Northwest Atlantic Fisheries Organization

Serial No. N4122 **NAFO SCR Doc. 99/63**

SCIENTIFIC COUNCIL MEETING – JUNE 1999

The Performance of the Engel (96) 145 High Lift Otter Trawl Used in DFO/ Industry Surveys of Yellowtail Flounder on the Grand Banks, NAFO Divisions 3LNO.

by

Stephen J. Walsh and Barry McCallum

Northwest Atlantic Fisheries Center, Department of Fisheries and Oceans,
P.O. Box 5667, St. John's, Newfoundland, Canada, A1C 5X1

Introduction

Beginning in July of 1996, bottom trawl surveys directed at yellowtail flounder have been conducted quarterly in NAFO Divisions 3NO by the Department of Fisheries and Oceans (DFO) and Fisheries Products International (FPI). These cooperative science-industry surveys are designed to provide data on the spatial distribution and abundance of yellowtail flounder in the survey area. (see Simpson et al. 1999 for details) In the fall of 1998, a new survey was initiated for American plaice on the Grand Banks (see Atkinson et al. 1999) using the same trawl but on different vessels.

Several factors affect the performance and catchability of a survey trawl. Chief among them are design, rigging, bottom type, currents, fishing crews, the amount of trawl warp used at each fishing depth , vessel noise, the behavior of the individual fish in the population and the interaction of these factors within the fish capture process (Pope et al. 1975; Byrne et al. 1981; Walsh et al. 1993). Many of these factors can result in a systematic error in the abundance estimate. Several of these factors can be minimized by introducing a rigid set of protocols which ensures the trawl is constructed, rigged and repaired to the same standard for each survey (McCallum and Walsh 1995). Trawl geometry and performance varies from tow to tow and the use of acoustic trawl instrumentation packages mounted on the fishing gear allows trawl geometry and performance to be monitored (Walsh and McCallum 1995).

This paper describes the design, rigging, geometry, performance and trawl efficiency of the Engel 145 High Lift otter trawl used in these cooperative surveys.

Materials and Methods

The fishing gear used is an Engel (96) 145 Hi-Lift otter trawl, reflective of trawls historically used by FPI in the yellowtail fishery. It is a two-panel trawl constructed entirely of polyethylene twine. It has been designed specifically for bottom fishing over rough ground with cut-away lower wings and heavy rubber rockhopper footgear (Fig 1). Table 1 gives a summary breakdown of specifications. The trawl is rigged with No. 7 Bergen trawl doors connected to the trawl with 3.0 m door legs, 91.5 m sweep wires and 18.3 m upper and lower bridles. The lower bridle is connected to the footgear with a 6.8 m bridle extension. A Danleno leg and a 8.3 cm (21") bobbin are used to connect the upper and lower bridles to the sweep line. The headline is equipped with 52 x 3.2 cm (8") Iceplast plastic trawl floats, 16 on each wing and 20 in the bosum. The rockhopper footrope is 30.5 m long and is constructed with a combination of 46, 41 and 36 mm rubber disks spaced evenly apart with rubber spacers (Fig. 2). The trawl is constructed of 4.0 and 6.0 mm polyethylene twine in mesh sizes varying from 180 mm in the wings and square, 160 and 148 mm in the bellies and 156 mm in the codend (Fig. 3). Double twine is used in the last belly and codend. Unlike trawls used in DFO research vessel surveys, no small mesh liner is used in the codend of this commercial trawl.

The vessel used in the DFO/FPI yellowtail flounder surveys is the Atlantic Lindsey, a 44 m total length, 665 G.R.T., 1500 HP commercial stern trawler in the Newfoundland fleet. Trawl geometry and performance parameters of this trawl were collected on the southern Grand Bank using Scanmar acoustic trawl instrumentation and recorded on NAFC customized logging program, SeaTrawl. Nineteen fishing hauls were made in depths from 55 to 247 m.

Trawl Geometry and Performance

Table 2 shows the summary statistics of the Engel 145 Hi-Lift trawl geometry and performance. The large average door spread of 83.7 m, compared to other survey gears used by DFO on the Grand Banks (Table 3) is due to the long sweep wires and bridles (109.8 m). For example the Campelen 1800 shrimp trawl currently used in DFO surveys of the Grand Bank uses 40 m sweeps (McCallum and Walsh 1999) and achieves an average doorspread of 44 m compared with 84 meters here. This high door spread and the resultant high wing spread may be overspreading the trawl (headline spread ratio = 60%), causing "strumming" of the headline which could account for the high CV's around the average trawl opening and the low CV's around the average wingspread.

The use of long sweep lines should increase the herding effect of the trawl in particular for flatfish and cod due to a wider sampling area created by the trawl doors (Walsh and McCallum 1997). This also results in a larger effective sweep zone or swept area as defined by the product of the doorspread and distance travelled (Table 3). It is expected that using this survey trawl on other vessels of different size could result in a difference in trawl geometry and performance. Such between vessel variation can be minimized by use of restrictor rope technology to standardize the door spread and minimize swept area variation (Walsh and McCallum 1996)

References

Atkinson, D.B., M.J. Morgan, W.B. Brodie, B. Smith and G. Gregory 1999. Results of a 1998 Canadian Industry Survey for American plaice in NAFO Divisions 3LNO with comparisons to results from the Canadian fall DFO survey. NAFO SCR Doc. 99/55;17p

Byrne, C.J., Azarovitz, T.R. and M.P. Sissenwine 1981. Factors affecting variability of research vessel trawl surveys. Can. Spec. Publ. Fish. Aquat Sci. 58:258-273

McCallum, B.R., and S.J. Walsh. MS 1995. Survey trawl standardization used in groundfish surveys. ICES C.M. Doc., No. B:25, 13p.

McCallum, B.R., and S.J.Walsh 1996, Groundfish survey trawls used at the northwest Atlantic fisheries centre, 1971-present, NAFO Sci. Coun. Studies, 29:93-104

McCallum, B.R., and S.J.Walsh 1999. The analysis of the performance of the Campelen 1800 shrimp trawl during the annual Canadian bottom trawl surveys of Sub-Area 2J + Divisions 3KLMNO, 3Ps and 3LNO, 1995-98. NAFO SCR Doc. 99/46:32p

Simpson, M. S.J. Walsh, W.B. Brodie and D. Maddock Parsons 1999. Update on Cooperative Surveys of Yellowtail Flounder in NAFO Division 3NO, 1996-1999. NAFO SCR Doc. 99/42:39p.

Pope, J.A., A.R. Margetts, J.M. Hanley and E.F. Akyuz 1975. Manual of Methods for Fish Stock Assessment: PartIII- Selectivity of Fishing Gear. FAO Fish. Tech. RPT. 41:65

Walsh, S.J. and B.R. McCallum. 1995 Survey trawl mensuration using acoustic trawl instrumentation. ICES C.M. 1995/B:26, 20pp

Walsh, S.J. and B.R. McCallum 1996. Preliminary analysis of controlling the geometry of a bottom trawl using the restrictor rope technique: effect on trawl performance and catchability of groundfish. NAFO SCR Doc. 96/53, 15p

Walsh, S.J. and B.R. McCallum 1998 Size selectivity and trawling efficiency of two sampling trawls used in resource surveys of yellowtail flounder on the Grand Bank, Div 3LNO. NAFO SCR Doc. 98/66: 18p

Walsh, S.J and McCallum 1997. Observations on the varying fishing powers of Canadian survey vessels and trawls, NAFO SCR Doc. 97/96:9p

Walsh, S.J., P.A. Koeller and W.D. McKone 1993. Proceedings of the international workshop on survey trawl mensuration, Northwest Atlantic Fisheries Centre, St. John's, Newfoundland, March 18-19, 1991. Can. Tech. Rep. Fish. Aquat. Sci. 1911:114

Table 1 Major specifications for the Engel 145 Hi-Lift trawl as used by the Atlantic Lindsay.

Parameter	Specification
Doors	5.3m^2/1450kg
Sweeps (m)	91.5
Upper Bridle (m)	18.3
Lower Bridle (m)	18.3
Lower Bridle Extension (m)	6.8
Headline (m)	29.3
Headline Floatation	52 x 8"
Footgear	
Length (m)	30.5
Material	Rubber Disks Rubber Spacers Danleno & Bobbin
Size (dia./cm)	46/41/36/15&53(Danleno Bobbin)
Mesh Size (mm)	
Wings/Square	180
Bellies	160/148
Codend	156
Material	Polyethylene

Table 2. Summary statistics of trawl geometry for the Engel 145 Hi-Lift groundfish trawl used by the Atlantic Lindsey during the 1999 Yellowtail catchability experiment.

Variable	No. Obs.	X	CV (%)	Min.	Max.
Depth	19	92.2	20.7	55.0	247.0
Doors	19	83.7	11.9	37.9	109.1
Wings	19	17.4	6.0	15.8	19.9
Opening	19	3.6	12.2	2.7	7.8
Bridle Angle	19	17.1	15.3	5.2	23.6

Table 3. Comparison of average geometry and swept area calculations for trawls used in groundfish surveys of yellowtail flounder on the Grand Bank by Canada (1meter =0.0005 nautical miles)

Trawl	Institute	Towing speed (Kts)	Distance (nm)	Doorspread (m)	Wingspread (m)	Swept area – doors (nm^2)	Swept area – wings (nm^2)
Engel 145 [1] otter trawl	DFO 1983-95	3.5	1.8	66.3	19.8	0.0597	0.0178
Engel 145 [2] Otter trawl	FPI 1999	3.0	1.5	83.7	17.4	0.0628	0.0131
Campelen [3] 1800 shrimp trawl	DFO 1998	3.0	0.8	43.8	15.9	0.0175	0.0064
Yankee 41.5 [4] Otter trawl	DFO 1971-82	3.5	1.8		13.0	--------	0.0117
Yankee 41 [5] shrimp trawl	DFO 1985-94	2.5	1.3	60.0	13.8	0.0390	0.0090

[1] Walsh and McCallum 1997
[2] Walsh and McCallum 1999: Table 2
[3] McCallum and Walsh 1999
[4] McCallum and Walsh 1996
[5] Walsh and McCallum 1998

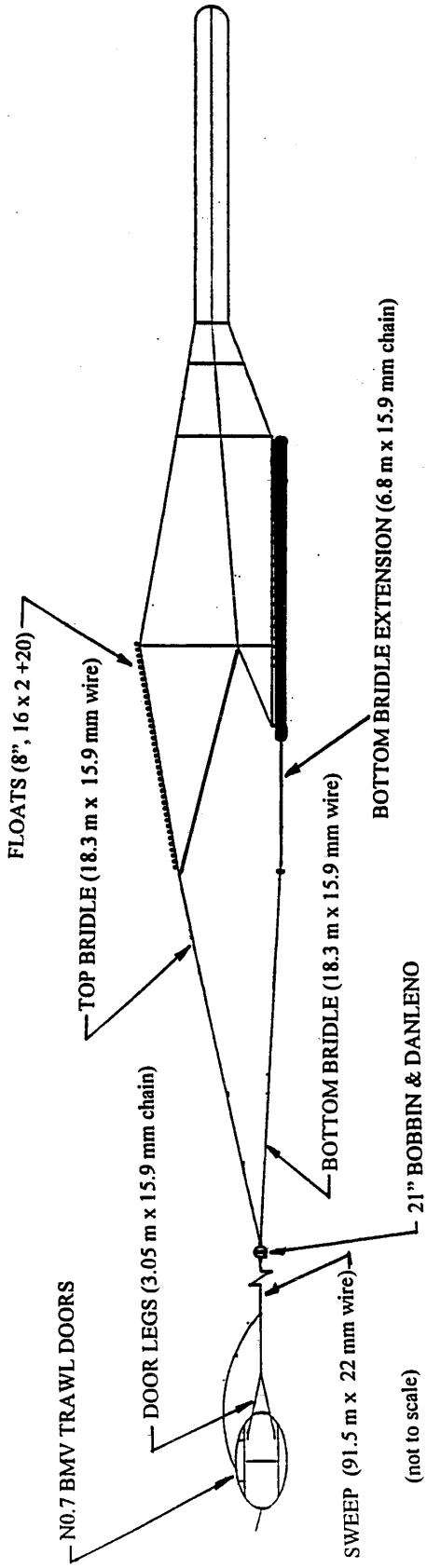

Fig. 1. Rigging diagram of the FPI Engel 145 Hi-Lift survey trawl.

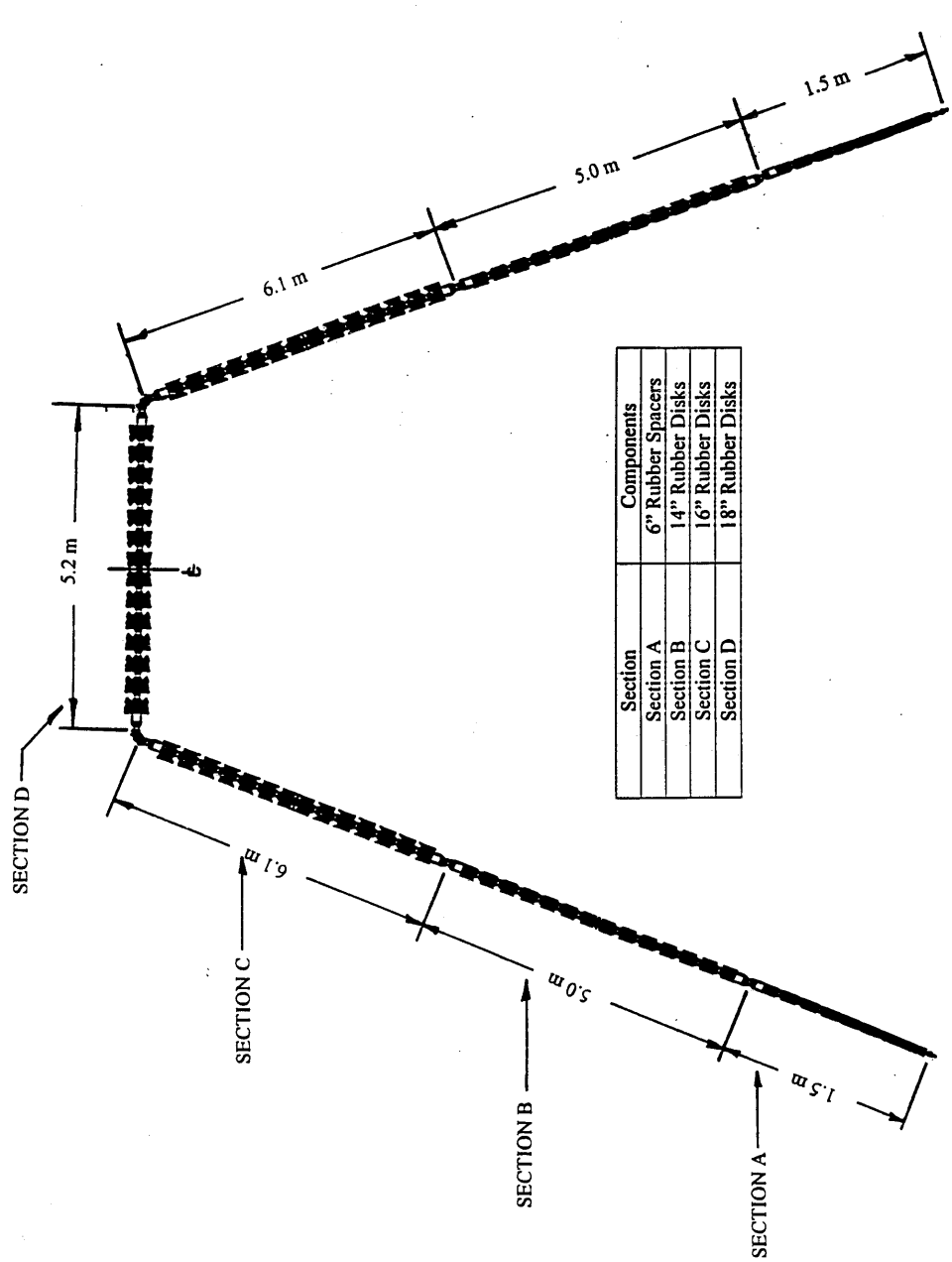

Fig. 2. Footgear details of the FPI Engel 145 Hi-Lift survey trawl.

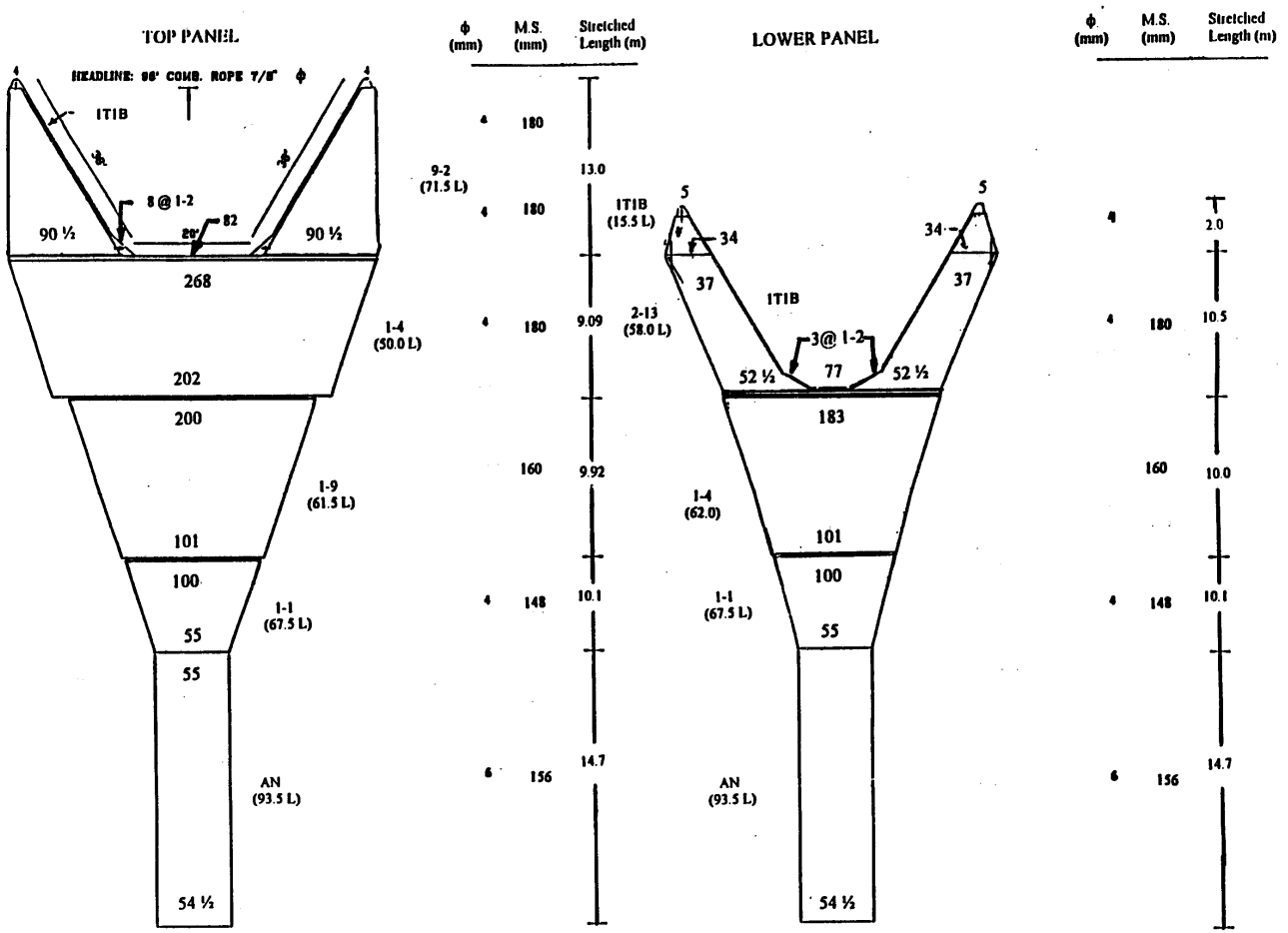

Fig. 3. Trawl plan of the FPI Engel Hi-Lift survey trawl.