Pilot project on pulse fishing and the landing obligation

Programme description

The Netherlands

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Background

The Basic Regulation (*Regulation* (EU) 1380/2013) established the Common Fisheries Policy for the coming years. The landing obligation plays a central role in this. To aid the implementation of the landing obligation, the Basic Regulation offers an option for Member States to carry out pilot projects with the aim of minimising unwanted catches.[1]

The landing obligation will be phased in from 1 January 2015. From 2019 onwards it will apply to all fisheries for quota species. Currently, in many fisheries, a considerable proportion of the catch is still discarded into the sea, because the fish is undersized or because the quota has already been filled. In future these catches will have to be landed, with the proviso that they may not be used for human consumption.

The landing obligation will make it necessary for fisheries to be more selective in their catches. This will contribute to one of the most important objectives of the Common Fisheries Policy, namely reducing unwanted by-catches. For several fisheries, such as flatfish, this will be a challenging task.

Flatfish fishery (particularly for sole and plaice) is very important for the Dutch fishery sector. This type of fishing involves by-catches that are relatively difficult to avoid. The landing obligation will therefore have a real impact on this fishery. The sector has been working for years on innovative fishery techniques to increase selectivity. The most promising innovation for flatfish fishery at the moment is pulse fishing. This technique, whereby fish are startled out of the seabed using small electrical impulses, is now recognised as having ecological advantages, such as greater selectivity and far less disturbance of the seabed. Co2 emissions have also been cut significantly by a reduction in fuel consumption of around 50%. Finally, the quality of the catch is also better.

Extensive research has been carried out by IMARES, LEI and ILVO among others. STECF and ICES have also issued positive recommendations on this technique.[2]

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[1] **Article 14: Avoidance and minimisation of unwanted catches**; 1. In order to facilitate the introduction of the obligation to land all catches in the respective fishery in accordance with Article 15 ("the landing obligation"), Member States may conduct pilot projects, based on the best available scientific advice and taking into account the opinions of the relevant Advisory Councils, with the aim of fully exploring all practicable methods for the avoidance, minimisation and elimination of unwanted catches in a fishery.

[2] http://www.wageningenur.nl/nl/locatie/IMARES-IJmuiden.htm

[2] http://pure.ilvo.vlaanderen.be/portal/nl/organisations/visserij--aquatische-productie(7621ad48-c68a-4e01-a61d-94fefc7e5698).html

[2] http://www.ices.dk/publications/library/Pages/default.aspx#k=pulse#s=10

[2] http://stecf.jrc.ec.europa.eu/meetings/2012 (spring plenary meeting; final report pages 71-74)

Objective

Based on the experience of recent years with the innovative and selective pulse technique, the Netherlands is working on a programme for which 42 extra pulse fishing licences have been issued. These will be linked to extensive monitoring and research activities. The programme has two objectives:

1. To examine on wide scale how the pulse fishing method, whether or not combined with certain arrangements and adaptations of the net design, can contribute to greater selectivity on the part of the Dutch flatfish fleet and so reduce the impact of the landing obligation to an acceptable level.
2. To gather missing/supplementary data and knowledge, with a view to full approval of pulse fishing in the North Sea.

Much research has already been done, both at sea and in the laboratory, on the impact of pulse gear on target species, on the by-catch of fish and the by-catch of benthos. The new focus is to apply existing and new knowledge to allow as much as possible of the unwanted catch to escape from the net during fishing.

The control and inspection of the use of the pulse fishing gear will occur on the basis of a technical file, physical controls and data transfer from the black box. See Annex 3 for further details.

Set up

To achieve the above objectives the pilot project has three parts:

1. Applied research into the best methods for allowing unwanted organisms caught during fishing to escape by means of arrangements and/or adaptations of the nets, in combination with the pulse fishing method
2. A monitoring programme in which the participating fisheries play a major role. The aim is to gather both relevant data on the catches and knowledge concerning the manageability, controllability and enforcement of the technique in practice. The programme will also provide experience with the practical consequences of the landing obligation.
3. A research agenda, aimed at further expansion of the knowledge base, and at the long-term effects of electricity in the marine environment.

The monitoring programme will focus on the North Sea. The fundamental research will be more concerned with general matters that may also apply outside the North Sea. The supervisory group will consist of:

- The Ministry of Economic Affairs
- The Cooperative Fishery Organisation (CVO)
- A representation of relevant NGOs, such as the North Sea Foundation, the Dutch Elasmobranch Society and the Worldwide Fund for Nature.

This project group reports to the yet existing Pulse Fishery Steering Group.

Although this is a Dutch programme, we value optimal harmonisation with national and international stakeholders. They will be frequently informed about the results:

- At the start of the programme EU Member States with fishing interests in the North Sea, civil society organisations, the European Commission and the European Parliament will be informed.
- In a scientific framework, information and feedback about the programme will be regularly provided.
- Regular progress reports will be issued on the programme. These will be available in various forms including on a website with all relevant information about pulse fisheries.

	2014				2015				2016			
	1	2	3	4	1	2	3	4	1	2	3	4
Project plan: investigation of project design and existing knowledge												
Issuing of pulse licences												
Duration of pilot project												
Pilot project interim reporting												

Spatial demarcation

The licences will be issued under a ministerial order. For the participating fisheries that means they can only fish in ICES zones IVc and IVb, and no further north than 55 NL.

Part 1: Field trials on avoiding by-catches

The first part of the project offers scope for research into the use of the pulse technique in combination with net adaptations to discharge by-catch during fishing.

Attention will also be paid to on-board sorting (“self-sampling”) of all fish to be landed, which will entail many extra man-hours. The monitoring exercise will also look at the practical consequences of this. With a view to the landing obligation and reducing the workload of the participating fisheries, systems will be examined that make it easier to enter data, for example, using a mobile app or an e-logbook. However, we know from experience that the user interface of the e-logbooks is not very friendly: according to the fisheries it could be much easier to use than it is now. Actually a single, simple-to-use logbook should be introduced. None of the available logbooks have yet met this criterion.

Part 2: Monitoring programme

The aim of the monitoring programme is to collect data on:

- Effort, landings and discards of Dutch pulse fishing for flatfish
- Effectiveness of the control and enforcement programme
- Effects on cod (broken backs)
- Special attention to by-catch and effects on benthos, debris, sharks, rays and ETP species, partly with a view to MSC certification
- Potential effects on ecosystems

Fishery effort by pulse trawlers is mapped by analysing logbooks and VMS data. Time series will be made of trends in the effort and charts of the spatial distribution of pulse fishing. Information on landing by pulse fishing vessels will be obtained from analyses of logbook data. Time series will be made of trends in the landings and charts of their spatial distribution. Information on discards will be obtained from sampling by the fisheries themselves ("self-sampling") and sampling by independent observers. The aim of sampling at sea is to determine the total amount of discards of the pulse fishing fleet and to make distinctions in the composition of the discards. The data are calculated based on the average quantity of discards per trip.

The monitoring programme will tie in as far as possible with the discard research being carried out in the *Data Collection Framework* (DCF). This research is commissioned from the Fishery Research Centre (CVO) by the Ministry of Economic Affairs and is carried out by IMARES researchers, in close cooperation with the fisheries sector.

It will also be necessary to build a bridge between the monitoring programme and the laboratory research. After all, situations are created in the laboratory setting that rarely, if ever, arise in practice. On the other hand, factors can be missed in the laboratory setting that actually do play a role in the field. It is important that laboratory research can be verified against the situation in the field, and to determine potential effects at ecosystem level that are not recognised in laboratory studies.

How this link will be established needs further consideration. Possibilities include tagging and returning species, a comparison between areas where pulse fishing does and does not take place, or observation/further investigation of fish caught in the pulse gear.

The pulse trawl monitoring carried out in 2011/2012 compared the pulse trawl (pulskor) with the beam trawl (boomkor), but did not consider the area fished. This omission undermines a clear comparison between the beam trawl and pulse trawl. In the next monitoring exercise it will be important to compare both beam trawl and pulse trawl fishing in the same area (comparison of selectivity), and the composition of the catches of the beam trawl and pulse trawl fleets (comparison of fleet catches in practice).

During the relevant trips the pulse fisheries involved in the on-board sampling collect data on the catches of the entire trip. This includes both standard data such as time, date, location, weather conditions and pulse arrangements, and additional data on landings and on specific by-catches (ETP species). The vessels also collect two sacks of discards from two operations (hauls) during the trip concerned. The sacks are left on the quay when the vessel is discharging, after which they are collected and sorted by IMARES.

There are three different groups participating in the monitoring programme:

- Current pulse fisheries under the Dutch flag
- Current pulse fisheries under British and German flags may participate on a voluntary basis
- New pulse fisheries

The aim is to give all fisheries a role in the programme, but it will only include vessels already practised with the gear that have already found the right settings.

Because there is debate about the validation of fishers' on-board sampling data, these will be checked by means of various observer trips. During the observer trips there will be extra research into the quantity of cod caught, in total, and with broken backs, and into the specific fish species caught.

Part 3: Pulse fishing research agenda for the short and long term.

In general we are addressing the knowledge gaps described by Soetaert et al. (2013):

- Is there a safe range of pulse parameters that excludes (significant) consequences for all marine organisms?
- What are the differences in sensitivity to electricity between various vertebrate and invertebrate marine species?
- What are the effects on the juvenile stages of marine species that spawn in shallow zones where pulse nets can be used?
- What is the long-term effect on small non-commercial species and on undersized commercial species that are repeatedly exposed?
- What is the effect on the electro-sensitive organs of sharks and rays?
- Is there an electrolysis effect from the substrate and the water column that could result in the formation of toxic metabolites?
- What is the effect of pulse fishing on various populations?
- Governance issues surrounding the introduction of pulse fishing and adequate regulation to ensure the manageability of development.

ANNEX 1 DRAFT RESEARCH AGENDA

The proposed research agenda was drawn up in consultation between IMARES and LEI. It contains a provisional prioritised research agenda that includes matters that can be resolved in the short and/or long term. The prioritisation of research themes should take place in the steering group on pulse fishing.

Issue	**Need expressed**	**Existing knowledge**	**Knowledge gaps**	**Proposed research**
Ecology				
Claims of damaged or dead fish and additional fish mortality from the industry.	Stakeholder analysis	Very little active monitoring of stakeholder claims	Claims are being presented of adverse effects due to pulse trawling without real evidence.	Collect and log the 'anecdotes', discuss them with pulse fisheries and others (if possible), try to under-stand a pattern if possible.
Current research only focusses on limited number of species. More species come into contact with pulse trawl that are not captured. New fisheries with pulse are developing (e.g. nephrops, spisula)	STECF	Cat sharks, cod, six benthic species studied. Effect on cod can be prominent, other effects were limited.	Why did Dutch find spinal damage in cod, and Belgians not? Potential impacts on non-researched species	Study effect of pulse on nephrops and on their burrows (since nephrops don't move). Underwater observation (Contacts with Scotia well advanced)
				Behavioural study on the effects of electricity on nephrops. Contacts with CSIC Barcelona, Spain.
				Develop monitoring approach for unaccounted mortality (e.g. by sampling on board of non-pulse vessels?)
				Compare Dutch and Belgian studies in a repeated experiment.
Sole and dab have blisters that are allegedly due to pulse fishing	Popular media	ILVO has done research on occurrence of blisters on dab and sole	Can we verify experimentally whether pulse could lead to blisters?	Test in laboratory conditions on farmed sole and dab taken from North Sea. After testing observe for 3 months.
Thresholds of short and long-term effects of pulse characteristics are not known. Pulse used in flatfish gears may be too strong	STECF, ICES	Optimal pulse for shrimps and sole developed	Can settings be reduced to decrease effects?	Fundamental research on various species under pulse stimulation with varying pulse characteristics.
Effect on electro-receptor organs of elasmobranchs fish is not known. Stocks of these fish are in decline, and special conservation measures might be required.	ICES	Such organs are very sensitive to electric currents, and may get disturbed. Only cat sharks as indicator species studied.	Fish may not be able to detect prey after exposure to electric fields of pulse trawls. What about rays?	Study elasmobranch prey detecting capabilities after exposure. Include rays.

Issue	Need expressed	Existing knowledge	Knowledge gaps	Proposed research
Long-term effects on populations (including mortality over longer time, reproduction, juvenile stadia and growth).	ICES/ Soetaert	Only short-term effects studied with limited pulse settings, and limited on direct mortality and larger sizes, only some indicator species.	Long-term effects (including mortality over longer time, reproduction, juvenile stadia and growth) on populations are not known.	Studies on target and non-target biota in contact with gears: indirect mortality, growth, reproduction, of adult and juvenile stadia on longer term.
Effect on substrate (habitats) and chemical composition in water column from electrolysis.	Soetaert et al.	Some claims of potential effects were given (e.g. Mike Breen on chlorine production).	Effect on substrate (habitats) and chemical composition in water column not known.	Research into effect on sediments of electric pulses. Research into dissolution of chlorine compounds by electric pulses.
Technology				
Technology progresses beyond the current status. Pulse trawling will be developed for other gears than beam trawls, e.g. twin-trawls, dredges,...	ICES	DELMECO integrates shrimp and flatfish pulse.	What are the new pulse settings, what are effects?	Monitor pulse technology development beyond the current status and the beam trawl applications.
Monitoring of spatial deployment of pulse gears	Stakeholder analysis	VMS data available	Do pulse vessels explore different grounds?	Monitor spatial deployment of pulse gears
Economy				
Economy of pulse trawling applications, and socio-economic aspects are not all known.	STECF?	Some existing systems are evaluated. This shows economic potential. NL industry invests in the method as the best alternative to tickler chain.	Does this apply to all systems? Can this be extended to new technical developments? What electric/pulse gear developments exist in other countries?	Monitor economic performance of more vessels (BENTHIS). Comparative study of economic performances of electric/pulse fishing in the Netherlands and other (Member) States
Governance				
Resistance to allow pulse trawling within other European member states (BE, DE, FR, UK). Problem perceived as a Dutch problem only.	Dutch government	Some EU member states oppose the implementation of pulse trawling on a wider scale.	Perceptions? Interests? Fears? Hidden agendas?	Stakeholder analysis, interviews. Research on political aspects.
Control and enforcement needs to be assured.	STECF / ICES	Control and enforcement documents and technology defined.	Practical experience with the suggested rules and technology.	Do pilot study with newly suggested regulations and performance monitoring technology with inspection agencies.
Decision framework and models are not fully developed.	IMARES	Crude models exist (e.g. Piet et al., 2009) and show potential in reducing discards in five target species.	Effects of new effort allocations, fisheries' response, effects on benthic species, definite ecosystem indicators.	Extend ecosystem research and models.

Issue	Need expressed	Existing knowledge	Knowledge gaps	Proposed research
Most reports only in grey literature.	ICES, STECF	Several papers in preparation, one published (van Marlen)		Finalize (x) papers in progress.
Insufficient visibility of international research	IMARES workshop	SGELECTRA platform for research	Need for more comprehensive expert groups on effects of electricity in marine environment	Expand scope and outreach of SGELECTRA

ANNEX 2: RECOMMENDATIONS FROM PREVIOUS MONITORING

In advance:

- Establish the object of the programme: is it about the composition of the catch or comparing the pulse trawl with the beam trawl?

Selection of vessels:

- Examine the fishery distribution of all pulse trawlers over 2013 (VMS data) as the basis for the selection of vessels. The analysis of the fishery distribution must provide useful information for:

(1) the number of vessels required to take part,

(2) the number of samples they need to take on board

(3) the fishing grounds that need to be covered by the selected cutters.

The aim of this power analysis is to try to collect sufficient data to provide reasonable certainty about, say, the composition of the catch of the pulse fishing fleet.

- Determine the chance of an extra number of pulse fishing exemptions being granted, and the sort of vessels concerned. Based on this data, estimate what effect the granting of new pulse-fishing exemptions will have on the fishery distribution.
- Concentrate more on quality and less on quantity by:

(1) Allowing fewer vessels to participate

(2) When selecting vessels, taking account of the quality the vessels can deliver

- Concentrating on fewer vessels provides scope for offering a payment to the participating vessels.

Harmonisation of self-sampling and observer trips:

- Harmonise the observer trips with the self-sampling method:

(1) Bring the level of detail of data collection of the two methods into line with each other

(2) Add night sampling to the self-sampling

(3) Use the same conversion methods in the analysis

(4) A new pulse fishing monitoring project must tie in with existing research efforts, such as the DCF

- How do you prevent/check bias? A general check of self-sampling data and observer data does not provide enough information about bias. It is more sensible to compare self-sampling data and observer data from the same fishing grounds and the same times.

On board (self-)sampling protocol

- Consider: when and how many samples the vessels must take. How many samples are required for reliable results? This should be discussed with a statistician.
- The protocol for on board sampling should be reviewed and adapted where necessary to make the overall process more practicable for the participants. This can be done in consultation with the participating fisheries or with a number of participants in the previous pulse fishing monitoring.
- The previous monitoring of pulse fishing was done partly on paper and partly digitally (by filling in a form in a Word document). It is important to talk to the participating fisheries about the best ways to submit data. Is it easier to use an app, Excel, e-logbook or to go through a website? If you design a good application for submitting data, it can relieve the researchers of a great deal of work, as fisheries will be automatically alerted to particular mistakes (forgetting to fill in fields, using the wrong units, etc) when they are entering the data. This will:

(1) benefit the quality of the samples (data are more complete),

(2) increase the motivation of the fishery by making it easier to submit data,

(3) reduce the workload of the researchers and sector representatives as the data are sent straight to a database, and the simplest errors have already been taken out.

Protocol for observer trips:

- Weigh benthos and debris on the trips
- Collect cod for research on spinal damage in cod

Data processing and analysis:

- Consider the best way to process the data.
- Consider how best to check self-sampling data against observer data (to check for bias in the self-sampling data)
- In comparison of beam and pulse trawling take account of the distribution of effort over the fishing grounds of the beam and pulse trawlers.
- It would also be interesting to link the results from the vessels to the vessel parameters. This could provide insight to benefit the control and enforcement aspects

Communication and instruction:

- Start with an instruction video. Experience shows that it is very useful to make a film and show it to the participants, as it prompts lively discussion about how the samples should actually be taken.
- Communication between participants and researchers can be improved.

ANNEX 3 CONTROL AND ENFORCEMENT

Control of the pulse gear will occur on the basis of a technical dossier, physical controls and data transfer from the black box.

The technical file comprises the basis for the control system. This technical file provides an extensive description of the pulse gear and the control mechanism, such as the black box. The technical file should be submitted by the owner of the fishing vessel that is authorised for pulse fisheries. The technical file must be accompanied by the manufacturer's declaration and must at least describe the following aspects (based on IMARES report):

- Above-water components (generators, winches, computers and storage medium (black box).
- System characteristics of the components (name and serial number of the products).
- Type of storage medium (black box) for the registration of the pulse values of the pulse gear.
- Details of the pulse gear:
    - The number of electrodes, with a description of the isolators, conductors and connectors with their minimum and maximum length, minimum and maximum diameter, average spacing and material used.
    - The number of pulse modules and their serial numbers, if applied.
- Characteristics of the pulse stimulation, including pulse shape, amplitude and pulse frequencies.
- The result of the measurements of pulse amplitude in true rms in an unloaded circuit (no impedance) and the peak amplitudes in a laboratory and/or on-board the vessel, carried out by a organisation certified by the Dutch Accreditation Council with a known and constant accuracy within 2%.
- A protocol describing the method and timing of safety inspections on the components of the fishing gear.
- Description of entire system. This applies both for the pulse gear as well as for the type of security module installed (black box).

The pulse system is certified by the manufacturer. The manufacturer certifies that the pulse gear on board the fishing vessel is installed according to description in the technical file and is operational. The technical file and the conformity of the system in practice will be controlled by the Human Environment and Transport Inspectorate and the Netherlands Food and Consumer Product Safety Authority on the basis of annual and unannounced inspections.

The limits established for the operation of the system are as follows:

- The supplied electrical power, as measured by the vessel's generator output, before the feeding cables of any single pulse gear may not exceed 1.0 kW per meter of beam length or width of the stimulation field.
- The field strength must not exceed 0.25 Vrms per centimetre of electrode distance.

- Maximum electrode distance 40 cm.
- The width of the stimulation field, defined as the horizontal distance between the first and last electrodes at the outside, and measured across the Stimulation field perpendicular to the electrodes may not exceed the width of the fishing net and in any case must not exceed 12m per pulse fishing gear.

If the field strength is exceeded this will be recorded by the black box and as signal will be immediately sent to the inspection body (The Netherlands Food and Consumer Product Safety Authority). The inspection body can then take the appropriate action.

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