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Newfoundland and Labrador Region

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NEWFOUNDLAND AND LABRADOR COMPARATIVE FISHING ANALYSIS – MV *CALVERT*

Image: The industry fishing trawler Marine Vessel Calvert. photo: Ocean Choice International.

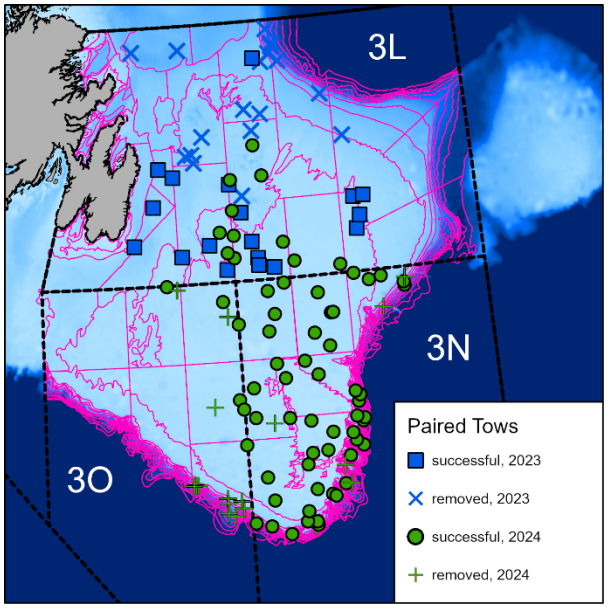

Figure 1. Map of MV Calvert paired tows on the Grand Bank. Newfoundland and Labrador Region Multispecies bottom trawl survey strata (pink) are shown for Northwest Atlantic Fisheries Organization Divisions (dashed lines) 3LNO.

CONTEXT

Multispecies bottom trawl surveys are conducted annually in the spring and fall in the Newfoundland and Labrador (NL) Region using a Campelen 1800 survey trawl aboard Canadian Coast Guard Ships (CCGSs). These surveys are used to estimate the distribution and abundance of many fish and invertebrate species, to determine species life history characteristics, and form the basis of a number of ecosystem indicators. Through a collaborative agreement between Fisheries and Oceans Canada (DFO) and the Atlantic Groundfish Council (AGC), comparative fishing was undertaken between an industry trawler, Marine Vessel (MV) *Calvert*, and the CCGS *John Cabot* to determine comparability of the MV *Calvert* for potential use supporting or complementing DFO survey capacity. Analyses and review of data collected during paired fishing operations in 2023 and 2024 are used to quantify differences in catchability between the MV *Calvert* and the current CCGSs in spring in Northwest Atlantic Fisheries Organization (NAFO) Divisions (Div.) 3LNO.

This Science Advisory Report is from the regional peer review of March 28, 2025, on the Newfoundland and Labrador Comparative Fishing Analysis for the Marine Vessel (MV) *Calvert*,

and summarizes the main scientific advice from this meeting. Additional publications from this meeting will be posted on the Fisheries and Oceans Canada (DFO) Science Advisory Schedule as they become available.

SUMMARY

- Comparative fishing was undertaken in the spring of 2023 and 2024 between the Marine Vessel (MV) *Calvert* and CCGS (Canadian Coast Guard Ship) *John Cabot*. Estimated conversion factors are directly applicable for the sister ships CCGS *John Cabot* and CCGS *Capt. Jacques Cartier* in Northwest Atlantic Fisheries Organization (NAFO) Divisions (Div.) 3LNO in spring.
- Conversion factors are required for seven taxa, none of which had significant length effects. Twenty six taxa showed no significant difference in relative catchability. All other taxa had insufficient data to determine if a conversion factor is appropriate.
- To support community-level analyses, conversion factor analysis was completed for functional groups on an Ecosystem Production Unit scale for the Grand Bank (NAFO Div. 3LNO). No difference in catchability was found across functional groups.

BACKGROUND

The NL Region of DFO undertook comparative fishing programs from 2021 to 2023 as DFO transitioned the vessels it uses for annual multispecies trawl surveys in the Atlantic Zone, moving from the CCGS *Teleost* and CCGS *Alfred Needler* to new Offshore Fishery Science Vessels (OFSVs) the CCGS *Capt. Jacques Cartier* and the CCGS *John Cabot* (*Cabot*) (DFO 2024, 2025). In addition to changing vessels, minor modifications (described in Wheeland et al. 2024a) to the standard Campelen 1800 survey trawl's net and footgear were completed for use in the NL survey going forward.

The vessel and equipment used in a standardized trawl survey can affect how fish and other organisms are caught – including species composition in survey tows as well as the numbers and size distribution captured for each species – which changes how the data are interpreted. In response to recent challenges with vessel availability and NL multispecies survey coverage comparative fishing was undertaken in 2023 and 2024 between a standard survey vessel (*Cabot*) and an industry trawler, the MV *Calvert* (*Calvert*), both fishing the modified Campelen 1800 survey trawl now standard to the NL multispecies surveys. This program occurred through a two-year collaborative agreement between DFO and the AGC. The intent of this work was to derive conversion factors for the *Calvert* so that if survey data were to be collected by this vessel in the future, these data could be used in series with existing standardized indices collected by the CCGS vessels.

Comparative Fishing

This comparative fishing program involved side-by-side survey trawling (paired tows) following a shadow survey approach (Thiess et al. 2018) between the two vessels, collecting data necessary to quantify differences in catch amounts and species composition, such that species and vessel-specific conversion factors could be developed. A total of 121 paired tows were completed in the spring of 2023 (N = 36) and 2024 (N = 85) between the *Calvert* and the *Cabot* across portions of the Grand Bank, NAFO Div. 3LNO (Figure 1).

Gear Performance

Trawl geometry and performance was monitored on both vessels using sensors which measure factors such as door spread, wing spread, and trawl opening height. At shallow depths (<~200 m) the door and wing spread of the *Calvert* was generally comparable to those of the *Cabot*, and the opening was generally lower. In deeper waters (>~200 m) the door and wing spread of the *Calvert* was smaller, and opening higher compared to the *Cabot*. The door and wing spread of the *Calvert* did not increase with depth to the same degree as expected based on normal trawl behaviour; this is attributed to the heavier warps on the *Calvert*, and results in a slightly narrower swept area for the *Calvert* with depth than the *Cabot*, with the difference between the vessels increasing with increasing depth.

At-sea observations and post-hoc examination of trawl measurements revealed significant issues with trawl performance, with unstable or collapsed trawl doors evident in some sets, attributed to the heavier trawl warps used on the *Calvert.* Issues were more pronounced with increasing depth. In some cases, short increases in speed were used by the vessel's crew to right the doors, however this led to tow speed exceeding acceptable survey limits and these sets were removed from the comparative dataset. Adjustments to the trawl scope ratio on the *Calvert* were made in 2024 to stabilize trawl performance. As a result of gear instability, 18 paired sets from 2023 and 18 paired sets from 2024 were removed from analyses (Figure 1). One additional pair was removed based on paired tow criteria defined in Wheeland et al. (2024a).

Program Coverage

After removing the sets deemed unsuccessful based on trawl performance, 84 successful paired tows were used for conversion factor estimation. These sets covered areas and benthic conditions representative of the normal survey. Species composition of the paired sets are representative of that recently (2017–21) encountered in the survey, with composition of each functional group in each Ecosystem Production Unit showing reasonable overlap between paired sets and the recent surveys in NAFO Div. 3LNO spring.

ANALYSIS

In the analysis of comparative fishing data, the goal is to estimate the relative catch efficiency by numbers and/or weight between a pair of vessel-gear combinations. Analyses here follow the methods adopted in DFO 2024 and DFO 2025. Conversion factors are defined as an estimate of relative catch efficiency (ρ), or catch efficiency at length $\rho(l)$ with the conversion factor being the ratio of catchabilities between the old and new vessels. The application of conversion factors converts data from the old vessel to new vessel equivalent, and vice versa, with catch from the *Calvert* multiplied by ρ to obtain *Cabot* equivalent catch.

A suite of 13 models with various assumptions for length and station (i.e., set location) effects on the relative catch efficiency were fit for all species with sufficient sample size (minimum 25 paired tows) and length information to estimate size-disaggregated conversion factors for catch numbers by length. For species or taxa groups with smaller sample size (minimum 15 paired tows) and/or where length information was not available, conversion factors were estimated for catches aggregated across all sizes (size-aggregated models). Details on these models are provided in Trueman et al. (2025).

Catch-aggregated biomass and abundance conversion factors are also estimated here with taxa grouped to the functional group level (Wells et al. 2021), consistent with DFO 2025. Data

limitations precluded the examination of possible size-effects in functional group conversion factors.

Where a conversion factor has been estimated for a taxa grouping, this factor is applicable only at the grouped level and should not be applied to a single species within the group. Any taxa not specifically mentioned in these analyses were not present in the comparative fishing data set or did not meet minimum sample size requirements, and differences in relative catch efficiency could not be evaluated.

Preliminary modelling for shrimp (single species and grouped taxa) showed residual patterns by time of day that corresponded to shift change on the vessel, suggesting differences in sampling between individuals at-sea. This introduces bias which could be misattributed to vessel differences, therefore only data collected from noon to midnight were used to estimate conversion factors for shrimp taxa and the shellfish functional group. This same mitigation was used to assess the shellfish functional group analysis as well.

Conversion Factors for the MV *Calvert*

Significant conversion factors were defined for seven taxa; no size effect was found for any taxa (Table 1). There was no significant difference in relative catchability for 26 taxa, while 11 groups were deemed to have insufficient data to determine conversion factors. It was not possible to determine if catchability of Witch Flounder (*Glyptocephalus cynoglossus*), Greenland Halibut (*Reinhardtius hippoglossoides*), and Striped Wolffish (*Anarhichas lupus*) differs with length between the vessels. Conversions estimated here are applicable to the *Calvert* only and cannot be applied to other industry or CCG vessels.

Catch-aggregated analyses indicated conversion factors were not required for the following taxa for the *Calvert*, Div. 3LNO spring: alligatorfishes and poachers, Capelin (*Mallotus villosus*), eelpouts (*Lycodes* sp.), gastropods, Roughhead Grenadier (*Macrourus berglax*), sand dollars (Clypeasteroida), sculpins, sea anemones, sea cucumbers, Polar Shrimp (*Sclerocrangon ferox*), benthopelagic shrimps, Cushion Sea Star (*Ceramaster granularis*), basket stars (*Gorgonocephalus* spp.), soft corals, jellyfish, sponge, and tunicates. There were insufficient data to determine conversion factors for the following taxa: sandlance (*Ammodytes* spp.), toad crab (*Hyas* spp.), amphipods and gammarids, annelids and polychaetes, bivalves, brittle stars, Atlantic Herring (*Clupea harengus*), Henricia sea stars (*Henricia* sp.), and bryozoans.

Conversion factors for all functional groups were not significant. Functional group analysis here are reflective of the species composition and size distribution at the time of, and at the location of, comparative fishing between the *Calvert* and *Cabot*.

Table 1. Summary of conversion factor (ρ) recommendations and estimates with 95% Confidence Intervals (CIs) for the Calvert in spring in NAFO Div. 3LNO. Listed here are commercial species, functional groups, and non-commercial taxa where a conversion factor was significant. Other taxa for which no conversion is required are noted in the text above. (-) indicates a conversion was not significant. Species denoted with an asterisk (*) used a reduced data set with sets completed between noon and midnight only.

Species, taxa group, or functional group	Size effects considered?	Recommendation	ρ (CI) numbers	ρ (CI) weight
Atlantic Cod (*Gadus morhua)*	Yes	No conversion required	-	-
American Plaice (*Hippoglossoides platesoides)*	Yes	No conversion required	-	-
Yellowtail Flounder (*Myzopetta ferrenguia)*	Yes	Significant conversion	0.76 ± 0.10	Apply conversion to catch numbers at length
Greenland Halibut	Yes	Data insufficient to determine length effect. No conversion required for bulk abundance and biomass.	-	-
Redfish (*Sebastes* spp.)	Yes	No conversion required	-	-
Thorny Skate (*Amblyraja radiata)*	Yes	No conversion required	-	-
Snow Crab (*Chionoecetes opilio)*	Yes	No conversion required	-	-
Striped Shrimp (*Pandalus montagui)**	No	No conversion required	-	-
Toad Crab	Yes	Data insufficient to evaluate conversion factors	n/a	n/a
Witch Flounder	Yes	Data insufficient to determine length effect. No conversion required for bulk abundance and biomass. Conversion conclusion applicable to 3NO only.	-	-
Striped Wolffish	Yes	Data insufficient to determine length effect. No conversion required for bulk abundance and biomass.	-	-
Grenadiers (*Macrouridae*; excluding Roughead)	No	Significant biomass conversion	-	0.72 (0.52–0.99)
Icelandic Scallop (*Chlamys islandic)*	No	Significant biomass and abundance conversion	1.64 (0.98–2.74)	2.42 (1.38–4.24)

Species, taxa group, or functional group	Size effects considered?	Recommendation	$\rho\,(CI)$ numbers	$\rho\,(CI)$ weight
Sea Potatoes (*Boltenia ovifera*)	No	Significant biomass and abundance conversion	2.44 (1.40–4.25)	2.65 (1.50–4.68)
Sea Stars (all grouped)	No	Significant biomass and abundance conversion	1.44 (1.07–1.96)	2.45 (1.73–3.48)
Sea Urchins (*Strongylocentrotus* sp., *Brisaster* sp., and *Phormosoma* sp.)	No	Significant biomass and abundance conversion	1.48 (1.03–2.11)	3.24 (2.16–4.84)
Comb Jellies (Ctenophora)	No	Significant biomass conversion	N/A	3.87 (2.51–5.96)
Large Benthivore	No	No conversion required	-	-
Medium Benthivore	No	No conversion required	-	-
Small Benthivore	No	No conversion required	-	-
Piscivore	No	No conversion required	-	-
Plank-piscivore	No	No conversion required	-	-
Planktivores	No	No conversion required	-	-
Shellfish*	No	No conversion required	-	-

Sources of Uncertainty

The representativeness of the paired tows with respect to normal survey conditions was assessed here based on all paired tows. However, distribution and sample size are taxa-specific (e.g., 74 paired tows for American Plaice spread across Div. 3LNO, 24 paired tows for Witch Flounder of which 23 were in Div. 3N), contributing to increased uncertainty in estimation of individual conversion factors (or lack thereof). Estimated uncertainties should be included in conversion factor application whenever possible, and data users are encouraged to critically evaluate results following appropriate conversion factor implementation, including situations where no conversion factor is recommended, within their own analytical frameworks on an ongoing basis.

In this program we see further evidence of an unquantified human dimension to comparative fishing (DFO 2024; ICES 2009), and more broadly within any trawl survey program (e.g., shift effect in shellfish sampling), stressing the importance of standardization in protocols and training.

The higher catches of Yellowtail Flounder on the *Calvert* cannot be assigned to any specific difference. This may be attributed to increased herding effect from heavier warps used on this vessel. There may also be a crew effect as the *Calvert* regularly harvests Yellowtail Flounder commercially. Uncertainty in attribution of the catch difference does not impact application of the conversion factor.

CONCLUSION

Generally, catches between the *Calvert* and the *Cabot* were statistically equivalent, with the exception of Yellowtail Flounder, grenadiers (excluding Roughead Grenadier), and a few invertebrate taxa for which significant conversion factors were estimated.

Conversion factor conclusions are specific to the *Calvert* operating in NAFO Div. 3LNO in spring, and are representative of the habitats, species, and size composition sampled at the time of comparative fishing. Any further application outside these conditions must be supported

by analyses (e.g., demonstrate consistency in physical habitat, biological conditions; see Wheeland et al. 2024b), and may introduce a bias into the survey indices.

Inconsistent trawl geometry and performance was observed on the *Calvert* and is attributed primarily to heavier warps than the standard CCGS survey rigging. Adjustments to the scope ratio made at sea were able to compensate for the warp difference, and all sets included in estimation of conversion factors are considered to be representative of normal fishing performance for a standardized survey set for this vessel. Extensive gear trials should be undertaken before any new vessel is introduced to a standardized program to ensure consistency in results.

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