



IFCA Fish Survey Best Practice Guidance



Developed by the IFCAs with the support of the Institute of Fisheries Management (IFM)

Written by Kathryn Nelson, Sussex IFCA, 2016

Contents

Executive summary	2
Introduction	4
Aim	4
Sections.....	4
Personnel requirements	4
Experience level/qualifications/training.....	4
Volunteer involvement/collaborative working	5
Quality assurance	5
Health and safety	6
Documentation	6
Equipment.....	6
Communications.....	7
Weather	8
Sampling techniques	8
Comparability.....	8
Number of methods	9
Environment Agency guidance.....	9
Sampling methods.....	9
Fyke nets	9
Seine nets.....	10
Beam trawls	12
Otter trawls	15
Riley push net.....	15
Shrimp push net	16
Hand net	17
Plankton nets	17
Biosecurity.....	18
Processing the catch	18
Non-fish species	19
Metadata	19
Suppliers	19
Sampling site selection	20
Tide	20
Survey time and frequency	21
Identifying fish.....	21
Where to get help.....	23
Data analysis	23
Data recording.....	23
Analysis and reporting	23
Sharing	24
Value.....	24
Conclusions	25

Executive summary

There are ten Inshore Fisheries and Conservation Authorities (IFCAs) around the coast of England, managing the sea fisheries resources and marine environment out to 6 nautical miles. Research is conducted to gather evidence to support management decisions. Many of the IFCAs conduct fish surveys, for a variety of reasons.

We have developed this guidance for all of the IFCAs and any other organisations which are conducting fish surveys or which are thinking of doing so. The guidance covers all aspects of fish surveys and can be read as a whole or any section can be taken in isolation, depending on requirements. It can be used to improve existing projects, to inform new staff, partners or volunteers and to provide a standard for collecting robust data whilst taking into consideration animal welfare and health and safety.

In each section, there are 'recommendations' which are key pieces of advice for best practice. There are also 'tips' which are smaller pieces of advice which will be useful in some circumstances. 'Information' offers further detail, for example: organisations which offer ID training courses.

We have developed many recommendations for best practice. The key recommendations are:

- There has been extensive work to develop methods and guidance for fish sampling by the Environment Agency for the Water Framework Directive. Whilst this is valuable work, other options might be more appropriate depending on the drivers for the survey, its aims, data comparability and site specific factors.
- Comparability between sites can be difficult as each site often has many unique characteristics. It depends on the aims of the survey(s), but it may be better to use methods that are tailored to sampling the fish population in specific sites, rather than generic methods which may be less suitable.
- For comparability seasonally and annually, it is best to apply the methods in the same way, in the same place, at the same tidal state.
- Each sampling method is selective and therefore the use of more than one method is recommended to obtain a more representative sample of the fish population.
- Sampling should be conducted in May/June (spring) and again in September/October (autumn). However, in some circumstances, it may be more appropriate to sample at other times.

- The number and position of sampling locations will depend on time, resources, access, methods and site-specific factors. A range of salinities, habitats and tidal excursions should be sampled.
- Welfare of the fish should be considered at all stages of sampling, particularly so for rare or endangered species.
- All fish should be identified to the lowest practical taxonomic level.
- Fifty individuals of each species in each sample (or sub-sample) should be measured to the nearest mm.
- Conspicuous non-fish species should be recorded at a practical taxonomic level, including estimates of number/amount present.
- Collaborations are good. They can reduce time and resource burdens and they increase knowledge sharing.

This guidance was developed during a two day workshop in July 2016 in Rye and Hastings, East Sussex. Sussex, Kent and Essex, Devon and Severn and Northumberland IFCAs, Natural England, Environment Agency, Sussex Wildlife Trust and the Institute of Fisheries Management were involved in one day conducting a survey, looking at various sampling techniques and ID skills, and one day open discussion of personnel requirements, health and safety and data analysis. The draft guidance was consulted on with all of the IFCAs before this final version was produced.



Introduction

There are ten Inshore Fisheries and Conservation Authorities (IFCAs) responsible for fisheries management around the coast of England out to 6 nautical miles. A range of research is conducted to gather evidence to support management measures. Different IFCAs have different priorities but many are involved in fish surveys. Fish surveys are also conducted by other organisations, most notably the Environment Agency which conducts monitoring for the Water Framework Directive. This document builds on extensive existing work on developing best practice guidance. It will be available as a guide for all IFCAs as well as other organisations.

Aim

To have clear best practice guidance about conducting coastal fish surveys focussed on small and juvenile fish.

Sections

Guidance has been developed for many aspects of fish surveying and these have been split into five sections with various sub-sections.

- Personnel requirements
- Health and safety
- Sampling
- ID
- Data analysis

Each (sub)section can be viewed in isolation.

Personnel requirements

Experience level/qualifications/training

RECOMMENDATION: There should be at least one person on the survey who has completed a fish ID training course.

This would usually be the person leading the survey. This person should also have been on a sampling techniques training course or have extensive experience of the sampling techniques.

INFORMATION: The Institute of Fisheries Management (IFM) runs an accredited ID course when sufficient demand. The NMBAQC also runs an ID course but it is not accredited. It is designed for government agencies and run on demand. The

Wildlife Trusts also run some local ID courses for fish and other marine species to support the Seasearch and Shoresearch projects.

TIP: ID training should include information about the life history, habitat preferences, juvenile and adult differences and seasonality of each species to assist with identification.

TIP: An ID expert present on a survey can be a useful way to improve and refresh ID skills, especially for species which are common on that particular survey. In the past, experts have included staff from the Natural History Museum London and the Institute of Fisheries Management.

TIP: When beginning a survey programme it would be useful to research what species you are likely to catch and be familiar with their diagnostic characteristics. Having an expert along for the first survey to help with identifying cryptic species could be particularly helpful.

[Volunteer involvement/collaborative working](#)

RECOMMENDATION: Collaborations are good. They can reduce time and resource burdens and they increase knowledge sharing. They are good networking opportunities and can increase local buy-in. Working with colleges and universities can lead to student participation.

RECOMMENDATION: If possible, there should be opportunities for people with no fish survey experience but it would be best to have a mix of experienced and unexperienced people on the survey. The less experienced people should be given easier, less critical tasks, at least to start with.

TIP: Where there are people with a mix of experience levels, it would be best to have a clear leader.

RECOMMENDATION: The survey leader should allocate each person with a specific task. These tasks should be rotated so that everyone is able to have a go at a range of tasks, building experience and confidence.

[Quality assurance](#)

RECOMMENDATION: There should be one person checking the ID of all the fish. This person should be named on the recording form as a point of contact if there are any ID queries in the future.

RECOMMENDATION: There should be at least one clear photograph of each species caught on the survey. These photos should be saved in a way that the species and survey are clear. This would be a good check if there were any ID queries and could also help to build an ID reference library, particularly useful for species which look different at different ages.

RECOMMENDATION: There should be an internal, local organisation ID test at the beginning of each survey season for personnel involved in the surveys. This

could include the refreshing of knowledge before the test. The details of the test could be determined by each IFCA and reflect their local species. For example, the test could include ten photographs of fish (perhaps from previous surveys), all of which have to be identified correctly. Test scores could be kept on record for quality assurance.

TIP: If you catch a fish and you are at all unsure of its species, send a photo to other IFCAs or experts to get a second opinion. Also see the ID section of this guidance.

INFORMATION: The NMBAQC provide a QA (reverse) ring test service. It is an annual test of fish (also other fauna) ID, aimed at large organisations which do frequent surveys. It is a requirement for Environment Agency staff. There is a significant (for IFCAs) cost. For IFCAs, it depends on who is using the data and how much QA is required. Some organisations may not accept the data without the NMBAQC QA. However, it is not a requirement for IFCA surveys.

Health and safety

Documentation

RECOMMENDATION: As is standard procedure for all IFCA activities, a risk assessment should be written for each survey.

Some surveys and sampling methods will have similar risks. Risk assessments can be shared between IFCAs and partner organisations to share guidance on common elements. The risk assessments should include dynamic risk assessments on site as the situation and conditions change.

TIP: It might be worth considering going on a health and safety training course. A pragmatic one, teaching how to think about risk, what to look out for and how to do dynamic risk assessments, could be useful.

RECOMMENDATION: It could be useful to develop site-specific method statements for each survey. It could include: sampling methods, survey plan, description and photographs of the site, specific risks, local information, map, access information, parking, phone numbers for relevant people/organisations/authorities, nearest hospital, phone reception, weather limitations and the need for a continual dynamic assessment of the situation and conditions when on site.

Equipment

RECOMMENDATION: Lifejackets should be worn when within 3 metres of water. However, in some circumstances, there is a greater risk of the lifejacket becoming entangled in the sampling equipment than of drowning. If you are sampling from the shore, are wearing a drysuit and there are several people and/or a small vessel nearby, then a lifejacket may not be necessary. When deploying a net from a small vessel, a lifejacket can increase the risk of entanglement. However, if you fall over wearing a drysuit, air can become

trapped in the boots and make it difficult to right yourself (without a lifejacket). All conditions and aspects should be considered when deciding to wear a lifejacket.

If your IFCA or organisation has more stringent or specific rules on the wearing of lifejackets, they should be followed at all times.

TIP: It could be useful to have a sheathed blunt-ended diving knife attached to the lifejacket, to help free yourself if tangled.

TIP: It could be helpful to select a lifejacket that is smaller, less intrusive and more suitable for surveying.

RECOMMENDATION: Drysuits are recommended for all personnel entering the water. Waders or wellies are suitable for personnel at the water's edge. In warm weather, a wetsuit or shorts, with immersible footwear, is also suitable.

Waders should not be worn when on a vessel. They can be put on when on the beach. Waders should always be worn with a lifejacket. People in thigh waders should not go into water deeper than knee high and people in chest waders should not go in deeper than their waist. There is a risk that if someone falls over wearing waders, the waders can fill with water and make it more difficult to retrieve the person from the water.

TIP: Depending on circumstances, it could be useful to carry mini flares, a personal EPIRB and/or VHF radio.

TIP: Consider wearing gloves as some fish can have sharp spines or there may be sharp debris caught in the net.

TIP: Weever fish have a poisonous spine, so consider carrying hot water which can help denature the poison. A small hand net or trowel could be used to reduce the amount of handling.

Communications

RECOMMENDATION: The survey leader should check in with the office or a senior member of staff when they arrive and leave the site or if there is a change of plan.

Depending on circumstances, it could be helpful to check in with the coastguard, site manager or harbour authority. It could also be useful to tell local groups/authorities that there is going to be a survey taking place, to raise awareness of the research and to allay concerns of illegal fishing or people in danger.

RECOMMENDATION: At the start of the survey, all personnel should provide details of an in-case-of-emergency contact.

Weather

RECOMMENDATION: The weather forecast should be monitored in the days preceding the survey. If there are personnel from a range of organisations on the survey, 24 hours' notice should be given if the survey has to be cancelled due to bad weather. It should be made clear that the survey could be cancelled at the start of, or at any point during, the day if the weather conditions are not suitable.

RECOMMENDATIONS: Set a limit for the weather conditions above which the survey will not take place. The weather limits will be specific for each site.

If the survey involves the use of a boat, the vessel's skipper should make the decision of whether the survey goes ahead or not. The conditions should be monitored continually throughout the survey period. The weather conditions should be recorded.

TIP: When selecting the survey dates for the year, also select back-up dates in case one or more of the first-choice dates have to be cancelled.

INFORMATION: Weather forecasts can change and can be variable depending on the source. It is worth looking at more than one forecast. Some options are: local radio or TV, the BBC, the Met Office, the shipping and inshore waters forecast, XC weather, Wind Guru, Magic Seaweed, Met Check and Windy TY.

Sampling techniques

Comparability

RECOMMENDATION: When setting up a survey program at a new site, it is worth trying a variety of methods. However, for comparability seasonally and annually, it is best to apply the methods in the same way, in the same place. The same tidal state is important but the time of day is less so.

See also the 'site selection' section of this guidance.

RECOMMENDATION: Comparability between sites can be difficult as each site often has many unique characteristics. It depends on the aims of the survey(s), but it may be better to use methods that are tailored to sampling the fish population in specific sites, rather than generic methods that may be less suitable.

TIP: Alongside the 'standard' methods which are used in the same place at the same time in the same way each time the survey is conducted, it could be useful to try some additional sampling. Even if this is more descriptive than quantifiable and not included in the analysis, it could be useful for understanding which species are using the site, how and when.

Number of methods

RECOMMENDATION: Each sampling method is selective and therefore the use of more than one method is recommended to obtain a more representative idea of the fish present.

Environment Agency guidance

INFORMATION: The Environment Agency recommends the use of two methods at each site. These two methods should be from a choice of three: 43m long seine, 1.5m wide beam trawl or 1m high 5m long fyke nets. If these methods were used, the data would be easier to compare with the Environment Agency data.

Sampling methods

INFORMATION: The Environment Agency have undertaken extensive work to develop methods and guidance for fish sampling for the Water Framework Directive. Whilst this is valuable work, other options might be more appropriate depending on the drivers for the survey, its aims, data comparability and site specific factors.

Fyke nets

These are long cylindrical static nets into which fish swim and become trapped. They are available in a range of sizes, mesh sizes, single or double nets, single or double leaders. The size and configuration depends on the site and target size of species.

Otter guards are recommended to stop otters becoming trapped in the nets. This is a plastic grid attached to the mouth of the net, preventing entry to large creatures.

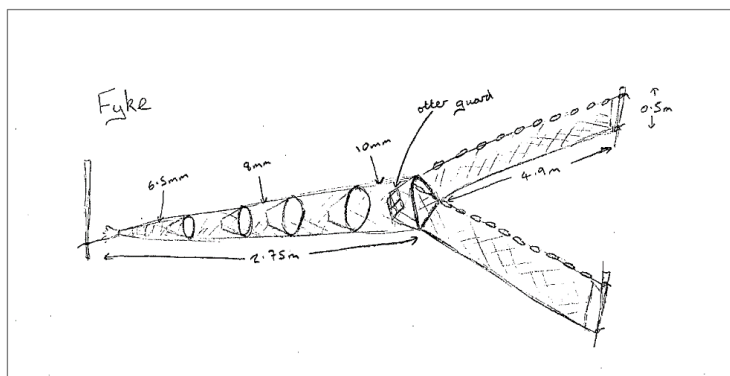
The codend, leaders and sometimes the mouth, are staked (with bamboo canes or metal fencing pins) or anchored.

The nets can be left for various amounts of time, for as little as an hour or several. They could be left for 6 hours, half ebb to half flood or whole ebb/flood. Other standard lengths of time are for 12 hours (one tidal cycle) or 24 hours (two tidal cycles). The longer the fykes are left, the greater the risk that the fish will be damaged or eaten by crabs.

The fykes can be set on the open coast, in enclosed water bodies, in large channels or so the leaders block smaller channels. A double fyke is recommended for open coasts or estuary edges and should always be set so the middle section of net between the frames is perpendicular to the shore. In smaller channels, the nets could be set facing upstream, so that on the incoming tide, the fish swim over them but on the ebb, the fish congregate in the channel

and swim into the net. If the channel is the single exit for an area of saltmarsh, it may be possible to estimate the amount of fish per area of habitat. Alternatively, fyke nets could be set facing downstream to capture species entering the site on an incoming tide.

A small to medium sized fyke can be deployed/recovered by one person in shallow water, though it would be easier with two or three people.



An example of a small fyke net.

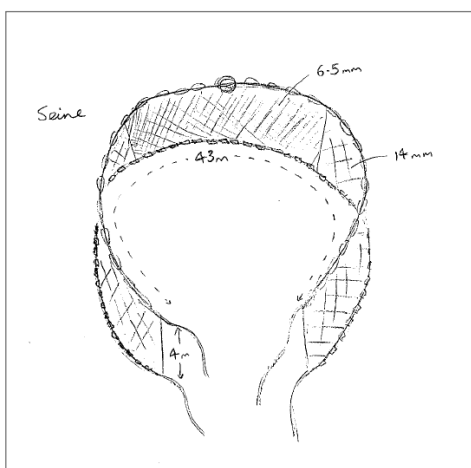
Seine nets

These are long rectangles of net, usually deployed in a semicircle then hauled on to the shore. Various lengths, widths, mesh sizes, floats, weights and end ropes are available. The size and configuration depends on the site and target size of species.

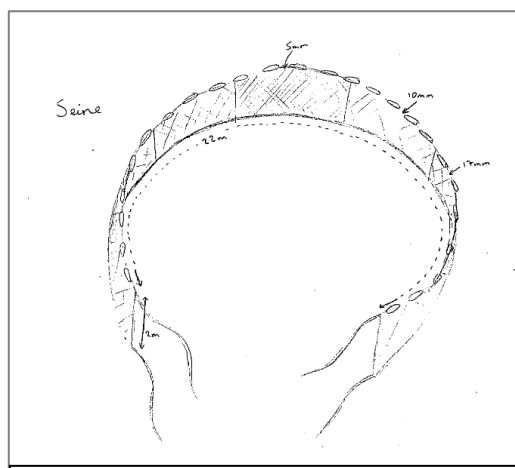
The Environment Agency standard is 43m long, 4m wide with 14mm mesh in the wings and 6.5mm mesh in the centre, weighing 60kg when dry. They can be as long as 150m or more and as small as 14m. Smaller nets usually have smaller mesh, either throughout or in panels.

Seine nets are usually deployed twice in close succession; within five minutes and 100m.

Seine nets can also be used as stop nets across small channels or hauled through the water in the manner of a trawl.



A 43m long seine net



A 22m long seine net

Deploying by wading

The net can be deployed by wading in shallow, gently shoaling water with a stable seabed. Pile the net on the shore, by the water line, by starting at one end and having one person pull the float line whilst someone else follows the lead line until you have a neat line of tangle-free net. A person in a drysuit should take the float line and wade out in a semi-circle. Other people can help feed the net round as it can be heavy to drag through the water. Another person should hold on to the other end of the float line.



Preparing the net



Wading out with the net

Deploying by boat

Where it is not suitable for wading, the net can be deployed from the bow of a small boat. Cover any snags on the bow of the vessel with a tarpaulin or the seine net bag. Pile the net into the bow of the boat by starting at one end and having one person pull the float line whilst someone else follows the lead line until you have a neat line of tangle-free net.

With someone holding on to the float line and someone in the bow of the boat helping deploy the net, reverse the boat round in a semicircle. This can be done by going out perpendicular to the beach until a third of the net has been deployed, then reversing parallel to the beach for another third of the net, before returning to the beach. Alternatively, it can be useful to attach a rope to the stern or amidships of the boat, the length of which is the radius of the semicircle. One person holds this rope taught as the boat reverses, keeping it on course.



Boat taking out the net



Net deployed



Pulling in the float line

Hauling in the net

When both ends of the float line are back at the waterline, haul the net up the beach by pulling steadily on the float lines. When approximately a third of each end of the net is out of the water, people can start to pull the lead line. Don't be tempted to pull on the lead line too early. It should be kept as close as possible to the seabed and be pulled steadily and slowly so no fish escape underneath. The float line should be held up to reduce the chance of fish jumping over. Keep the net taught between the lead line and the float line to reduce the risk of anything being trapped in the folds of the net. The aim is to shake everything down to the centre of the net. The catch can then be tipped into a bucket of seawater.



Hauling the float and lead lines



Shaking the catch into the centre of net

Aim to use the seine net when and where there is very little current. If using a big seine, and it picks up the current, it will be heavy. The personnel holding the float lines can move up stream with the flow to keep the semicircle shape and to make it easier to haul.

Usually at least four people are required for the seine net; one for each float line and one for each lead line. More people are useful for large nets.

If necessary, a net can be hauled by three people; one for each float line and one for both lead lines.

If necessary, just two people can use a seine. This could be done by anchoring one end of the net whilst one person hauls the float line and the other person hauls the lead line. Alternatively, both people could haul the float lines until almost all of the net is out of the water.

Beam trawls

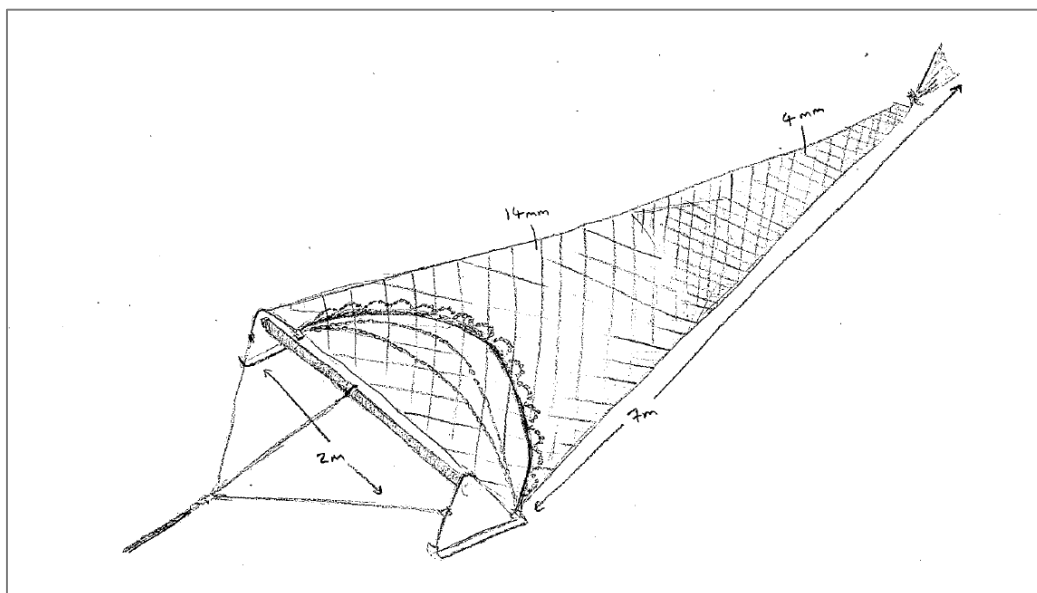
These are long cones of net attached to a beam with triangular skids or shoes on either end, which is dragged along the seabed behind a vessel.

These are available in a range of sizes and configurations. The size of a beam trawl usually refers to the length of the beam. The Environment Agency use a 1.5m beam trawl for the Water Framework Directive monitoring. Cefas used a 2m beam trawl for juvenile fish surveys. The size and configuration used will depend on the site and target species.

Beam trawls are good for catching flatfish but many round fish can swim out of the way.

The length of towing warp should be 3-5 times the water depth.

If the vessel has an echosounder, use this in the vicinity of the transect to identify potential snags or debris which should be avoided.



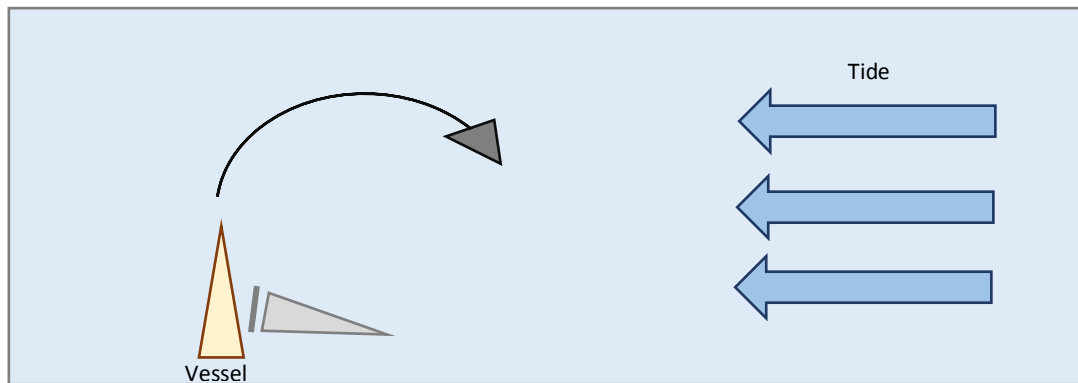
An example of a beam trawl.

Deploying from the shore

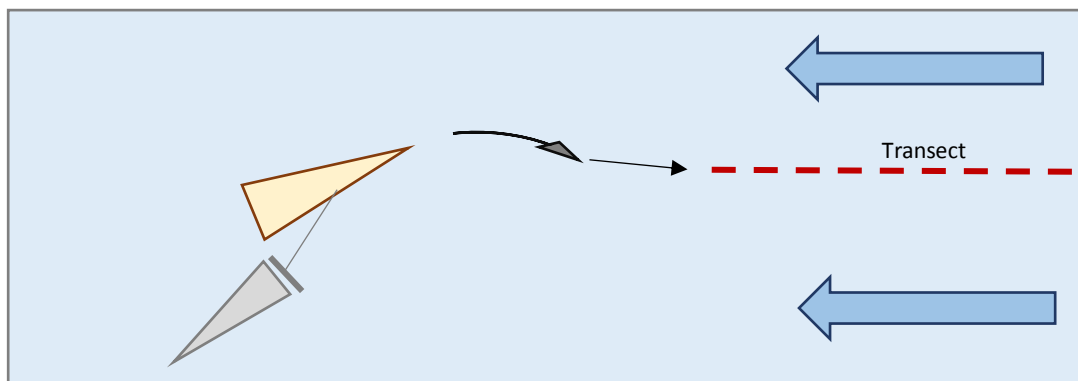
If using a small beam trawl near the shore, set up the trawl on the beach, facing the water. Attach the towing warp to the vessel. Motor the vessel away from the beach, dragging the trawl into the water.

Deploying from the side of a vessel

1. Lay the vessel broadside to the tide, starboard (or port) side upstream, near the downstream end of the transect.
2. Throw the codend, net, chains and ground rope over the starboard side so that the net streams away from the vessel, as the vessel drifts down tide. Make sure the net is clear of the propellers.
3. Start to turn the vessel in a large, slow circle to starboard (or port if the net is out the port side).
4. With one person holding each end, lift the beam clear over the gunnel. Lower the beam into the water but keep hold of it.



5. As the water flow gets under the trawl, the person holding the forward end of the beam can let go. The beam will swing out perpendicular to the vessel's hull.
6. The person holding the warp should ease it out. The person guiding the end of the beam closest to the vessel should ensure it does not hit the hull as the beam moves astern. Let go when it has sunk and moved clear astern.
7. Straighten up the vessel on to the survey transect.



8. Let out the warp to the required distance and then tie it off on a cleat or towing post.
9. To recover, put the vessel into neutral. Haul the warp, bringing the net alongside. Lift it on to the deck.

Larger beam trawls could require a winch and/or A frame for deployment/recovery.

The speed of the vessel and length of tow will depend on the site and the net configuration. This should be the same each time the net is used. Cefas recommend towing the 2m beam trawl for 10 minutes at 1-3 knots, covering a distance of 350-600m.

The trawl should be towed into the tide. This can make it easier to recover if the net becomes snagged and could increase the catch as the fish tire more quickly swimming against the current.

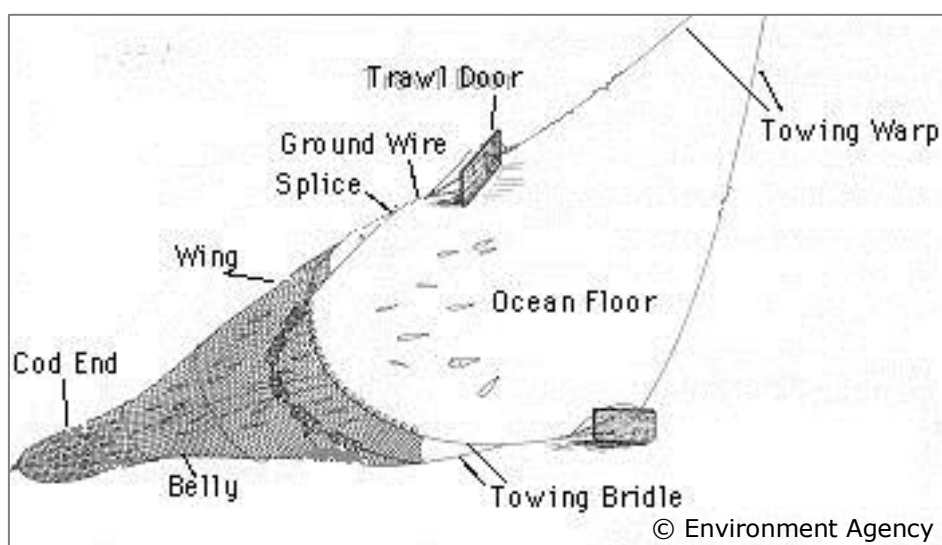
Otter trawls

These are long cones of net with a board on either side of the trawl mouth. The boards are attached/removed each time the net is deployed/hailed.

They are available in a range of sizes and configurations. These are usually used in larger water bodies.

They are best used from a fishing vessel by experienced people. Using a fishing vessel can also improve stakeholder engagement and can be valuable for sharing local knowledge.

Otter trawls can give a more complete picture of the fish population than a beam trawl, as they catch flatfish and round fish.



An example of an otter trawl.

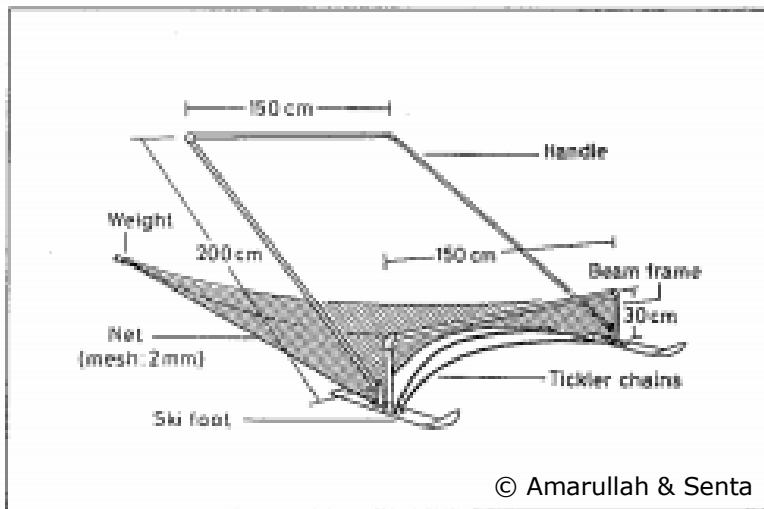
Riley push net

This is similar to a beam trawl but it is pushed by hand rather than towed behind a vessel.

It is available in various sizes and configurations. It can have a single codend or two, so the operator can push from directly behind the beam with a codend either side.

It is good over firm, fairly uniform seabed. It is not recommended for use over soft mud or rocky habitats.

It can be used for a specific time or distance, to standardise method.



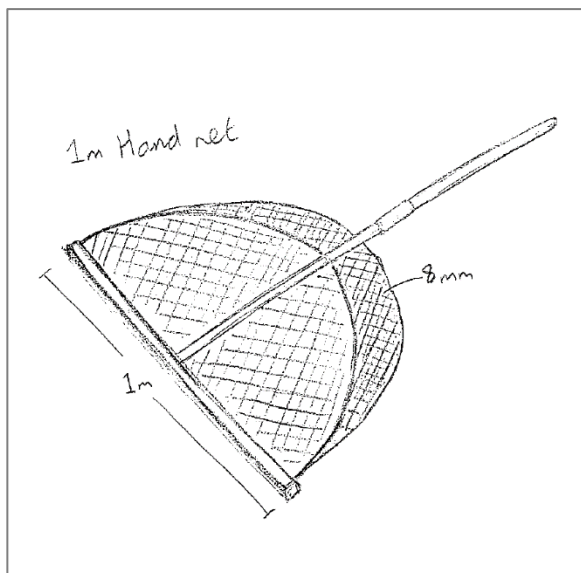
An example of a Riley push net.

Shrimp push net

This is a push net 1-2m wide pushed in front of a person wading through shallow water.

It is good over firm, fairly uniform seabed. It is not recommended for use over soft mud or rocky habitats.

It can be used for a specific time or distance, to standardise method.



An example of a push net.

Hand net

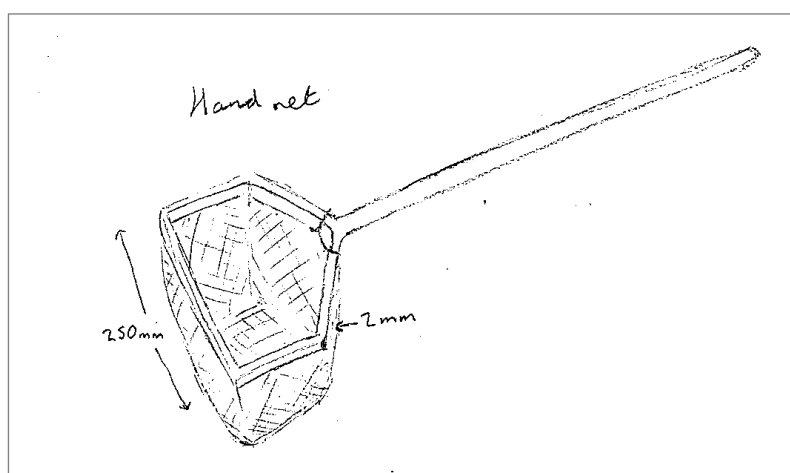
It can be useful for small channels or pools.

It is selective for fry up to about 20mm long. Bigger than this and the fish will swim away. If necessary, you could stir up some sediment so that the small fish find it difficult to see, and therefore avoid, the net.

It can be used for a specific distance or time, to standardise method.

It could be used by standing in a flow of water and seeing what is swept into the net. An elver sampling net is a type of large hand net used in this way.

Alternatively, it could be used by shuffling/walking backwards upstream with the net held in front, collecting the species that are stirred up.



An example of a hand/kick sampling net.

Plankton nets

These are small cone shaped nets with a fixed opening and very small mesh (<1mm).

These can be good for sampling 9-12mm long fry. These may be difficult to identify but can be useful for understanding how the site is used by early life stages.

The net could be towed alongside or behind a vessel, or it could be towed by hand in shallow water.

Alternatively, the vessel could anchor in the flow and hold the net overboard. Or the net could be staked or anchored in shallow water, similar to a fyke net, for 30 minutes or several hours.

Biosecurity

RECOMMENDATION: Nets should be ideally rinsed with fresh water, or at least thoroughly dried after use. This is particularly important when using the same net at different sites. Nets should be checked to ensure that no creatures are trapped in the net and accidentally transferred between sites.

Processing the catch

RECOMMENDATION: When you have caught some fish, put them into a bucket of seawater. This should be aerated to improve fish welfare.

Bottled oxygen can be used but this involves the cost of refills, bottle maintenance and storage.

Small aerators are available from angling shops but are not particularly durable. Larger air pumps can be run off a motorbike or car/leisure battery, with a simple manifold and air stones.

RECOMMENDATION: Use a small hand net to move a few fish at a time from the bucket to a white tray filled with seawater. This makes it easier to ID the fish. A jam jar or a pot with a magnifying lid can also help ID fish.

RECOMMENDATION: Measure the first 50 of each species in each sample (or sub-sample), ensuring that they are representative of the sizes present. Measure from nose to tail tip, to nearest millimetre below. In some circumstances, to reduce fish stress, an estimate of length may be suitable, for example for eels or fry.

TIP: For eels, you want to do measuring on dry land, handle firmly and place upside down on the measure. By rubbing your thumb along the belly they will usually calm down. Expect weird croaking noises and they may regurgitate stomach contents. Latex gloves make the job easier and not as slimy.

TIP: If the fish are very lively and difficult to handle, a small amount of clove oil (2 drops per gallon (4.5l)) can be added to the water to act as an anaesthetic. Prolonged exposure or too strong a concentration will result in mortality. Some fish are more robust than others. The sedated fish should be put in a bucket of fresh seawater to recover before being released.

RECOMMENDATION: Sometimes, large numbers (many hundred) of a single species can be caught. Start counting and releasing these as soon as possible, as only a subsample of 50 needs to be measured. This will increase the chance that more fish will survive.

The sub-sample should be appropriate to the number of fish caught, with a minimum of 50, but if there is time, measure everything.

For very large catches, consider counting a subsample for weighing and then weigh the remainder of that species, to estimate number. Also consider visually or volumetrically estimating number so that the fish can be released as soon as possible.

TIP: Sometimes a few large fish will be caught with the usual smaller fish. Measure and release these as soon as possible, as they can use large amounts of oxygen out of the water in a small bucket.

TIP: Welfare of the fish should be considered at all stages of sampling, particularly so for rare or endangered species:

Keeping the water cool can increase survivability. Consider putting the buckets in shade or adding freezer packs to the water.

Some species, particularly mullet, are good at jumping out of the bucket. Consider putting another bucket or lid over the bucket so they do not harm themselves.

Reducing the amount of handling can reduce fish stress. A ruler placed in the tray can be useful for measuring small fish as they swim over it. Marking the bottom or side of the bucket can help measure fish which are difficult to handle, such as eels. A jam jar or a pot with a magnifying lid can be useful to see identifying features without handling the fish.

Non-fish species

RECOMMENDATION: Conspicuous non-fish species should be recorded at a practical taxonomic level, including estimates of number/amount present.

This can be useful for understanding the wider ecology of the site, for monitoring non-native species and for noting species of commercial importance. Large numbers of certain species could be of interest (eg: shore crabs, shrimps, jelly fish). Other organisations may be interested in these observations. Non-native, invasive species should be reported to the Environment Agency and Natural England.

Metadata

RECOMMENDATION: It can be useful to record a range of parameters during the survey: weather (as observed or recorded in the field as well as from weather stations) and water temperature and salinity (these two can influence fish movement). Recording water pH and dissolved oxygen can also be useful, as can measuring turbidity. Other metadata could include: date, time and location of samples, tide, personnel names, details of the methods and water depth.

Suppliers

INFORMATION: There are a range of options for suppliers of sampling equipment. Some suggestions are listed below.

- Collins Nets (www.collinsnets.co.uk) can supply a range of seine and fyke nets and are able to adapt nets to specific requirements.
- Lexter Trawls, Dorset (Greg Lexter greg.lexster@yahoo.co.uk) can make and repair a range of trawls.
- Coastal Nets (www.coastalnets.co.uk) can make a range of nets.

- NHBS (www.nhbs.com) can supply a range of sampling equipment; hand nets, magnifying glasses, sample pots, trays, clip boards, etc.
- Moore and Moore Carp (01189 882844) can supply expensive but well-made fish measures which are easy to slide the fish off.
- Aquatic Services (Steve Cook, www.aquatic-services.co.uk) can supply aeration solutions.
- Xylem Analytics (www.xylemanalytics.co.uk) can supply instruments for measuring water temperature, salinity, dissolved oxygen, pH, turbidity, chlorophyll, etc.
- Ultima Computers (www.ultima-computers.co.uk) can supply ruggedized laptops and tablet computers, useful for in-the-field data entry.

Ask local fishermen, consultancies and researchers for other suppliers. Look at books and articles for further information on sampling techniques.

Sampling site selection

RECOMMENDATION: The number and location of sampling sites will depend on time, resources, access, methods and site-specific factors. A range of salinities, habitats and tidal excursions should be sampled.

INFORMATION: The Environment Agency recommends that a large water body should have 8 sampling locations, a medium water body should have 5 and a small water body should have 3.

TIP: When setting up a sampling program at a new site, visit the site at various states of the tide (springs and neaps), try a variety of methods at various locations and times, seek local knowledge, find out if any surveys have been conducted there in the past and look at what others are doing in similar sites.

TIP: Consider avoiding areas that may be close to anthropogenic effects (marinas, moorings, sewage outfalls, etc.). Also consider how the sampling location may be affected by flooding or tidal surges, where there may be areas of varying light intensity or water temperature and where there may be a strong current.

Tide

RECOMMENDATION: Each sampling occasion should take place at the same state of tide, so the data can be compared across seasons and years. Many species will stay in their preferred salinity range and move up and down the estuary with the tide. Sampling at different states of the tide, could result in catching different species.

RECOMMENDATION: Seine netting should take place during slack water around low or high tide, so there is reduced current.

INFORMATION: Sampling on an incoming tide can be useful for understanding which species are entering the site. Sampling on an ebb tide can be useful for

understanding which species have been using the site. Sometimes fish are concentrated into channels on an ebbing tide.

INFORMATION: Sometimes different age classes of the same species have different habitat and food preferences, so will be in different areas of the site at different tidal states.

Survey time and frequency

RECOMMENDATION: Sampling should be conducted in May/June (spring) and again in September/October (autumn), as this will bracket the appearance of juveniles.

This can be useful for assessing ecosystem health and furthering understanding of the fish population within the site.

Different species and different abundance of species can be found in the spring and autumn.

If group 0 fry were found in the spring and the same species as older group 0 were found later in the year, it can be assumed that they have spent the summer in the site. If only autumn sampling was done, it would not be known how long the juveniles had been in the site. Also if only autumn sampling was conducted and no juveniles were found, it would not be known if they had been present earlier in the year and died or not been present at all.

TIP: If time and resources only allow for one sampling session, this should be in the autumn rather than the spring. There are likely to be more group 0 juveniles present at this time.

TIP: The timing and frequency of sampling can vary depending on the aims of the survey. For example, a survey designed to investigate food availability for breeding birds, may occur once a month April to July.

INFORMATION: In estuaries and close inshore, there are very few fish during the winter months as it is too cold and there is too much rain run-off (low salinity) for many species.

INFORMATION: There can be a difference in the fish population between day and night time but generally not much difference across the day, morning to afternoon.

Identifying fish

RECOMMENDATION: All fish should be identified to species level.

If this cannot be done in the field, take a clear photograph or consider putting the fish in a sample pot with ethanol, for later ID confirmation. Surgical spirit is suitable; it is 90% ethanol and available from pharmacies.

RECOMMENDATION: Fish welfare should be considered at all times when sampling. All fish should be returned to the sea alive, post sampling. In some circumstances, fish welfare may supersede the recommendation to identify all fish to species level. This will depend on the aims of the survey, the experience level of personnel, time, weather conditions, site-specific factors and number of fish.

Some species have a similar ecological niche and are difficult to tell apart, for example common and sand gobies. There may be better welfare and less risk of wrong identification, if these species were grouped together and recorded as common/sand goby. Another example would be Allis and Twaite shad.

RECOMMENDATION: Another exception to the recommendation to identify all fish to species level could be for juveniles. Some juveniles may be too small to see their identifying features. This may depend on which method you are using and what size mesh it has.

For example, a mixed shoal of juvenile sprat and herring may include examples which are too small to see distinguishing features. Especially if there are many of them in the sample, it may be best to group them together and record them as juvenile sprat/herring.

TIP: Some species can look very different at different ages, though distinct in their own way. Taking clear photographs of juveniles can help to build a reference library. Many ID books only refer to the adults.

TIP: The mnemonic FLEMMSS can help clarify identifying features:

F – Fins: number, shape, position

L – Lateral line: shape, colour, prominence

E – Eyes: relative size, position

M – Mouth: size, shape, position of upper/lower jaw

M – Markings: distinctive spots, lines, stripes, blotches, saddles, colour

S – Size: maximum for species, size for age class, relative size of features

S – Shape: overall shape, shape of features, shape relative to similar species

TIP: Some species have handy hints to tell them apart from similar species:

- Herring/sprat: Look at the front edge of the dorsal fin and compare its position to the front edge of the pelvic fin. Herring: dorsal in front of pelvic. Sprat: dorsal in line with or behind pelvic.
- Brill/turbot: Both are relatively round flatfish. Brill have a frill near their mouth that is absent in turbot.
- Plaice/flounder: Both are relatively diamond shaped flatfish. Flounder have prickles at the base of the dorsal and anal fins which are absent in plaice.
- Sole/solenette: Both are relatively oval shaped flatfish. Sole have a black mark on their pectoral fin whereas solenettes have black lines striping their dorsal and anal fins.
- Grey mullets: Golden grey: golden mark on gill cover, pectoral fin reaches eye. Thin lipped: dark mark at base of pectoral fin, pectoral fin does not reach eye. Thick lipped: thick lips, pectoral fin reaches eye.

- Common/sand goby: common: more stout, tadpole shape, gill cover attached to whole throat. Sand: slimmer, more carrot shaped, gill cover attached only to front of throat.

Where to get help

RECOMMENDATION: If you are at all unsure about the identity of a fish send a clear photograph to fellow IFCA's or other experts for verification.

Photographs can be sent to the IFM via email or their Facebook page.

INFORMATION: There are a range of good books available, for example:

- Key to the marine and freshwater fishes of Britain and Ireland, Environment Agency
- A field guide to the marine fishes of Wales and adjacent waters, Paul Kay and Francis Dipper (This is good for the whole of the UK, not just Wales)
- Identification guide to the inshore fish of the British Isles, Peter Henderson.
- Key to the fishes of Northern Europe, Alwyne Wheeler

TIP: Some ID guides/photos are available on mobile devices (phone, e-reader, tablet computer) which could be useful in the field.

TIP: Different guides have different photographs or drawings of the same species which can look quite different. It can be helpful to use multiple books to identify some fish.

Data analysis

Data recording

RECOMMENDATION: There are a range of recording forms in use. It should include space for the metadata and the measurements of various fish species. It is helpful if it is clear when 50 measurements of any one species have been recorded.

TIP: Printing the recording forms on to waterproof paper can be helpful. Ruggedized laptops/tablets allow for in-the-field data entry, but paper forms should also be available as a backup.

Analysis and reporting

RECOMMENDATION: Analysis will depend on the aims of the survey. Options include: number of species, total abundance, relative abundance, length-frequency (for the most common species), diversity (Simpson's or Shannon-Weiner).

INFORMATION: The Environment Agency have developed a Transitional Fish Classification Index which uses ten metrics to calculate an Ecological Quality Ratio. The health of the sampled site is compared to pristine reference conditions.

This may not be suitable for all survey data, but part of the tool assesses the composition of fish species in feeding and functional guilds, which may be an interesting aspect for analysis.

TIP: Some surveys and the data they collect may be suitable for student projects.

RECOMMENDATION: It depends on the aims of the survey and the audience, but generally, reports should be clear, concise and easy to understand with engaging graphs, diagrams and photographs.

INFORMATION: It can be difficult to extrapolate the data and develop estimates of fish populations, as their distribution can be clumped and mobile. The survey data may not be representative of the entire water body.

Sharing

RECOMMENDATION: The data and reports should be made publically available and, in particular, to project partners.

Value

INFORMATION: There are a variety of reasons for conducting fish surveys:

- The fish populations of the UK, together with the fisheries they support, are of enormous environmental, social and economic value.
- Environmentally, fish are a major contributor and component of aquatic communities and a key constituent in the majority of marine and estuarine food webs.
- They are a good general indicator of ecological status and habitat health.
- Fish are commonly used as specific indicators to monitor change in the marine environment for example, temperature (climate change) and water quality (the effects of urban development and pollution).
- The near-shore marine environment provides valuable commercial and recreational fisheries, in addition to a multitude of other activities from water sports to renewable energy.
- Near-shore marine and estuarine environments commonly have high productivity and high biodiversity.
- These zones are home to many small fish species, from those which have evolved to be adapted to the specific near-shore conditions and remain in-situ for the majority of their life-cycle (e.g. gobies and sticklebacks) to species which utilise the near-shore environment during vulnerable stages in their life cycle, for example as 'nursery' grounds where the juveniles of

larger fish species use the features of the near-shore area for shelter (e.g. bass, herring and sprat).

- The value of the surveys is not only in the data collected, that can inform management decisions in relation to statutory drivers and in monitoring Marine Protected Areas, but also in the mutual benefit of partnership working and the sharing of resources and data.

Conclusions

The IFCA's have developed this best practice guidance to support and encourage existing and potential fish surveys. Fish surveys are conducted for a variety of reasons and the data that they gather is valuable. They are also great opportunities for collaboration and community engagement.

There has been extensive work to develop methods and guidance for fish sampling by the Environment Agency for the Water Framework Directive. Whilst this is valuable work, other options might be more appropriate depending on the drivers for the survey, its aims, data comparability and site specific factors.

More than one sampling method should be used and if possible, sampling should cover a range of habitats, salinities and tidal excursions within the survey site. Sampling methods and locations should be the same each time the samples are replicated.

All fish should be identified to species level where possible. Fifty fish of each species in each (sub)sample should be measured. Conspicuous non-fish species should be recorded to a suitable taxonomic level.

Welfare of the fish and other species should be considered at all times, as should health and safety of personnel.

