Methodology

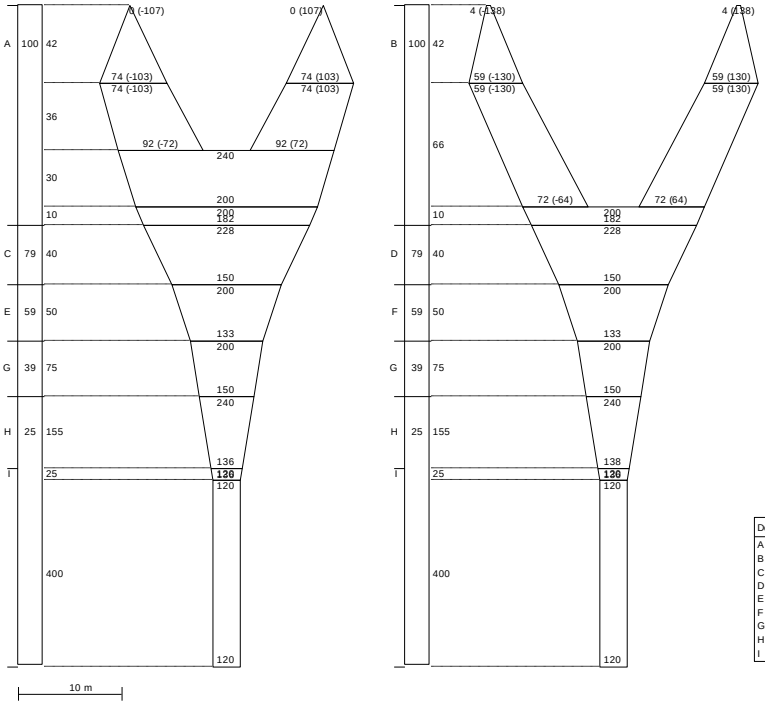
Technical description of the hauls

The trawl is towed for 30min at 4 knots ensuring good consistent contact with the seabed and a minimum headline height of 3.5m. All fish and commercial shellfish are sorted to species level prior to taking lengths and other biological measurements such as age, sex and maturity. Where species are abundant all or parts of the length frequency will be sub-sampled to ensure the final raised data is a true reflection of the length frequency of the catch. Weights and measurements are entered directly into an electronic measuring system in the fish-room with biological targets being flagged and met during this routine length frequency sampling.

Vessel and gear

The IGFS is carried out on board the R/V *Celtic Explorer*, a 65 m vessel with 4320 KW engine power. The trawl used is a high headline "*Grande Overture Verticale*" (GOV 36/47), as is used throughout much of the shallow NE Atlantic shelf and North Sea areas within IBTS (See Figure 4). A nylon 20mm liner is used in the cod-end to retain juvenile fish. In line with IBTS recommendations, sweeps are lengthened to maintain trawl geometry in deeper water, from 55m up to depths of 80m to 110m in deeper water.

Due to the generally harder and more difficult trawling grounds off the northwest coast all hauls in Area VIa of the survey are carried out using a GOV rigged with 16"" hoppers to minimise gear damage (Fig 5). The remaining survey is completed using GOV's in their more traditional A-gear configuration (8" disks centre).



Description	Material	Runnage (m/kg)	Mesh side (mm)	Diameter (mm)
A	PA	280	100	2.87
B	PA	140	100	4.5
C	PA	280	80	2.87
D	PA	180	80	3.8
E	PA	280	60	2.87
F	PA	180	60	3.8
G	PA	280	40	2.87
H	PA	280	25	2.87
I	PA	180	25	3.8

Figure 4. Net panels for the GOV 36/47 trawl gear used on the IGFS survey

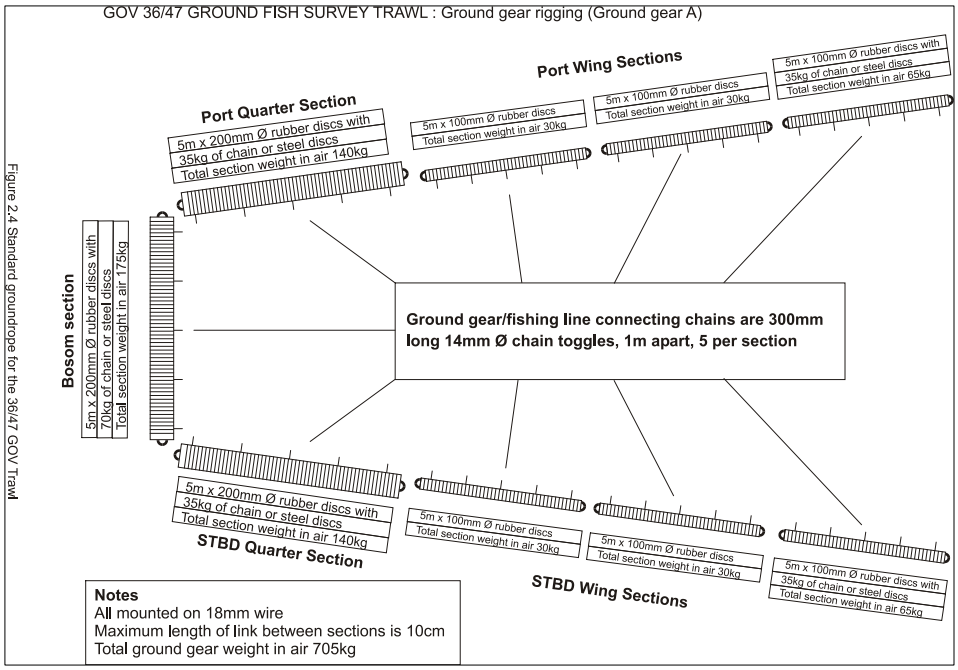


Figure 2.4 Standard groundrope for the 36/47 GOV Trawl

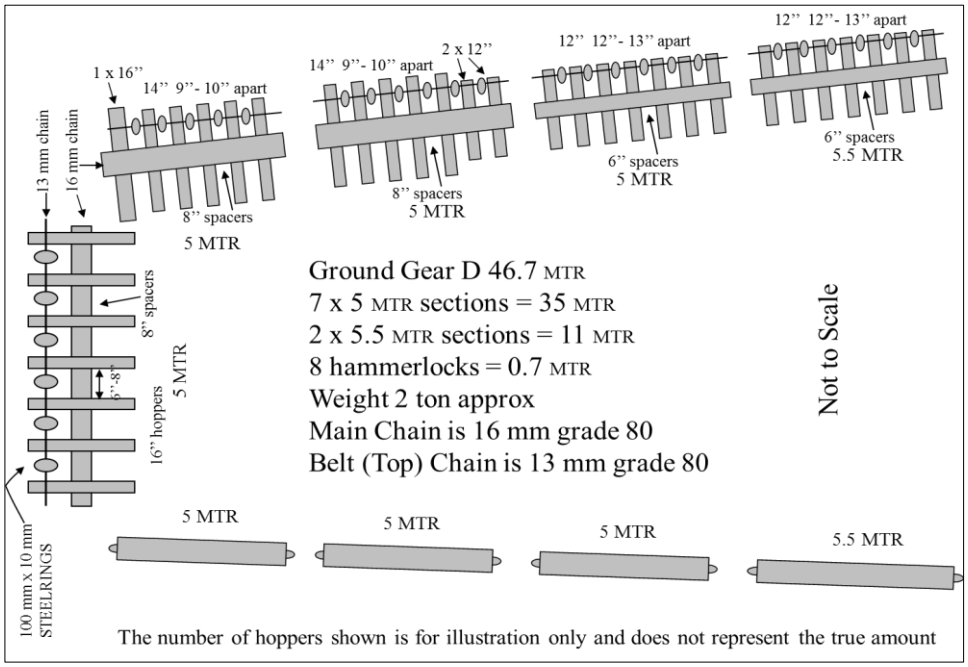


Figure 5 Standard A-type groundrope for the 36/47 GOV trawl groundgear 'A' top and groundgear D below.

Data QA and storage

All catch data for each haul is entered directly into Access databases via electronic measuring boards. A range of automated quality checks are run in the fish room after each haul to capture any erroneous records as early as possible.

Quality checked catch data for the day is then loaded on to a central secure server running SQLServer 2010. This survey database also contains the other positional and gear parameter meta-data for the tows. Raw navigation and gear monitoring information is also logged directly into SQLServer.

Additional sampling undertaken

i. CTD sampling

A HydroBios CTD is attached to the starboard trawl door for each fishing tow. This instrument collects Conductivity (analogous to salinity), Temperature and Depth information during the fishing tow which is subsequently downloaded on a daily basis and stored on a central server.

ii. Oceanographic sampling for the CaNDyFloSS project

The UK NERC funded CANDYFLOSS project is a work-package of the substantial Shelf Sea Biogeochemistry programme (SSB). For this project seawater samples were taken at 6 metres below the surface with the ship's CTD rosette once a day during the duration of the survey. The three parameters of interest were Nutrients, Dissolved Inorganic Carbon and Dissolved Organic Matter. The aim of the sampling was to look at fluxes of carbon dioxide into and out of the NW European shelf seas and at air-sea exchange. Partner organisations include the University of Liverpool, the UK MET Office, University of Bergen, Norway; the University of California as well as partners in Spain, Germany, Denmark, Scotland and France.

iii. Oceanographic transects

Three dedicated CTD transects are also carried out annually. These are located off the Northwest, Southwest and Southeast coasts to collect data on shelf currents. With the ship stationary the CTD rosette is lowered to just above the seabed before retrieval providing real time data of the vertical temperature and salinity profile. Sampling is repeated along these transects at 6 nautical mile intervals to provide data for spatial modelling of oceanographic currents.

iv. Collection of benthic invertebrates by beam trawl

As part of an internal review the inter-annual variability of the benthic component of the catch was reviewed. Being more suited for targeted benthic sampling a small beam trawl was used to compare directly the benthic species diversity within the GOV versus parallel tows using a beam trawl at selected locations (Fig. 6).

Fig. 6 Locations of beam trawl (black triangle) and GOV (white triangle) comparison hauls on the South west coast of Ireland.

The invertebrate macro-fauna has routinely been recorded throughout the groundfish time series to the extent that resources and staff experience allow. The protocol involves sorting to as near species level as is practical prior to recording weights. In addition, for 2014, recording a count of individuals was trialled and will be evaluated prior to inclusion hereafter.

In order to review specific animal groups causing taxonomic identification problems between survey legs and years, a number of samples were sent externally to the Marine Institute for independent expert validation.

v. Seabass

Seabass sampling was carried out in the Celtic sea to assist with an M.Sc. programme. The work involved attaching of Floy tags to anaesthetised adult fish prior to releasing them back

to sea. The data will be used to investigate stock distribution and migratory patterns in the Celtic Sea.

vi. Mackerel

A number of juvenile mackerel, between 15 and 22cm in length, were collected and frozen for subsequent stomach analysis by the Danish National Institute of Aquatic Resources.

vii. Sprat & Herring

A number of sprat and herring samples were collected for a Ph. D. study. The aim of the project is to describe the population structure, ecology and stock identity of *Sprattus sprattus* within the Celtic Sea Eco-Region. Sampling involved freezing >300g samples of sprat and >100g samples of herring from as many stations as possible.

viii. Sepiolids

All sepiolids were identified, counted and stored in alcohol. The samples are subsequently sent to the National Museum of Natural History in the Netherlands annually for formal identification as part of an ongoing sample request.

ix. Elasmobranchs

Genetic fin clip samples were collected from *Raja clavata* and stored in alcohol for a French study.

Various elasmobranchs such as Common Skate, Tope, Blue shark, Smooth Hound, Porbeagle and large Spurdog were tagged on an opportunistic basis using Jumbo rototags. Fish in good condition were quickly removed for measurement, tagging and release. Post survey, the tag data was sent to Inland Fisheries Ireland who manage the programme.

Egg cases for *Leucoraja circularis* and any skate species were identified but not retained.
A request was made to collect fin clip samples from any Blue shark encountered, however none were found.

x. Litter

All litter collected during trawl hauls is recorded by type, weight and volume. The litter categories are those agreed on by the IBTS Working Group.

xi. Seapens

Seapens from any hauls were collected for the UK Natural History Museum. The samples were frozen whole with the objective being to carry out population genetic analysis using microsatellite markers.