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Newfoundland and Labrador Region

Canadian Science Advisory Secretariat
Science Advisory Report 2025/037

NEWFOUNDLAND AND LABRADOR COMPARATIVE FISHING ANALYSIS - PART II

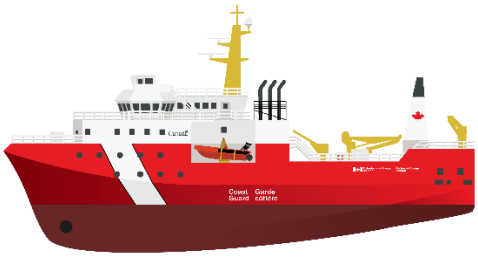

Image: The new Offshore Fishery Science Vessels (OFSVs).

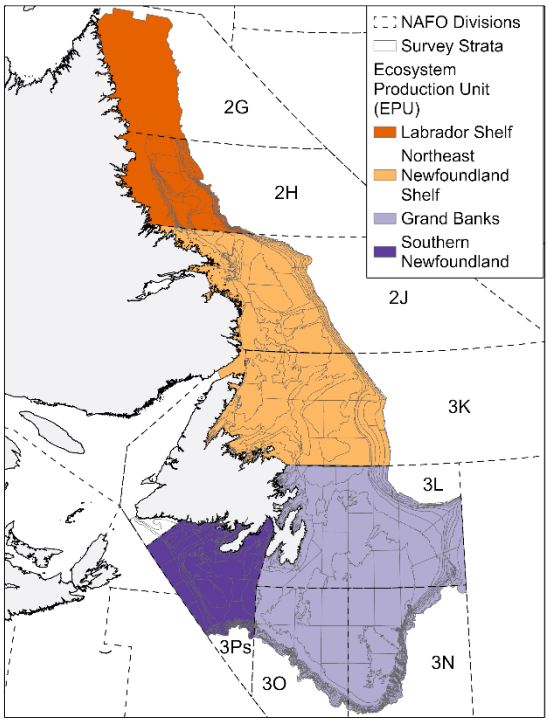

Figure 1. Map of the Newfoundland and Labrador Region Multispecies bottom trawl survey strata (grey lines) showing Northwest Atlantic Fisheries Organization (NAFO) Divisions (dashed lines) and Ecosystem Production Units (EPUs).

CONTEXT

Multispecies bottom trawl surveys have been conducted annually in the spring and fall in the Newfoundland and Labrador (NL) Region aboard the Canadian Coast Guard Ship (CCGS) *Teleost* and the CCGS *Alfred Needler* or its sister ship the CCGS *Wilfred Templeman* (previously retired), since fall 1995 using a Campelen 1800 survey trawl. 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. The CCGS *Alfred Needler* and CCGS *Teleost* will no longer be used for these surveys after 2022 and 2023, respectively, and have been replaced by new Offshore Fishery Science Vessels (OFSVs), the CCGS *John Cabot* and CCGS *Capt Jacques Cartier*. Comparative fishing (i.e., direct side by side comparison between the old and new vessels) was

completed from fall 2021 through fall 2023 in the NL Region. This is a standard approach for determining differences in catchability between the outgoing vessels with the standard Campelen trawl and the new vessels with the modified Campelen trawl.

Analysis and review of this program has occurred across two Canadian Science Advisory Secretariat (CSAS) processes to quantify conversion factors: Part 1 (DFO 2024a) and Part 2 (i.e., this report). Data collected in 2023 are used here alongside data and methods reviewed in Part I in order to expand the analysis of comparative fishing for multispecies survey in the NL Region and address recommendations identified in Part 1. The use of conversion factors or lack of suitable conversion factors determined in these meetings will be discussed during subsequent Regional Assessment Processes.

This Science Advisory Report is from the April 15–18, 2024, regional peer review Newfoundland & Labrador Comparative Fishing Analysis – Part 2, and summarizes the main scientific advice from this meeting as well as overarching conclusions from Parts 1 & 2. A number of data sources and analyses were explored over the course of these meetings. These, as well as further details on analyses contained herein, can be found in the CSAS Research Document Series and Technical Report in Fisheries and Aquatic Science series. Additional publications from this meeting will be posted on the Fisheries and Oceans Canada (DFO) Science Advisory Schedule as they become available.

SUMMARY

- An extension of the Newfoundland and Labrador (NL) comparative fishing program was undertaken in 2023, expanding coverage and addressing data gaps in the 2021–22 comparative program. Results presented here must be considered alongside those reported during Newfoundland & Labrador Comparative Fishing Analysis – Part I.
- Comparative fishing in the spring of 2023 between the Canadian Coast Guard Ship (CCGS) *Teleost* and CCGS *John Cabot* indicated that conversion factors are required for Div. 3LNO for 12 taxa, including two with significant length effects. Thirty four taxa showed no significant difference in relative catchability, and three evaluated taxa had insufficient data to determine if a conversion factor is appropriate.
- Deep water (>750 m) comparative fishing in the fall of 2023 supported the estimation of conversion factors for the fall CCGS *Teleost* survey series for seven taxa, including one (Greenland Halibut) which showed a significant length effect. Sixteen taxa showed no significant difference in relative catchability.
- A re-evaluation of some taxa groupings, following a recommendation from Part I, led to the additional estimation of eight conversion factors for the CCGS *Teleost* and nine for the CCGS *Alfred Needler* in fall. Two re-evaluated groupings for the *Teleost* fall had insufficient data to determine if a conversion factor is appropriate.
- To support community-level analyses, conversion factors were estimated for functional groups on an Ecosystem Production Unit scale and for Division (Div.) 2J3KL. Consistent with single-species analyses, coverage and sample size were insufficient to estimate conversion factors in Subdivision (Subdiv.) 3Ps or for the CCGS *Alfred Needler* on the Grand Bank (Div. 3LNO).
- Conversion factors are specific to the area, season and species, taxa, or functional group for which they have been estimated, and are not interchangeable between the CCGS *Alfred Needler* and CCGS *Teleost*.

- The CCGS *Teleost* and CCGS *Alfred Needler* have been used interchangeably in the NL multispecies surveys, with catchability previously assumed to be equal. Though no direct comparisons of catchability were performed, trawl performance and geometry, and variation in conversion factors estimated for each of these vessels relative to the new Offshore Fishery Science Vessels (OFSVs) indicate differing catchability.

BACKGROUND

The NL Region has transitioned the vessels it uses for annual multispecies trawl surveys, moving from the CCGS *Teleost* (hereafter, "*Teleost*") and CCGS *Alfred Needler* ("*Needler*") to new OFSVs the CCGS *Capt Jacques Cartier* ("*Cartier*") and the CCGS *John Cabot* ("*Cabot*"). In addition to changing vessels, minor modifications (described in Wheeland et al. 2024) to the standard Campelen 1800 survey trawl's net and footgear were completed for use in the survey going forward. Changing vessels and equipment 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. To ensure continuity in the survey time series it is necessary to quantify differences in catch from the new OFSVs (*Cabot* and *Cartier*) relative to the outgoing vessels (*Teleost* and *Needler*) and we do so here through comparative fishing. This comparative fishing program involves side-by-side survey trawling ("paired tows") between the old and new vessels, collecting data necessary to quantify differences in catch amounts and composition (e.g., by species, size, etc.), and estimating species and vessel-specific conversion factors.

There are two annual multispecies surveys in the NL Region: fall covering North Atlantic Fisheries Organization (NAFO) Div. 2HJ3KLNO and spring covering NAFO Div. 3LNOPs (Figure 1). These surveys have been completed with the *Teleost* and the *Needler* or its sister ship the CCGS *Wilfred Templeman* (hereafter "*Templeman*") which was previously retired, since the mid-1990s. Generally, the *Needler*/*Templeman* have surveyed depths to 732 m in Div. 3LNOPs, and to 750 m in Div. 3K, while the *Teleost* covers depths to 1,500 m in Div. 2HJ3KL, though areas and seasons covered by each vessel have changed in some years depending on vessel availability and changes in survey extent. Details of vessel use by year are provided in Rideout et al. 2022 and references therein. The *Needler* and *Templeman* are sister ships and have been shown to have equal catchability for a few species in Div. 3LNOPs (Warren et al. 1997; Cadigan et al. 2006) and are broadly assumed to be interchangeable for NL survey indices.

COMPARATIVE FISHING

Paired tows were completed between the *Needler* and the *Cabot* in the spring and fall of 2022, between the *Teleost* and the *Cabot* and *Cartier* in the fall of 2021, 2022, and 2023, and between the *Teleost* and *Cabot* in the spring of 2023 (Figure 2). A mix of shadow survey (Thiess et al. 2018) and targeted paired tows was implemented throughout the program in NL. Full details of the comparative program from 2021–22 are described in DFO 2024a, Trueman et al. 2025, and Wheeland et al. 2024.

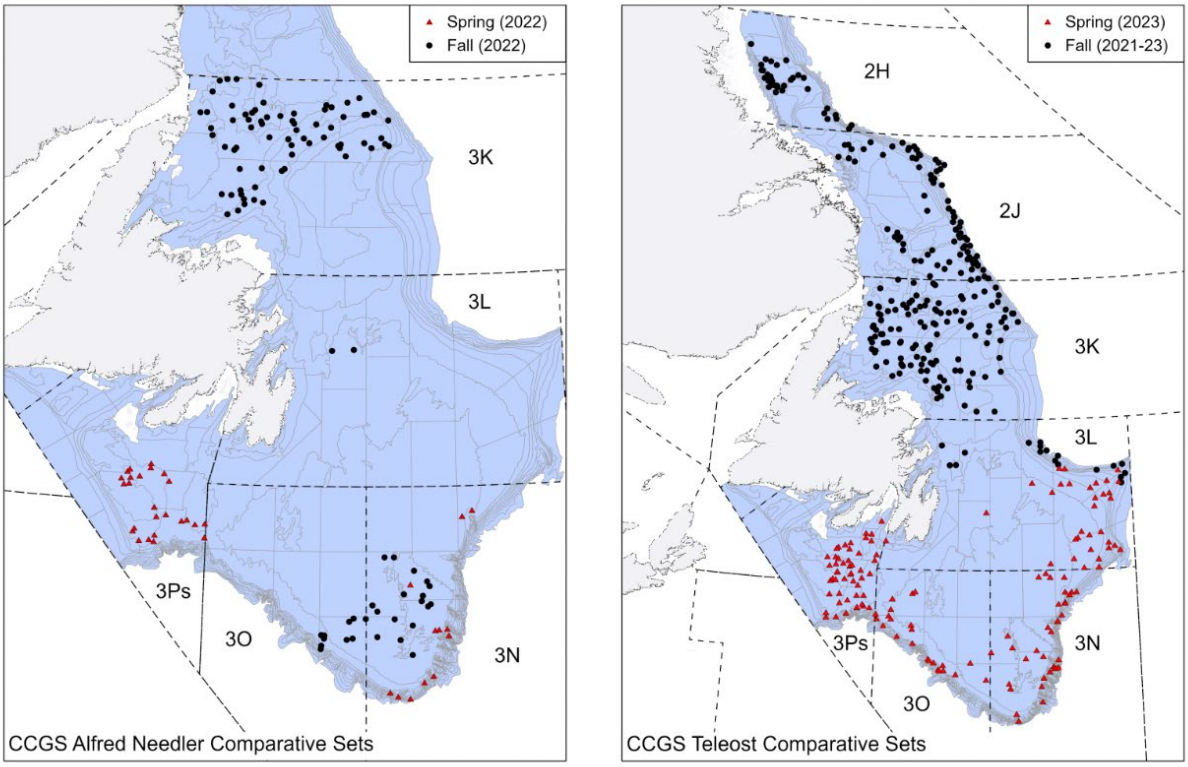

Figure 2. Map of paired tow locations for the CCGS Alfred Needler *(left) and CCGS* Teleost *(right) with the new OFSVs from 2021 to 2023. Shaded area indicates the multispecies survey strata.*

Comparative fishing in the spring of 2023 used a shadow survey approach on the Grand Bank (Div. 3LNO), completing 141 paired tows across this area during the standard multispecies survey. These sets covered areas and benthic conditions representative of the normal survey.

A targeted approach was used in Subdiv. 3Ps, focusing on strata important for Atlantic Cod and Snow Crab. This 3Ps comparative fishing occurred in June, approximately two months later than the normal survey in this area. Additionally, the sets primarily sampled strata containing shallow, flat habitats in sandy or gravelly bottom, and omitted deep basins and structurally complex areas. This program in 3Ps is not broadly representative of the normal survey.

In fall 2023, additional paired tows were completed between the *Teleost* and *Cabot* on the slope of Div. 2J (n = 28) and Div. 3L (n = 14) from 750 to 1,500 m, extending paired tows into areas and depths not previously sampled by the comparative fishing program. This extension allowed for the estimation of representative conversion factors for deep-water species (e.g., Greenland Halibut, Roughhead Grenadier). In Div. 3K, 22 paired tows were completed, targeting areas for small Snow Crab and shallow water, addressing a gap in coverage identified during Part I.

ANALYSIS

Trawl Geometry and Performance

Trawl geometry – including door and wing spread, trawl opening, and clearance – was measured during paired tows using SCANMAR trawl instrumentation. Analysis of 2021–22 comparative fishing (DFO 2024a) demonstrated considerable differences in trawl geometry and

performance of the *Needler* when compared to that of the other three vessels – *Teleost*, *Cabot*, and *Cartier*. The standard and modified Campelen trawl geometry were comparable among and between the *Teleost* and the new vessels, *Cabot* and *Cartier* when fishing <1,000 m. However, as depth is one of the main factors impacting trawl geometry, comparisons of trawl performance in shallow water cannot be extended beyond the depth range examined.

For deep water (>750 m) paired tows in the fall of 2023, differences were noted in trawl clearance and opening between the *Teleost* and *Cabot*, with the *Cabot* showing more consistent bottom contact. Differences in wingspread and door spread were likely driven by a combination of vessel differences and variation in fishing depth. It was noted that *Teleost* SCANMAR data recording was inconsistent in some cases, which may have artificially inflated the variability and differences in geometry observed.

Functional Groups

Conversion factors were estimated for many species, but data were not sufficient to estimate conversions for all taxa. To support ecosystem-based analyses, conversions are estimated here with taxa grouped to the functional group level (Wells et al. 2021) at the Ecosystem Production Unit (EPU) scale and for Div. 2J3KL. These conversions are estimated for catch-aggregated biomass and abundance. Data limitations precluded the examination of possible size-effects in functional group conversion factors.

Consistent with single-species analyses, coverage and sample size were insufficient to estimate conversion factors in Subdiv. 3Ps or for the *Needler* on the Grand Bank (Div. 3LNO).

Species composition of the paired sets are representative of that recently (2017–21) encountered in the survey. The species composition of each functional group in each EPU showed reasonable overlap between paired sets and the recent survey conducted by the corresponding survey vessel. Areas with fewer comparative fishing sets, such as Div. 2H, tended to have less complete representation of the community composition but were considered a reasonable characterization. Medium Benthivores are shown here as an example (Figure 3), with conclusions consistent across groups and areas.

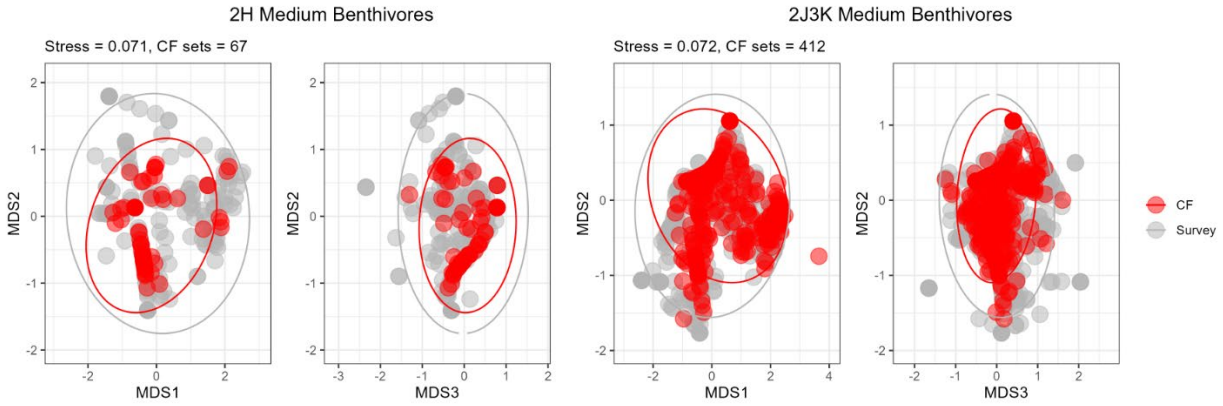

Figure 3. Species composition comparison of the Medium Benthivore functional group using non-metric multidimensional scaling (nMDS) in Div. 2H (left) and Div. 2J3K (right) from comparative fishing sets (red) and survey sets from 2017–20 (grey). Colored ellipses represent 95% confidence intervals.

Estimating Conversion Factors

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. A suite of 13 binomial and

beta-binomial 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 taxa or 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 DFO 2024a and Trueman et al. 2025.

The 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 catch, and vice versa, with catch from new vessel multiplied by ρ to obtain old vessel equivalent catch.

Where a conversion factor has been estimated for a taxa group, 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 was 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.

CCGS *Teleost* – Spring 3LNO

For the *Teleost* in Div. 3LNO in spring, conversion factors (Table 1) were defined for 12 taxa including two with significant length effects. Thirty-four taxa showed no significant difference in relative catchability, whereas three groups were deemed to have insufficient data to determine conversion factors. Conversions estimated here are applicable to the *Teleost* only and cannot be applied to years when the *Needler* or *Templeman* completed the spring survey. For White Hake (*Urophycis tenuis*) and Silver Hake (*Merluccius bilinearis*), which are primarily caught on the shelf edge in the spring survey, paired data collected in Subdiv. 3Ps were also included and conclusions are considered appropriate for application across Div. 3NOPs.

Table 1. Conversion factor (ρ) recommendations and estimates with 95% Confidence Intervals (CIs) for catch-aggregated conversions for the Canadian Coast Guard Ship (CCGS) Teleost *in spring in Div. 3LNO. (-) indicates a conversion was not significant. Estimates of the conversion factor at length $\rho(l)$ for species where a size-based conversion was supported are presented in Figure 4. Conversions for Silver Hake and White Hake were estimated for Div. 3NOPs. Additional taxa with no conversion required are listed below the table.*

Species or taxa group	Size effects considered?	Recommendation	$\boldsymbol{\rho}$ $(\boldsymbol{CI})$ numbers	$\boldsymbol{\rho}$ $(\boldsymbol{CI})$ weight
American Plaice	Yes	No conversion required	-	-
Greenland Halibut	Yes	No conversion required	-	-
Redfish	Yes	No conversion required	-	-
Roughead Grenadier	Yes	No conversion required	-	-
Silver Hake	Yes	No conversion required	-	-
White Hake	Yes	No conversion required	-	-
Witch Flounder	Yes	No conversion required	-	-
Yellowtail Flounder	Yes	No conversion required	-	-

Species or taxa group	Size effects considered?	Recommendation	ρ (CI) numbers	ρ (CI) weight
Thorny Skate	Yes	Significant length-based conversion	See Figure 4	Apply conversion to catch numbers at length
Northern Shrimp	No	No conversion required	-	-
Striped Shrimp	No	No conversion required	-	-
Toad Crab	Yes	Significant length-based conversion	See Figure 4	Apply conversion to catch numbers at length
Atlantic Argentine	No	Conversion required for biomass.	-	1.61 (1.06-2.46)
Longnose Eel	No	Conversion required for biomass	-	1.29 (1.07-1.55)
Capelin	No	No conversion required	-	-
Sandlance	No	No conversion required	-	-
Striped Wolffish	No	Conversion required for abundance	0.70 (0.52-0.96)	-
Gastropods	No	Conversion required for biomass	-	0.63 (0.40-0.99)
Sea stars n.s	No	Conversions required for abundance and biomass	0.70 (0.53-0.93)	0.54 (0.42-0.70)
Mud stars	No	Conversion required for abundance	2.46 (1.05-5.76)	-
Sea anemones	No	Conversion required for abundance	0.58 (0.39-0.87)	-
Sea urchins	No	Conversions required for abundance and biomass	0.65 (0.43-0.98)	0.63 (0.42-0.95)
Benthopelagic shrimp	No	Conversion required for biomass	-	0.61 (0.39-0.94)
Soft corals	No	Conversion required for biomass	Count data not available	0.62 (0.42-0.91)

Catch-aggregated analyses indicated conversion factors were not required for the following taxa for the *Teleost*, Div. 3LNO spring: alligatorfish and poachers, Atlantic Herring, barracudina and lancetfish, Boa Dragonfish, Broadhead Wolffish, eelpouts n.s., sculpin not speciated (n.s.), grenadier n.s. (excluding Roughead Grenadier), lanternfish, Longfin Hake, rocklings, Icelandic Scallop, cushion sea stars (*Ceramaster granularis*, and *Hippasteria phrygiana*), *Henricia* sp., sand dollars, sea cucumbers n.s., benthic shrimp, pelagic shrimp, brittle stars, sponge, jellyfish, and basketstars.

Bivalves, Spotted Wolffish, and tunicates met the minimum sample size requirements for catch-aggregated analysis but data were deemed insufficient to determine if conversion factors are required for this species.

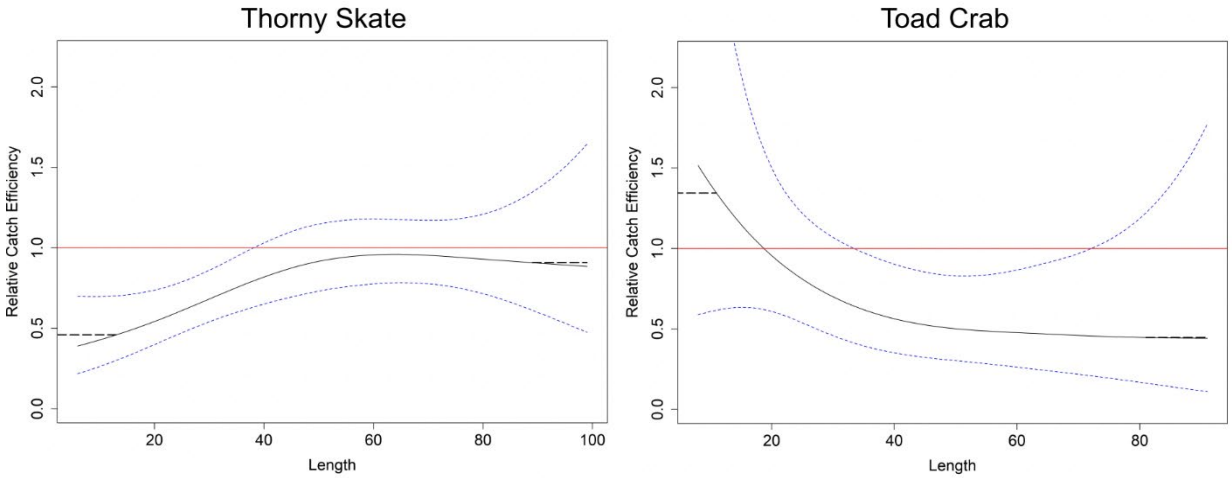

Figure 4. Length-based estimates of relative catch efficiency with 95% Confidence Intervals for Thorny Skate (left; total length, cm) and Toad Crab (right; carapace width, mm) in Div. 3LNO, Teleost *spring. Dashed lines indicate the constant conversion below the 0.5 and above the 99.5 length percentiles.*

CCGS *Teleost* – Fall 2HJ3KL

For the *Teleost* in fall in Div. 2HJ3KL, conversion factor analysis was undertaken for 23 deep water taxa. Significant conversion factors were estimated for seven taxa including one (Greenland Halibut) with a significant length effect (Table 2), while 16 taxa showed no significant difference in relative catchability. Conversion factors estimated here are considered directly applicable across the standard *Teleost* fall survey. Additional data collected in the fall of 2023 allowed for a re-evaluation of conversion factors for Common Lumpfish and lumpsuckers, previously considered to be data deficient. Some taxa groupings were re-evaluated following recommendations from Part I and updated conversion factors for those groupings are presented. Eight groupings had significant conversions, eight were not significant, and two were determined to have insufficient data.

Table 2. Conversion factor (ρ) recommendations and estimates with 95% Confidence Intervals (CIs) for catch-aggregated conversions for the Teleost *fall series. (-) indicates a conversion was not significant. Estimates of the conversion factor at length $\rho(l)$ for species where a size-based conversion was supported are presented in Figure 5. Conversions here are appropriate for use across the standard fall CCGS* Teleost *survey area, Div. 2HJ3KL. Additional taxa with no conversion required are listed below the table.*

Species or taxa group	Size effects considered?	Recommendation	$\boldsymbol{\rho}$ **(CI) numbers**	$\boldsymbol{\rho}$ **(CI) weight**
Greenland Halibut	Yes	Significant length-based conversion	See Figure 5	Apply conversion to catch numbers at length
Roughhead Grenadier	Yes	No conversion required	-	-
Common Grenadier	Yes	No conversion required	-	-
Roundnose Grenadier	Yes	No conversion required	-	-
Smooth Skate	Yes	No conversion required	-	-
Eelpouts	No	Conversions required for abundance and biomass	0.9 (0.81-1.01)	0.82 (0.73-0.92)

Species or taxa group	Size effects considered?	Recommendation	ρ (CI) numbers	ρ (CI) weight
Atlantic Hagfish	No	Conversion required for biomass	-	2.13 (1.12-4.03)
Longnose Eel	No	Abundance and biomass conversion	1.2 (0.99-1.46)	1.32 (1.11-1.57)
Common Lumpfish	No	No conversion required	-	-
Scopelosaurus sp.	No	Conversion required for biomass	-	0.4 (0.23-0.71)
Deepsea Cat Shark	No	Conversions required for abundance and biomass	1.63 (1.03-2.58)	1.64 (1.04-2.59)
Viperfish	No	Conversions required for abundance and biomass	0.66 (0.46-0.97)	0.65 (0.46-0.92)
Wolf eel	No	Conversion required for biomass	-	1.77 (1.05-3)
Benthopelagic shrimp	No	Conversions required for abundance and biomass	1.9 (1.39-2.61)	1.8 (1.42-2.27)
Gastropods	No	Conversion required for biomass	-	0.56 (0.38-0.81)
Rigid Cushion Star	No	Conversions required for abundance and biomass	0.75 (0.58-0.97)	0.62 (0.45-0.84)
Henricia Star	No	Conversion required for biomass	-	0.59 (0.42-0.83)
Mud Star	No	Conversions required for abundance and biomass	0.42 (0.3-0.6)	0.19 (0.13-0.27)
Sea Urchins	No	Conversions required for abundance and biomass	0.52 (0.36-0.75)	0.49 (0.32-0.77)
Sea stars n.s	No	Conversions required for abundance and biomass	0.7 (0.58-0.85)	0.44 (0.35-0.55)

Catch-aggregated analyses indicated conversion factors were not required for the following taxa for the *Teleost* fall survey series: Atlantic Gymnast, barracudina and lancetfish, Goitre Blacksmelt, Black Dogfish, Boa Dragonfish, grenadier n.s., Blue Hake, lanternfish n.s., loosejaw, lumpsuckers, sculpins, smoothheads, Atlantic Snipe Eel, Shortnose Snipe Eel, tapirfish, benthic shrimp, pelagic shrimp, cushion stars, and sea cucumbers n.s.

While Icelandic Scallop and the broader bivalve grouping met minimum sample size requirements for catch-aggregated analyses, data were deemed insufficient (e.g., due to poor model performance) to determine if conversion factors are required for these taxa.

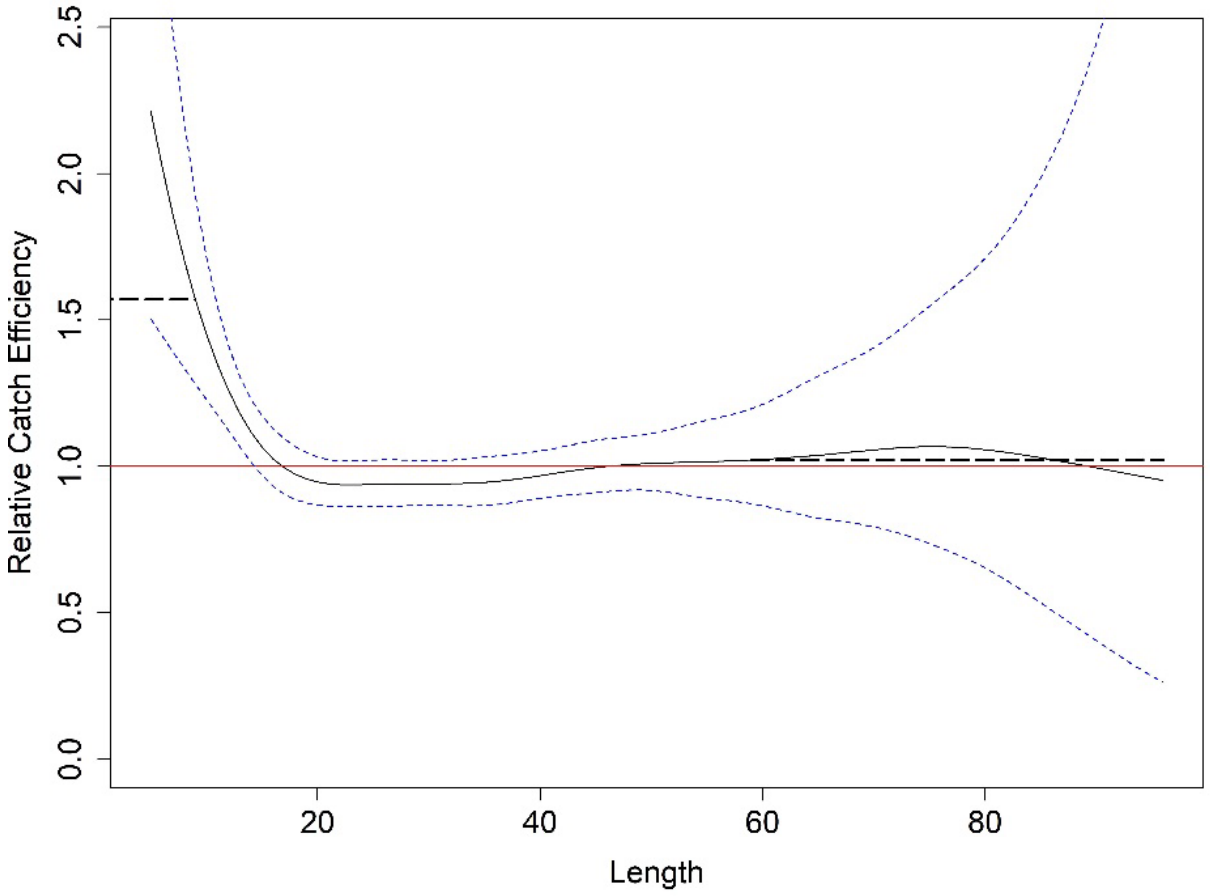

Figure 5. Length-based estimates of relative catch efficiency with 95% Confidence Intervals (CIs) for Greenland Halibut (total length, cm). Dashed lines indicate the constant conversion below the 0.5 and above the 99.5 length percentiles.

CCGS *Alfred Needler* – Fall 3KL

No additional data were collected for the *Needler* since Part I; however, a re-evaluation of taxa groupings led to the estimation of conversion factors for nine taxa in the fall that were not previously reported (Table 3), and determined no conversion is required for an additional four taxa.

Table 3. Conversion factor (ρ) recommendations and estimates with 95% Confidence Intervals (CIs) for catch-aggregated conversions for the Needler *fall series. (-) indicates a conversion was not significant. All* Needler *conversions here are for use in Div. 3KL Fall. Additional taxa with no conversion required are listed below the table.*

Species or taxa group	Size effects considered?	Recommendation	ρ (CI) numbers	ρ (CI) weight
Benthic shrimp	No	Conversions required for abundance and biomass	0.58 (0.34-0.99)	0.57 (0.39-0.82)
Benthopelagic shrimp	No	Conversion required for biomass	-	0.43 (0.25-0.72)

Species or taxa group	Size effects considered?	Recommendation	ρ (CI) numbers	ρ (CI) weight
Pelagic shrimp	No	Conversions required for abundance	2.67 (1.48-4.84)	-
Eelpouts	No	Conversions required for abundance and biomass	0.72 (0.62-0.85)	0.83 (0.72-0.95)
Gastropods	No	Conversions required for abundance and biomass	0.54 (0.33-0.9)	0.25 (0.13-0.45)
Henricia Star	No	Conversion required for biomass	-	0.56 (0.42-0.76)
Mud Star	No	Conversions required for abundance and biomass	0.29 (0.15-0.55)	0.09 (0.04-0.17)
Sea stars n.s	No	Conversions required for abundance and biomass	0.39 (0.28-0.55)	0.33 (0.22-0.5)
Sculpins	No	Conversions required for abundance and biomass	0.71 (0.51-0.97)	0.47 (0.36-0.63)

Catch-aggregated analyses indicated conversion factors were not required for the following taxa for the *Needler* fall survey series: Rigid Cushion Star, sea cucumbers n.s., sea urchins, and Smooth Skate.

Functional Groups

Functional group conversion factors (Table 4) were defined primarily at the EPU scale, with conversion factors estimated for the *Teleost* on the Labrador Shelf (Div. 2H), Newfoundland Shelf (Div. 2J3K) in fall, and on the Grand Bank (Div. 3LNO) in spring. For the *Needler*, functional group conversion factors were defined for the Newfoundland Shelf (Div. 2J3K) and Div. 2J3KL in fall. Data were insufficient to estimate conversions for Subdiv. 3Ps for either vessel or for Div. 3LNO for the *Needler*. To facilitate ecosystem advice provided for stock assessments overlapping multiple EPUs, functional group conversion factors were also estimated for the *Teleost* in Div. 2J3KL in fall. The functional group conversion factors here are reflective of the species composition and size distribution at the time of comparative fishing.

Table 4. Conversion factor (ρ) estimates with 95% Confidence Intervals (CIs) for functional group catch-aggregated conversions. (-) indicates a conversion was not significant and no conversion is required.

Area	Vessel	Season	Functional Group	Recommendation	ρ (CI) numbers	ρ (CI) weight
2H	*Teleost*	Fall	Large Benthivore	No conversion required	-	-
2H	*Teleost*	Fall	Medium Benthivore	Conversion required for biomass	-	0.80 (0.64-0.99)
2H	*Teleost*	Fall	Small Benthivore	No conversion required	-	-
2H	*Teleost*	Fall	Piscivore	No conversion required	-	-
2H	*Teleost*	Fall	Plank-piscivore	No conversion required	-	-
2H	*Teleost*	Fall	Planktivores	No conversion required	-	-
2H	*Teleost*	Fall	Shellfish	No conversion required	-	-
2J3K	*Teleost*	Fall	Large Benthivore	No conversion required	-	-

Area	Vessel	Season	Functional Group	Recommendation	ρ (CI) numbers	ρ (CI) weight
2J3K	*Teleost*	Fall	Medium Benthivore	No conversion required	-	-
2J3K	*Teleost*	Fall	Small Benthivore	Conversion required for abundance	1.17 (1.02-1.35)	-
2J3K	*Teleost*	Fall	Piscivore	No conversion required	-	-
2J3K	*Teleost*	Fall	Plank-piscivore	Conversion required for biomass	-	0.88 (0.81-0.96)
2J3K	*Teleost*	Fall	Planktivores	Conversions required for abundance and biomass	1.28 (1.06-1.53)	1.25 (1.08-1.44)
2J3K	*Teleost*	Fall	Shellfish	Conversion required for abundance	1.24 (1.11-1.38)	-
2J3K	*Needler*	Fall	Large Benthivore	No conversion required	-	-
2J3K	*Needler*	Fall	Medium Benthivore	Conversions required for abundance and biomass	0.78 (0.68-0.9)	0.89 (0.79 – 1.01)
2J3K	*Needler*	Fall	Small Benthivore	Conversions required for abundance and biomass	0.77 (0.58-1.02)	0.66 (0.53 – 0.81)
2J3K	*Needler*	Fall	Piscivore	Conversion required for abundance	0.91 (0.83-0.99)	-
2J3K	*Needler*	Fall	Plank-piscivore	No conversion required	-	-
2J3K	*Needler*	Fall	Planktivores	No conversion required	-	-
2J3K	*Needler*	Fall	Shellfish	Conversions required for abundance and biomass	0.75 (0.66-0.85)	0.81 (0.72 – 0.90)
2J3KL	*Teleost*	Fall	Large Benthivore	No conversion required	-	-
2J3KL	*Teleost*	Fall	Medium Benthivore	No conversion required	-	-
2J3KL	*Teleost*	Fall	Small Benthivore	Conversion required for abundance	1.18 (1.04-1.34)	-
2J3KL	*Teleost*	Fall	Piscivore	No conversion required	-	-
2J3KL	*Teleost*	Fall	Plank-piscivore	Conversion required for biomass	-	0.88 (0.80-0.96)
2J3KL	*Teleost*	Fall	Planktivores	Conversions required for abundance and biomass	1.29 (1.09-1.52)	1.24 (1.08-1.42)
2J3KL	*Teleost*	Fall	Shellfish	Conversion required for abundance	1.23 (1.11-1.37)	-
2J3KL	*Needler*	Fall	Large Benthivore	No conversion required	-	-
2J3KL	*Needler*	Fall	Medium Benthivore	Conversions required for abundance and biomass	0.87 (0.78-0.97)	0.98 (0.89 – 1.08)
2J3KL	*Needler*	Fall	Small Benthivore	Conversions required for abundance and biomass	0.65 (0.51-0.84)	0.63 (0.51 – 0.76)
2J3KL	*Needler*	Fall	Piscivore	Conversion required for abundance	0.91 (0.84-0.99)	-
2J3KL	*Needler*	Fall	Plank-piscivore	Conversion required for abundance	0.85 (0.73-0.99)	-
2J3KL	*Needler*	Fall	Planktivores	No conversion required	-	-

Area	Vessel	Season	Functional Group	Recommendation	ρ (CI) numbers	ρ (CI) weight
2J3KL	*Needler*	Fall	Shellfish	Conversions required for abundance and biomass	0.64 (0.56-0.75)	0.79 (0.71 – 0.88)
3LNO	*Teleost*	Spring	Large Benthivore	No conversion required	-	-
3LNO	*Teleost*	Spring	Medium Benthivore	Conversion required for biomass	-	1.15 (1.02-1.30)
3LNO	*Teleost*	Spring	Small Benthivore	No conversion required	-	-
3LNO	*Teleost*	Spring	Piscivore	No conversion required	-	-
3LNO	*Teleost*	Spring	Plank-piscivore	No conversion required	-	-
3LNO	*Teleost*	Spring	Planktivores	No conversion required	-	-
3LNO	*Teleost*	Spring	Shellfish	No conversion required	-	-

Relative Catchability of the CCGS *Alfred Needler* and CCGS *Teleost*

The *Teleost* and *Needler* were both used in the NL multispecies surveys during the Campelen series. These vessels were planned to operate across the same general spatial pattern from year to year, resulting in survey indices that are thought to be comparable across time. However, in some years when one vessel was unable to complete the survey, the other was substituted or used to supplement coverage. Catchability of the *Teleost* and *Needler* was previously assumed to be equal, with indices from both vessels used in series. However, no direct comparisons of catchability have been performed between these vessels in the NL surveys.

Through the comparative fishing program we were able to compare trawl performance and geometry between these vessels operating under similar conditions. Trawl mensuration data (SCANMAR) from sets in fall 2022, where these vessels fished in the same strata in Div. 3K, were used to examine trawl performance under similar conditions and consistent depths. As sets did not occur simultaneously or at the exact same positions, factors such as current, sea state, and slope, that can also impact trawl performance, may differ.

Variation in trawl performance is evident between the *Needler* and *Teleost* (Figure 6), with notable differences in tow speed and duration, door spread, and wing spread. These differences are largely attributed to the difference in vessel power, size, and winch systems.

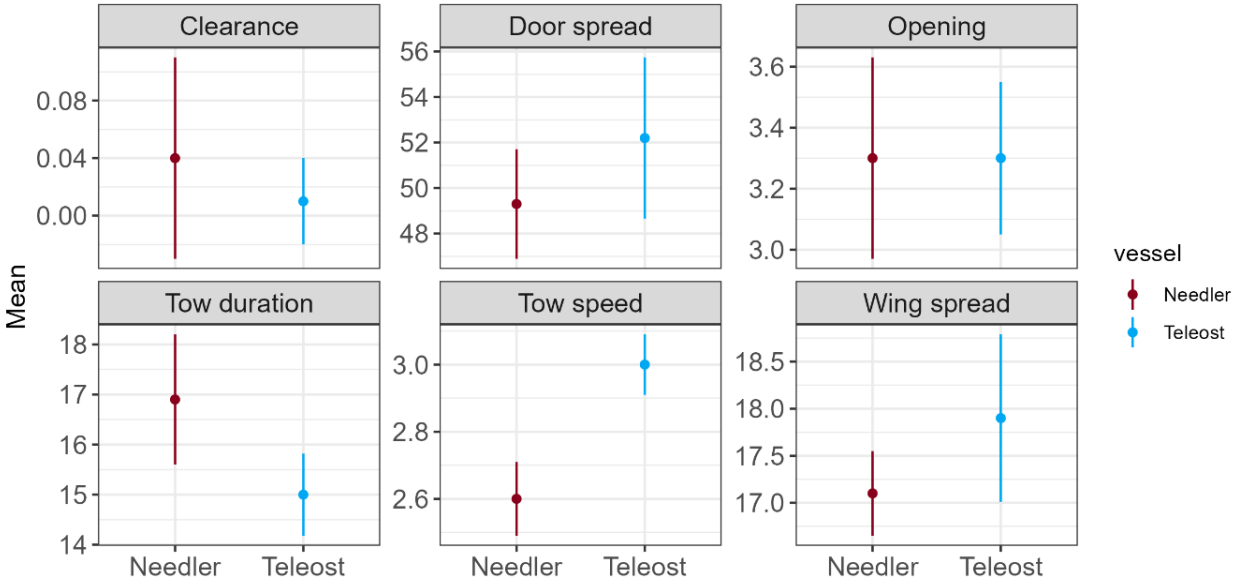

Figure 6. Comparison of trawl mensuration data (mean ± SD) for the CCGS Alfred Needler *and CCGS* Teleost *from sets completed in Div. 3K in the Fall 2022 Comparative Fishing program.*

Variation in conversion factors estimated for each of these vessels relative to the new OFSVs indicate differences in catchability. While taxa-specific conversion factors have been estimated at different spatial scales, conversions were more prevalent and more often size-based for the *Needler* than for the *Teleost*. Species-specific conversions often differed in significance, direction, and/or magnitude across vessels (Figure 7), though in some cases (e.g., Atlantic Cod and Roughead Grenadier) conversions were consistent between these two vessels. Additionally, the significance and magnitude of functional group conversions (Figure 8) differed between these vessels.

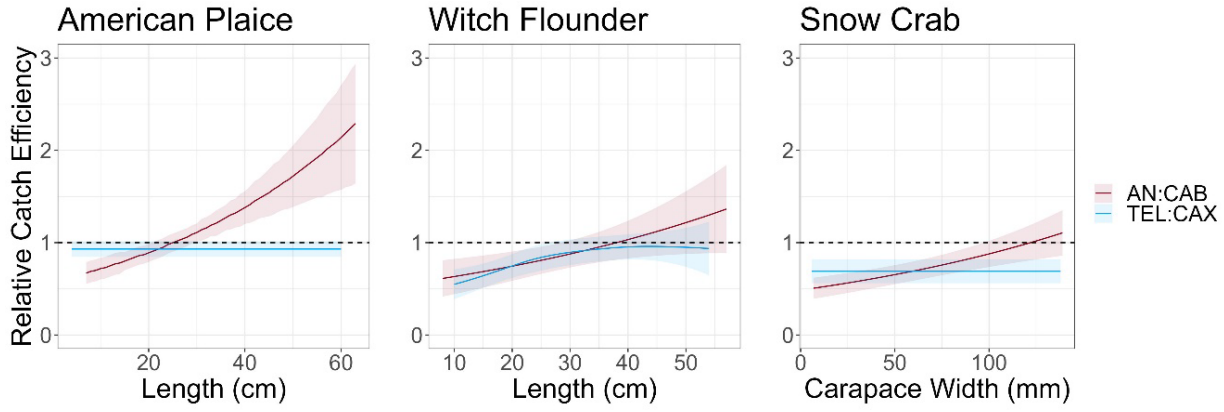

Figure 7. Examples of conversion factors for the fall survey for the Needler *("AN") and* Teleost *("TEL") demonstrating differences in estimates to the new OFSVs ("CAB", "CAX").*

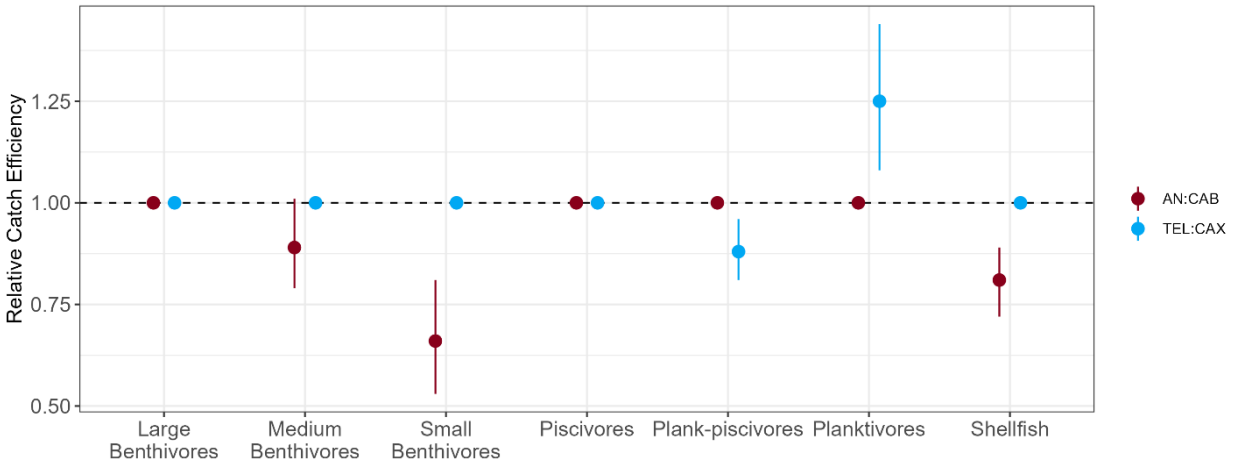

Figure 8. Comparison on conversion factor estimates (relative catch efficiency) with 95% confidence intervals (CIs) for functional group biomass on the Newfoundland Shelf Ecosystem Production Unit (Div. 2J3K). Points at one (black dashed line) indicate no significant conversion for this group.

Sources of Uncertainty

In Div. 2H, deep and structurally complex strata were not sampled by comparative fishing, limiting the ability to account for differences in relative catchability in these habitats for this EPU. However, these deep strata are also inconsistently covered in the *Teleost* survey series (1996–2023). Community composition was well represented, and results for individual deep water taxa in Div. 2HJ3KL are consistent with those for functional groups in Div. 2H. Therefore, the functional group conversions estimated for the Labrador Shelf EPU are considered representative despite this coverage gap.

Taxa-grouped conversions were required in some cases due to limitations in the taxonomic resolution of species identification at sea. These conversions are largely consistent with the resolution of data through much of the Campelen series, however there may be underlying species-specific, size, or behavioral differences within these groupings that are unaccounted for. Improving the reliability of the identifications across taxonomic groups is necessary going forward, requiring a significant breadth of expertise. While efforts are underway to incrementally improve these identifications, further support and expertise (e.g., training, improvements to area-specific reference materials) are required.

RESEARCH RECOMMENDATIONS

This meeting addressed research recommendations from Comparative Fishing Part I including, estimating conversion factors for deep water taxa following additional comparative fishing in fall 2023, revisiting species groupings, and expanding analyses to include functional group level conversions to support ecosystem analyses. In addition, work presented at the assessments of Atlantic Cod (2023) and Snow Crab (2024) completed the analysis of comparative fishing data for these species.

The following Research Recommendations are reiterated from Part 1:

- As frozen samples are processed, sufficient length data may become available to test for size-based conversions in some species only considered so far in size-aggregated analyses. These should be revisited on an ongoing basis as data availability permits.

- Conversion factors calculated here include estimates of uncertainty. It is recommended that these uncertainties be included in their application whenever possible.

The *Teleost* and *Needler* have previously been assumed to have equal catchability; however, results presented here challenge this assumption. These vessels have different trawl performance and geometry, and conversions to the new OFSVs differ in direction and magnitude across many taxa. Implications of this on the use and interpretation of the historic Campelen series must be carefully considered.

CONCLUSION

Conversion factors estimated are specific to the vessel, area, and season for which they have been estimated. These conversions are representative of the habitats, species, and size composition sampled at the time of comparative fishing.

Overall, conversion factors have been estimated for the *Teleost* fall survey series across Div. 2HJ3KL and spring for Div. 3LNO, and for the *Needler* in Div. 3KL in fall. Data are insufficient to estimate conversion factors for either vessel in Subdiv. 3Ps or for the *Needler* in Div. 3LNO spring or 3NO fall.

Further application of the comparative fishing data or estimated conversions must be supported by additional analyses which should include consistency in physical habitat, seasonal, biological conditions, and trawl performance. Any application of a conversion factor outside of the conditions for which it was estimated may introduce a bias into the survey indices; this should only be considered following careful examination of the paired and survey data.

As demonstrated by the *Teleost* spring 2023 program, the shadow survey approach recommended in Thiess et al. 2018 was successful in collecting comparative data representative of the standard survey, even if coverage is incomplete. While a targeted approach can be implemented successfully when vessel time is limited (DFO 2024a), this requires the prioritization of areas and species of main concern, and increases the risk of biasing the paired sampling. The shadow survey is recommended as the best approach for comparative fishing across a multispecies survey.

OTHER CONSIDERATIONS

The information provided in this SAR and associated Research Documents covers the analysis conducted for the second of two CSAS Regional Peer Review processes for the NL comparative fishing program, and presented conclusions across Part 1 and Part 2.

Results for spring comparative fishing between the *Teleost* and *Cabot* in Div. 3LNO and Subdiv. 3Ps were reviewed in the assessments of Atlantic Cod (DFO 2024b; Wheeland and Trueman 2024) and Snow Crab (DFO 2025) in the fall of 2023 and winter of 2024, respectively. For a full understanding of the comparative fishing program and implementation of conversion factors, readers are encouraged to consult all current and future publications related to the project, to ensure decisions made are based on the most up-to-date documentation.

MV *Calvert*

Comparative fishing is ongoing between the MV *Calvert* and the *Cabot* through a two-year collaborative agreement between DFO and the Atlantic Groundfish Council. The aim of this program is to estimate conversion factors for the MV *Calvert* which would allow data collected by this vessel, fishing the Campelen 1800 trawl following standard survey protocols, to be used equivalently with the *Cabot* and *Cartier*. In spring 2023, 36 paired tows were completed between

the *Calvert* and *Cabot* in Div. 3L, using a shadow survey approach within the Canadian Exclusive Economic Zone. Further work is planned for spring 2024 in Div. 3NO, expanding coverage and increasing sample size for this program, after which conversion factors will be determined.

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