at least at the current stage of knowledge"? (Fish veterinary scientist, Switzerland)
- There is no explanation of what is the farmability index (Marine biologist, Portugal).

Criteria definitions in general

- Definition/severity of criteria: in some criteria (e.g. home range), score=12 will probably never be reached by any species
-> FEB will not be taken seriously by industry
-> make a thought experiment with any species, calculate what must be done to reach score=12 and compare costs to possible revenues for added value. (CCMAR, PT)
- Criteria for farmability in each case need to be clearly stated. Reasoning for each classification needs to be explained. In most cases it is obvious, but transparency is important especially where judgement may be open to opinion. (Biologist, animal welfare NGO, UK)
- Some criteria could be divided up according to existing vs potential and/or according to system. For example, farmability of tilapia will be higher if kept in lower densities in ponds, higher still if extensive or if forage-free diets could easily be formulated. Potential for increasing farmability and the effect on scoring could be explained in an additional paragraph. (Biologist, animal welfare NGO, UK)
- Instead of asking "do usual farming conditions..." ask "can farming conditions...". This is an important distinction that suggests the ability of industry to change. (Ethologist, animal welfare NGO, USA)
- No background documentation on the scientific bases used for establishing the 12 criteria for ethical practices in fish farming. Some seemed to ask related questions and perform as subsets of other criteria (eg, home range, depth, and habitat). (Aquacultur scientist, USA)

Scoring issues

- Scores for unlikely and unclear should not be the same and should differ by colour (CCMAR, PT)
- it would be useful to have a definition for each grading in the farmability index, something like:
score 1 = completely unsuitable for farming
3 = farming causes severe welfare problems and is not recommended
5 = farming can cause welfare problems and must be done under strict guidance, etc. (Director of an Animal welfare NGO, UK)
- Score "unclear" separate from "unlikely" (aquaculture scientist, USA)

Wild or domesticated?

- in aquaculture we deal with selected domesticated animals; comparing the situation in aquaculture with the wild habitat is not valid from my point of view. (Aquac. expert, CH)
- Each of the species is widely cultured with significant level of research in place. They are well adapted to culture conditions and so comparison to how what a "natural" condition would be may not really have relevance. (Researcher, USA)
- Domestication level: Astonishingly high for all species - how was the level assessed? (Biologist, fair-fish, CH)

Weighing of the criteria

- It appears that all criteria are weighted equally. Certain criteria may play a much larger role in both the duration of (poor) welfare and the extent of (poor) welfare. (Scientific advisor of an animal welfare NGO, SE)
- The farmability index creates the impression that all the categories are of equal value. One could argue that some are of more concern, eg crit 8 (stress) might be seen as more important for fish welfare than crit 11 (domestication). Is there some index score that you would regard as necessary to indicate a fish is suitable for farming, or some indices that you would prioritise – i.e. the core farmability traits? (Ethologist, UK)
- Concrete proposition for weighing by 1-3 points:
1 point for criteria like reproduction, habitat elements, aggression/territoriality, migration, domestication.
2 points for: home/depth range, aggregation, malformations, etc.
3 points for: retreat options, human slaughter protocol, fish-free feed protocol, etc.
However, this proposition wants also to change the definition and the number of criteria and is therefore not applicable on the 12 existing criteria. No robust justification is given for the weighing.

(Ethologist, animal welfare NGO, USA)

- Some criteria seemed more critical than other criteria and could be more heavily weighted (eg, slaughter protocol). (Aquaculture scientist, USA)
- Question if all criteria need to be valued equally – is the home range criterion as important as the stress criterion? Personally, I think home range is an option but not a must and thus I would grade it low. In contrast, stress has adverse impacts every minute and every second, and this I would grade much higher. With such a weighing of criteria, maybe seabream would end up with a higher farmability index and tilapia with a lower one – just as an example, can be applied to all species. (Fish veterinary scientist, Switzerland)

Crit. 1: Home range

- Does it make sense to assess this for eggs? (Biologist, fair-fish, CH)
- Rather than ensuring that fish are able to migrate long distances as they would in the wild, it would be beneficial to examine the driving factors behind home range size and usage and determine if those needs can be met in captivity. Can aquaculture facilities provide the fish with the necessary habitat features? If fish are provided with those features, do outcome-based welfare measures indicate a high level of welfare? (Ethologist, animal welfare NGO, USA)
- How would you apply these criteria (and crit, 2) to truly domesticated fish that have demonstrably different requirements than their relatives in the wild? (Marine ecologist and science advisor of a fishermen NGO, USA)

Crit. 2: Depth range

- Unlikely for Rainbow trout – because adults can swim down to 20 m? The other age class don't swim that deep... (Biologist, fair-fish, CH)
- Change the question into: Can the farming conditions provide either the depth range of the species or provide fish with the necessary elements of the natural depth range? (Ethologist, animal welfare NGO, USA)
- How would you apply these criteria (and crit, 1) to truly domesticated fish that have demonstrably different requirements than their relatives in the wild? (Marine ecologist and science advisor of a fishermen NGO, USA)

Crit. 3: Migration

- Is it okay to score=unlikely if there are also stationary Rainbow trout populations? (Biologist, fair-fish, CH)
- Change to: Can the farming conditions provide either the depth range of the species or provide fish with the necessary elements of the natural depth range? (Ethologist, animal welfare NGO, USA)

Crit. 5: Aggregation

- The criterion is focused solely on the nature-based approach to welfare and should also take into account at least the physical-based approach. (Ethologist, animal welfare NGO, USA)
- Stocking density: What is the recommendation, when high AND low densities for Parr and Smolt are problematic? Should acceptable densities be defined for each age class? (Biologist, fair-fish, CH)

Crit. 6: Aggression, territoriality

- I would also consider whether aggression is increased by usual farming conditions and whether it is ethical to stimulate that behavior, which may be distressing to both the aggressor and recipient fish, even if it is just an elevation of natural behavior. (Marine ecologist and science advisor of a fishermen NGO, USA)
- Add in the following: If aggression decreases under farming conditions, are there indications of reduced welfare? (Ethologist, animal welfare NGO, USA)

Crit. 7: Substrate and shelter

- Perhaps you could somehow incorporate natural light cycles into this? Also: In mimicking natural habitat conditions, plastic substitutes are not desirable. (Marine ecologist and science advisor of a fishermen NGO, USA)
- Change to: Do the usual farming conditions match or mimic the natural substrate and shelter needs of the species? (Ethologist, animal welfare NGO, USA)

Crit. 8: Stress

- Important criterion. A comprehensive answer should include many factors so the parenthetical list should perhaps be more inclusive; e.g. appropriate density, configuration, avoidance of accumulating excrement, absence of important habitat elements, light regime, placement of feed. (Marine ecologist and science advisor of a fishermen NGO, USA)
- Frame this question as follows: Does investigation of outcome-based indicators show that fish are able to cope effectively with usual farming conditions? (Ethologist, animal welfare NGO, USA)

Crit. 9: Malformations

- Nature is much more "cruel", most larvae turn out to be the food part of the food chain, spawning thousands, only one or two organisms reach maturity. Which favors the survival of the fittest. In aquaculture, thousands survive of one spawning. I think they cannot be compared, we cultivate, select, it's a continuous process, and some species become domesticated. (Researcher, BR)
- What is your cut-off for rare? (Ethologist, animal welfare NGO, USA)
- I think you could include disease and frequency and nature of treatment for disease in this question. (Marine ecologist and science advisor of a fishermen NGO, USA)

Crit. 10: Humane slaughter protocols

- The presence of a humane protocol is sometimes described as unclear for species such as whiteleg shrimp or perch where it is not available, but unlikely for others such as trout and seabream. But RSPCA certifies humanely killed trout. Ace Aquatec manufacture in-water electric stunning equipment for stunning fish in water that they produce machines which can humanely slaughter: Sea bass, Sea bream, Tilapia, Yellowtail, Arctic charr, Salmon (coho, Atlantic, wild roe), Sea trout, and Rainbow trout. And they are developing machines for: Prawns, Pangasius, Sturgeon. They are working with Bristol University to check EEGs. Some producers are using a Norwegian Seaside Stansas semi-dry electric stunner for Sea bass and Sea bream. (Biologist, animal welfare NGO, UK)
- Humane slaughter is THE meeting point of common interest of industry and welfarists: low stress = high quality. Here we can meet your moral issues without having to understand them... (A big in Tilapia farming, USA)
- The mere presence of a humane slaughter protocol does not ensure high welfare. Amend: "... available and easily implemented?" (Ethologist, animal welfare NGO, USA)
- Stunning: Hint to look at a new publication (Feb 2017) from TIHO University Hannover on stunning methods for various species. (Tierschutzakademie DE)

Crit. 11: Domestication

- Define what you mean by the term. It should require genetic and behavioral adaptation to captivity – not just being kept in captivity for many generations. If you consider domestication a positive trait, I would think some sort of deliberate selection for farmable habits and personality would be preferred. E.g. salmon have been farmed for many generations but there has been no deliberate attempt to select for behavior, so I would hesitate to call them domesticated. I don't believe there has even been a preference for naturally landlocked fish instead of ocean going fish as brood stock for aquaculture. While it's possible that through several generations they have genetically drifted toward more placid behavior, how do you distinguish between domestication and mental depression?
- I do not understand why the domestication level of all 12 species is that high. On which basis has this been assessed? (Biologist, fair-fish, CH)

- good question. However, species who have not yet been domesticated may be able to be domesticated in a way that focuses on welfare-specific traits in conjunction with production traits. (Ethologist, animal welfare NGO, USA)
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Crit. 12: Feed without fish

- (Rainbow trout) Is the question of the criterion if fish can be replaced by plant components only? Should not all alternatives to fish components be assessed? (Biologist, fair-fish, CH)
 - Add: If no protocol available: Can fish-based feed ingredients be sourced solely from fish slaughter waste? (Ethologist, animal welfare NGO, USA)
 - Instead ask: Is the natural food lower on the food chain than forage fish and can it be cultivated sustainably? Feeding carnivores a vegetarian diet (often land-based crops) turns them into a different animal and probably compromises their health as well as quality of the product. Aquaculture should preferentially grow fish that naturally feed low on the food chain. (Marine ecologist and science advisor of a fishermen NGO, USA)
 - "Fish components are present in the feed" is a ubiquitous statement in the general remarks and criteria summaries. However, more helpful would be a presentation of the trophic level of the fish, and whether it is herbivorous. (Aquaculture scientist, USA)
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Missing criteria

- Missing: Escapes of exotic species (HCMR, GR)
- Genetic improvement of farmed stocks is missing, including the questions:
 - how far shall we go with genetical improvement?
 - what is its impact on fish welfare? (HCMR, GR)
- Add a criterion about sensory preferences of fish (visual, olfactory, taste, etc.). (researcher, RU)
- Include certifications: some companies have it so the consumer can choose products that are reared under the "best" conditions or to the highest standards. (Researcher, USA)
- Missing: disease (and disease susceptibility). As the database is focused on welfare and well-being should risk of disease or susceptibility not be considered as one of the main 12 criteria? (Aquaculture analyst, USA, currently working on aqua profiles (with a focus on management) and disease management).
- Proposition for a new criterion: Potential of farmed individuals to adapt to the wild – since there is an extensive use of farming for release to the wild. (Fishery policy officer, NGO, SE)
- As you have recognized, behavior research is badly needed. It should include the possibility of induced mental or learning disorders in farmed fish? (Marine ecologist)

and science advisor of a fishermen NGO, USA)

- Has the precautionary principle been applied in the usual design of farms? (Marine ecologist and science advisor of a fishermen NGO, USA)
- (Marine ecologist and science advisor of a fishermen NGO, USA:)
- Do the usual farming conditions
 - prevent the unhealthy accumulation of pollution conditions created by excess feed and excrement.
 - mimic natural conditions
 - avoid negative impacts on the welfare of wild fish
 - deal humanely with excess reproduction?
 - have negative impacts on mental condition of the fish –e.g. learning disabilities; retardation; depression; etc.
 - enable normal communication among individuals of the species.
- Is the aquaculture of this species customarily done on a scale that is compatible with the needs of the wildlife in the ecosystem(s) it utilizes? (Marine ecologist and science advisor of a fishermen NGO, USA)
- I know you have intentionally decided that fish density should not be a criterion, but I'm not convinced. It seems to me that in your final recommendations– e.g. for tilapia and salmon – you actually find density considerations critical, as they indeed are. (Marine ecologist and science advisor of a fishermen NGO, USA)
- A specific criterion that encompasses the welfare of non-farmed animals found in the farming environment. (Aquaculture scientist, USA)
- A criterion for pain, with references from the scientific literature? Or are all of the fish and crustaceans, which range from primitive to more evolutionarily advanced, perceived/documentated to experience the same level of pain? (Aquaculture scientist, USA)
- Evaluation of stress, data on environmental conditions, temperature, oxygen, nutritional needs, parasite loads (marine biologist, Portugal)

Sparus aurata

- crit. 4, reproduction: does not reflect reality, wrong interpretation of the available literature! Some citations are interpreted strikingly incorrectly (e.g. refer to females when the article was using only males)! (Researcher, HCMR, GR)
- This species DOES reproduce in captivity without direct manipulation! It is probably the best adapted fish in Europe (the world?) in terms of reproductive function. Of course it needs temperature and photoperiod manipulation – you cannot expect to put the fish in a 7am-7pm photoperiod all year long, and undergo reproductive maturation as in nature! (Researcher, HCMR, GR)
- I could not understand why the Seabream, one of the most cultured species in southern Europe, is classified with a lower index than *Seriola*, that only recently started to be reared in aquaculture and little is known. Besides the fact that it is a large migrating species. (Marine biologist, Portugal)

Dicentrarchus labrax

- crit. 4, reproduction: does not reflect reality, wrong interpretation of the available literature! Some citations are interpreted strikingly incorrectly (e.g. refer to females when the article was using only males)!
This species DOES reproduce in most farms, but not always reliably. Fish are very seldom stripped for commercial production (I know of only one farm in Europe!). In most farms, the fish spawn without any hormonal manipulation. Of course it needs temperature and photoperiod manipulation – you cannot expect to put the fish in a 7am-7pm photoperiod all year long, and undergo reproductive maturation as in nature! (Researcher, HCMR, GR)
- A research group in Italy on Sea bream uses physiological telemetry (EMG tags). (researcher at NGO, GR/IT)
- Suggestion to change some scores from unlikely to unclear (lack of data; aquaculture scientist, USA)

Perca fluviatilis

- Researcher and farm manager, CH:
 - Crit. 5, aggregation: Intensive conditions in tanks: 100 larvae/L, not 20-50 larvae/L,
 - Juveniles in tanks: 25-50 kg/m³, not 1.6 to 3 kg/m³. Low densities during production are detrimental to fish welfare as perch like to be in schools and this reduces aggressive behaviour.
 - Crit 6, aggression: clear cannibalistic behaviour at larval and juvenile stages
 - Crit. 8, stress: Intensive conditions try to limit stress from production and handling using adequate feeding protocols and water quality parameters as well as low light, salt...
 - Crit. 9, deformities: Disagree. This way of stocking does not reduce deformities as such. It is only because there is already a selection and fish with deformities will not survive in those conditions. In controlled conditions, survival will be a lot higher and this inevitably leads to more deformed fish surviving
 - Crit. 10: Slaughtering usually with electricity but this depends on local regulations.

Sander lucioperca

- Cannibalistic, sensitive to different light conditions... natural behavior as a pelagic and far swimming hunter in low light conditions is for sure something very far from being farmed in nets or tanks (but that is true for salmon of more or less all kinds also). (Fishery policy officer, NGO, SE)
- The base for the assessment of the 12 short-list points seems to be weak for pike perch. We are - however - neither in a position to further contribute with essential literature on these aspects. (farming expert, CH)

Salmo salar

- Marine ecologist and science advisor of a fishermen NGO, USA:
 - crit. 5, aggregation: you assessed as unclear. It is true that much of wild Atlantic salmon behavior at sea is unknown. But schooling is known to occur on feeding grounds.
 - crit. 10, slaughter: I don't know if the method described is indeed humane or if it is administered properly, so I would just raise a question-mark on that criterion.
 - crit. 11, domestication: I don't believe Atlantic salmon are truly domesticated (for reasons explained earlier) so I would call that 'unlikely.'
 - crit. 12, feed: plant-based feed sources. I believe that diet would stress the health of carnivores such as salmon and it would degrade the quality of the meat.
 - Given the farmability score, this species is not suitable for aquaculture. The industry has had plenty of time to try to make it work humanely and has not succeeded.
 - How many of the problems if any are solved by closed-system, land-based aquaculture? You've raised the possibility that fish be raised up to but not past the parr stage to avoid some of the aggressive and far ranging behaviors associated with migrations. That deserves further investigation and would be more amenable to closed system aquaculture.
 - In the summary, which is generally excellent, you mention that it isn't clear whether escaped Atlantic salmon survive in the wild. It is abundantly clear that they do. They and the offspring of their interbreeding with wild fish dominate the wild fish populations of Norway. Escaped Atlantic salmon have been found occupying and breeding in streams in British Columbia. Chile, a region that has no native salmon at all, now has runs of Atlantic salmon.

Oreochromis niloticus

- Marine ecologist and science advisor of a fishermen NGO, USA:
 - The general remarks are good. The recommendation favoring extensive farming fully based on sustainable sources is defensible and important.
 - You are on the way to providing useful guidance for feasible, and sometimes easy, modifications that would improve the welfare of this species in culture.
 - Your discussion of stocking densities and the need for fish to form small groups is particularly useful.
 - The argument for substrate is convincing and should motivate a change away from suspended pens.
- Suggestion to change some scores from unlikely to unclear (lack of data; aquaculture scientist, USA)

Farmability index 5 – surprising to me. These guys can be really aggressive, and I have seen much more stress in any tilapia system than in e.g. seabream. (Fish veterinary scientist, Switzerland)

Acipenser baerii

- Suggestion to change some scores from unlikely to unclear (lack of data; aquaculture scientist, USA)

Sturgeon: farmability index 1 – I would grade clearly higher. Of course, the fish cannot migrate – thus the “home range criterion” is not fulfilled – but it is a fish with low stress level in culture, even handling/sorting appears to impose little stress on this species. (Fish veterinary scientist, Switzerland)

Oncorhynchus masou

- Suggestion to change some scores from unlikely to unclear (lack of data; aquaculture scientist, USA)

Oncorhynchus mykiss

- Suggestion to change some scores from unlikely to unclear (lack of data; aquaculture scientist, USA)
- Fish veterinary scientist, Switzerland:
- The FishEthoBase classifies rainbow trout with a farmability index of 1, i.e. very low – although this is one of the species with a longer history of domestication.
- Crit. 1, home range: is the absolute distance really a criterion for the fish? What counts for the fish is probably movement, not the actual distance travelled
- Crit. 2, depth range: same question.
- Crit. 3, staying in a single habitat: of course, anadromous populations are not staying in a single habitat, but stationary populations do.
- Crit. 4 “natural reproduction”. Indeed, it is not a natural reproduction, but is this the criterion or whether the striping procedure is a stressful procedure to the animal?
- Crit. 5, territoriality: In rivers, rainbow trout is territorial. However, if I place them at sufficient density into a culture facility, they stop territorial behaviour. Does this change in behavior automatically implicate low welfare?
- Crit. 7, actually, here I would have given an “unlikely”, because neither shelter nor substrate preferences are fulfilled in intensive farming environments. And during summer we receive quite a number of sunburnt trout.
- Crit. 8, proneness to stress: Culture procedures like sorting and handling are stressful to rainbow trout. However, in culture such treatments are unavoidable (also to reduce intra-species aggression and thereby reduce stress). Thus, we employ short-term handling stress to reduce long-term social stress.
- Crit. Ad 9, frequency of malformations: indeed, in some cultures very high levels of malformations occur. But I also know many farms (perhaps the majority) with very low frequencies of malformations. What does it mean with respect to the classification – with regard to those farms with high levels of malformations, the answer would be “unlikely”, whereas for farms with low malformations levels, the answer would be “likely” ?
- Crit. 10, humane slaughter: disagree, for rainbow trout meanwhile quite elaborated methods are available.
- Crit. 12, forage feed: here I would even go for “unlikely”.

Litopenaeus vannamei

- Density: personal observations in ponds: schooling, the species seems behaviorally adapted for culture conditions.
Humane slaughter: common practice is rapid chilling to temperatures near 0 C.
Domestication: selective breeding has already led to observable changes in behavior (incl. calmer) and physiology, increased growth rate and disease resistance, etc. (farmer and label-scheme board member, USA)
- Suggestion to change some scores from unlikely to unclear (lack of data; aquaculture scientist, USA)

Seriola lalandi

- Amberjack: farmability index 3 – surprising. We have so little knowledge on the biology of this species that I would not dare to score it 3. (Fish veterinary scientist, Switzerland)

Further literature

- Fish ethology: check work already accomplished: www.cost.eu/COST_Actions/fa/867 (researcher at NGO, GR/IT)
- There are more references on *Oreochromis niloticus* (researcher, Bangladesh)
- I wonder if you are aware of a fairly comprehensive piece of work that was completed by the USDA- ARS focused on Fish Welfare. The work is referenced in the National Agricultural Library Cataloging Record as: Erickson, Heidi S., Information Resources on Fish Welfare: 1970-2003 (AWIC resource series; no. 20) This work contains many more references. (Aquaculture specialist officer, USA)
- Much of the literature cited does not extend to before 1990. This can cause bias in some of the criteria ratings for highly-researched v little-researched species. (Aquaculture scientist, USA)

Feedbacks gathered from the expert workshop of 18 April 2017 in Zurich

Participants:

- Andreas Graber, expert for Tilapia, Aquaponic and RAS, Switzerland
- Beat von Siebenthal, fish expert of Swiss Vet auth.
- Timo Stadtlander, organic fish farming expert, Research Institute for Organic Farming (FiBL), Switzerland
- Linda Tschirren, PhD cand on definition and operationalisation of fish welfare, Zurich Univ. of Applied Sciences (ZHAW)
- Maria Filipa Castanheira, FEB
- Joao Luis Saraiva, FEB
- Pablo Arechavala-Lopez, FEB
- Billo Heinzpeter Studer, FEB
- Susanne Hagen, co-director fair-fish Switzerland

To prepare for this workshop, the participants had received a copy of the above summary of stakeholder feedbacks.

Individuality, personality

- The farmer can do nothing with that, he cannot cope with it – he wants all fish to be the same.
- Objection to the FEB claim: If a fish can live up to its potential, it does not suffer – it's the other way round: If a fish does not suffer, it can live up to its potential.
- Make individuality one criterion among other (health, etc.).
- In consultancy, be happy if you contributed to 30% improvement (while still aiming at 100%)

Number of species

- In aquaculture, we are talking about 100s of species, quite different from terrestrial animal husbandry.

Definition/aim of FEB

- concentrating on natural behaviour = too narrow, frightens off the farmers.
- [We can make a link to biological measures of fish welfare.](#)
- Still you have to make clear first that FEB is not covering fish welfare as a whole but only the ethological criteria.
- Make clear that FEB does not act against aquaculture.
- As a farmer, I would be interested in information on which species can be farmed in a good way → make clear what FEB aims at with the short profiles and the farmability index and put it in a way that it **must** be read **first**.
- How does FEB interpret and score findings? Where can I read that as a user?
- [In addition to what we publish already on the website \(the file on our Rationale\), we could also link to our operating manual which answers in details.](#)

Wild vs. domestication

- Hatching is always a selection, you de-select traits which are important in nature.
- [By selection you narrow the gene pool, but behaviour is still there as it is also connected with environment and social group.](#)
- Gold standard should be: in the wild, the fish reacts to nature – in farming, it reacts to the farming conditions (but it is still the fish who reacts).

- Plasticity, dependent of the species.
- What is a happy fish? We have to look at the behaviour (and at its plasticity) and to the environment.
- Behaviour is linked to the environment, and this has to be taken into account by FB: which type of aquaculture?
- A lot of behaviour patterns are important for survival and reproduction in the wild, but not in farms.
- Fish in the wild does not only feed and reproduce, but live and has intrinsic needs.
- Wild = gold standard in the sense that the fishes pass their full live i a farm, so we try to minimise its effects.
- How do you define the potential of a fish, per species?
- Is domestication positive for fish welfare? or, by selection, negative?
- Behaviour is linked to many genes, thus if you select for 1, there will be other genes to have their unattended effects. The farming system is are a selector by itself; the ones that are better for welfare are better for survival and reproduction.
- Mental disease: stereotypes, stress.
- This is a very long and difficult discussion; we better omit the domestication level as a criterion.
- Selection and adaptation are normal also in nature!
- Yes, but over long periods!
- More important than the domestication level are the species' ability and plasticity.
- But there will be few literature on plasticity; we just mentioned references in our profiles if ever available.

Farmabilty index

- Far away from practice; almost mo species will ever reach the max of 12 or even at least >5. I understand the idea behind, generally a good idea, but for practitioners it's off-putting and frustrating.
- The Summaries of the short profiles (General remarks) raise some hope, but the single criteria don't. The summaries and the criteria are not well linked, there seems some information to be missing in between.
- Farmability index is the wrong term, it's rather a welfare index or something the like.
- Welfare index is also wrong, fish welfare depends of many other criteria as well.
- Etho-index?
- We could create 2 indices: one for average farming and one for improvements. Or we could follow the model of risk analysis and assess the intensity of farming, the probability of improvements and the certainty of it.

Scoring

- Better score High/Low instead of likely/unlikely. Un/likely is not the answer to formability, but High/Low.
- Make clear that Low means: give more attention to this criterion.
- Put the index at the end of a short profile, not at the beginning.
- We could score the farmability of a species separately according to the intensity of farming (extensive, semi-intensive, intensive)

Weighing of the criteria

- Some criteria should weigh more than others, and some should be more discrete.
- Criteria for survival and health should weigh more.
- Weighing according the severeness and duration of negative factors
- Weighing would differ from species to species.

Criteria

- **Crit. 1 + 2** (home and depth range): Will never be met by any species except carps, and by most terrestrial farm animals neither.
- There are species with small home range, not just carps.
- I would weigh these crit. lower than others
- **Crit. 4** (reproduction): Example of Rainbow trout farming: closed circle, spawning occurs "naturally", i.e. the fishes are only stopped when obviously ripe.
- Should be considered unter crit. 4 as well: How are parents fishes doing after stripping?
- **Crit. 12** (fish in the feed): Skip it as it is not directly linked to fish welfare.
- The welfare of the forage fish is questioned here.

FEB and stakeholders

- FEB should clarify its place in the broader picture:
 - as the agency for fish ethology and welfare
 - embedded into a context of sustainable aquaculture (ASC, FOS, Organic, etc.)
 - and helping fish farmers to improve fish welfare
- and consequently define the intersections with all these players

Missing criteria

- Manipulation of temperature and photoperiod
- Feed ingredients like e.g. hormones

Decisions taken at the end of the workshop

Criteria to omit

Unanimously we found that these 2 criteria can be taken out of the scoring:

- crit. 11: domestication level
- crit. 12: fish in the feed

Replacement of farmability index by a risk analysis model

The workshop participants agreed upon the idea that the outcome of the short profiles would improve if it yields an index that not only depicts the current state of fish welfare but also indicates the potential of further improvements. This new index, which could be called FishEthoBase, should be built of 3 dimensions:

- basic welfare of a species in fish farming today
- potential for improving the species' welfare
- probability/certainty

FEB definiton of fish welfare

Rethink the definition.

Probably there is no need of a proper definition but of a clearer statement what FEB is aiming at.

First decisions taken by the FishEthoBase team answering the stakeholders' inputs

We felt richly rewarded by the amount of suggestions. For the time being, we cannot answer to all of them at the same time. However, all issues raised will be addressed step by step.

FishEthoScore to replace farmability index

One major change kept us working for the two months after the stakeholder dialogue in order to develop and implement a risk analysis and to build the "FishEthoScore". The result is published online, for currently 20 short profiles (2 further short profiles will follow by end of June and 2 in July):
<http://fishethobase.fair-fish.net/en/ethology/>

FEB definition of fish welfare; range of criteria

Stakeholders criticised that we don't explain well enough what we understand by welfare.

Stakeholders also criticised that the short profiles do not cover **all** criteria necessary for welfare.

→ Fish welfare depends on 3 types of factors: physiological, behavioural, and mental factors. FEB focusses on behaviour, but we have to make this explicit in the beginning. In response, we refer to

→ Felicity Huntingford and Sunil Kadri (2014)¹: "Defining, assessing and promoting the welfare of farmed fish", together with

→ Catarina I M Martins et al. (2011)²: "Behavioural indicators of welfare in farmed fish" that provides a checklist for farmers what to do if they want to improve welfare.

Reducing the number of criteria to 10

The FEB team has always intended to reduce the number of criteria to the 10 most crucial ones, in order to accelerate the research process.

→ We profit by the stakeholder feedback and eliminate crit. 11 (domestication level) and crit. 12 (forage fish). However, the findings for the two criteria will remain online, as side notes without scoring.

Weighing the criteria

Stakeholders criticised that we do not weigh the criteria according to their relevance for fish welfare.

→ We decided to not introduce weighing, a) because it would be arbitrary either way, and b) because weighing would have to be established individually for each species to encompass its specific problems under farming conditions, thus making it impossible to compare the results across the species.

¹ www.oie.int/doc/ged/D13671.PDF

² link.springer.com/article/10.1007%2Fs10695-011-9518-8

The scoring of the criteria is transparent and can be traced back to the references by the user in order to make up his own evaluation.

Incongruity between full and short profile

Stakeholder criticised that full profile doesn't match the short profile.

→ Recommendations in the full profile must theoretically be a more detailed version of the dimension Potential in the short profile. In the General comment of a short profile, authors say, e.g., cages must be deep enough and link to recommendations for details. In recommendations, we will then have to say: Provide cages of at least 50 m deep, etc.

However, for most species we will not be able to publish a full profile as it needs much more work than a short profile.

18.06.2017 Billo Heinzpeter Studer