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Report of the Study Group on Survey Trawl Gear for the IBTS Western and Southern Areas (SGSTG)

11–13 February 2004
Santander, Spain

International Council for the Exploration of the Sea

Conseil International pour l'Exploration de la Mer

Palægade 2–4 DK–1261 Copenhagen K Denmark
Telephone + 45 33 15 42 25 · Telefax +45 33 93 42 15
www.ices.dk · info@ices.dk

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1 TERMS OF REFERENCE AND PARTICIPATION

The **Study Group on Survey Trawl Gear for the IBTS Western and Southern Areas** [SGSTG] (Chair: Francisco Velasco, Spain) will meet in Santander, Spain from 11–13 February 2004 to:

a) review the modifications and field trials of candidate trawl gears proposed at the 2003 meeting;

b) propose the candidate net and ground gear configurations to be used in the different surveys in the area, according to the results of (a);

c) determine standardized trawling procedures after appropriate trawl gear has been chosen, in relation to the procedures used in the North Sea;

d) define the required scope of continuing inter-calibration work required to maintain continuity in time-series, including the North Sea time-series;

e) recommend appropriate survey design for multi-vessel/gear permutations such as stratification, overlap, and the combining of data to provide indices of abundance and biodiversity and any other appropriate indicators of stock and regional scales;

f) review gear design proposals from commercial net manufacturers.

SGSTG will report by 28 February 2004 for the attention of the Fisheries Technology and the Living Resources Committees.

The meeting was attended by:

Aida Campos	Portugal		Non-member
Jim Ellis	UK (England)		
Paulo Fonseca	Portugal		Non-member
Frankie Griffin	Ireland		Non-member
Ingvar Huse	Norway		Non-member
Irene Huse	Norway		Non-member
Robert Kynoch	UK (Scotland)		
Kevin Peach	UK (Scotland)		
Antonio Punzón	Spain	(Part time)	
Alberto Serrano	Spain		
David Stokes	Ireland		
François Theret	France		Non-member
Francisco Velasco (Chair)	Spain		
Benoit Vincent	France		Non-member

2 INTRODUCTION

A large number of different benthic, demersal and semi-pelagic species are targeted in the North-eastern Atlantic. The information on the various commercial species collected during bottom trawl surveys carried out by the research institutes of the countries concerned is used by the assessment Working Groups (e.g., Northern Shelf, and Hake, Monk and Megrim Working Groups) to calibrate assessment models.

At present these surveys use different gears: the GOV trawl is used in Irish, Scottish, English and French research vessel surveys, although there are some differences in gear specifications, while Spanish surveys use the traditional baca gear (in Iberian waters) and a modified version, the Porcupine baca, on the Porcupine Bank, and the Portuguese use the NCT (Norwegian Campelen trawl). These gears are known to sample poorly some of the target species: flatfish and benthic species in the case of GOV, flatfish and monkfish for the NCT trawl and pelagic or semi pelagic species (i.e., adult hake and horse mackerel) for the traditional baca. The Porcupine baca was adapted to overcome the sampling problems for hake and other semi-pelagic species on the Porcupine Bank, but was found to be unsuitable for hard grounds in the Irish Sea, North-west Scotland or some parts of the Celtic Sea.

In its 2003 report, the Study Group on Survey Trawl Gear for the IBTS North Eastern Atlantic Area[1] (ICES, 2003) reviewed the IBTS data uses and needs, as well as the target species, ground types and the gears used in surveys. Two main areas were defined in terms of type of grounds and species targeted: soft ground areas including at least some

[1] In 2002, "IBTSWG considered that the current quarterly classification of Southern and Western Division surveys creates temporal distinctions between surveys that are artificial." (ICES, 2002a) Eastern Atlantic Area was proposed as a more adequate definition for the area and so it is used in this report.

more benthic target species (both megrims, *Nephrops*, anglerfish) as Iberian waters, Bay of Biscay, parts of the Celtic Sea, Porcupine and Western Ireland, for which the Porcupine baca was thought to be more suitable as a sampling trawl; and areas with hard grounds and demersal and semi-pelagic target species (mackerel, horse mackerel and gadoids), like eastern and northern parts of the Celtic Sea, Irish Sea, western Channel and North-west Scotland, where the GOV performs better.

The rest of the Terms of Reference that were proposed when the Study Group was established were postponed until later meetings considering that no work could be done in the first meeting without previous decisions on the gears and areas.

3 REVIEW OF THE TESTS OF THE MODIFICATIONS OF CANDIDATE GEARS

3.1 GOV

3.1.1 Trials conducted by FRS

During an FRS Marine Laboratory survey in May 2003 on FRV Scotia, the performance of the ICES Young Fish Sampling Trawl (Chalut GOV 36/47) was investigated with and without the Exocet kite. Thereafter, a number of modifications were tested which replaced the Exocet kite to provide lift by the addition of extra flotation. Separate gear performance trials were also made with the standard GOV to compare the performance of short and long sweeps in water depths >70 m.

Results from these trials (Working Document 1) conclude that the Exocet kite is very effective at providing hydrodynamic lift to the headline and wings of the GOV without compromising net efficiency. The kite provides additional rigidity throughout the top sheet of the net particularly at the quarters. It has been demonstrated that it is not simply a case of replacing the kite by the addition of extra flotation as this can cause ground gear contact to reduce and therefore affect catchability.

It is clear from these trials and the data collected from previous surveys that bridle angle can increase significantly when using the shorter sweep lines fishing in depths >70 m. The upper range of the achieved bridle angle >20° may well negatively influence the herding capability of the net. Given the limited number of hauls made during these trials it is not possible to draw any conclusions from the catch data with regards to size selection. To test conclusively further trials would be required to compare catching efficiency for a range of bridle angles up to the maximum recorded during previous surveys. Also to be considered during any future trials would be tidal conditions and their possible effect on gear geometry especially during strong tidal periods.

3.1.2 Trials conducted by CEFAS: modified GOV with rock-hopper ground-gear

Possible modifications for the GOV trawl that were raised previously by SGSTG (ICES, 2003) were to:

1) Replace the kite with flotation
2) Incorporate new twine technology
3) Strengthen the belly with tearing strips and/or belly lines
4) Develop ground gear D (Rock-hopper) experimental design
5) Investigate the effect of removing the middle bridle
6) Alter flotation to compensate for instrumentation

The GOV used by CEFAS in the southwest survey incorporated four of the modifications suggested, thus differing from the standard GOV design used in the North Sea (Working Document 2). The aspects not addressed were the incorporation of new twine technology and the alteration of flotation to compensate for instrumentation.

These modifications were made after discussions and liaison with Sea Fish (Hull), and incorporated flume tank trials with a scale model of the GOV (20 October 2003). These modifications were made with a view to establishing a robust GOV that could be fished on coarse grounds, although further trials at sea, including direct observation, are still required.

- The model indicated that much of the towing force was through the middle bridle, which created slack in the forward lower panels, which would then be subject to damage on coarse ground. Hence the middle bridle was removed.

- The model also indicated that when the bosom of the net was reduced from 5 m to 3 m, then the fishing line was tighter to the ground gear and the slack in the lower wings was further reduced. Following the flume tank trials, it was decided to modify the bosom section of the GOV used (i.e., from 5 m to 3 m, with the meshes hung in this area by 1 in 3 and not 1 in 2). Direct observations on gear geometry and gear performance for this gear change are essential.
- The ground gear was replaced with a rock-hopper set. The proposed rock-hopper set was composed of nine sections, the bosom section (3 m, with 16" rock-hoppers with one 6" spacer), the bunt section (each 5 m long, with 16" rock-hoppers with two 6" spacers), the wing sections (each 5 m long, with 14" rock-hoppers and three 6" spacers) and the wing end sections (each 5 m long, with 12" rock-hoppers with three 6" spacers).
- The fishing line was 0.6 m longer than the ground gear, tight on the wings with the 0.6 m slack set behind the central 13 m of ground gear.
- The headline floatation (60 x 8 inch bottles, 175 kg of static lift) was spread evenly over the headline and extra floats used (12 x 11 inch plastic bottles) used instead of the kite.
- Both the upper and lower bridles were kept at 40 m and the lower bridle incorporated a bumper bobbin and chain adjuster set at 2 m.
- The polyvalent doors were used with a 20 m sweep behind the door and 2 m of heavy chain (5 eighths) between the sweep-end and the bridles incorporated.
- Tearing strips were added to selected parts of the net (between panels 4 and 5, and panels 5 and 6, and bunt section of panel 4) to minimise damage. The inclusion of additional tearing strips (across panels 4, 5 and 6, and along the salvages) to further restrict gear damage and to aid repairs is to be addressed in future years.

Additional modifications were suggested following on from the 2003 survey, most of which are minor changes to improve the durability of the net and should have minimal effects on the overall fishing performance. Such modifications could include:

- The use of green polyethylene instead of nylon. Polyethylene is more robust and the net would sustain less damage, especially on the net drum. Although changing from nylon to PE is a major change, this would not disrupt any time-series for CEFAS and would assist in the standardisation with both FRS and MI.
- The addition of half-teal bobbins between the fishplate and the rock-hoppers, or replacing the fishplate with half-teal bobbins, could reduce minor damage to the wing ends whilst hauling the net aboard.
- To minimise chafing, the nylon rope on the lower wing line could be replaced with combination and/or eye thimbles used to protect the eye splice.
- Whilst shooting and hauling, there was strain on the first sections of the rock-hopper/fishing line, and the lashings were causing some minor damage to the lower wings. The inclusion of double 6 mm tearing strips, 3–4 meshes deep should alleviate this problem. The addition of a protective rope to the fishing line, wound between meshes in the lower wing, would also reduce chafing. Double nylon/PE (5–6 mm) should reduce damage to meshes in the lower wings.
- The inclusion of short dangle chains on the central section of the rock-hopper ground-gear so that ground contact can be monitored.
- The aluminium floats, when wound around the net drum, caused minor damage to the fastenings on the headline. It is suggested that plastic floats, which have a different method of attachment would alleviate this problem. Also, the use of larger (11") plastic floats would reduce the number of floats needed, which would also increase the capacity to bring the net in on the net-drum.

More fundamental changes that could be considered include:

- Adjusting the dimensions of panels 5 and 6 so that the net tapers more smoothly, which will reduce the likelihood of "boiling" and "blowback". This is a more radical change from the standard gear and thus needs to be considered in relation to both fishing efficiency and standardisation.
- The bolt-rope may be redundant, given that the middle bridle is no longer used, and could therefore be removed, as it is may affect the tension and shape of the net.

Other aspects of the rigging of the GOV that could usefully be examined at sea would include:

- The effects of different lengths and combinations of wire and chain on the sweeps and lower bridles should be investigated in both the flume tank and in the field.

- The use of a tickler chain should be investigated for use on different grounds, the length of which should be 1 in 10 shorter then the ground rope (ca. 40 m for the current specifications), so that it is between the headline and fishing line, but not so close to the ground rope that it will turn stones into the net.

3.2 Porcupine baca

Of the modifications proposed to Porcupine baca in (ICES, 2003), those that *a priori* were considered to have a stronger effect in the behaviour of the gear were:

1) A graduation of mesh size with 90 mm in the anterior panels and 70 in the posterior ones keeping the inner 20 mm liner
2) The substitution of the double wrapped ground-rope for 8.5 cm rubber discs, and stiffer twine types of the wings and belly panels

A new net with these modifications was built by the Marine Institute and was tested during the 2003 Porcupine survey on board the Spanish R/V "Vizconde de Eza" (Working Document 3). The results of these comparison experiments were presented to the group in Working Document 2. Nine comparative and subsequent tows were performed using the Standard 39/52 Porcupine baca described in ICES (2003). Both nets were equally rigged and used the same doors, sweeps, wire length and Scanmar sensors. In each of the comparative hauls one of the gears was alternatively deployed first. Standard trawling and catch processing protocols for the Porcupine Survey (ICES, 2002b) were followed in all the trials. Species with less than 30 individuals in the 18 hauls performed were not considered in the comparisons of the catches. Length distribution of the catches of most common species, including flat and ground fishes of different sizes, was analysed to detect possible differences in selectivity due to the different mesh size of both nets.

The modified net had a slightly smaller vertical opening and door spread, although the differences were not statistically significant. On the other hand, total catches per haul were larger for the modified net in 7 of the 9 hauls performed; although only in 3 of them did this difference persist once the catches of most abundant schooling species (blue whiting, argentine and black-mouth catshark) were removed. For most abundant fish and commercial species a t-test was applied to detect significant differences in the mean catches on the nine hauls, these differences were only significant ($p<0.05$) for blue whiting and black-mouth catshark.

The species composition of the haul catches did not show important differences after the exclusion of blue whiting, due to its schooling behaviour. Therefore decrease in catchability for benthic species due to the new ground-rope in the modified net could be inferred.

The comparison of the length distribution in the catches of both gears indicates that the smaller mesh size of the modified gear results in a slightly higher capture of small individuals. Nevertheless these differences did not have an important effect in the overall length distribution of the species considered in this study.

An aspect that needs further research is the robustness of the modified gear, and its suitability for rough grounds, given that only one modified gear was available, and no replacement panels or twine were on hand.

Additional trials of these modifications are expected in the next Porcupine survey to test the differences found and the suitability of the gear for rough grounds. If the former are not found significant and the later favourable these changes could be implemented in Porcupine baca to improve its performance in hard grounds.

4 REVIEW OF PROPOSALS FROM COMMERCIAL NET MANUFACTURERS

Marlab approached a number of commercial net manufacturers in Scotland with a view to establishing whether an existing gear fully matches the net design specification to target species and survey areas outlined by the group. From these communications it was apparent that even though gears currently used by the Scottish demersal fleet broadly match the specifications not one individual design matches all criteria. In other words, the knowledge and technology to develop a gear matching all the needs of the IBTS North Eastern Atlantic Area surveys exists, and this task can be achieved within a relatively short period. Since the gears are usually designed and built for fishing vessels with specific requirements, to develop this gear it would be necessary to have a collaborative study involving gear experts from the WGFTFB, cruise representatives from the IBTSWG, and commercial net manufacturers.

5 NEW GEAR CONCEPTS AND PROSPECTS FOR THE FUTURE

5.1 "AM Surveytrawl"

The *"Surveytrawl"* accompanying measure (for 2003) was intended to provide the strategic basis and initial design for a new survey trawl, which would represent a good compromise in terms of being non-herding and non-selective, and with stable and consistent operation. The final objective was to design a new trawl with the characteristics of a beam trawl (no herding effect, stability), but with no beam.

To avoid the herding effect, different rigging concepts were studied. The netting parts of the different trawls are very similar for each concept, but the riggings are very different. The designs have been tested by means of numerical simulation, using DynamiT software, to verify whether the designs represent hydrodynamically viable options. Some of the most feasible designs were also tested in flume tanks and at the sea.

The different concepts initially addressed were presented during the SGSTG meeting in 2003 (ICES. 2003) and the further achievements of the project were presented in 2004.

5.2 Continuation of "Surveytrawl"

The "Surveytrawl" accompanying measure and subsequent developments have led to a Norwegian (IMR) project with the objective to deliver a new survey trawl for the Barents Sea groundfish survey by 2006, to be implemented in the survey by 2008 after extensive inter-calibration and testing. The gear design will be based on recent developments in the trawl manufacturing industry (e.g., self-spreading through the use of net mounted canvas side kites and a flexible plate based ground-gear providing solid bottom contact on a variety of bottom types and developing horizontal spreading force, potential trouser trawl design to reduce spreading force requirements, and possible use of square meshes in the front part for the same purpose), but with focus on the special requirements of the survey situation (predictable, minimal or no herding; solid bottom contact/minimal escapement under the trawl; sampling a wide variety of species and size groups on a wide variety of bottom types).

An international resource group consisting of gear and survey experts will aid the project team. The design will be in compliance with requirements identified by SGSTG/IBTS and will have potential for optional configurations regarding critical elements like vertical opening (up to 8 m) and ground gear (plate gear, wrapped wire, rock-hopper) and rigging (e.g., sweeping angle 0 – 20°). This will provide IBTS with the necessary flexibility to define protocols for rigging, deploying and maintaining the gear. Patenting of any new developments will be counteracted by early publication of results.

The project welcomes interested parties to participate in the development and in surveys. In order to ascertain two-way communication and a mutually favourable outcome SGSTG/IBTS should set up liaison to facilitate communication with the Surveytrawl project group.

The Norwegian project is funded nationally. If a parallel development within the EU is deemed necessary, financial support should be sought under the research funding available for improved data collection (DG Fisheries, EU Commission) for the criteria laid down by the group. Regardless of what new trawl or modification is decided on, funding should also be sought to accomplish the extensive inter-calibration needed to implement any new or altered design.

Although the concepts and present developments of the Norwegian Surveytrawl project are considered very promising, some doubts still remain regarding the suitability of the final design for all the species and ground types within the IBTS North Eastern Atlantic area. Therefore and considering what has been stated in Section 4 the recommendation of the SGSTG is that, in the first instance, the SGSTG and the IBTSWG should collaborate fully with the Surveytrawl project group. In addition, and recognising that this is a national project with national aims, funding should be sought for a wider project to build on the results of Surveytrawl. This should be in combination with commercial net makers, taking advantage of their experience in commercial net design and construction techniques. The aim of such a project would be to design a net for the 21st century, which fully matches the SGSTG criteria for the North Eastern Atlantic IBTS surveys, and which can have a broad application.

6 OPTIONS TO STANDARDIZE THE IBTS NORTH EASTERN ATLANTIC AREA GEAR

The group concluded that at the moment there is no gear that addresses all of the criteria, but considered that it is feasible to have an appropriated gear design within a short time if there is funding. As stated in Sections 4 and 5, there are options of having a new survey trawl within a 3–5 year period:

1) Development of a new trawl in combination with expert commercial net makers within the frame of a EU project.
2) Norwegian Survey Trawl project: this new gear, which is still in the development stage, has been partly tested and is hoped to be an appropriate sampling device for the target species and ground types covered by the IBTS Northeast Atlantic area, as described in SGSTG 2003 Report. This project designing the gear has not considered all the characteristics of the species and ground types defined in this report, therefore would need to be tested in the survey areas and species.

After what was agreed in the last report and revisions of the modifications carried out during this year, to standardize the surveys in the North-Eastern Atlantic area would require major changes: areas covered at the moment by GOV (Western Ireland and France at least outer Celtic Sea and Bay of Biscay), Traditional Spanish baca and Portuguese NCT would have to change to Porcupine baca type gear. These changes imply important inter-calibrations for surveys with long time-series: EVOHE-GOV, both Spanish Traditional Baca-Surveys in Iberian area and NCT Portuguese Survey (that also has the problem of limited vessel capability to tow the Porcupine Baca gear). The group agrees that standardising to this gear in the short-term, given that there is the possibility of changing to a new all purpose trawl in the short to medium term, is not worthy or practical given the economic and work effort needed and the implied breaks in existing time series.

On the other hand some standardising within the GOV trawls in rougher areas where different configurations of GOV are used at the moment (Northwest Scotland, Irish Sea, western Channel and north-eastern parts of the Celtic Sea) was viewed as the most appropriate and realistic option for the short-term. This development and standardization would have two advantages: the improvement in performance of the new GOV regarding hard grounds and making future inter-calibrations with a new survey gear more straightforward.

Regarding the combination of the different survey abundance indices to provide broader distribution maps, while a standard gear is being designed and implemented: conversion coefficients are available for most the important commercial species between EVOHE GOV and the Traditional Baca used in Spanish surveys in the Iberian Peninsula, and also between the Traditional Baca and the Portuguese NCT, both obtained in the inter-calibrations carried out within the SESITS project (Sánchez, 1999). On the other hand, the studies carried out in IPROST project (Mahé, 2001) did not find conclusive evidence that conversion factors are required to map distribution and abundance of combined results from the Scottish, Irish and French GOV surveys for the most important commercial species.

Therefore the SESITS conversion coefficients can be used to combine the information of Iberian areas with the information of the rest of the GOV surveys and produce combined distribution maps and abundances for main commercial species until a Standard Gear is adopted and more precise indices of abundance, biodiversity and regional stock indicators can be obtained. The only gear used in the IBTS North Eastern Atlantic area that has not been inter-calibrated with a second gear is the Porcupine Baca, an inter-calibration experiment with the Irish survey in Western Ireland is thus recommended.

7 CHARACTERISATION OF SURVEYS BY GEAR AND AREAS

Given the large spatial extent of the surveys undertaken in the IBTS North Eastern Atlantic area (Figure 7.1), as well as differences in target species, it is important to have a clear overview of the requirements of each survey on the ground, in order to find as much commonality as possible.

Table 7.1 gives the survey parameters for the areas concerned, updated from the SGSTG Report in 2003. The surveys range from 36°N to 60°N and from 15 m – 800 m in depth. Vessels range from the 43.5m (880 Kw) Lough Foyle to the new 74 m (3240 Kw) CEFAS Endeavour.

More importantly, from SGSTG's perspective, ground types vary from the hard rocky seabed of the west of Scotland and northern Celtic Sea to the much cleaner and softer grounds such as the west of Ireland, Bay of Biscay and Irish Sea. In general this is allied with a strong shift away from target species that include pelagic/semi-pelagicspecies such as herring and horse mackerel as well as some other roundfish (mainly gadoids), which require a net with good vertical opening, as surveys move west towards the shelf edge. In more western areas and as depths increase target species tend to be more demersal/benthic living and include monkfish, megrim and *Nephrops*. The latter species are often associated with fine sediments, so survey nets require good ground contact and headline height becomes less of a concern, although roundfish (e.g., hake) are also important target species.

The heterogeneous nature of the grounds and target species encountered by these surveys has led to the variety of gear types and configurations outlined in this document. In general, however, as the traditional GOV surveys migrated out of the North Sea several new configurations developed largely to overcome the much rougher nature of the seabed. This gear still predominates the western area surveys from the Bay of Biscay north to the west of Scotland, and out to the shelf edge down to 200–400 m. In deeper waters where target species tend to be dominated more by flatfish and

Nephrops, and grounds less destructive to the gear, alternative gears are being used. The baca trawl is used along the Spanish coast, with a modified higher headline version, the Porcupine baca, being used on the Porcupine Bank. Finally the Norwegian Campelen Trawl is being used during the 3rd and 4th quarter Portuguese surveys.

Discussions within, and recommendations emanating from the SGSTG are necessarily structured around the framework of requirements outlined above.

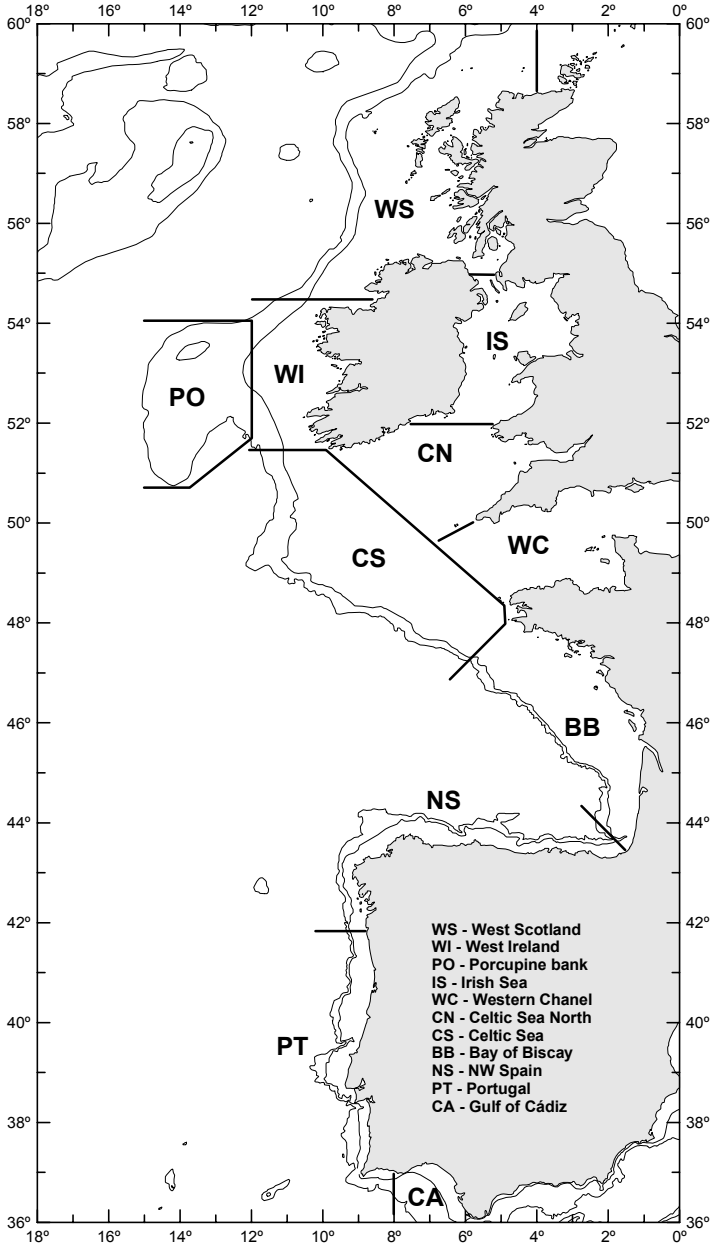

Figure 7.1. Homogeneous surveyed areas in the Atlantic European shelf taking into consideration target species and ground types.

Table 7.1. Technical details of the IBTS coordinated surveys in the North Eastern Atlantic area.

Country/Institute	Ireland	UK/ Scotland	UK/North Ireland	UK/ England & Wales	France	Spain	Spain /Porcupine	Portugal
	MI	MLA	DARD	CEFAS	IFREMER	IEO	IEO	IPIMAR
Survey Area	WS, IS, CS, CN	WS, IS	WS, IS	IS, WC CN. CS	BB, CS, CN	NS & CA	PO	PT, CA
Survey Code	IGFS	SCOGFS	NIRGFS	CEFAS	EVHOE	SPGFS	SPGFP	PGFS
Initiated (as per quarter)	2003	1985 & 1992	1991	2002 baca 2003 GOV	1997	1983 & 1993	2001	1979
Duration (days)	*42*	*21& 21*	*19 & 19*	*32*	*50*	*30 & 12*	*30*	*30 & 30*
Quarter	*4*	*1& 4*	*1 & 4*	*4*[2]	*4*	*2 & 4*	*3 & 4*	*3 & 4*
Hauls	*160*		*60*	*70*	*140*	*114 & 35*	*80*	*97 & 30*
Research vessel	*Celtic Explorer*	*Scotia*	*Lough Foyle*	*Endeavour*	*Thalassa*	*Cornide de Saavedra*	*Vizconde de Eza*	*Noruega*
Stern Ramp	No	Yes	No	No	Yes	Yes	Yes	Yes
GRT	2000	2619	547	2983	3022	1133	1400	496
KW	4000	3000	880	3240	2200	1650	1800	1100
Overall length (m)	65.5	68.6	43.5	74	72.7	67	53	47.5
Gear Type	GOV 36/47	GOV 36/47	Rock Hopper	GOV 35/45 Rock-hopper	GOV 36/47	BACA 44/60	Porcupine BACA 40/52	NCT
Depth range (m)	15–200	20–200	20–120	15 - 200	30–400	30–700	180–800	30–750
Trawling speed (knots)	3.5/4	4	3	4	4	3	3.5	3.5
Haul duration (min)	30	30	30	30	30	30 & 60	30	60
Doors weight (kg)	1450	1100	N/A	1440	1350	650	850	650
Doors surface (m^2)	5.5	4.5	N/A	4.5	4.5	3.58	4.2	3.75
Sweep length (m)	55 110	60	12.5	20	50 100	200	250	No
Diameter of Lower Bridle (mm)	28	20	18	20	22	N/A	18	16
Diameter of Upper Bridle (mm)	22	14	20	14	12	N/A	18	14
Diameter of Middle Bridle (mm)	22	14	N/A	N/A	12	N/A	N/A	14
Exocet Kite	No	Yes	No	No	No	No	No	No
Floats in Headline	14(8") + 10(11")	20	N/R	12 (11")	18	25	12	80
Floats in Winglines	20 + 20(8")	20 + 20	N/R	50(8")+2(11")	24 +24	15 + 15	50	80
Mean vertical opening (m)	4.8 +4.5	4.6	3	4.3	4 4.1	2.0	3.5	4.8
Mean doors spread (m)	76.7 + 114.7	82	37	N/R	76.9 112.7	107.1	120.4	44.3
Mean horizontal opening (m)	20.5 + 21.5	19.6	N/R	20.4	18.7 20.5	18.9	20	15.6
Sweeps Angle (º)	15.5 + 16.9	18	N/R	N/R	16.9	12.7	11.5	N/A
Groundrope	Rubber disks + chain (type A + C)	Bobbins	Rubber disks	Rubber disks + Hoppers (16"-12")	Rubber disks and Chains Rubber and metal disks	Synthetic wrapped wire core	Synthetic wrapped wire core double coat	Bobbins

8 PROPOSED STEPS IN STANDARDIZATION OF THE GOV

As stated in Section 6 the development of a new ground-gear for the GOV used in rough ground areas is thought an important objective in the short term. The potential users of this new design agreed that there should be a standardised rock-hopper design (ground-gear D). Two potential designs were tabled, one described in section 3.1.2, and an optional design described below. The standardised design should be finalised in the short term following liaison between the laboratories and after consultation with industry.

[2] There is also a 1st Quarter survey using a Portuguese High Headline Trawl as described in ICES (2003).

Ground-gear D: alternative Rock-hopper rig

- Bosom section 2 x 2.5 m 16 inch hoppers spaced at 6–8 inches with 8 inch diameter spacers.
- Quarter section 2 x 5 m 14 inch hoppers spaced at 6–8 inches with 8 inch diameter spacers.
- Wing section 3 x 5 m 12 inch hoppers spaced at 12–16 inches with 6 inch diameter spacers.
- Steel washers between each spacer and hopper.
- The grade and design of chains used for both ground rope attachment and through the hoppers would be decided after consultation with industry.
- The wing end section should be increased by ~0.8–1.0 m to accommodate any excess in the fishing line to mount the triangle square.

A dedicated engineering performance survey should be implemented to measure and compare the net geometry of the new and old ground-gear configurations. The main goal of these trials is to adjust the new set-up to were possible mimic the net geometry of the existing set-up prior to catch inter-calibration trials.

8.1 Proposal of inter-calibrations

In order to inter-calibrate a new rock-hopper ground gear (D) with ground gear C, parallel survey hauls should be made preferably in a twin rig configuration to reduce between haul variability. SGSTG recommends that inter-calibration of ground gear D uses this method (see Section 10).

9 SUGGESTIONS FOR SURVEY DESIGN FOR MULTI-VESSEL/GEARS

Although standardisation to a single gear type was not considered appropriate at the current time, progress towards standardising survey design was viewed more favourably. Some key aspects of survey protocol related with the ToRs of SGSTG are discussed below, and it is recommended that progress towards a more detailed survey manual for the IBTS North-Eastern Atlantic area is vital if standardised survey design and quality assurance are to be addressed, as is also addressed in the Terms of Reference of the IBTS Working Group for 2004.

Nowadays the Manual for the IBTS bottom trawl surveys in the western and southern areas (ICES, 2002b) covers in part this function, but is more a review of the different surveys than an actual manual about the work on board. As a first step a collection of some the issues that should be addressed by this manual and the information available to the group is proposed and reviewed in Appendix II. Further work is needed to gather all the relevant information for all the Surveys – Institutes – Countries involved, and to include the relevant aspects from the DATRAS database and exchange formats.

9.1 Survey stratification

Grids in some other surveys (e.g., North Sea) are stratified by ICES rectangle, and in other surveys geographically and by depth after studying distribution of ecological guilds. The utility of more ecologically meaningful strata (e.g., by a combination of latitude, depth, sediment and habitat type) in those surveys where it is not implemented at the moment should be investigated. The number of stations should be in proportion to the spatial extent and/or the variability in the strata. A further consideration would be having clusters of stations (e.g., areas of commercial importance), which as long as the data are raised appropriately and do not bias the overall survey grid, would maximise sampling at this time of year.

9.2 Overlap between adjacent surveys

There is some spatial overlap between the station grids undertaken by the countries involved in the western surveys: fishing the same stations in the areas of overlap and using those as comparative tows is recommended. An inter-calibration overlap area for all the adjacent surveys should be implemented. Greater coordination in the timing of work within these areas is an important role for IBTS; given ship time is often booked a year or more in advance. Given the limited availability of ship time and the geographical extent of the IBTS North Eastern Atlantic Area simultaneous pair trawling, although ideally desirable, is not considered a feasible approach, therefore alternative comparison methodology with hauls carried out in the same positions within the shortest feasible interval is encouraged and should be coordinated in the IBTSWG.

9.3 Staff exchange

Exchange of appropriate staff during groundfish surveys would be a useful method of ensuring consistency between surveys in terms of protocol and data quality issues, and would facilitate standardisation.

9.4 Quality control

Quality control is a crucial aspect to be considered in the standardization of the surveys and should be extensively detailed in the manual. The cruise leaders are responsible for controlling that the gear and rigging meet the specifications before each cruise is started, and that these specifications are maintained during the whole survey. A quick checklist of the items to be controlled during the survey and a protocol to maintain them should be agreed for each gear (see proposal for 36/47 GOV as used in the North Sea in Appendix II). This information should be filed as a permanent historical record of net deployment.

10 FUNDING

10.1 Development of a new survey trawl

The Norwegian Surveytrawl project will be carried out at a national expense. Work is required by EU partners to undertake a complementary development project in order to insure that wide-ranging acceptance and adaptability is achieved. This work will encompass development and evaluation of design criteria, modelling, tank testing, initial sea trials, evaluation work and dissemination. The costs are expected to amount to between 0.5–1 M€.

Funding will have to be sought for a collaborative study to design and build an alternative new survey gear with scientific, working group and commercial input. This process will incur significant costs from the design to implementation phase. To reduce costs Initial development could be undertaken using scale flume tank models. Only the most promising designs would therefore be taken through to full scale testing on research vessels.

As a separate issue funding would have to be sought to cover a 2 week engineering trip on a suitable research vessel to assess the gear geometry of the new ground-gear D with the old ground-gear C. An approximate cost of € 250,000 is anticipated.

10.2 Inter-calibration

Standardisation of present, and implementation of new survey trawls will require inter-calibration. Inter-calibration will require two vessels working alongside, or a twin trawler towing both trawls to be inter-calibrated. This will incur substantial costs, as the number of parallel hauls required will be in the order of magnitude of 30 per area/depth range. Ideally the trawls should be inter-calibrated for each bottom type/depth range encountered during the survey in question. This amounts to in the order of 100–150 parallel hauls per survey. Survey vessels can normally carry out 6 hauls per day, meaning that an inter-calibration exercise will amount to a total of 40 ship days using two vessels, and about half of that using a twin rig trawler. With a vessel cost of € 10,000 per day for a standard research vessel, and € 5000 for a commercial twin rig vessel with additional scientific staff, an inter-calibration will cost in the order of magnitude of € 100,000 using a commercial twin rig vessel, which is the cheapest option. Considering all of the IBTS area the total cost will be between 0.5 and 1 M €.

10.3 Financing

It will be difficult finding national funding for all these expenses. Most of the IBTS data, however, constitute national contributions towards meeting the requirements of the EU Council Regulation 1543/2000 “Regulation for Data Collection”. DG Fisheries should therefore be motivated to finance such exercises through funding available for research related to this Council Regulation.

11 RECOMMENDATIONS

1) Development of a Standard Gear using all the previously described SGSTG criteria should be decided by the IBTSWG in consultation with WGFTFB.
2) To set up a liaison between IBTS/SGSTG and Surveytrawl project group to exchange and update the necessary information regarding the requirements of the IBTS North Eastern Atlantic standard gear.
3) Develop a working manual for Southern and Western areas, which will include gear diagrams and descriptions covering all survey gears. All aspects of survey work should be covered including sampling protocols. This should be considered as a working manual and updated as the surveys develop.

4) Standardise the GOV sweep, kite and ground-gear usage (FRS, CEFAS, & MI).
5) Inter-calibrate the new rock-hopper ground-gear D with previously used ground-gears. Paired hauls or dedicated twin rig survey to compare net geometry and catch data would be required.
6) Carry out an inter-calibration between Western Irish Survey and Porcupine survey to complete the inter-calibrations between all the gears currently used in the area.
7) Identify current areas of survey overlap and design inter-calibration exercises to assess vessel and fishing gear variability. Possible overlap areas should also be considered for adjacent surveys without overlap at present.
8) Inter-calibration in relation to maintaining time series data will be revisited when the new candidate gear has been designed.
9) Surveys that currently are not depth and geographical stratified should investigate this issue through an analysis of the distribution of target species and the ecological communities in their area.

12 LITERATURE

12.1 References

ICES, 1999. Manual for the International Bottom Trawl Surveys. Revision VI. Addendum to ICES CM 1999/D:2. Lisbon, Portugal 7–10 April 1999. 49 pp.

ICES, 2002a. Report of the International Bottom Trawl Surveys Working Group. Dublin, Ireland 8–11 April. ICES CM 2002/D:03. 59 pp.

ICES, 2002b. Manual for The International Bottom Trawl Surveys in the Western And Southern Areas. Revision II. Addendum to ICES CM 2002/D:03. Dublin, Ireland 8–11 April 2002. 27 pp.

ICES. 2003. Report of the Study Group on Survey Trawl Gear for the IBTS Western and Southern Areas. Vigo February 12–14 February 2003. ICES CM 2003/B:01. 22 pp.

Mahé, J.-C. ed. 2001. International Program of Standardised Trawl Surveys (IPROST). Study EC-DGXIV No. 98–0587. Ifremer – Marine Laboratory – Marine Institute. 122 pp.

Sánchez, F. ed 1999. Evaluation of demersal resources of southwestern Europe from standardised groundfish surveys (SESITS). Study EC-DGXIV No. 96–029. IEO -IFREMER - IPIMAR: 195 pp.

12.2 Working Documents

1) Peach, K. and Kynoch, R.J. The effect on GOV performance of changes in flotation and sweep length.
2) Ellis, J., Harley, B. and Flatman, S. Modifications to the GOV trawl for use in Western groundfish survey. PowerPoint presentation.
3) Velasco, F. Performance Comparison Between Standard and Modified Porcupine Baca.

APPENDIX I: LIST OF CONTACT ADDRESSES

STUDY GROUP ON SURVEY TRAWL GEAR FOR THE IBTS EASTERN ATLANTIC AREA

Santander, 11–13 February 2004

NAME	ADDRESS	TELEPHONE	FAX	E-MAIL
Francisco Velasco (Chair)	Instituto Español de Oceanografía Laboratorio de Santander Apdo 240 E-39080 Santander Spain	+34 942 291060	+34 942 275072	francisco.velasco@st.ieo.es
Aida Campos Non-member	Instituto Nacional de Investigação Agraria e das Pescas (INIAP/IPIMAR) Av Brasilia 1449–006 Lisbon Portugal	+351 21 3027165	+351 21 3015948	acampos@ipimar.pt
Paulo Fonsec Non-membera	Instituto Nacional de Investigação Agraria e das Pescas (INIAP/IPIMAR) Av Brasilia 1449–006 Lisbon Portugal	+351 21 3027163	+351 21 3015948	pfonseca@ipimar.pt
Jim Ellis	CEFAS, Lowestoft Laboratory, Pakefield Road, Lowestoft, Suffolk, NR33 OHT, UK	+44 1502 524300	+44 1502 513865	j.r.ellis@cefas.co.uk
Frankie Griffin Non-member	Ardmanagh, Schull Co Cork Ireland	+353 282 8139	+353 282 8023	frankiegriff@hotmail.com
Ingvar Huse Non-member	Institute Of Marine Research P.O. Box 1870 Nordnes, 5817 Bergen, Norway	+47 5523 6807	+47 5523 6830	ingvar.huse@iMrno
Irene Huse Non-member	Institute Of Marine Research P.O. Box 1870 Nordnes, 5817 Bergen, Norway	+47 5523 6822	+47 5523 6830	irene.huse@iMrno
Robert Kynoch	Fisheries Research Services Marine Laboratory, PO Box 101 375 Victoria Road Aberdeen, UK, AB11 9DB	+44 1224 295478	+44 1224 295511	kynochr@marlab.ac.uk
Kevin Peach	Fisheries Research Services Marine Laboratory, PO Box 101 375 Victoria Road Aberdeen, UK, AB11 9DB	+44 1224 295376	+44 1224 295511	peachkj@marlab.ac.uk
Antonio Punzón (Observer)	Instituto Español de Oceanografía Laboratorio de Santander Apdo 240 E-39080 Santander Spain	+34 942 291060	+34 942 275072	antonio.punzon@st.ieo.es

NAME	ADDRESS	TELEPHONE	FAX	E-MAIL
Alberto Serrano (Observer)	Instituto Español de Oceanografia Laboratorio de Santander Apdo 240 E-39080 Santander Spain	+34 942 291060	+34 942 275072	aserrano@st.ieo.es
David Stokes	The Marine Institute Galway Technology Park Parkmore Galway Ireland	+353 (0)91730400	+353 (0)91773908	david.stokes@marine.ie
Francois Theret Non-member	IFREMER 8 rue François TOULLEC F 56100 LORIENT France	+33 2 97 87 3829	+33 2 97 83 3801	Francois.Theret@ifremer.fr
Benoit Vincent Non-member	IFREMER 8 rue François TOULLEC F 56100 LORIENT France	+33 2 97 87 3804	+33 2 97 83 3801	benoit.vincent@ifremer.fr

APPENDIX II: DRAFT OF SURVEY MANUAL AND QUALITY CHECKS

Fishing methods

Standard fishing speed

IBTS recommend a towing speed of 4 knots (ICES, 1999) in the case of GOV, 3 in Standard baca, 3.5 Porcupine baca and NCT. Towing speed, to be effective, should be greater than the maximum sustainable swimming speed for the fish species targeted. Field studies examining the effect of trawl speed may be required when standardised gears are agreed.

Trawl duration

Trawl duration is currently 30 minutes for some surveys and 60 minutes in other surveys. Further work to examine optimal trawl duration should be undertaken, both in terms of the sample size and data requirements for stock assessment of commercial species, and in terms of biodiversity monitoring.

Recording of net geometry

Vertical net opening (headline height) and both door and wing spread should be recorded for all hauls. The use of ground-contact sensors should be encouraged. These data should be collected at 30-second intervals and mean values reported, as recommend by ICES (1999). Protocols for rigging Scanmar or alternative monitoring equipment should be established for each gear.

Swept area

Swept area should be calculated as standard. Further studies on swept volume are required.

Warp:depth ratio

This ratio (or the function used to determine the warp length from depth) should be stated for various surveys and depths.

Daylight fishing

Trawling should be conducted in daylight hours, as defined as the time between 15 minutes before sunrise and 15 minutes past sunset, as per ICES (1999).

Sub-optimal fishing conditions:

Members of the group considered that the effects of strong tides were an important consideration, and further guidance is required from IBTS on trawl protocol (e.g., heading and speed) in relation to strong tides (heading and tidal strength). Similarly, severe swells or other poor fishing conditions that may effect either gear performance or fish behaviour should be noted, possibly in conjunction with fields related to validity codes.

Validity codes

Valid, invalid, partially valid, as per ICES (1999) and DATRAS exchange formats agreed in ICES (2002a).

Fishing positions and survey grid design

Station positions

As per ICES (1999) and DATRAS protocols.

Stratification

Grids in some other surveys (e.g., North Sea) are stratified by ICES rectangle and in other surveys geographically and by depth after studying distribution of ecological guilds. The utility of more ecologically meaningful strata (e.g., by a combination of latitude, depth, sediment and habitat type) in those surveys where it is not implemented at the moment should be investigated. The number of stations should be in proportion to the spatial extent and/or the variability in the strata. A further consideration would be having clusters of stations (e.g., areas of commercial importance), which as long as the data are raised appropriately and do not bias the overall survey grid, would maximise sampling at this time of year.

Overlap of surveys

There is some spatial overlap between the station grids undertaken by the countries involved in the western surveys: fishing the same stations in the areas of overlap and using those as comparative tows is recommended. An inter-calibration overlap area for all the adjacent surveys should be implemented. Greater coordination in the timing of work within these areas is an important role for IBTS; given ship time is often booked a year or more in advance.

Sampling of trawl catches

Length distribution of finfish

As per ICES (1999): All finfish measured to the centimetre below, except herring, sprat, anchovy and sardine, which are measured to the 0.5cm below.

Sub-sampling

As per ICES (1999)

Size categories

As per ICES (1999)

Fish identification

QA for identification of fish species important, especially for less common species that may be an important issue for biodiversity studies.

Otolith sampling and maturity data:

Follow the Data collection regulations.

Shellfish:

All cephalopods to be identified to species level, data collection for commercial shellfish to be agreed (e.g., numbers, weight and size distribution, and for which species)

Taxa	Number	Biomass	Length	Sex[2]
Squid[1] (Loliginidae)	✓	✓	✓	
Cuttlefish[1] (Sepiidae/Sepiolidae)	✓	✓		
Octopus[1] (Octopodidae)	✓	✓		
Scallop *Pecten maximus*	✓	✓		
Edible crab *Cancer pagurus*	✓	✓	✓	✓
Lobster *Homarus gammarus*	✓	✓	✓	✓
Crawfish *Palinurus elephas*	✓	✓	✓	✓
Norwegian lobster *Nephrops*	✓	✓	✓	✓
Other species	to be agreed			

[1] To be identified to species level; [2] Male, female and berried

Benthos

Data to be collected for other species caught, although the method of quantification (e.g., presence/absence, biomass and/or numbers) should be established and standardised.

Environmental data

Temperature

Surface and bottom temperature should be collected for all haul positions. Effects of mini-CTD on net geometry should be investigated.

Salinity

Surface and bottom temperature should be collected for all haul positions. Surface samples should be collected for calibration.

Other hydrographic data

Tidal direction and strength, wind speed and direction, swell height and direction should be recorded.

Standardisation

Staff exchange:

Exchange of appropriate staff during groundfish surveys would be a useful method of ensuring consistency between surveys in terms of protocol and data quality issues, and would facilitate standardisation.

Quality control and quick CHECKLIST

The cruise leader is responsible for controlling that the gear and rigging meet the specifications before each cruise is started. For each gear, the following checks should be applied. The checklists and deck haul summary sheet filled out by the scientist in charge (SIC) or appointed net person (scientific staff). This information should be filed as a permanent historical record of net deployment.

A detailed trawl checklist figure must be used for each gear and all rigging, and trawl specification should be reported (filled in and signed) before the start of the cruise. The framework of the trawl, sweeps and doors must be included in the checklists. As an example, GOV checklist figures are detailed below.

GOV

The IBTS manual (ICES 1999) must include the original checklist figures. The checklist figures needs to be extended and detailed:

Overall rigging diagram (
Figure 1*)*
Should be extended with: Diameter of backstops (16 mm?)
Type of ribline
Total length of ribline
Length for each panel
Detail of rigging adjustments: figures should include hammerlocks, lengths should be measured from centerpin in hammerlock
Floats should be standardised to 8' plastic deepwater floats
Netting Panel diagram (Figure 2)
Frame ropes diagram (Figure 3)
Prior to delivery, new nets should be measured and checked against the IBTS net record by the net maker and institute netman. (Netting panel and Frame ropes diagram above). After in-house repairs, the same rules will apply. All documentation should be filed by the netman and available for future scrutiny.

Ground gear rigging (Figure 4)
Detailed drawings with individual measurements of component parts and relevant hardware (shackles hammerlocks) including ground-gears B and C should be in the IBTS manual. All ground-gear components should be measured and checked prior to the survey by the relevant person (netman and or SIC). Confusion exists over the additional chain wrapped around ground-gear A, the current IBTS expanded drawing shows no chain. The net diagram with the 3 ground-gears included shows 35 kg of chain to be added to each section. The checking list document above shows chain wrapped on 5 sections.

"Exocet" kite rigging (Figure 5)
The floats that should be used within the kite are 8 inch deepwater plastic as with the rest of the floatation.

Doors
Detailed drawings with individual measurements as a checklist for the door rigging should be made. Specifications of the length and type of backstrops, holes in bracket to be used and minimum shoe thickness must be included. When gear performances indicate a problem, (bottom contact, less doorspread) shoes should be checked and eventually replaced.

Deck summary sheet

The purpose of this sheet is to record significant information about the fishing gear for every haul. The designated person should observe the net being shot and retrieved each haul noting any damage or problems with the gear. The rigging of the GOV should state that the adjuster chains must be measured on initial rigging and this information should appear on the first haul record (See Net deployment check Table below).

Net deployment check table. Tick means yes/OK.

Haul No_____		Date_____		Net No_____		Adjuster Chain Length_____	
Valid Haul		Foul Haul		Clear Haul		Fast Haul	
Items to comment on are: Polished Doors & Bunt, Twisted Bridles, Twisted wings, Damaged Wings, Damaged Net, Ground-gear Attachment, Codend damage, Floatation intact, Scanmar sensor attachment.							
Comments: Signed							

All damage large or small must be rectified prior to the next haul; all hauls should be carried out using the same standard gear. Any damage must be repaired between hauls.

Every 20–25 hauls the 'Adjuster Chains' at the 'Bunt Bobbins' must be checked and measured. Indicate in the appropriate haul record that these measurements have been taken noting any changes made.

Porcupine baca and other gears

The above definitions for checklist figures for the GOV should be used as a model also for the porcupine baca and other gears used in the area. At present, the following information regarding the Porcupine baca is available to the Study Group. This information must be included in the checklist. For the deck summary sheet we suggest that the same sheet as suggested for the GOV is used and filed by the netman for references.

General description

Vertical opening of this net is around 3.5 – 4 m, and horizontal opening is around 20 m. The net has a roof panel that overhangs the ground-rope by 7.60 m. The Porcupine baca ground rope weighs 350 kg and is wrapped with a double coat of nylon to strengthen it and to increase its diameter avoiding hook-ups. This gear is designed to be used at a moderate towing speed between 3–4 kn.

All the panels in the lower part of the net are totally or partially strengthened. Ground rope is made with iron wire (22 mm diameter) with a double nylon coat and ballasted (how much?) with chains to ensure contact with the bottom.

The allocation of floats in the float rope is: 11 (280 mm) on the headline every 50 cm + 34 (200 mm) on the wings every 50 cm + 16 (200 mm) on the wings every 100 cm + 1 additional float (200 mm) at each butterfly or danleno. The floats are made of Polystyrene designed to work at a maximum depth of 1800 m. One additional float should be placed over the net monitoring sensor.

The bridles are 10 m long.

Main dimensions and materials	
Materials	PE and nylon
Mesh size	90 mm
Ground rope	51.96 m
Headline	39.96 m
Vertical opening	3.5 – 4 m
Horizontal opening	20 m

Codend – Liner – Protection

Technical specification	
Materials	PE + Euroline
Mesh size	90 mm
Liner	22 mm mesh, nylon

The liner is made of nylon with a 22 mm mesh size and the same shape as the codend.

Protection is a strengthening bag placed in the lower and rear part of the codend, made of nylon with polyethylene fringe curls. Mesh size is 180 mm.

Sweeps

Material	Stainless steel with Eurosteel coat
Diameter	55 mm
Length	250 m
Weight	250 kg / 100 m

GOV checklist diagrams (modified from ICES 1999):

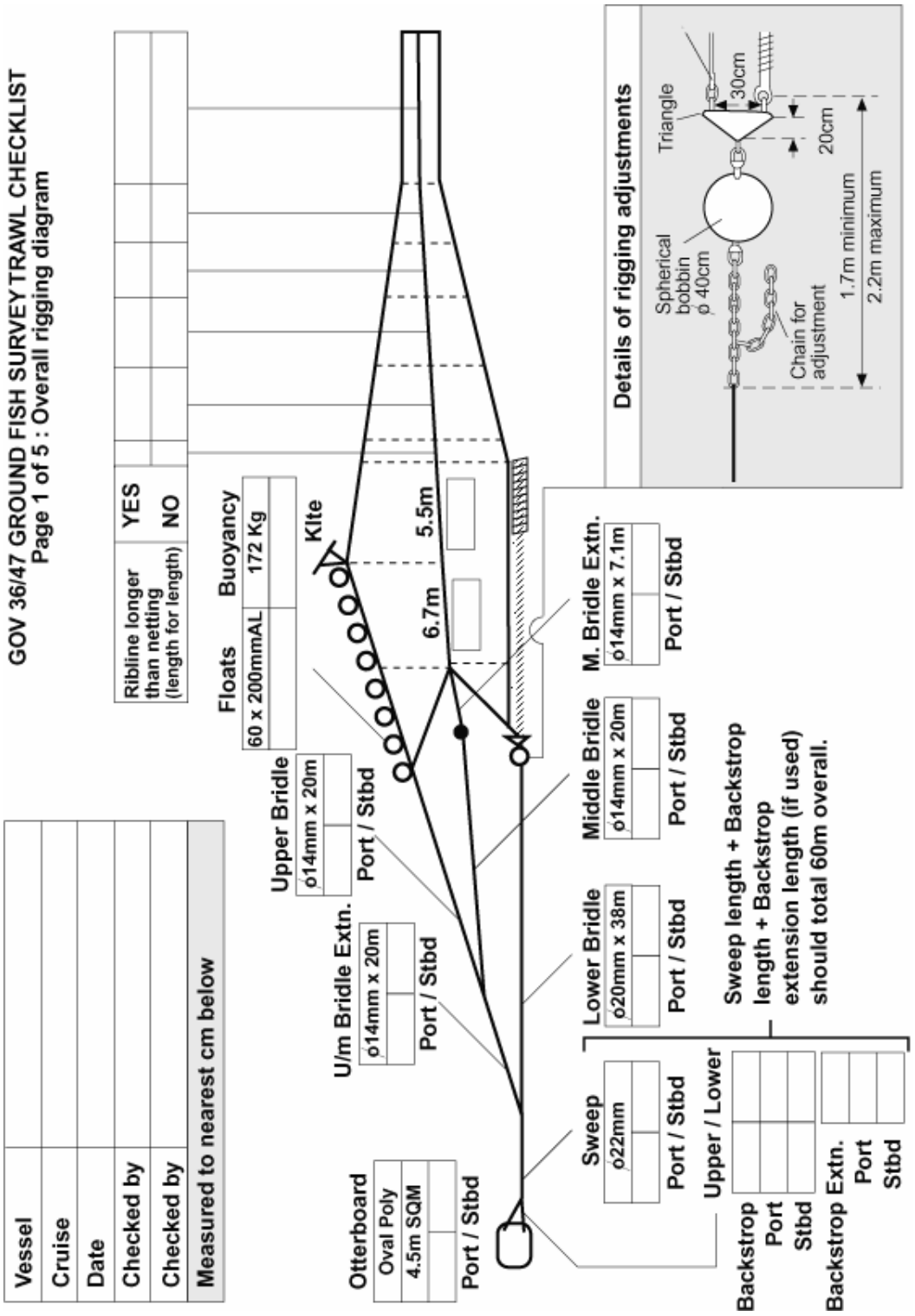

Figure 1. Checklist figure of the GOV Overall rigging diagram.

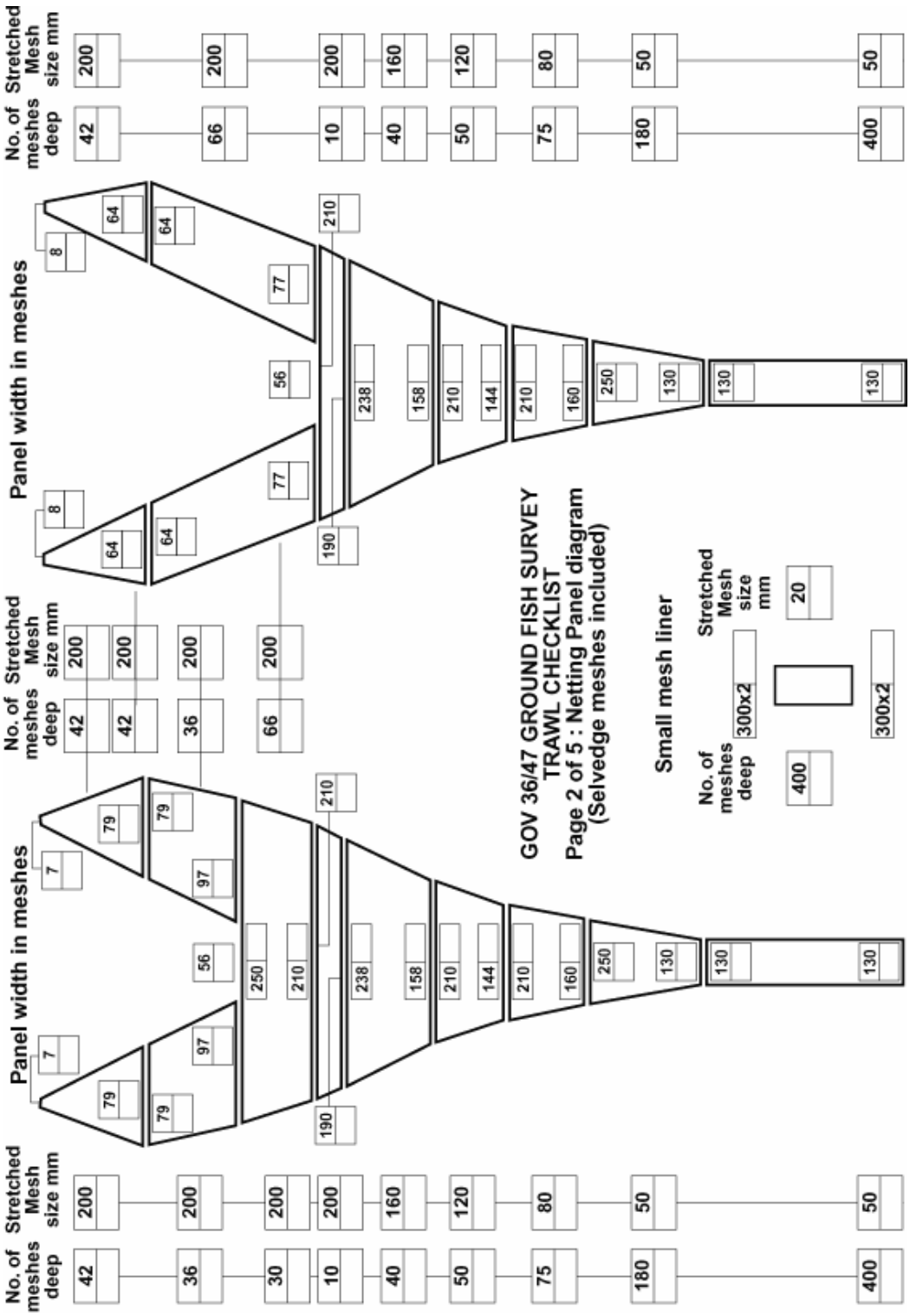

Figure 2. Checklist diagram of the 36/47 GOV trawl netting panel.

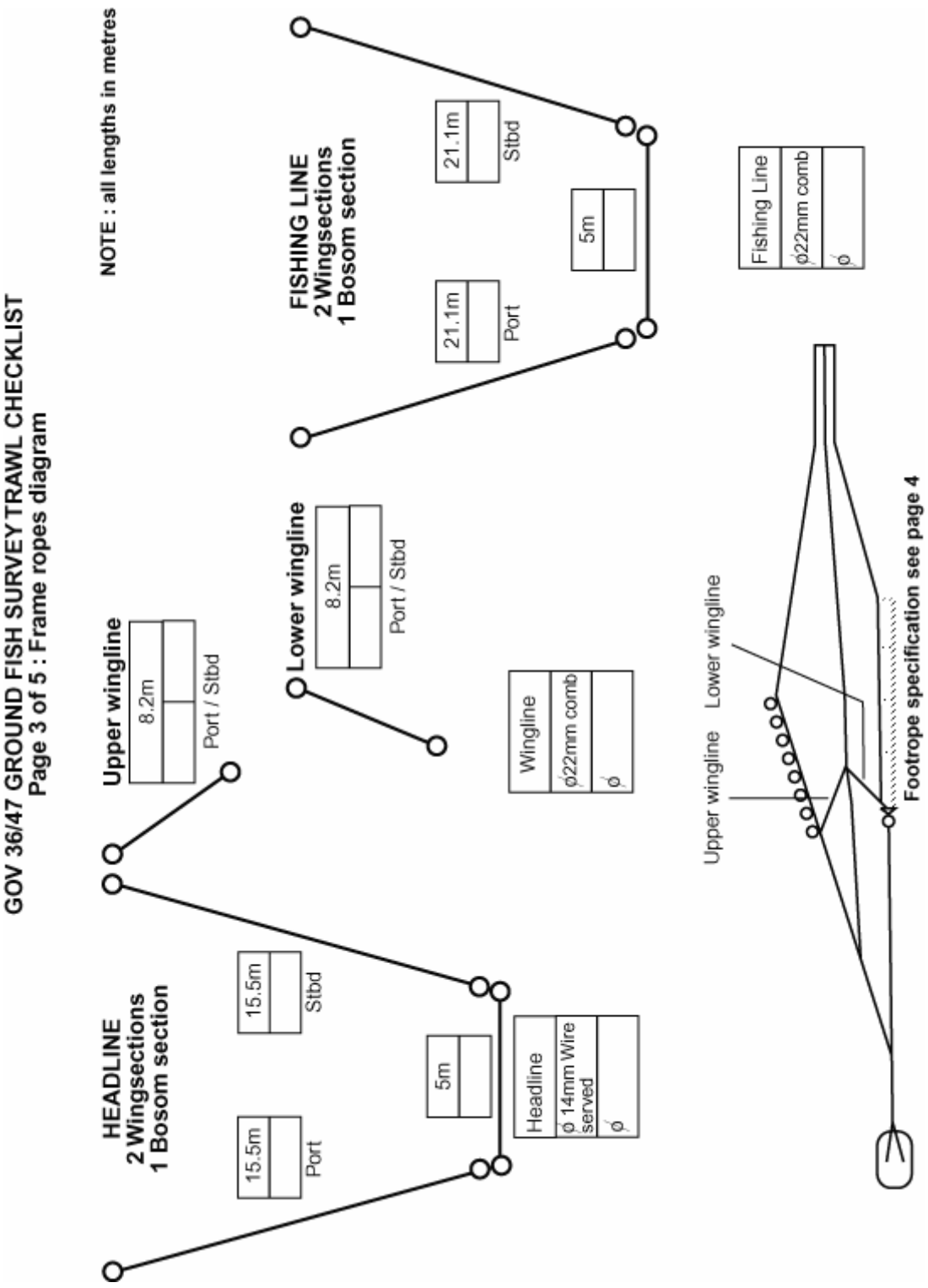

Figure 3. Checklist diagram of the GOV 36/47 frame ropes.

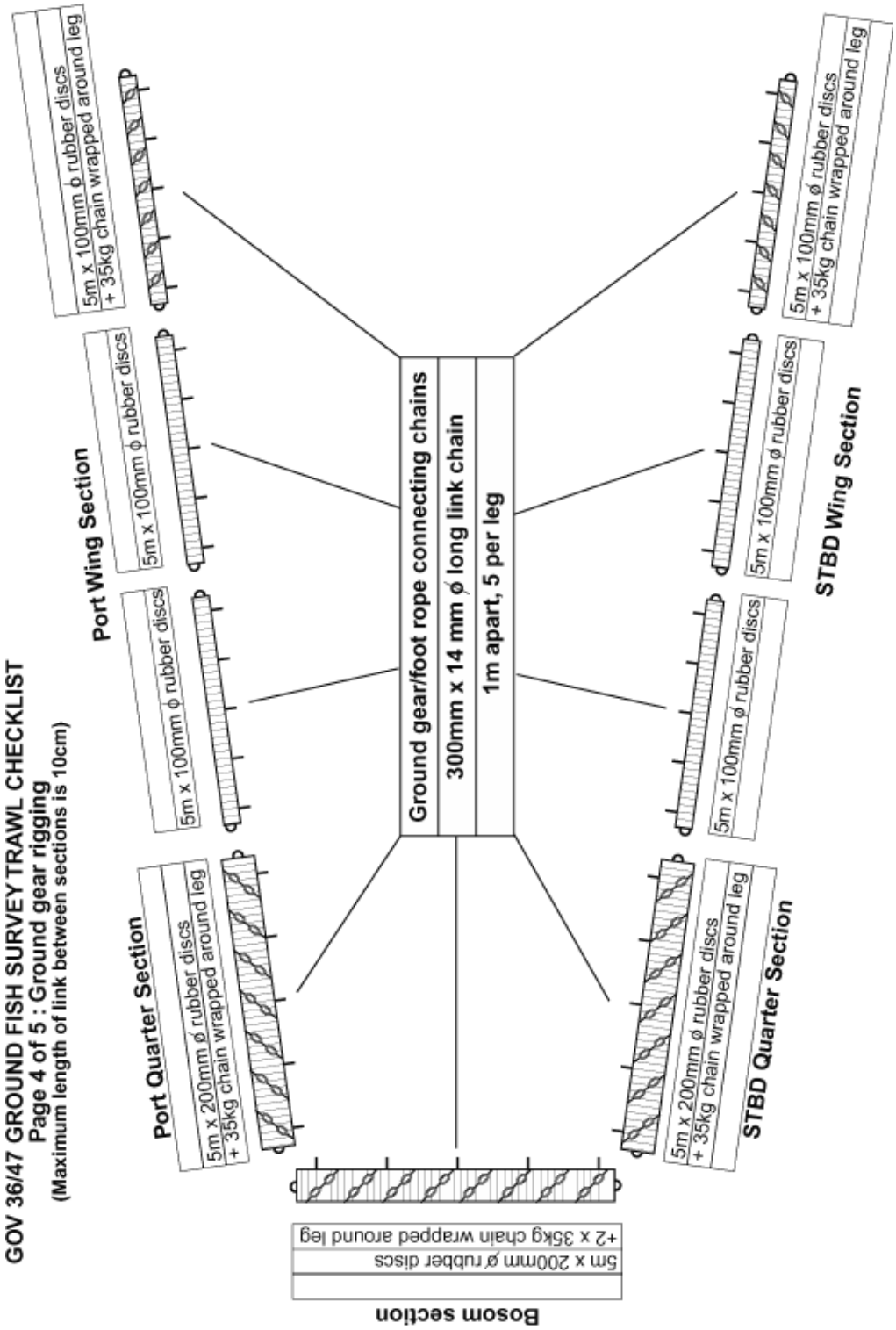

Figure 4. Checklist diagram of the GOV 36/40 ground gear rigging.

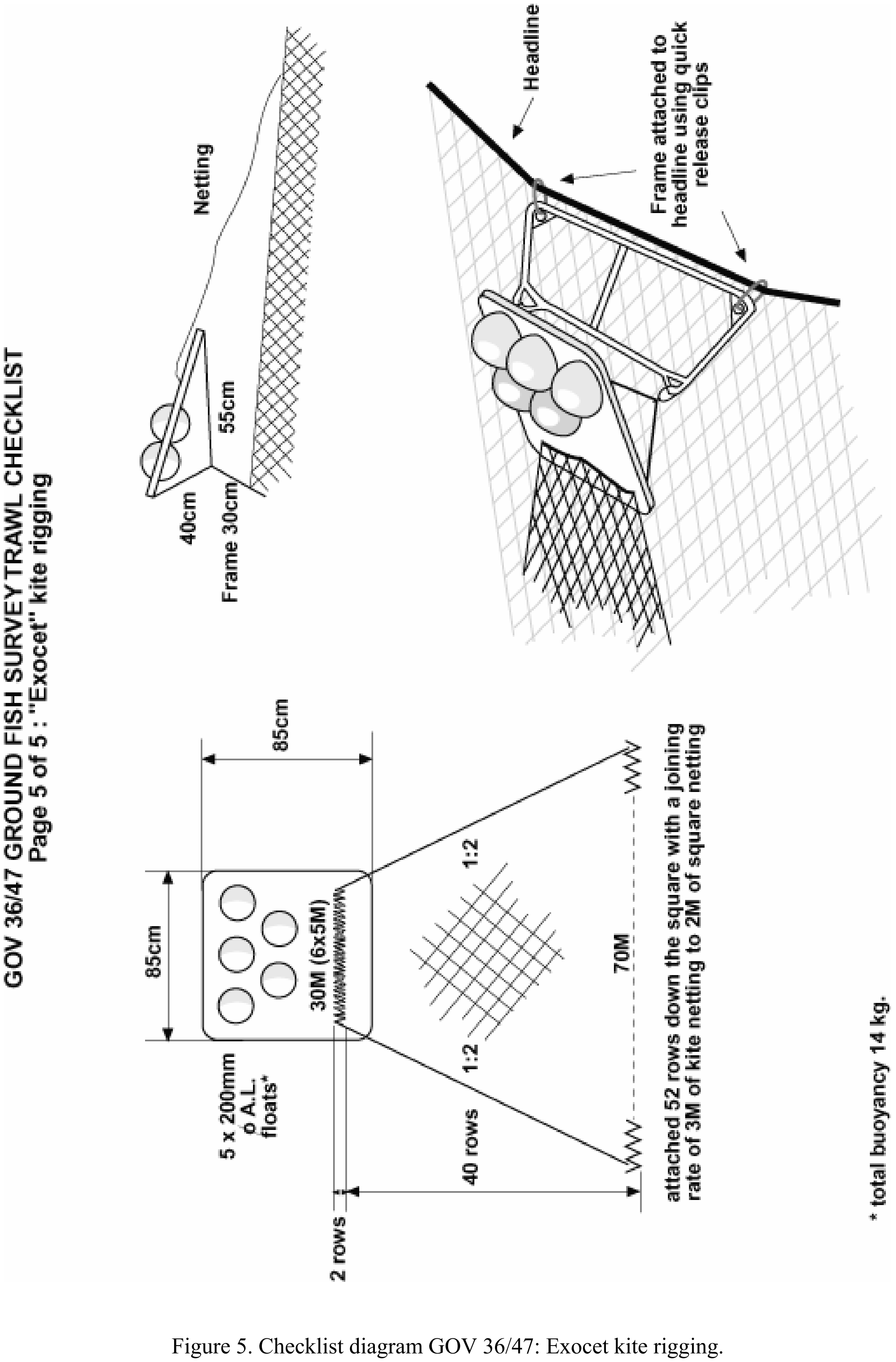

Figure 5. Checklist diagram GOV 36/47: Exocet kite rigging.