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Agri-Food and Biosciences Institute
Standard Operating Procedure

SOP Code:	FAEB (Branch)	MARFISH (Unit/Group)	042 (SOP No.)	V4 (Version)
Location:	Marine Fisheries Programme, Newforge Lane			
Author:				
Title:	Sampling retained fish catches, *Nephrops* and discards from commercial vessels at sea			
Purpose: (Please specify: analyse / measure / test / operate a method / equipment etc.	This procedure details the operations to be carried out in order to ensure that the following is carried out in a consistent manner.			
Date of Creation/Amendment	16/01/2015			

It is the project leader's responsibility to ensure that the appropriate SOP is specified for scientific work and that the SOP and training are provided to staff conducting the work.
It is the responsibility of the operator to follow the method, to record which SOP is used and any deviation from the written SOP.

Procedure

Guidance:

- *Standard operating procedures may be in numbered point format, with or without subheadings, or in a defined format as appropriate to the work.*
- *Any other documents referred to must be clearly cross-referenced.*
- *If it is necessary to amend the SOP, a new version must be created and copied to all who use it. Old versions must be withdrawn and archived and dates of amendments recorded.*

Signed:	(author)	(date)
	(laboratory manager)	(date)
	(unit manager or project leader)	(date)

Standard Operating Procedure MARFISH 042v3

Sampling retained fish catches, *Nephrops* and discards from commercial vessels at sea

CONTENTS

Sampling retained fish catches,
Nephrops and discards from commercial vessels at sea.

1. **Scope**
   1.1. Samples of commercial catches from fishing vessels provide information on the fish and/or shellfish populations exploited, along with qualitative and quantitative data on discards. Discards are fish, shellfish and all the other organisms that have been caught and discarded at sea. Discards from *Nephrops* trawlers are composed of undersized commercial fish species, *Nephrops*, other commercial species, and other fish, shellfish and other organisms which are not marketable or cannot be landed for other reasons (e.g. species for which there is no Total Allowable Catch (TAC) remaining in the fishing area).
2. **Field of application**
   2.1. The data collected is used for commercial fish and *Nephrops* stock assessment. It is also used in quantifying the discard rates of commercial fish species. Otoliths are collected on commercial species for aging. This information is then used to provide a scientific basis to management options for the Irish Sea fishery.
3. **References**
   3.1. MARFISH006 Sampling at sea aboard RV Corystes: *Nephrops*
   3.2. Risk assessment documents (and relevant manual handling checklists):
   MARFISHRA01
   MARFISHRA07
4. **Principle**
   4.1. Fleet observers measure length frequencies and collect samples at sea on board vessels within the NI fishing fleet.
   4.2. The vessels to be sampled are randomly selected using the Skipper Contacts spreadsheet. An up to date boat list is generated every six months along with a new random sampling list for each observer.
   4.3. The level of sampling is as advised by the Project Leader to comply with EU and national sampling programmes.
   4.4. Each individual tow (hauls) should be sampled. Sampling strategy will largely depend on the main target species *i.e. Nephrops* or fish. The majority of trawlers within the Northern Irish fleet target *Nephrops* using otter trawls with ground gear rig suitable for *Nephrops* trawling. Cod, haddock, whiting and other commercial species are also retained depending on fish size, market conditions and quota (TAC) availability. Sampling technique will also depend on the type of gear used, e.g. single trawl or twin trawls. The crew of commercial vessels sort the catch at a sorting bench or on a wooden table positioned on one side of the vessel. The sampling technique will be adapted to fit around the working practices of the crew on each vessel.
5. **Reagents**
   5.1. None
6. **Equipment**
   6.1. Sampling equipment:
   - Sampling baskets marked in fractions
   - Measuring boards both long and short
   - Forceps
   - Pencils
   - Recording forms for details of trawl deployment (MARFISHFM02)

- Recording forms for catch composition, length, and otoliths (MARFISHFM03, MARFISHFM40)
- Notebook
- Erasers
- Vernier callipers
- Knives for otolith extraction, and taking biological samples
- Otolith packets/trays
- Scales

7. Sampling

7.1. When the catch has been sorted by the vessel's crew, two catch components are sampled. Fish length is measured from the tip of the nose to the tip of the tail and the measurements are recorded to the nearest cm below. Certain species such as herring, sprat and mackerel are measured according to groundfish survey protocols i.e nearest half cm below. Carapace length of *Nephrops* is measured from the eye socket to the posterior mid dorsal point of the carapace and recording the measurements to the nearest mm below.

7.2. Retained Catch: All of the retained catch is measured and the length frequencies are recorded, but very large catches are sub-sampled and the total number and size of retained baskets or boxes is noted in order to apply an appropriate raising factor.

Marketable fish are removed and separated into species.

Nephrops above the minimum landing size are removed.

1. Very large *Nephrops* of carapace lengths exceeding 30mm are landed whole and a sample of these separated into males and females and measured. At least a third of a basket should be measured.
2. Smaller *Nephrops* of marketable size are 'tailed' (the 'head' or carapace region is separated from the 'tail' abdomen and only the 'tail' is landed). The tails are not measured.

7.3. Otolith collection

Otoliths must be removed following the procedure described in MARFISH017. Each pair of otoliths (from an individual fish) must be placed and stored either in a 25 cells plastic box or in an envelope appropriately labelled (Species code, otolith number, fish length, tow number). Within each tow, up to 25 pairs of otoliths per category can be taken for each species.

7.4. Discards:

1. Discarded *Nephrops*. At present a sample (approx 1.5 kg) of discarded Nephrops is collected from each individual haul during an observer trip. The sample is collected by observers and subsequently process by AFBI marine fisheries staff. Samples are divided into four categories: 1. Heads; 2. Males; 3. Females and 4.Scrap. The weight of these individual categories is required to calculate the total Nephrops catch for each haul. Further, a length frequency of each category (excluding scrap) is recorded by measuring all individual Nephrops within each category.

   During periods of intensive at sea sampling it may be necessary to apply a sub-sampling strategy when processing length frequencies of discards Nephrops samples. It is possible to process up to 30 samples (30 hauls) within one week of sample collection. During circumstance that sample numbers exceed 30 a random sample of one haul for each day of the trip and each fishing area (6a, 7aW, 7aE) is taken, for 'standard' gear types (single and twin rig Nephrops). This sample should be processed using the standard protocol as detailed

above. For all other hauls from these trips the sample should be split into the categories (males, females, heads and scarp) and weights recorded, as above. Further, compete processing is required of one in four trips. The hauls to be sampled during sub-sampling and the trips identified for complete sampling are identified using the 'Nephrops Sampler' excel tool ("P:\AFESD\FAEB\Marine Fisheries\Otolith\Discard sampling\Observer sampling\ 2009-2014 Discard summary"). For all other gear types, such as triple and quad rigs, compete sampling must be applied at all times.

Nephrops heads. A sample of the heads separated into males and females and measured. (Because fisheries scientists and managers use the carapace length dimension for stock assessment and legislation, it is necessary to sample the discarded component of the catch at sea, to obtain length frequency samples of the *Nephrops* 'heads' that correspond to the landed 'tails'.)

Small *Nephrops*. A sample of these separated into males and females and measured.

2. Discarded fish are separated into species and measured.

8. Operational procedure

8.1. Vessel selection:

1. Each week a random list of boats is drawn up for each observer. This should ensure that vessels are not sampled too frequently and that as far as possible, these vessels sampled are representative across gear types (single boat trawl, twin-rig, semi-pelagic and pelagic etc.), according to the data-collection framework. For effective sampling it is better a range of vessels is sampled as opposed to long trips on one vessel. Observers will attempt to contact skippers on the list, until they find a skipper who can take them at sea that week. All attempts to contact fishing skippers and the reasons for vessel non availability are recorded on the Fleet Observer Vessel Selection spreadsheet. If no vessel on the list is available, the team manager will generate replacement list for the observer.

8.2. Sampling:

8.2.1 Sampling a Single Boat *Nephrops* Trawl:

Total Catch: The catch will be placed in baskets then emptied onto a bench for sorting by the Crew. Throughout the sorting process ask a member of the crew to pick out any large or unusual fish that are to be discarded and place these together in the same basket. These can be measured later and given a raising factor of one because they are total catch.

Retained Catch: Retained fish will also be sorted by the crew. Length frequencies are measured for all of the fish species in the retained catch and a raising factor of one is applied.

Discarded Catch: It will be impossible to measure all the *Nephrops* and discards therefore a sub-sample is taken.

Fill two baskets using a shovel and take scoops from different parts of the catch. This will help make the sample as representative as possible. Do not include large/unusual discards or retained fish in the sample. These will be measured separately and given a raising factor of one. Hardy fish such as dogfish can survive out of water for longer periods, thus these species should be measured first and returned to the water as quickly as possible.

Fill another basket with half of each of the two baskets and use one of the half baskets as a sample.

Raising Factor: Keep a tally of the total number of baskets as this will be used as a raising factor for the sample basket. However the retained catch and large discards must be subtracted from the total bulk catch before the raising factor is applied.

E.g. if there were 18 baskets for the total bulk catch, 5 baskets of retained catch and 1 basket of large discards then the raising factor is 18- (5+1) = 12

Take the sample basket and separate the *Nephrops* from the discarded fish. Keep a record of the proportion of fish to prawns e.g. 3/8 basket of fish to 5/8 Nephrops.

Measuring *Nephrops*: The size composition of the *Nephrops* catch is also measured.

Total catch *Nephrops*: The sample size to be measured will depend on haul size and the time that is available between hauls to carry out the work, although at least 3.0 kg of *Nephrops* should be measured. The carapace lengths of male, female and berried female *Nephrops* are measured separately, to the nearest mm below using vernier callipers. The sample should be as representative of the total prawn catch as possible. An estimation of males and females weight has to be provided too.

Discarded Catch *Nephrops*: A sample of discarded *Nephrops* (discarded whole prawns and discarded heads) from each haul is bagged (about 1.5 kg) and kept in ice for processing on return to the lab; this will free up time to carry out retained and discarded fish measurements.

N.B. The raising factor for Retained *Nephrops* Heads can be calculated by dividing the Total Retained Heads (e.g. 3 baskets) by the proportion measured (e.g. 1/3 basket gives RF of 9). Using scales and sample weights will give a more accurate raising factor.

Measuring Fish: When the catch has been sorted the retained and larger discarded fish are measured from the tip of the nose to the tip of the tail and recorded to the nearest cm or mm below, depending on species. Measure all fish and apply a raising factor of one to the data.

If catches are large and there is time pressure, the retained catch may be sub-sampled and raising factors applied. For example, if the retained catch included 60 haddock then 1 of every 2 fish may be measured and a raising factor of 2 applied to the data. Ensure that the sample includes fish across the size range in order to be as representative as possible.

8.2.2 Sampling a Twin Rig *Nephrops* Trawl.

On board a twin rigger the catch is deposited into a hopper, therefore working out total bulk catch is more difficult. Consult with the skipper whenever catch from the two nets has been deposited. He may have an idea of the total catch estimate in baskets in which case a visual estimate can be made

Alternative method for recording the ratio of retained *Nephrops* to discarded *Nephrops*.

Fill another whole basket with *Nephrops* only. Try and make the sample as representative as possible by taking samples from both

nets and from throughout the catch so far as reasonably practical. Get a member of the crew to sort the *Nephrops* into:

1. Retained whole (carapace >30mm),
2. Retained tails,
3. Discarded whole,
4. Discarded heads.

Put each of these 4 portions into 4 baskets marked with fractions and note how full each basket is. Note the ratio of retained *Nephrops* to discarded heads and whole *Nephrops*. E.g. ¼ retained ½ discarded whole ¼ discarded heads. The total retained *Nephrops* of each haul will be known so the total amount of prawns can be calculated.

E.g. if there were 3 baskets of retained (both whole and tailed) then by using the fractions above there would have been approximately 6 baskets discarded whole and 3 baskets of discarded heads. The total amount of *Nephrops* for that particular haul would be 12 baskets.

To raise the discard data, the ratio of '*Nephrops* to discards' within a sample basket is worked out. Take a sample basket as mentioned before ensuring that scoops are taken from both nets and from throughout the catch. (Do not include retained and large discarded fish that can be picked out, measured separately and given a raising factor of one. These will be measured later). Separate the sample into *Nephrops* and fish. Note the proportions e.g. '1/3 small discarded fish**:** 2/3 *Nephrops*'. Using the above example, if there were 12 baskets of *Nephrops* (2/3) then there would be 6 baskets of small discarded fish (1/3). Therefore the raising factor for the discard data within the sample basket is 6.

N.B. By adding the total retained catch and large discard catch to the '*Nephrops* and discards' total, a total bulk catch estimate can be made.

9. Expression of results

9.1. Fish are measured in cm from the tip of the snout to the end of the tail fin (total length). *Nephrops* carapace lengths are recorded in mm from the eye socket to the posterior mid dorsal point of the carapace. Record measurements to the nearest mm below for *Nephrops* and the nearest cm below for fish. For biological samples (weight, maturity, otolith removal, etc.), record fish lengths to the nearest mm below if practical.

Recording forms for catch composition and length

Length frequencies for fish species and catch composition are initially recorded onto measuring boards. Transfer this information onto the appropriate recording forms (MARFISHFM03) after measurement of the haul.

Recording forms for otolith collection

The information from each of the fish used for otolith collection must be recorded on the appropriate recording form (MARFISHFM40) after the processing of each tow.

10. Quality Assurance

Do not discard any fish in the sample until you are sure that the lengths have been recorded. Ensure fish totals are tallied correctly using a calculator if necessary. Ensure that the sample forms are fully and properly completed as well as legibly filled in. Document any computations or raising factors clearly.

11. Reporting of results

Details of trawl deployment have to be recorded using the specific forms. Time and date when leaving port and time and date on return to port have to be recorded too. Also record number of crew and vessel conditions.

The positions, times and depth of trawl station are recorded at the commencement and completion of the tow (from the time the net reaches the seabed to the time it lifts off again). Record this information on the relevant forms, which can be filled in by the fishing skipper if the observer is not present.

Recording forms for catch composition and length

Length frequencies for fish species and catch composition are initially recorded onto measuring boards. Transfer this information onto the appropriate recording forms after measurement of the haul.

12. Safety

Observers must have an up to date ENG1 and sea survival before going to sea. Safety gear comprising of a flotation aid, hard hat, protective gloves, safety boots/Wellingtons with steel toe caps must be worn. Use oilskins when working at sea and lab coat with waterproof apron when working onshore in lab.

Do not work on deck whilst trawling is being carried out. Ensure equipment is properly stored or secured in rough weather.

Think before lifting heavy and/or awkward objects. Ensure that you comply with Manual Handling Operations Regulations. Never be afraid to ask for help with a "lift". Heavy and bulky objects can be split in smaller parts to make lifting and handling easier and safer. The Health and Safety at work legislation requires everyone to have a duty of care both to themselves and others.

Always split the load in smaller portions when possible before handling and lifting.

Always try to establish a comfortable measuring platform to avoid kneeling and stooping.

Take adequate pauses to rest muscles, ensure the measuring board is in a suitable stable position that avoids the need for twisting. Rest individual fish on the measuring board, so that the weight of each fish is supported by the handler for the minimum length of time.

Correct use of Protective Gloves

1. Protective gloves in various thicknesses are provided for your protection. All staff must wear protective gloves when handling or sorting fish/shellfish and where appropriate when carrying out other tasks. Chain mail gloves must be worn when taking otoliths or using a knife. The correct gloves to wear are those which provide appropriate protection from the suspected risk (claws, teeth, spines, fish bones, toxins and electric shock) and which do not restrict hand movements to an unnecessary degree.
2. In addition, the degree of operator experience and the liveliness of fish and shellfish in the sample will also determine the choice of gloves to be worn. If you are unsure of any procedure or the degree of protection to be used, consult your line manager before beginning work.

Safety Equipment checklist

1. Safety boots
2. Steel toecap Wellington boots
3. Protective gloves
4. Mullion suit
5. Small portable fire extinguisher
6. EPIRB
7. Mini flare kit

8. Lifejacket
9. Hard hat
10. First aid kit
11. Pen knife
12. Warm outdoor clothing
13. Oilskins

Appendix 1 - Sampling Techniques

Technique One - Applies when the catch is "clean", i.e. hardly any discards.

Let the crew process the catch in their usual way, except ask them to put anything they don't want for whatever reason (e.g. undersized, no market, damaged, no quota available) in a separate basket. Measure and record every individual fish under the category 'DT' (Discards Total). This works well for the lone sampler provided the number of baskets of trash fish doesn't exceed two. If there are more than two baskets then measure a sub sample but make a note of the total number of baskets discarded and number of baskets measured. This will be used to calculate raising factors.

If the retained portion of the catch has to be sub-sampled, at random times throughout the processing of the catch, take one full basket of fish (don't include fish that are to be discarded) and measure and record under the category 'R' (Retained). It is best to aim at measuring three baskets or more. Take a count of the total number of baskets of retained fish per species at the end of the haul, as this will be used in calculating the raising factors.

There may be a few odd uncommon species that are kept as retained fish. Generally speaking, aim to measure a species as total catch ('RT', Retained Total) if it fills less than a basket or if it is a particularly large specimen. This will most likely apply to rays, ling, conger eel, flatfish, spurdog, pollack, saithe and monkfish. Take a rough basket count of each species so measured.

Technique 2 - Used when there is obviously going to be much discarded fish.

Let the crew process the catch as normal, except at intervals throughout the catch fill a basket with fish. This basket will contain fish that are to be retained and discarded. Ask one of the crew to sort that one basket into fish that he would retain and those to be discarded. Make a note of the ratio of retained to discarded fish. Measure the retained portion first as category 'R' (Retained) and return to the crew. Measure the discarded fish as category 'D' (Discards) and keep to one side. Aim to measure at least three baskets of fish, each time keeping the discarded portion in a separate basket (estimating a small quantity is not as accurate as estimating a larger quantity). Record the final proportion of retained to discards (e.g. 2.8:0.2).

As in the first technique, measure any large or uncommon fish separately and record as 'RT' (Retained Total).

A count of total number of baskets per species that is sent down to the fish hold must also be kept.

Technique 3 (*Nephrops* Trawlers) - Applies when there is a large amount of retained fish.

Before the crew process the catch, take a sample of the total catch. In order to get a representative sample, take scoops from as many different parts of the catch as possible. If the vessel is a twin rig trawler there must be an equal amount of sample from both nets. The number of baskets taken will depend on time available between hauls. Aim to sort as many as possible as this will

generate more accurate raising factors and a smaller margin for error. At least 3 baskets should be sorted in this way.

Ask the crew to keep any unusual discards they come across during sorting, 'Total Discarded Fish' (TDF) These can be placed in a basket and measured later as total catch, i.e. raising factor of one.

Separate the sample into *Nephrops*, fish and benthos, and place each of these into baskets.

Ask a member of the crew to separate the fish into:

'Sample, Retained Fish' (SRF)

'Sample, Discarded Fish' (SDF) portions.

Ask a member of the crew to separate *Nephrops* into:

'Sample, Retained Whole *Nephrops*' (SRW),

'Sample, Retained Tails' (SRT),

'Sample, Discarded Whole *Nephrops* plus Tailed Heads' (SDNH).

Make a note of each of these portions i.e. 1/8 basket, 1/5 basket etc. Measure the carapace lengths of at least 20 retained whole prawns. A bag of discarded whole *Nephrops* plus the heads from tailed *Nephrops* should be kept from each haul (at least 1.5 kg). This will be processed upon returning to the lab and carapace lengths measured.

Measure the length of the retained fish and return to the crew. Return the retained *Nephrops* to the crew. Measure length of the discarded fish.

After the crew have processed the catch make a note of the total number of baskets of 'Total Retained Fish' (TRF), 'Total Retained Tailed' *Nephrops* (TRT) and 'Total Retained Whole *Nephrops*', (TRW). This will be used to calculate raising factors.

The total catch is calculated using the ratio of baskets of retained fish and *Nephrops* in the sample and relating this to the total amount of retained fish and *Nephrops*.

Total baskets = (total. baskets sampled / baskets of retained fish & *Nephrops* in sample) * total baskets retained fish and *Nephrops*.

The raising factor is calculated by dividing the total catch in baskets by the number of baskets sampled.

Raising factor = Total baskets / total baskets sampled

N.B. Any large or unusual discards should be removed, measured separately and giving a raising factor of one. This must be subtracted from the total basket catch before any raising factor for discarded and retained fish can be applied.

<u>Sample Codes:</u>

SRF – Sample, Retained Fish
SRT – Sample, Retained Tails
SDF – Sample, Discarded Fish
TDF – Total Discarded Fish
SDNH – Sample, Discarded Whole *Nephrops* plus Tailed Heads
SRW – Sample, Retained Whole *Nephrops*
TRF – Total Retained Fish
TBS – Total baskets sampled
TRT – Total Retained Tailed *Nephrops*
RF – Raising factor
TRW – Total Retained Whole *Nephrops*
TB – Total baskets

Technique 4 (*Nephrops* Trawlers) - Applies when there is a small number of retained fish.

Collect a representative sample from the catch as in technique 3, only do not include any retained fish ('Total Retained Fish' - TRF), or large/unusual discards ('Total Discarded Fish' - TDF). Ask the crew to keep these to one side where they can be measured later and a raising factor of one applied to the data.

Separate the sample into *Nephrops*, fish and benthos.

Ask a member of the crew to separate the *Nephrops* sample into:

'Sample, Retained Whole *Nephrops'* (SRW)

'Sample, Retained Tails' (SRT)

'Sample, Discarded Whole *Nephrops* plus Tailed Heads' (SDNH)

Make a note of each of these portions.

After the crew have processed the catch make a note of the total number of baskets of 'Total Retained Whole *Nephrops*' (TRW) and 'Total Retained Tailed' *Nephrops*' (TRT).

The total catch is calculated using the ratio of baskets of retained *Nephrop*s in the sample and relating this to the total amount of *Nephrops*.

Total baskets = (total baskets sampled / baskets retained. *Nephrops* in sample) * total baskets retained *Nephrops*

The raising factor is calculated by dividing the total catch in baskets by the number of baskets sampled.

Raising factor = total baskets / baskets sampled

Technique 5 (*Nephrops* Trawlers) - As (Technique 4) above only using Nephrops tails data only.

Total baskets = (total baskets sampled / baskets tails in sample) * total baskets retained tails.

Raising factor = total baskets / baskets sampled

Technique 6 (*Nephrops* Trawlers) - Applies when total number of baskets for bulk catch can be recorded and there are few retained fish.

E.g. on a small single trawl *Nephrops* vessel the working procedure on board may allow the catch to be put into baskets before sorting.

Take a representative sample by using methods described in previous techniques. Ask the crew to process the catch in the normal way. Tally up the total number of baskets by making a note every-time a basket is filled by the crew for sorting. Placing a small fish in a basket every time a basket is placed onto the sorting bench will keep count. This will give a total count of the number of baskets sorted by the crew and therefore the total catch. Add on any baskets that have been sampled to give a final basket total count (Total Baskets TB).

Make a note of the total number of retained fish in baskets and carryout length frequency measurements. Apply a raising factor of one to this data and also to any unusual or large discards. When calculating raising factors for the discarded catch the retained plus large or unusual discards (which have been measured separately and a raising factor of one applied. N.B. – 'Total Discarded Fish' (TDF) and 'Total Retained Fish' (TRF) must be subtracted from the total number of baskets.

Total baskets *Nephrops* and discarded fish = Total baskets – baskets retained fish and unusual/large discards

Raising factor = Total baskets *Nephrops* and discarded fish / baskets sampled