

Report of the International Pulse Dialogue Meeting

Scheveningen, The Netherlands, 2 July 2015

The dialogue meeting is organised by the Dutch Ministry of Economic Affairs. Fisheries Director Marieke Mossink welcomes the participants. The Netherlands has been working on the pulse fishery as an alternative to the traditional beam-trawl fishery for some years. The ministry has realised that so far the information flow has not been high on the agenda. In view of the concerns raised by a wide number of stakeholders on the developments of pulse fisheries, it is seen as essential to be transparent about the innovation process. This meeting is intended as a fresh start in this respect.

The key objective of the meeting is to share information on the current state of knowledge on the flatfish pulse, and to engage in a dialogue on the research agenda for the future with a wide range of international stakeholders. Michel Kaiser of the University of Bangor is the chairperson of the meeting during the day. Some 60 stakeholders are present: representing fishermen from the Netherlands, United Kingdom, Germany and France; national and international NGOs; European Parliament; governments from the Netherlands, Germany and France; as well as scientists from the Netherlands, Belgium, France and Germany; and members of the assessment team for the Marine Stewardship Council (MSC) pulse process.

Setting the scene

The meeting starts with three presentations providing the context for the discussion. All presentations can be downloaded from www.pulsefishing.eu.

Nathalie Steins of the Dutch applied marine research institute IMARES gives an overview of the history of the development of the pulse trawl. She emphasises that the process so far has been driven by a strong technological push aside from the economic and ecological drivers. However, technological developments are always strongly related with societal processes. The understanding for the need to engage with stakeholders and to be transparent about the impacts, the concerns and how these are or should be addressed has grown during the process. This meeting is an opportunity to discuss some of the dilemmas and uncertainties around gear innovation.

Mike Turenhout of the Dutch Institute for Agricultural Economics gives a background to the economics of the Dutch fishing fleet and in particular the beam-trawl fleet. The introduction of the pulse trawl has significantly improved the economic performance of this fleet.

Following his presentation, Mike clarifies that calculations on CO2 emissions related to fuel reduction in the pulse fishery have not yet been done.

Bart Verschueren of the Belgian research institute ILVO describes the technology behind the flatfish and shrimp pulse gears and shows some of the results related to reduced by-catch of fish and benthos in the shrimp pulse gear and some future applications of the pulse technique to reduce fishing impacts.

This presentation results in a number of questions.

Following questions by the fishing industry Bart explains that for shrimp the same towing speed is used with pulse in comparison with conventional shrimp trawls, which means that there is no difference in swept area. For flatfish the pulse trawl has a lower towing speed (around 5 knots vs. 6.5 knots) and hence the swept area is smaller. It is possible to calculate the differences in swept area (the area covered by the gear) between the gears. This is done by comparing outcomes of multiplying gear width with towing speed and the duration of towing on the seabed.

He also clarifies that in the video in his presentation, the pulse that is used for experiments on the response of fish and shrimp is the same as the one used on the vessels. The pulse is indeed the same as on board. The only difference is that in the lab the stainless steel electrodes are plate shaped to create a homogenous electrical field, while the field at sea using cable like electrodes is heterogeneous. The response of the sole is, however, the same for the same field strength.

The basic goal in the shrimp pulse fishery is to reduce unwanted by-catch by raising the footrope, thus creating an escape opening for non-target species. Stimulated shrimp jump up from the seafloor and enter the net above the footrope. In response to a question from the scientific community, Bart explains that this is also the reason why you get less smaller shrimp in the catch, because their response is less pronounced. He also gives some further information on exposure rates of shrimp. At sea, the shrimp are only exposed for 1 second. If longer exposures in the lab are conducted, then the shrimp may become exhausted. This exhaustion may lead to mortality. Experiments on flatfish showed no effects of repeated exposure.

Bart confirms the statement of one of the participating scientists that the electrical field is affected by the salinity of the water. It is all about electrical resistance; the more salty, the more the current will flow from one electrode to the other and the more vivid the response of an animal in the field will be. Fishermen will look for the optimal amplitude to get the best catch, which is not necessary the maximum power output of the equipment.

On request from a scientist, Harmen Klein Wolthuis, a manufacturer of pulse gears, explains that in a twinrig net the pulse generating electronics will be put into floats attached to the head rope. The electrodes will run down from the floats towards the foot rope. Since the electrodes are around seven meter (four meter per runner, three meter electrode) the foot rope will follow the head rope seven meter after. The electrodes will run in towing direction.

Representatives from NGOs and the fishing industry are raising questions on the effect of the pulse on marine animals. These questions are addressed in the presentation by Adriaan Rijnsdorp later during the meeting.

Current state of knowledge and research agenda

Adriaan Rijnsdorp of IMARES presents an overview of the current state of knowledge on the impact of the pulse gear on the marine ecosystem. In summary, the pulse fishery has (in comparison with traditional beam trawl gear): (i) higher selectivity for sole; (ii) lower catch efficiency for undersized fish; (iii) lower catch efficiency for benthos; and (iv) lower penetration depth. The fishery has also resulted in a change in spatial distribution (v); and occurrence of injuries in cod and whiting (bone fractures, haemorrhages)(vi) have been studied.

As part of the presentation Adriaan introduces a proposed multi-annual integrated research programme. This programme comprises of three PhD studies on the effects of the pulse on the marine organisms, on the benthic ecosystem and the upscaling of the effects to fleet and ecosystem level. The programme also foresees a comparative study of the effect of pulse trawling and beam trawling on the seabed and benthic ecosystem structure and functioning. The proposed programme has been developed following an analysis of concerns felt by stakeholders on the pulse trawl and consultations of amongst others the North Sea Advisory Committee.

The presentation of Adriaan is also available on www.pulsefishing.eu.

Following Adriaan his presentation a series of questions and comments are raised.

Adriaan confirms to a representative of the German fisheries that the two aspects that came up in the North Sea Advisory Council (NSAC) discussion - structure and function of benthic ecosystem and effects on bacteria and biochemistry of this system - will be part of the PHD programme. Samples of whole seabed will be taken and exposed to pulse from which biochemical fluxes can be measured.

The fishing industry poses questions on the consequences of N2000 in EU water for the status of the pulse gear as a new plan or project. How should an impact assessment be carried out? Is the proposed research programme sufficient to address these more formal issues? Adriaan answers that the role of science is to develop a knowledge base that society can use for decision-making. Kees Verboeg of the Dutch Ministry of Economic Affairs suggests that the discussion on this issue at European level should be intensified as at present there is no formal way to support decisions on how new gears can be implemented. A representative from the Dutch fishing industry adds that under Dutch N2000 law any new fishery/fishing gear is seen as a new plan or project. The consequence is that the pulse gear should be evaluated as any other gear (as a plan or project).

Following a question from a member of European Parliament, Adriaan gives further clarification on the cod experiments. Scientists from IMARES and ILVO tested a whole range of different pulse characteristics including the settings used in the commercial fishery. From this it is possible to make a prediction on the probability that a cod will break its spine at a certain pulse setting. So if the pulse settings change you can directly predict if it is going in the right or wrong direction. As the electrical field at sea is heterogeneous, the place and orientation of the fish in the field determines the level of injury.

In addition to this answer, Bob van Marlen, gear technologist at IMARES, says that in the North Sea fisheries the Dutch part of the cod catches is less than 5%. [In the catch comparison of 2011¹](#), it was found that some 10% of cod are affected. This means that only some 0.5% of the North Sea cod catches will be affected if all flatfish beam trawls are replaced by pulse trawls. We also used the Piet et al. 2009 model to appraise the effect on landings and discards of five major fish species, showing substantial potential reductions in discards in this case. Although spinal injuries in cod do not look very nice, a trade-off has to be made between accepting this negative effect vs. a potential substantial reduction in unwanted bycatch of at least 10-20% overall. Furthermore, the negative effect on cod only happens in the working area of the gear, which means that the far majority of the affected cod is actually cod, making this an economic and moral issue, instead of an environmental. In response to this remark, a few stakeholders point out that the problem is that this spinal damage is highlighted by adversaries and therefore it is an issue.

Adriaan confirms in response to a statement from an NGO that our knowledge base of the *broader* effects of pulse fishing are still in its infancy. We are not able to answer these broader questions yet.

Coastal fishermen in the UK understand the potential advantages. An NGO from the United Kingdom states that the coastal fishermen are seeing adverse effects of the pulse fishery and continues by saying

¹ <http://www.pulsefishing.eu/en/research-articles/catch-comparison-pulse-trawls-vessels-and-tickler-chain-beam-trawler/summary>

that the development is driven by economics. They are of the opinion that the effort has increased with limited research being done. Coastal fishermen are picking up fish with broken bones and burns. They also see a concentration of effort in the soft grounds in the SW North Sea that weren't fished previously and catches are significant. When effort is so concentrated in a spawning area, it can have huge effects. Adriaan emphasises that the experiments with dab have been done in response to these concerns about dead fish, burns and blisters. With respect to the changes in effort distribution Adriaan points out that if a fishery moves to other areas this may lead to competitive interactions between fleets. This is not unique to pulse fishing and has happened in other fisheries as well. This forms part of the natural process of fisheries. The fishing industry representative is well aware of this but the concern is not the economic competition, but the fact the pulse was used on a pre-spawning stock.

Following this discussion, a question is raised by the fishing industry on how the level knowledge on the pulse trawl relates to the level of knowledge for other fisheries. Adriaan answers that the level of research on the pulse is not in line with all the concerns that were raised in the debate during this day. But if we consider other fisheries such as Scottish seining that is also evolving as an innovation or twin trawling on Nephrops, there is hardly any knowledge on that gear. For a new gear, the level of knowledge on pulse trawl is high, but the demand for information is higher. When there is a societal debate, you get challenged which can result in research. Kees Verbogt adds that there is a need to make a distinction between research questions and management questions. Extra research does not automatically bring the solution, you may need management measures.

In relation to the field experiments, an NGO representative asks how science can make sure that there are appropriate reference sites. Adriaan stresses that scientists are not in control of this. Scientists can only give the parameters needed to carry out studies. If the government creates these N2000/MFSD protected areas and the legal basis allows them to carry out experiments, then these would be ideal areas. If this does not happen, we need to find other reference areas and the industry has to cooperate in closing reference areas from fishing activities.

Adriaan confirms following a question from an NGO that research on the reduction of discards/gear selectivity is part of the research and will be included in the integrated modelling of PhD3.

Pulse fishery demonstration

Following the morning programme, the whole group proceeds on a short demonstration pulse fishing trip on board of OD1.

Future research and dialogue

Kees Verbogt of the Ministry of Economic Affairs introduces the afternoon programme. He re-emphasises that the Dutch government has catching up to do when it concerns the information flow and transparency on pulse developments. This should be an on-going process and is seen as important. As part of the research programme, the Dutch government will establish a Scientific Advisory Board and organise an annual progress meeting like this to monitor the developments. Mike Kaiser suggests to also include someone from the social side in the peer-review board to monitor societal developments on perceptions in relation to the pulse fishery.

An NGO representative points out that it is essential to know what drives the research programme. It is important for the discussion to decide on topics that are 'nice to know' and 'must have'. Is it licenses, is it a legal obligation? Kees Verbogt answers that there is no clear process on how to introduce new gear in the EU. There is a gap now in what we already know and what people want to know. If this method of fishery is to be introduced for the long term you have to do impact research. But there are limitations to resources and this is why we need to prioritise. Therefore the Dutch government seeks the opinions of the participants. There is no clear cut "if we do this, then this happens".

Mike Kaiser adds that the fishery is prohibited now. Without the evidence that the technique has less adverse effects than the conventional beam trawl it is unlikely that the Commission lifts the ban. There are two outcomes, pulse trawling becomes accepted or it does not. It is not by default that the gear will be allowed if you do research. It depends on the outcomes of the research and the consideration of these outcomes.

A representative from the Dutch fishing industry asks how we should distinguish between the scientific part and the social part. It is important to know the real reasons behind the concerns people raise. Sometimes people raise concerns while their only real concern is for example that they are against more brown shrimp production, i.e. they use a call for research as a pretext. He feels that as part of the research agenda social science should be included to make these real concerns visible. Kees Verbogt follows on and says that it is also about keeping the dialogue alive. We did not do that enough in past years and want to do this more. Mike Kaiser suggests that an impact analysis of management consequences is important.

A representative of the German fishing industry states that the experience in Germany is that once you enter the field of formal impact assessments under N2000, a lot of expensive research ends up in court. It does not matter whether or not a scientist feels something is relevant. The suggestion is made by the fishing industry to use experiences from specific court cases to prevent a situation where you carry out research and then at the end find out that some questions have not been addressed.

A question is raised on monitoring and control of pulse fishery by an NGO. Is there a chance the fishery can become more effective or is there technology creep? Bob van Marlen explains that a set of rules and procedures was developed with the participation of scientists, pulse fishing gear producers, policy makers, inspection services, fishermen organisations, and practising fishermen. There are two ongoing projects on flatfish and shrimp control and enforcement to test these procedures and see if they are working in practice. The Dutch fishing industry add that in the meantime the fishermen's organisations have implemented a monitoring and control plan on their own initiative. A representative from the Dutch inspectorate informs the participants that the legislative framework is currently being reviewed. Some aspects still have to be changed and then after the summer the enforcement of the allowed gear specifications will start.

One of the NGOs asks if it is possible to see where the fleet is fishing, as it is their understanding that it is currently not possible to distinguish between a traditional beam trawl and a pulse trawl. The Dutch fishing industry representative answers that the official logbook codes do indeed not allow the distinction but that it is possible to map the distribution of the fleet. The pulse licenses are manually included in the VMS database IMARES has at their disposal, and data for pulse trawling can be extracted from the database using vessel IDs. Adriaan confirms this statement.

The pulse frequency used on board of the vessel (OD1) that gave the demonstration was 60Hz. One of the scientists asks whether such a high frequency is necessary. Manufacturer Harm Klein Woolthuis explains that for shrimp fishing ILVO used a frequency of 5Hz; for flatfish 60Hz works well. A range from 35-100Hz was tried, and it was found that 60Hz is the best for optimal catches. For commercial application one should avoid to lose money. Maybe fishing at lower frequencies should be part of the research; it is not exactly clear what happens. Adriaan refers to his slide that showed that the probability of injuries decreases at higher frequencies.

One of the scientists asks if it is possible to observe under water how the fish are responding to the pulse. Bob van Marlen answers that this is very difficult, as the sediment stirred up by electrodes and the footrope hampers visibility.

Following the Q&A session, Mike Kaiser invites the participants to give feedback on the proposed research programme presented by Adriaan Rijnsdorp. The research programme is ambitious and costly and choices may have to be made on which components can be carried out. Each participant was asked to write down on sticky notes which research they considered important to be carried out. In addition they were asked to distinguish between research that is *essential* and research that is *nice to have*. The table below shows the input from the participants and whether or not their knowledge question is included in the proposed research agenda. The whole analysis of the sticky notes is included on page five of this report.

Table 1: the coverage of the sticky notes by ongoing or planned research projects

	Yes	No	Partly/perhaps	Not a research question
Essential	42	19	3	8
Nice to have	8	13	1	9
Total	50	32	4	17

Closure

Mike Kaiser concludes that the participation of today exceeded expectations. There has been good interaction and detailed commentary. Some comments are already being addressed by the research programme, some are not. It seems though as if the research proposal addresses the majority of the concerns, with the comments from the floor providing much greater refinements. Together with the inventory of Must Haves and Nice To Knows, the dialogue meeting will contribute to the finalisation of the research agenda. Mike notes that the issue of animal welfare is not being addressed as core part of the future programme, but is probably going to sit in the background. The Ministry of Economic Affairs has already announced that they seek to continue an annual dialogue meeting for the duration of the research programme.

Hans Hoogeveen, Director-General of the Ministry of Economic Affairs, closes the meeting. He underlines that to maintain sustainable fisheries in the EU, innovations are needed and that these are not limited to pulse fisheries. For the Dutch government it is important to be transparent about the innovation process. The government values research and wishes to interact continuously with stakeholders in the future. Getting a good picture on the pros and cons of the pulse fishery is considered as a very important input for taking management decisions. He thanks the chair, the presenters and participants for their contributions today and invites them for closing drinks.

Analysis sticky notes International Pulse Dialogue Meeting

By Brita Trapman and Adriaan Rijnsdorp

Introduction

The participants of the International Pulse Dialogue Meeting on 2 July 2015 were asked to write down on sticky notes which research they considered important to be carried out. In addition they were asked to distinguish between research that is *essential* and research that is *nice to have*. This resulted in 72 sticky notes with essential questions and 31 with nice to have-questions. Around half of the sticky notes the background of the writer was noted down. Table 2 demonstrates these backgrounds. This analysis summarizes the content of the questions and statements made by the participants and to what extent they are covered in research projects that are planned or already ongoing by IMARES. The detailed information of the sticky notes are described in annex 1 of this report.

Table 2: background of participants on sticky notes

Background	Essential	Nice to have	Total
industry	9	4	13
industry (producer organization)	2		2
NGO	3	1	4
research	13	4	17
government	7	6	13
government/ conservation	3	1	4
unknown	35	15	50
Total	72	31	103

Disciplinary fields

The sticky notes were first analysed by grouping them in a disciplinary field of research (ecology, economy, fisheries behaviour, technology and governance). The essential note '*Research on benthic ecosystem impacts, including cumulative effects*' was for instance grouped in the ecology domain. Some research requests covered more than one domain. For instance '*relation between effects and pulse settings*', also considered essential, was grouped in both the ecology domain and the technology domain. One group of sticky notes contained messages that did not state a research request but rather a statement about the process or about what needed to happen. For instance '*transparent communication on where the ministry wants to go with the shrimp pulse*' (essential) or '*build links with other states on electro fishing*' (nice to have). These notes were grouped in the domain 'other'. Two sticky notes were very general and therefore grouped in the domain 'multiple'. Table 3 demonstrates the number of times a sticky notes was assigned to a certain domain. The totals are higher than the number of sticky notes because some sticky notes could be assigned to more than one domain. This shows that in the Essential- as well as in the Nice to have category, ecological questions were most prominent. Followed by statements in the *other* domain and governance. The content of the sticky notes will now be discussed.

Table 3: the number of sticky notes per domain

Discipline	Essential	Nice to have
ecology	33	9
economy	5	3
fisheries behaviour	5	2
governance	18	7
technology	8	2
multiple	2	
other	9	11
total	80	34

Ecology

In the various disciplinary domains several topics could be identified. Most essential ecology questions considered the impact of the pulse on the whole ecosystem (and not only on commercial species) and the impact on benthos and fish. Seven times it was particularly mentioned to take into account the long term effect or repetitive exposure. While most notes were short, some contained instructions about how to conduct the research, e.g.: '*immediate post trawl collection of all organisms that came into contact*

with the gear with subsequent investigations'. Three questions were about the effect of pulse on elasmobranchs, two about the effect on the reproductive potential of target species and one about the effect on cod, and one (essential and one nice to have) about the varying effect under various pulse settings. The nice to have-questions contained similar concerns with in addition a question about the behaviour of fish entering the net, what the effect of the pulse is on razor clams and finally what the effect is of the increased selectivity on the population structure.

Economy

The socio-economic impact of the pulse is mentioned once as an essential issue to examine and three times as knowledge that is nice to have. Another question, considered essential and posed by someone from a producer organization is: *'What is the influence of pulse fishing further down the chain? E.g. processors, retailers. As it probably does not only affect fishermen.'*

Fishers behaviour

Essential questions grouped in this category regarded the fishermen's perception of pulse and a better understanding of the distribution of pulse vessels. Two essential- and two nice to have sticky notes mentioned the need to do research on discard reduction. Discard reduction can be achieved to a certain extent with technical adaptations of the fishing gear but the fisherman's behaviour also play a role.

Governance

Most questions in this domain considered essential, addressed the need to develop effective control and enforcement mechanisms and to develop well-functioning management plans. In addition the need was expressed to get insight in the perceptions of all stakeholders about pulse, and in the social impact of the pulse on the fishing community. In particular fishing communities fishing in the southern north sea and to examine communication. The nice to have questions contained similar questions with in addition the question of the social impact of a derogation stop and the monitoring of shrimp vessels with pulse.

Technology

Three essential questions and the only two nice to have questions in this domain regarded the ability of the pulse to reduce discards, it was added that this is important *'as the purpose of article 14 CFP is the avoidance and minimisation of unwanted catches'*. In line with this, one note requested the quantification of the selectivity gain of the pulse gear. Finally, one note contained the suggestion to experiment with other gears than pulse and beam trawl and another the need to model the future catch efficiency of the pulse fleet.

Multiple

The sticky notes grouped in this category contained broad issues, largely covered by more specific questions by other participants: *'impact assessments'* and *'food production + social impact - economy, - efficiency, - sustainability, - less unwanted catch'*.

Other

Sticky notes with statements rather than knowledge questions were grouped in the *other*-category. The statements concern a variety of issues. Issues considered essential are for instance the need for transparency, the unfair competition between Dutch pulse vessels and other European non-pulse vessels, the need to carry out a whole research program and not just parts and the suggestion to define a minimum set of knowledge requirements on which a decision on the permanent allowance of pulse fishing can be made. Nice to have are international research cooperation on pulse, a management plan from the industry, no MSC-certification and no more derogations before the knowledge gaps are filled, a permanent permit, and a new code for pulse vessels (not TBB).

Research projects that cover questions on the sticky notes

This section discusses research projects that are currently being conducted or planned and its relevance to the questions raised on the sticky notes. 42 of the 72 essential questions on the sticky notes are covered by ongoing or planned research projects, and 8 of 31 of the nice to have questions. See table 4 for an overview of the number of questions that are covered, not covered or partly covered by ongoing or planned research or the sticky notes that did not contain a research question but a statement.

Table 4: the coverage of the sticky notes by ongoing or planned research projects

	Yes	No	Partly/perhaps	Not a research question
Essential	42	19	3	8
Nice to have	8	13	1	9
Total	50	32	4	17

The Research agenda on pulse

The planned research agenda on pulse, developed by IMARES and ILVO, consists among others of three PhDs. PhD1 will examine through lab experiments to what extent electrical pulses on fish and benthos will lead to mechanical damage, physiological changes and changes of the natural behaviour. The questions about the (long term) impact of pulse on benthos, including the varying impacts under changing pulse settings, the impact on species that do not end up in the fishing net, on elasmobranchs etc. will be covered by this research project. Also PhD2, that through lab- and field experiments will examine what the (long term) effect of pulse is on ecosystem functioning, will contribute to a better understanding of the topics that these questions address. PhD3 will apply and develop fleet dynamics- and ecosystem models that are necessary to calculate the effects of the transition to pulse on the scale of the North Sea. This research project will address questions about the displacement of the fishing fleet since the transition to pulse, and the impact on pulse on quota depletion.

BENTHIS

BENTHIS² is a 5-year project that is already ongoing. It examines the physical impact of bottom trawling fisheries (including pulse) on the seabed and the animals living on and in the seabed. This research project will cover the questions about a comparison between tickler chain and pulse gear and it will provide insight on the question about unaccounted mortality in the trawl track.

Comparative fishing experiments

IMARES has conducted a comparative fishing experiment to study the catch efficiency and selectivity of the beam trawl and the pulse trawls. IMARES has recommended to continue these experiments. The questions on the sticky notes concerning discards, selectivity and efficiency can be answered by these experiments. A first experiment is planned in conjunction with the beam trawl survey carried out by the fishing sector in summer of 2015. In addition a project is also conducted at IMARES in which interviews are held with skippers about the possibilities that they see for behavioural change to avoid discards, including pulse fishers.

Stakeholder report pulse

A report on the perceptions of various European stakeholders about pulse is recently finished by IMARES. This research, and this sticky notes exercise, provide insight in the questions and concerns that stakeholders have about pulse fishing.

Shrimp research plan

Together with the sector IMARES and ILVO are involved in developing a research agenda on the shrimp pulse. Questions about the efficiency of the shrimp gear may be incorporated in this agenda.

Black box system in development

In the context of the control and enforcement, a black box system is being developed that collects information on the electrical characteristics of the pulse trawl gear of a fishing vessel. This project covers the technical side of questions about (fool proof) control, monitoring and enforcement.

Synthesis

A number of questions raised may be answered by the synthesis of the research projects that are mentioned above, such as the effect of the increased efficiency on the population structure, the impact of the displacement of the fleet, and modelling of future impacts and landings.

Other

A number of statements that are about the process and the communication around pulse fishing, and not research questions, are covered by new institutions or regular meetings. Regular progress information can be provided in the annual pulse dialogues meeting. Links about pulse fishing with researchers from other member states are forged in WGELECTRA at ICES. The International Advisory Board, that is currently being established, can organize feedback on the research that is being conducted.

Sticky notes that are not yet covered

There are various reasons why some sticky notes are not (yet) addressed. Some statements on the sticky notes aren't research questions, but are related to the process undertaken by the Dutch government, related to management plans, stakeholder participation and control and enforcement. One sticky note states that the whole research program should be conducted, this is still uncertain because of a limited budget. And some sticky notes contained very broad comments, for instance 'economics'. Finally, some research questions are simply not (yet) addressed in any (planned) research program.

Topics that are often mentioned and that are not (yet) covered are questions about the social and the economic impact of the transition to pulse on North Sea fishing communities, including the Dutch and on other actors in the production chain. The effect of pulse on reproduction of target species is not yet planned in any research program and the development of scenarios in case of a derogation stop are not (yet) conducted or planned.

² See <http://www.wageningenur.nl/nl/show/Benthic-Ecosystem-Fisheries-Impact-Study-BENTHIS.htm>