# Science-industry partnerships: The value of cooperative research in fisheries and marine management

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# Theme session L

## Science-industry partnerships: The value of cooperative research in fisheries and marine management

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**Background and objectives of the theme session**

The arena of fisheries and ocean management is becoming ever more complex with the inclusion of broader objectives, more stringent legislative targets and increased competition for marine space. Under these circumstances, the amalgamation of the fishers's experiential knowledge of marine ecosystems and the knowledge scientists have gained by data analysis and experimentation makes collaboration between fishing industry and science partners particularly valuable. Alliances are forming between agency, industry and management experts to improve the efficiency and utility of data collection, to jointly frame research hypotheses and to carry out pilot implementation trials.

Such industry-science partnerships (ISP) are expected to be useful in a number of management issues involving fisheries, and in particular issues linked to (i) achieving reductions in discard levels and/or environmental affects of fishing operations, (ii) improving the accuracy of stock and ecosystem assessments, and (iii) identifying critical areas and habitats for Marine Spatial Planning. In all cases, fishers and scientists have different types of knowledge and at different scales, and much can be gained by bringing these together.

This session aimed to provide a broad overview on the challenges and added value of these many Fisheries-Science Partnerships and solicited submission of papers on the following topics:

- Recent case study experiences in co-operative research addressing:
- Mitigation of discards and benthic affects of fisheries;
- Enhancements to stock and ecosystem assessments;
- Identification of species-specific habitat preferences;
- Characterization of benthic and pelagic habitats;
- Overarching relationships between ecological, economic and regulatory drivers of change;
- Resolution of multiple-use conflicts in spatial planning.
- Methodologies regarding pilot trial design, extent, control and standardization.
- Design issues which can inform improved scientific and policy relevant outputs from future trials.
- Conditions and structures which incentivise industry innovation and participation e.g. Are the most creative solutions found when the stakes become critically high? Do industry attitudes towards the policy influence their desire to participate?
- Challenges to cooperative research, and how these have been addressed.

- Can input from experts in other areas, such as change management or behavioural economics, improve the design of and output from co-operative research?
- Options for wider use of commercial surveys for ecosystem observation and monitoring.
- Emerging needs for cooperative research.

**Scientific contributions**

The session comprised 31 oral presentations and 11 posters, spanning a comprehensive and interdisciplinary spectrum of cooperative research that was highly responsive to the call for papers.

The presentations were grouped in a number of thematic sessions, presented in the following order : Generic reviews of ISP across Europe and North America (L10, L:11), that set the stage and brought some central questions and issues; ISP for better knowledge and management of single species (L:01, L:02,L:27, L:12, L:26,L:15), that focused on case experiences in how partnerships helped collect new biological knowledge, often for the species without a formal analytical assessment; ISP for ecosystem-based fisheries management (L:07, L:04, L:06, L:13, L:17, L:23; Posters L:35, L:38, L:39, L:40,L:32), with a focus on bycatch mitigation for PET species, Marine Spatial Planning and survival; Fisheries management and participatory modelling (L:20, L:09, L:05, L:03) showing experiences of including fishers's knowledge and views in bioeconomic management models; Mixed fisheries and the landings obligation (L:24, L:25, L:28, L:16, L:14, L:21; Posters L:34,L:37,L:41, L:33, L:36,L:42), with a broad focus on the issues of choke species and optimal use of the quota portfolio across several species; Social and institutional considerations (L:30, L:19, L:18, L:31, L:29), reflecting on some mechanizms that can affect whether ISP might end up with positive or negative outcomes.

Given the large number of abstracts received and accepted for this session, and the nature of the session's topic, at the interface between science and society, the session was structured to encourage open discussion and exploration of central issues among audience members and presenters. The session was broken into suites of two to five presentations of 10 minutes that were not provided with individual question and answer periods. Each group of talks in the theme was followed by a 10 minute open question/answer and discussion period. Some guidelines and specific questions had also been formulated by the conveners ahead of the session, requesting authors to highlight the most salient points of their work, including e.g. : How and to what degree was the research co-operative? How were scientific protocols integrated with industry operations and constraints? What were the positive/negative outcomes for industry or science from this research? Which factors incentivized participation? What are the opportunities for follow-up actions based on the research?

It is the conveners' opinion that all selected presentations and posters have been of high quality, presenting interesting and innovative cases of ISP in a lively way, and providing insights and what might work well and why. Among those, a number of presentations have been particularly useful in bringing original or highly generic viewpoints. The presentation by Mackinson and Holm (Experiments in the heart of the transition zone: Practice, pitfalls and potential L:11) summarized 13 Case Studies (CS) from the GAP projects, that have developed in different settings across Europe all with clear commitment to collaboration in search of best practices. The GAP approach was built in response to the acknowledged underperformance of management regimes that excluded industry based knowledge. GAP projects were built around the idea that

collaboration between industry, academia and civil society is vital to developing truly effective, good governance of our natural resources. A number of best practices were highlighted including the need for effective communication with all partners through the development of a 'common language' that avoids alienating formal language. Reilly et al. (Reflections on a stakeholder-centred approach to fisheries management, L:30) described an approach for the assessment of freshwater fish in the Great Lakes of the US, that is actively engaging stakeholders and fisheries managers in formal management strategies evaluations and structured decision-making. The approach has increased understanding of issues and information and built trust in the analytical process involved in stock assessment, and created transparency in management practices. O' Keefe et al. (Collaborative approaches to optimize harvest within bycatch constraints in the New England multispecies fishery, L:24) discussed collaborative work in New England USA to identify a suite of bycatch reduction techniques, including real time communication systems for hot spot avoidance, risk- pooling of quotas, voluntary rolling closures, and gear modifications, that can be applied holistically to optimize harvest of healthy targeted stocks, while minimizing bycatch of a groundfish. However the condition of groundfish stocks and/or management of them within the region has made it exceptionally difficult for the industry to remain economically viable within the context of regulatory constraints. O'Keefe highlighted the need to confront such difficult and seemingly intractable problems with the industry, fisheries managers as well as a diversity of experts in social sciences, economics and other fields (e.g. change management) traditionally not included in fisheries science and management; she highlighted also that sometimes when no viable solutions are at hand within the current management frame, then options for a different approach to management should be investigated. Grey (How the sausage is made: When science-industry partnerships lead to decreased trust of scientific assessment L:31) described results of a survey of fishers and scientists evaluating the effects of different levels of collaboration on trust of fisheries resource assessment science. Surprisingly, it was found out that among fishers trust increased with the level of collaboration except at the highest level (i.e. co-created projects) where the level of trust declined. Among fisheries scientists the high levels of trust in fisheries resource assessment science did not vary with the level of collaboration. Grey suggested that decreasing trust among fishers exposed to the "sausage making" of science, including dealing with uncertainty and the socio-cultural aspects of science that are messy or subjective may negatively influence trust in the quality of resource assessments. Finally, Pastoors et al. poster (Industry science: unlocking the real potential of industry data, curiosity and knowledge L:42) highlighted the benefits of being a scientific researcher working with a fishing industry organization. These included access to the wealth of knowledge, data and curiosity in the fishing industry that would be very difficult to achieve from a position outside the industry. The industry research positions avoid the one-sided collaboration and extractive use of industry information that often occurs in partnerships involving academic and government scientists, but it can also present dilemmas for fisheries scientists.

**Discussion and debate**

The session was very well attended throughout the 2 days period. While bulk of presenters and audience members were fisheries and social scientists, one industry partner was a co-presenter, an industry scientist contributed a poster, and several fishing industry experts (~6) were active and vocal participants in discussions throughout the session. The diversity of expertise and interests represented in the session contributed to lively debate and was important to the success of the session. In

addition to the several 10 minutes discussion periods at the end of each suite of talks, a 1.5 hour discussion period followed the final theme session. Providing 200 minutes of time for open question/answer and discussion throughout the session allowed the most important issues to percolate to the surface for discussion. As a result the audience appeared to be quite engaged in an exploration of broader issues related to the nature of collaborations, incentives for participation for both science and industry partners, issues of trust and communication and exploration of "best" practices and those that may "not be so good".

During the final debate, audience members were encouraged to form small groups, to discuss key issues arising from the theme session and then to report back briefly on their thoughts. This kicked off a lively debate which covered many of the key issues raised by the conveners in the original theme description.

Questions and subsequent discussion raised from the floor included:

- We know already that trust and communication are key issues – the critical issue is how do we move forward on these? Answers to this question covered the importance of people and relationships, also an Australian perspective on this emphasized that the cultural asymmetry between scientists and fishers can be overcome by putting responsibility on fishers to push research forward. The value of cost-recovery model as in Australia vs. publicly financed science as in Europe was discussed.
- The degree of collaboration can be dependent on sophistication of industry, which can be a challenge for small-scale and less educated segments of the industry.
- The importance of the teaching of interdisciplinary skills to students as part of their training was stressed
- The science is not neutral but is part of the system, so transparency is needed on the scientific choices and decisions, also within ICES. It was noted that the length of this session on ISP is a sign of progress within ICES, and should be built-upon in future
- For fishers, attending meetings requires some time away from them earning their livelihood at sea, and this is therefore often motivated by whether they see a direct or indirect benefit of involvement, mainly about management outcomes. Incentives to the industry for being involved in cooperative research often appear to be negative in the sense that industry partners usually engage to avoid "another management disaster". Only few ISP highlighted incentives to scientists and fishers for participating in collaborative research beyond the socio-political benefits.
- Managers must be involved in ISP and also attention must be given to who is framing the questions. Industry involvement is needed at the earliest stage.
- The issue of ISP is often being required by funders rather than initially desired by scientists. Increasingly, research cannot be funded if it doesn't involved stakeholders involvement. This should be recognized and the actual time, skills and availability of scientists to engage in communication, feedbacks and dissemination, especially around the end of the project, should be planned upfront and budgeted for.
- An important and recurrent issue is when there are large disparity between the outcomes of the fisheries assessment and management system on the

one hand, and the perceptions of fishers on the other hand regarding trends in the population sizes in the ecosystem. These divergences can produce negative ecological as well as economic consequences. The industry needs to be engaged in the process at the fundamental levels of assessment surveys and assessment science. The industry needs to take ownership in the assessment and management process.

- Cooperative research including industry engagement in all phases of the science process needs to be institutionalized as the method of applied research supporting ecosystem based fisheries management. Institutionalizing the approach as a standard operating procedure will lead to better science and continually bring partners back to the table even when the results do not produce win-win outcomes.

**Conclusions**

Cooperative research, within the context of fisheries science and management, is an increasingly broad concept, ranging from fishers providing scientists with data or access, thereby "cooperating," to fully collaborative, participatory models in which fisheries stakeholders, scientists, and managers collaboratively frame research questions and prioritize research that informs the management process. The complexity of fisheries management challenges within the broader marine ecosystem is increasing rapidly, as managers are required to consider ecosystem effects of fishing, competing uses of marine resources, statutory requirements to reduce or eliminate discards, and the implications of climate change. As the complexity of these in the marine environment increases, the need for interdisciplinary, collaborative solutions to these challenges has never been greater, and points to an important future focal point for ICES.

The session yielded numerous recommendations for best practices, with consistent emphases on the importance of effective communication strategies, relationship building between researchers and industry, effective engagement of industry at all stages of research, and the importance of understanding incentives to participation in the vernacular of each fishery. Incentives are complex and can range from compensatory incentives (e.g. direct compensation, additional quota, etc.) to indirect benefits such as those that may derive from improving the quality of a stock assessment. Impediments to successful cooperative research should be considered before projects are developed and funded (e.g. the "premortem analysis", L:29), to ensure that investigators have effectively anticipated impediments to success in the design and implementation of the research plan. Finally, in order to ensure that cooperative research is effectively integrated into the management process, managers, industry, and researchers should all be engaged in the prioritization of research and the long-lasting financing of ISP beyond the usually short lifetime of projects.