Prioritisation of knowledge-needs for sustainable aquaculture: a national and global perspective

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Aquaculture is currently the fastest expanding global animal food production sector and is a key future contributor to food security. An increase in food security will be dependent upon the development and improvement of sustainable practices. A prioritisation exercise was undertaken, focusing on the future knowledge-needs to underpin U.K. sustainable aquaculture (both domestic and imported products) using a 'task force' group of 36 'practitioners' and twelve 'research scientists' who have an active interest in sustainable aquaculture. A long list of 264 knowledge-needs related to sustainable aquaculture was developed in conjunction with the task force. The long list was further refined through a three stage process of voting and scoring, including discussions of each knowledge-need. The top 25 knowledge-needs are presented, as scored separately by 'practitioners' or 'research scientists'. There was similar agreement in priorities identified by these two groups. The priority knowledge-needs will provide guidance to structure on-going work to make science accessible to practitioners and help to prioritise future science policy needs and funding. The process of knowledge exchange, and the mechanisms by which this can be achieved, effectively emerged as the top priority for sustainable aquaculture. Viable alternatives to wild fish-based aquaculture feeds, resource constraints that will potentially limit expansion of aquaculture, sustainable offshore aquaculture and the treatment of sea lice also emerged as strong priorities. Although the exercise was focused on U.K. needs for sustainable aquaculture many of the emergent issues are considered to have global application.

Top 25 priority knowledge-needs to facilitate the expansion of Sustainable Aquaculture

1. Mechanisms for knowledge exchange, to communicate and interpret current scientific knowledge to the practitioner audience.
2. What are the alternative sources of protein and oil for use in aquaculture feeds that are sustainable, technically and economically feasible and nutritionally suitable for the cultured livestock, and that also meet consumer nutritional needs and acceptability?
3. How does resource availability (fishmeal, water, space and others) constrain the potential of aquaculture to meet the increasing demand for seafood?
4. Development of technology to enable safe, sustainable and economically feasible offshore aquaculture

5. What technologies can be developed to increase the range and flexibility of available treatments and integrated management techniques to control sea lice infections on marine-farmed fish?
6. Identify and develop solutions for the constraints (biological, economic, legislative and environmental) hampering expansion of the U.K. shellfish industry
7. What are the environmental and socioeconomic effects that might occur with expansion of aquaculture in the offshore environment?
8. How can different aquaculture technologies enhance ecosystem services and increase the carrying capacity of fisheries?
9. What is the feasibility of co-locating aquaculture and renewable energy installations in U.K. waters and what are the implications of doing so?
10. What are the impediments and opportunities in developing integrated multi-trophic aquaculture?
11. How can depuration be enhanced through acceptable novel methods to reduce or eliminate viral contaminants from shellfish?
12. What new feed additives and micro-nutrients can be developed or used to improve or complement uptake and utilisation of bulk nutrients in aquaculture feeds?
13. How can we rapidly distinguish between disease-causing and non-pathogenic forms of norovirus?
14. How can we simplify and speed-up the consenting regime and regulatory process in the U.K.?
15. How do imported and locally produced aquaculture products in the U.K. compare, with regard to food security in producing countries and at home?
16. Globally, which elements of best practice in pest management and biosecurity from advanced aquaculture systems can be applied in emerging aquaculture systems?
17. What socio-economic and coastal infrastructure benefits and synergies can be identified and encouraged, to enhance local co-operation and co-existence of aquaculture and capture fishery interests?
18. How can we ensure consumer confidence in the integrity of the aquaculture supply chain by mapping risks, identifying mitigation actions, and what is the role of certification in this process?
19. What are the environmental drivers that cause harmful algal blooms and can they be predicted?
20. What environmental impacts might result from an expansion of aquaculture in the freshwater environment and what precautions can be taken to mitigate for these impacts?
21. What are the nature and extent of ecosystem services provided by shellfish cultivation?
22. Undertake a systematic review of the impact of aquaculture on wild Atlantic salmon
23. How can amoebic gill disease of salmonids be avoided, prevented or effectively treated at sustainable economic cost in the U.K.?
24. What are the consumer and technical barriers to aquaculture using genetically modified inputs and livestock?
25. What is the mechanism whereby long-chain, essential fatty acids and other micronutrients are more readily absorbed by humans through the consumption of fish, shellfish and algae products rather than neutraceutical (oil capsule) products, and how does the efficiency of uptake vary between different farmed species?