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Results of Comparative Fishing Between the Canadian Coast Guard Ship (CCGS) *Teleost* and the CCGS *John Cabot* in the Newfoundland and Labrador Region in Spring 2023

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Foreword

This series documents the scientific basis for the evaluation of aquatic resources and ecosystems in Canada. As such, it addresses the issues of the day in the time frames required and the documents it contains are not intended as definitive statements on the subjects addressed but rather as progress reports on ongoing investigations.

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ABSTRACT

Comparative fishing has been ongoing since 2021 in the Newfoundland and Labrador Region as the multispecies survey transitions to new vessels, the Canadian Coast Guard Ship (CCGS) *John Cabot* and CCGS *Capt. Jacques Cartier.* This program aims to determine differences in relative catchability between the outgoing vessels using the Campelen trawl and the new vessels, using the modified Campelen trawl. Analysis of this program was considered in two CSAS Regional Peer Review meetings. This document presents analyses for the CCGS *Teleost* operating in spring based on paired tows completed in 2023. The CCGS *Teleost* is not a primary survey vessel in this region in spring but has been used to supplement or replace the CCGS *Wilfred Templeman* and CCGS *Alfred Needler* during the Campelen series. Comparative fishing data were sufficient to estimate conversions for 12 taxa and determine no conversion is required for 34 taxa for the CCGS *Teleost* spring time series. Additionally, three taxa were found to have insufficient data to estimate a conversion factor. Due to poor sampling coverage in Subdivision 3Ps, data were deemed representative for Northwest Atlantic Fishery Organization (NAFO) Divisions 3LNO only, with a few exceptions made for Subdivision 3Ps.

1. INTRODUCTION

The Newfoundland and Labrador (NL) spring multispecies survey covers Northwest Atlantic Fisheries Organization (NAFO) Divisions 3LNOPs, including the Grand Bank (3LNO) and Southern Newfoundland (3Ps). Data from these surveys are used to inform stock assessment and fisheries management, ecosystem assessments, species at risk, marine conservation monitoring, and a variety of research programs. This survey has primarily been conducted using the Canadian Coast Guard Ship (CCGS) *Alfred Needler*, hereafter referred to as the "Needler (AN)," or its sister ship, the CCGS *Wilfred Templeman*, hereafter referred to as the "Templeman (WT)." The CCGS *Teleost*, hereafter referred to as the "Teleost," has been used in select Divisions in certain years when the Needler was unavailable, starting from the mid-1990s.

The Teleost and Needler are now being replaced by the CCGS *Capt. Jacques Cartier* and the CCGS *John Cabot*, hereafter referred to as the "Cartier (CAR)" and "Cabot (CAB)," or collectively as "CAX." Comparative fishing between the old and new vessels was undertaken to ensure that data collected from these new vessels is comparable to that from the old vessels, so that existing survey data time series can be extended. This involves fishing old and new vessels side by side to quantify differences in catch size and composition (by species, size, etc.).

The information presented here outlines the results of the spring 2023 comparative fishing program with the Teleost and Cabot in NAFO Divisions 3LNO and Subdivision 3Ps. Results from the fall 2021–22 and spring 2022 comparative fishing program can be found in Trueman et al. (2025).

2. METHODS

2.1. COMPARATIVE FISHING PROGRAM

A shadow survey was implemented for NAFO Divisions 3LNO; paired sets were undertaken during the standard multispecies survey at regular survey stations chosen according to the stratified random design. Not all allocated survey sets were completed as paired tows as some vessels were only available for a portion of the season. However, sets were distributed across Division 3L (n = 32 paired tows), 3N (n = 35), and 3O (n = 23), across the normal spatial range of the survey (Figure 1).

For Subdivision 3Ps, ship and time limitations resulted in a switch to a “targeted” program. Sets completed were not part of the regular survey design, and stations for targeted sampling were chosen within a subset of normal survey stratum following the same random set selection. The number and distribution of stratum sampled was limited, with a focus on stratum expected to yield consistent catches of Atlantic Cod (*Gadus morhua*) and Snow Crab (*Chionoecetes opilio*) (Figure 2), and the number of sets within a stratum was adjusted to distribute set allocations across depth more consistently. Fifty-one paired sets were completed in Subdivision 3Ps between the Teleost and Cabot in spring 2023. This program in Subdivision 3Ps occurred in June, approximately two months later than the typical survey timing for this area.

At each station, the vessels within a pair fished as close together in space and in time as operationally feasible as per the guidelines outlined in Wheeland et al. (2024). Distance between tows within a pair ranged from 0.03 to 1.28 nautical miles (nm) but was 0.49 ± 0.02 nm on average. Depth difference within a pair averaged 4.33 ± 0.66 m (0–30 m range). To ensure paired tows were being conducted properly, tows were evaluated for difference in time, distance, and depth between the vessels as per the methods outlined in Wheeland et al. (2024). Six sets were identified as being out of range for original set check parameters. Five of these were deemed acceptable, while one set was removed (pair number three) due to a 72 m difference in mean set depth with no overlap in depth between the two vessels within the pair.

For species with sufficient size data (minimum 25 paired tows), a suite of 13 binomial (Table 1) and beta-binomial models (Table 2) with various assumptions were used to estimate size-disaggregated conversion factors for catch numbers by length. For those species with no size information, size-aggregated analysis was completed to determine a conversion for abundance and biomass (minimum 15 paired tows). 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. A $\rho < 1$ indicates the new vessels catch a greater amount, while a $\rho > 1$ indicates the new vessel catches less. If $\rho = 1$, conversion of catches between vessels is not required. A full description of model specifics and the data analysis framework for comparative fishing is outlined in DFO (2024a), and Trueman et al. (2025).

3. SPATIAL CONSIDERATIONS

Seabed characteristics of the comparative fishing strata completed in spring were compared to the characteristics of the total spring survey area to assess whether the comparative fishing program was carried out on a representative subsample of the survey strata. Seabed characteristics included in this analysis are depth (GEBCO 2023) and terrain attributes (slope, ruggedness, and benthic position index); bottom current velocity (Assis et al. 2017; Tyberghein et al. 2012); and modeled dominant substrate (E. Novaczek, unpublished data). These variables are described in detail in Trueman et al. (2025).

Summary statistics were calculated for each variable using the zonal statistics to table tool in ArcGIS Pro for the entire spring survey areas for the Teleost (strata within NAFO Divisions 3LNO and Subdivision 3Ps). This was repeated for the subset of survey strata where >2 successful paired sets were completed in spring 2023. This comparison is limited to quantitative variables, and therefore categorical information on substrate and geomorphology were not included.

4. RESULTS AND DISCUSSION

To calculate conversion factors, data were first considered across Ecosystem Production Units (EPUs; Pepin et al. 2014): The Grand Bank (Divisions 3LNO) and Southern Newfoundland (Subdivision 3Ps). Since the sampling completed in Subdivision 3Ps was done as a targeted program these data are not considered representative for species outside of Atlantic Cod and Snow Crab for which the targeted design was intended. Additionally, the 3Ps program took place two months later (June) than the normal survey timing (April) which could have implications for some species where distributions are known to differ during this time. Therefore, for the majority of taxa, conversion factors are only considered for Divisions 3LNO. The only exceptions made were for White Hake (*Urophycis tenuis*) and Silver Hake (*Merluccius bilinearis*) where the paired set coverage in Subdivision 3Ps was deemed acceptable based on distribution of both species during the spring survey.

4.1. PRESENTATION OF CONVERSION FACTORS

Here we provide detailed figures and tables (Table 3–Table 6) that describe the results, support decisions for the application of conversion factors, and provide some interpretation for a selection of commercial species and species of conservation concern. Results are presented across two appendices:

- **Appendix 1** contains results for all taxa where data allowed the estimation of conversions via length-disaggregated modeling.
- **Appendix 2** contains results for all taxa where conversions were estimated with size-aggregated (abundance, biomass) methods.

All results presented are valid for the Teleost and Cabot (or Cartier) for the spring survey only and should not be directly applied to Teleost in the fall given potential seasonal differences in relative catchability. These conversion factors are not transferable between vessels and cannot be applied to the Needler.

To inform the provision of science advice, analyses of this program for Atlantic Cod and Snow Crab were completed at their respective stock assessments. Analysis for Atlantic Cod showed no conversion factor is required for Atlantic Cod in the NL multispecies survey, irrespective of vessel, season, or NAFO Division (DFO 2024b, Wheeland and Trueman 2024). No significant conversion was found for Snow Crab between the Teleost and Cabot in spring (Wheeland et al. In press).

4.1.1. American Plaice (*Hippoglossoides platessoides*)

American Plaice were caught in 77 sets with a length range of 5–69 cm across Divisions 3LNO. The best model selected was BB1 with no significant length effect, resulting in a flat conversion with confidence intervals (CIs) overlapping with one, and therefore no significant conversion. Size-aggregated analysis supports no conversion required with both abundance and biomass resulting in a non-significant conversion. No conversion factor is required for American Plaice in Divisions 3LNO.

4.1.2. Greenland Halibut (*Reinhardtius hippoglossoides*)

Greenland halibut were caught in 56 sets across Divisions 3LNO, with a length range of 7–69 cm. The best model selected was BI1 with no significant length effect, resulting in a flat conversion with CIs overlapping with one. This is consistent with the size-aggregated analysis where no significant conversion was found for abundance or biomass. No conversion factor is required for Greenland Halibut in Divisions 3LNO.

4.1.3. Northern Shrimp (*Pandalus borealis*)

Northern Shrimp were present in 36 sets across Divisions 3LNO. Data for Divisions 3LNO were deemed insufficient for size-disaggregated analysis but were enough for aggregated analysis. No significant conversion was found for either abundance or biomass, and therefore no conversion factor is required for Northern Shrimp for size-aggregated catches in Divisions 3LNO, however we cannot inform on potential size effects.

4.1.4. Redfish (*Sebastes mentella* and *S. fasciatus*)

Redfish were caught in 52 sets across Divisions 3LNO, with a length range of 6–68 cm recorded. The best model selected was BB1 with no significant length effect, resulting in a flat conversion with CIs overlapping with one. Though the delta (Δ) values compared to lowest Aikaike Information Criterion (AIC) and the Bayesian Information Criterion (BIC) for length-based models (BB4 and BB5) are close to BB1, the length effect is driven by a few larger individuals caught. This was supported by the length sensitivity testing, where the conclusion of no conversion factor remains true across the three length ranges tested. Additionally, size-aggregated analysis indicates no conversion factor for bulk abundance and biomass.

Therefore, BB1 is selected as the final model for disaggregated analysis and no conversion factor is required for redfish in Divisions 3LNO.

4.1.5. Roughhead Grenadier (*Macrourus berglax*)

Roughhead Grenadier were caught in 35 sets across Divisions 3LNO with a length range of 1.5–31.5 cm (anal length, measured from rostrum to anal fin). No significant conversion was found in size-disaggregated or aggregated analysis, and therefore no conversion factor is required for Roughhead Grenadier in Divisions 3LNO.

4.1.6. Silver Hake (*Merluccius bilinearis*)

Analysis for Silver Hake was considered across Divisions 3NOPs. The distribution of the species in spring in this area is concentrated to the shelf slope, primarily along a continuous area that straddles Divisions 3OPs. Though Silver Hake were only caught in 23 paired sets, size-disaggregated analysis was attempted and resulted in BB5 as the best model selected. Though a length-based model was the best fit, the CI's overlapped with one for the entirety of the length range. Size-aggregated analysis also showed no significance. No conversion factor is required for Silver Hake in Divisions 3NOPs.

4.1.7. Thorny Skate (*Amblyraja radiata*)

Though the stock boundaries for Thorny Skate are NAFO Divisions 3LNOPs, conversion factor analysis was completed for Divisions 3LNO only. The inclusion of Subdivision 3Ps was considered, however the timing of the targeted program in the region was deemed not representative, as Thorny Skate are known to move between the shelf slope and edge through the spring (Kulka et al. 2004).

Thorny Skate were present in 76 sets in Divisions 3LNO, with a length range of 6–99 cm. Though the best model selected based on ΔBIC was BB1, the ΔBIC for BB4 was five, and the ΔAIC indicated the best model was BB4. Comparing the two models, BB4 appeared to fit the data slightly better from the residuals, station effect distribution, and calibration of the length frequency in the smaller skates (<40 cm). This is supported by the size-aggregated analysis where a significant conversion was found for abundance but not biomass, indicating a potential size effect. Therefore, the implementation of BB4 was selected for the best model fit, and a length-based conversion factor is required for Thorny Skate in Divisions 3LNO.

4.1.8. Toad Crab (*Hyas* sp.)

Toad Crab were caught in 52 sets across Divisions 3LNO. The best model selected by ΔBIC was BB1 with no length effect and no significant conversion. Though no other model was close when comparing the ΔBIC values, the ΔAIC indicated the best model to be BB4/BB5, which are both length-based models. Comparison of residuals and station effect distribution between BB1 and BB4 indicated similar fits. For size-aggregated analysis, no significant conversion was found for abundance, but a significant conversion was found for biomass. Therefore, the implementation of BB4 was selected for best model fit, and a length-based conversion factor for Toad Crab is required in Divisions 3LNO.

4.1.9. White Hake (*Urophycis tenuis*)

White Hake were caught in 28 sets, with a length range of 11–95 cm across Divisions 3NOPs. Subdivision 3Ps was included for these analyses since White Hake in 3Ps are found along the slope edge, consistent across 3NOPs, there are no known seasonal changes in their distribution across the spring, and the stock boundary is Divisions 3NOPs. No significant length effect was found, and the best model selected was BI1. Size-aggregated analysis also showed no significant conversion for abundance or biomass, and therefore no conversion factor is required for White Hake in Divisions 3NOPs.

4.1.10. Witch Flounder (*Glyptocephalus cynoglossus*)

Witch Flounder were caught in 52 sets across Divisions 3LNO with a length range of 7–58 cm. Size-disaggregated analysis was considered for Witch Flounder for Divisions 3LNO, and Divisions 3NO (36 sets) to support analyses on the EPU and stock scale, respectively. For both groupings, the estimated conversion factor was not significantly different than one, thus no conversion is required. The same was observed in the size-aggregated analysis. No conversion factor is required for Witch Flounder in Divisions 3LNO.

4.1.11. Yellowtail Flounder (*Myzopsetta ferruginea*)

Yellowtail Flounder were caught in 29 sets across Divisions 3LNO, with a length range of 4–58 cm. The best model selected was BB5, with a length effect, however the CI's for the model overlapped with one for the entirety of the derived values. Size-aggregated analysis also showed no significant conversion for abundance or biomass. No conversion factor is required for Yellowtail Flounder in Divisions 3LNO.

4.2. SPATIAL ANALYSIS

The spring survey strata where comparative fishing was completed with the Teleost in NAFO Divisions 3LNO represented the 3LNO spring survey area well. For the tested terrain variables (depth, slope, ruggedness, benthic position index [BPI], current velocity, and substrate) the mean and range of the comparative fishing strata closely matched those observed across the total survey area (Figure 3). These results highlight the ability of the shadow survey approach to sample conditions representative of the normal survey, even with reduced coverage.

The spring survey strata where comparative fishing was completed with the Teleost in NAFO Subdivision 3Ps were not representative of the full range of seabed characteristics of the survey area due to the targeted approach that was implemented for the region. There was truncation of the sampled range for several variables including depth, slope, ruggedness, and broad and fine BPI. This difference was most evident for depth; the depth of the completed comparative fishing strata (mean = 105 m, range = 21–366 m) was much shallower than the survey area (mean = 205 m, range = 0–732 m, Figure 4). Current velocity was well represented, and generally the substrate types also appeared to be well represented in the 3Ps comparative fishing strata. These results indicate that deep and structurally complex strata were not completed in spring comparative fishing in NAFO Subdivision 3Ps, which limits the ability to inform on conversion factors for species that occupy those habitats.

5. CONCLUSIONS

The data obtained during the 2023 comparative fish program were sufficient to test for differences in relative catch efficiency for the CCGS Teleost in spring in Divisions 3LNO, though limited coverage and differences in timing limited applicability in Subdivision 3Ps. Conversion factors were defined for 12 taxa, including length-based conversions for Thorny Skate and Toad Crab. No conversion factor was required for 42 taxa, and three taxa were found to have insufficient data to estimate a conversion factor.

6. ACKNOWLEDGEMENTS

The Comparative Fishing program could not have been undertaken without the massive effort, sacrifice, and dedication from sea-going staff and shore support! Thanks also to all Coast Guard crew aboard these vessels, without whom fishing operations would not be possible.

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8. FIGURES

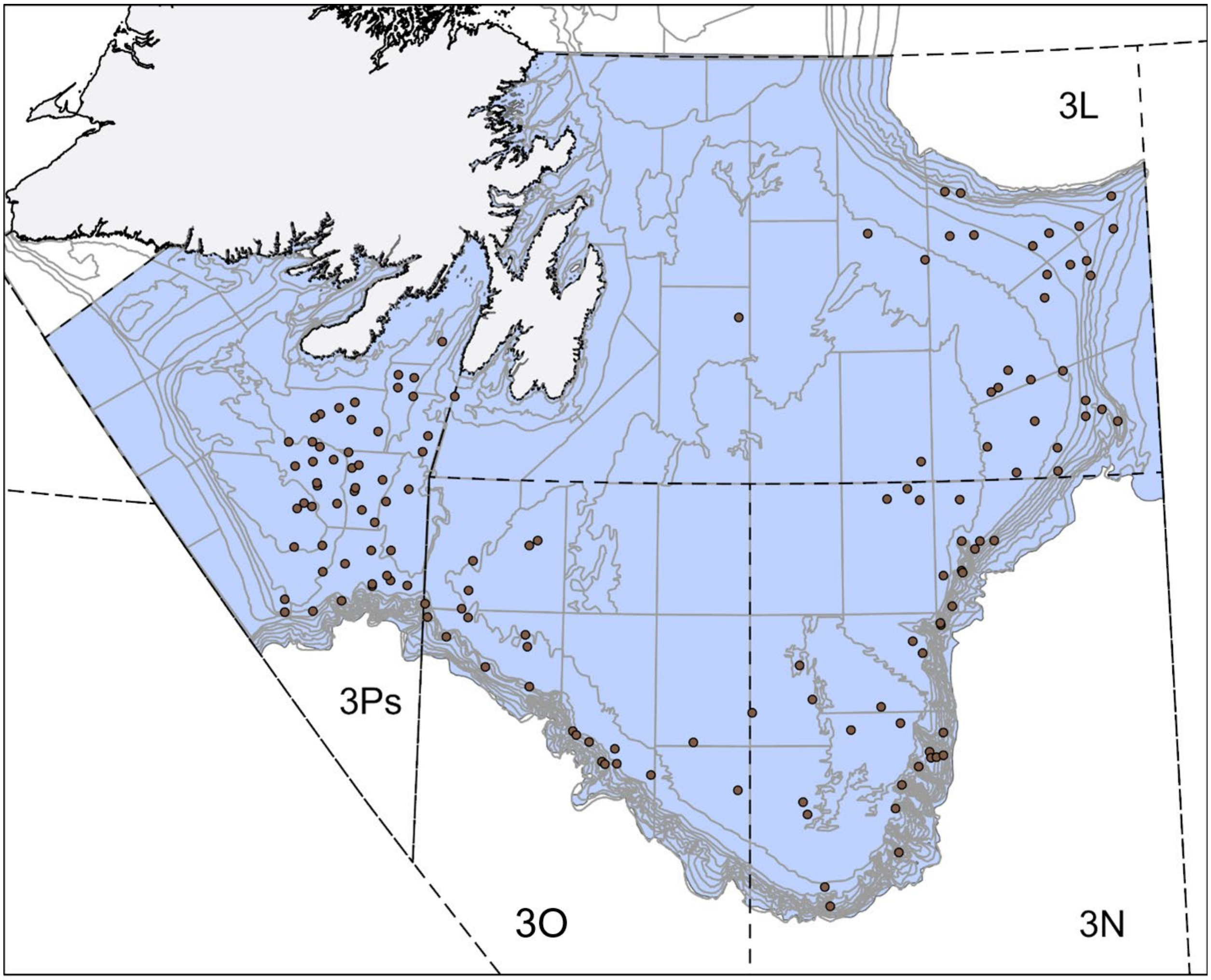


Figure 1. Paired set locations in spring 2023 in Northwest Atlantic Fisheries Organization (NAFO) Divisions 3LNOPs between the Canadian Coast Guard Ship (CCGS) Teleost and CCGS John Cabot. Blue area shows the DFO Newfoundland and Labrador multispecies survey strata. Note that strata >732 m are not surveyed in spring.

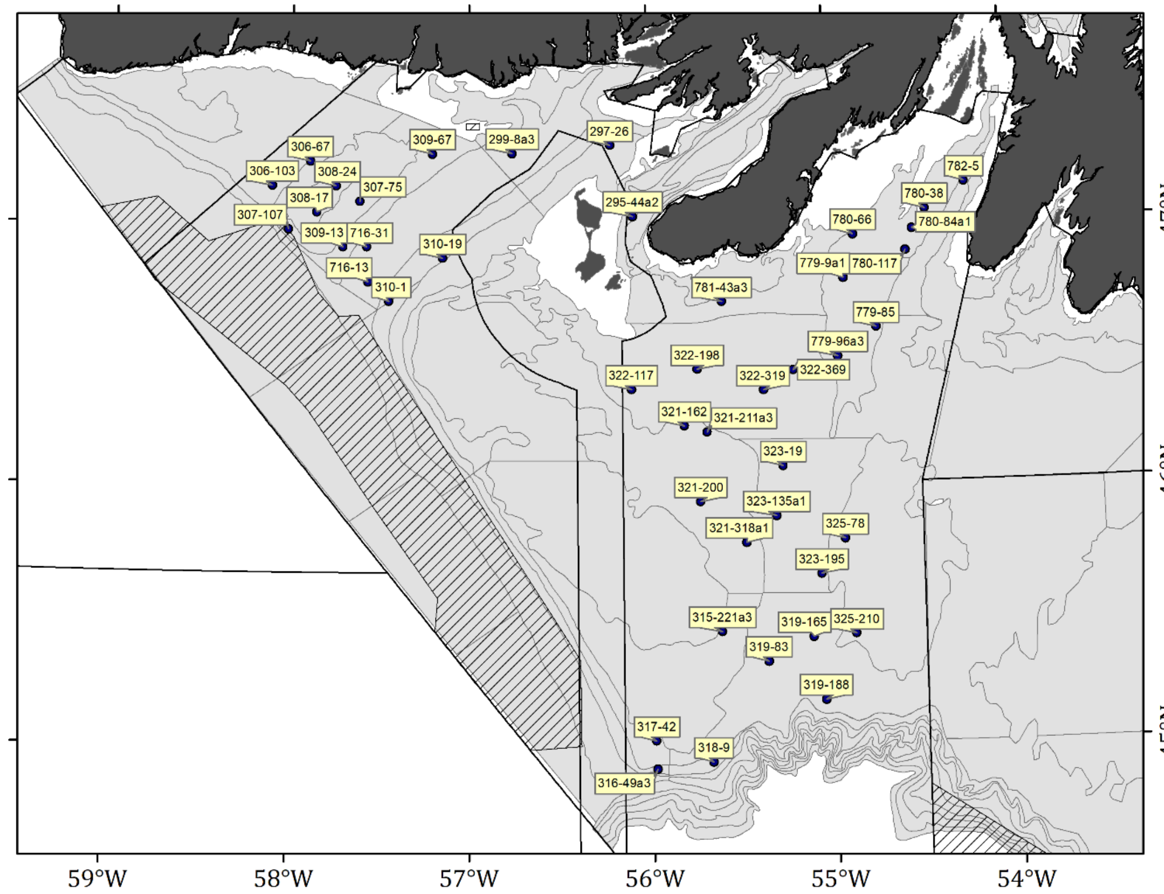


Figure 2. Planned coverage for the targeted program in Northwest Atlantic Fisheries Organization (NAFO) Subdivision 3Ps. Strata were selected to be representative for Atlantic Cod and Snow Crab and were not intended to be representative of the entire survey area in this Subdivision.

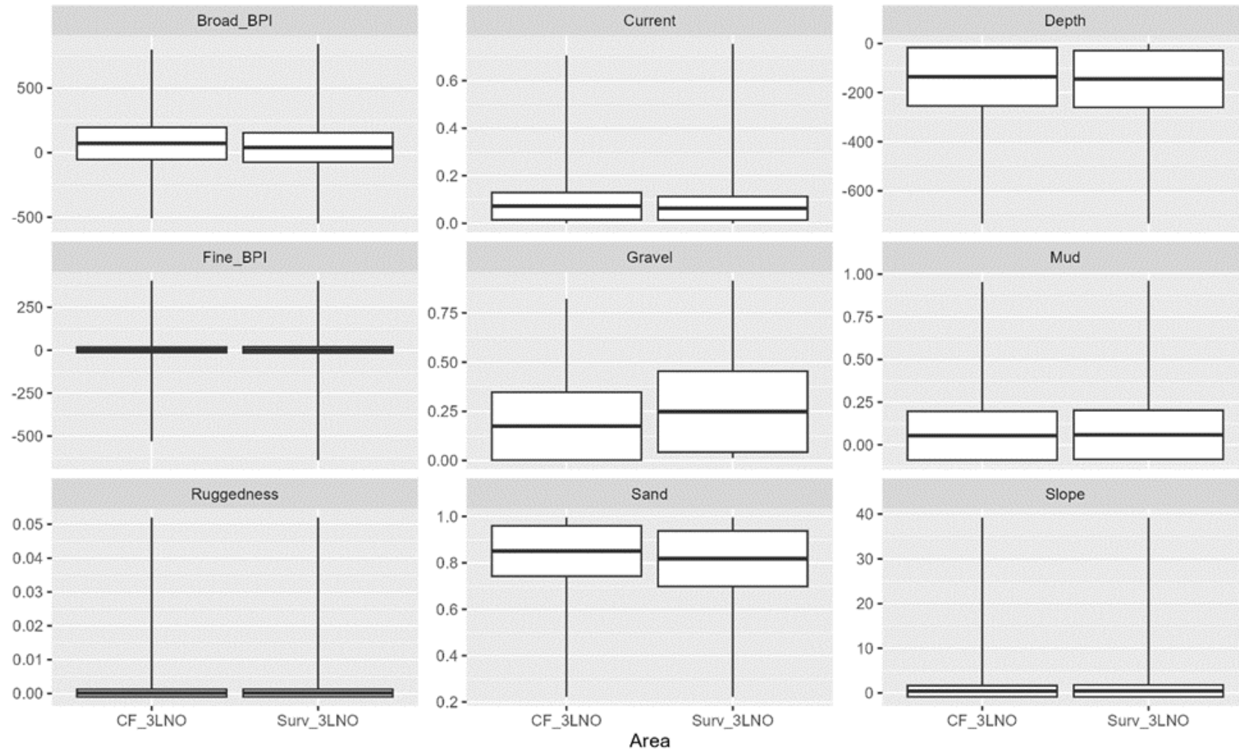


Figure 3. Seabed characteristics of the Newfoundland and Labrador multispecies survey Canadian Coast Guard Ship (CCGS) Teleost spring survey area in Northwest Atlantic Fisheries Organization (NAFO) Divisions 3LNO (Surv_3LNO) and for the comparative fishing strata completed with the CCGS Teleost (CF_3LNO), including broad Benthic Position Index (BPI), fine BPI, ruggedness, current (m/s), depth (m), slope, and percent likelihood that sand, gravel, or mud make up the dominant substrate type.

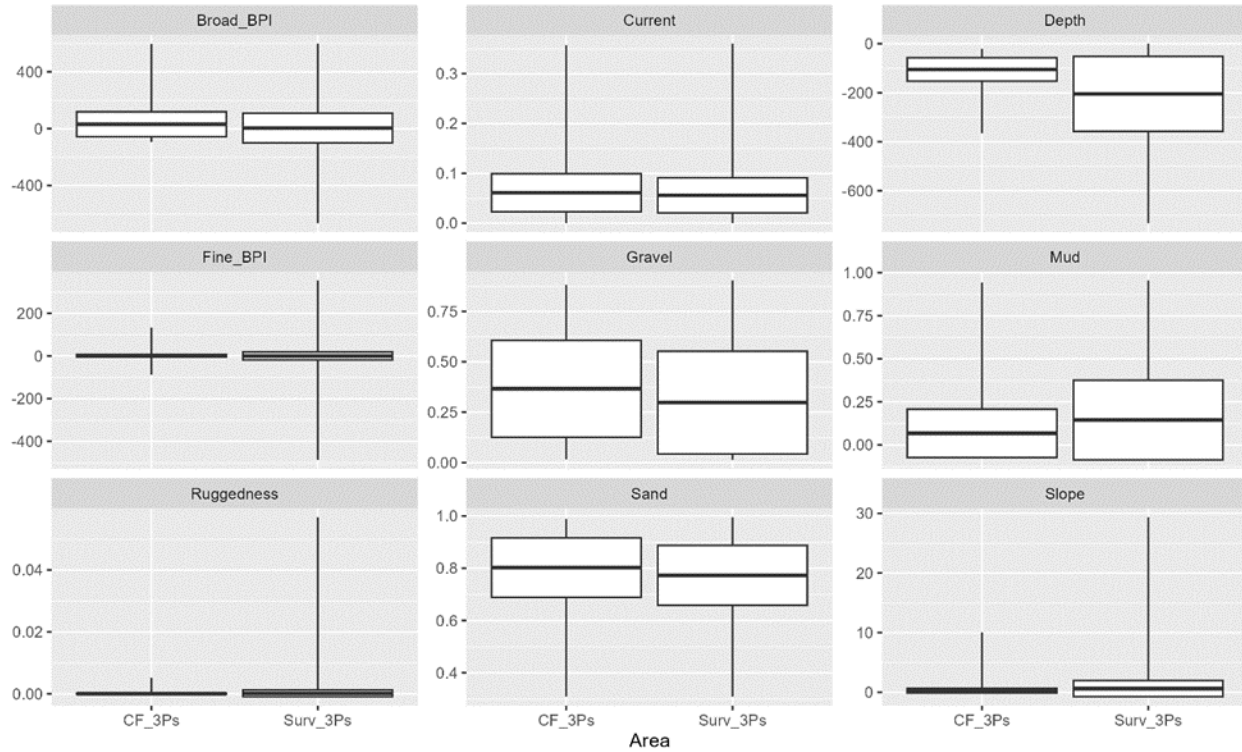


Figure 4. Seabed characteristics of the Newfoundland and Labrador multispecies survey Canadian Coast Guard Ship (CCGS) Teleost Spring survey area in Northwest Atlantic Fisheries Organization (NAFO) Subdivision 3Ps (Surv_3Ps) and for the comparative fishing strata completed with the CCGS Teleost (CF_3Ps), including broad Benthic Position Index (BPI), fine BPI, ruggedness, current (m/s), depth (m), slope, and predicted likelihood that sand, gravel, or mud make up the dominant substrate type.

9. TABLES

Table 1. A set of binomial models with various assumptions for the length effect and station effect in the relative catch efficiency. A smoothing length effect can be considered, and the station effect can be added to the intercept, without interaction with the length effect, or added to both the intercept and smoother to allow for interaction between the two effects.

Model	$\boldsymbol{log(\rho)}$	Length Effect	Station Effect
$BI0$	β_0	constant	not considered
$BI1$	$\beta_0 + \delta_{0,i}$	constant	intercept
$BI2$	$\mathbf{X}_f^T \boldsymbol{\beta}_f + \mathbf{X}_r^T \mathbf{b}$	smoothing	not considered
$BI3$	$\mathbf{X}_f^T \boldsymbol{\beta}_f + \mathbf{X}_r^T \mathbf{b} + \delta_{0,i}$	smoothing	intercept
$BI4$	$\mathbf{X}_f^T (\boldsymbol{\beta}_f + \boldsymbol{\delta}_i) + \mathbf{X}_r^T (\mathbf{b} + \boldsymbol{\epsilon}_i)$	smoothing	intercept, smoother

Table 2. A set of beta-binomial models with various assumptions for the length effect and station effect in the relative catch efficiency, and the length effect on the variance parameter. A smoothing length effect can be considered in both the conversion factor and the variance parameter. A station effect can be added to the intercept, without interaction with the length effect, or added to both the intercept and the smoother to allow for interaction between the two effects.

Model	$\boldsymbol{log(\rho)}$	$\boldsymbol{log(\phi)}$	Length Effects	Station Effect
$BB0$	β_0	γ_0	constant/constant	not considered
BB1	$\beta_0 + \delta_{0,i}$	γ_0	constant/constant	intercept
BB2	$\mathbf{X}_f^T \boldsymbol{\beta}_f + \mathbf{X}_r^T \mathbf{b}$	γ_0	smoothing/constant	not considered
BB3	$\mathbf{X}_f^T \boldsymbol{\beta}_f + \mathbf{X}_r^T \mathbf{b}$	$\mathbf{X}_f^T \boldsymbol{\gamma} + \mathbf{X}_r^T \mathbf{g}$	smoothing/smoothing	not considered
BB4	$\mathbf{X}_f^T \boldsymbol{\beta}_f + \mathbf{X}_r^T \mathbf{b} + \delta_{0,i}$	γ_0	smoothing/constant	intercept
BB5	$\mathbf{X}_f^T \boldsymbol{\beta}_f + \mathbf{X}_r^T \mathbf{b} + \delta_{0,i}$	$\mathbf{X}_f^T \boldsymbol{\gamma} + \mathbf{X}_r^T \mathbf{g}$	smoothing/smoothing	intercept
$BB6$	$\mathbf{X}_f^T (\boldsymbol{\beta}_f + \boldsymbol{\delta}_i) + \mathbf{X}_r^T (\mathbf{b} + \boldsymbol{\epsilon}_i)$	γ_0	smoothing/constant	intercept, smoother
BB7	$\mathbf{X}_f^T (\boldsymbol{\beta}_f + \boldsymbol{\delta}_i) + \mathbf{X}_r^T (\mathbf{b} + \boldsymbol{\epsilon}_i)$	$\mathbf{X}_f^T \boldsymbol{\gamma} + \mathbf{X}_r^T \mathbf{g}$	smoothing/smoothing	intercept, smoother

Table 3. Relative evidence for length-disaggregated binomial and beta-binomial models for the CCGS Teleost and CCGS John Cabot/Capt. Jacques Cartier comparative fishing analysis based on the Aikaike Information Criterion (AIC) and the Bayesian Information Criterion (BIC) and delta (Δ) values compared to lowest AIC/BIC per species. Entries with '-' indicate models that did not converge. BB6 did not converge for any species and is not included in the table.

Value	Species	NAFO Divisions	BI0	BI1	BI2	BI3	BI4	BB0	BB1	BB2	BB3	BB4	BB5
AIC	American Plaice	3LNO	3543	3293	3534	3295	-	3392	3267	3396	3388	3271	-
ΔAIC	American Plaice	3LNO	276	25	267	28	-	125	0	129	120	4	-
BIC	American Plaice	3LNO	3549	3306	3554	3322	-	3405	3287	3422	3427	3304	-
ΔBIC	American Plaice	3LNO	263	19	267	35	-	118	0	135	140	17	-
AIC	Greenland Halibut	3LNO	2197	2072	2197	2074	-	2144	2066	2146	2148	2069	2071
ΔAIC	Greenland Halibut	3LNO	131	6	131	8	-	78	0	80	82	3	4
BIC	Greenland Halibut	3LNO	2203	2084	2216	2099	-	2157	2085	2171	2185	2100	2114
ΔBIC	Greenland Halibut	3LNO	119	0	132	15	-	72	0	87	101	15	29
AIC	Redfish	3LNO	4920	3814	4896	3771	3500	3593	3407	3592	3590	3401	3393
ΔAIC	Redfish	3LNO	1527	421	1503	378	107	200	14	199	197	8	0
BIC	Redfish	3LNO	4926	3826	4914	3795	3542	3605	3425	3616	3627	3431	3436
ΔBIC	Redfish	3LNO	1501	400	1489	370	117	180	0	191	201	6	10
AIC	Roughhead Grenadier	3LNO	1726	1719	1729	1723	-	1715	1713	1719	1712	1717	1711
ΔAIC	Roughhead Grenadier	3LNO	15	7	18	11	-	4	1	8	1	5	0
BIC	Roughhead Grenadier	3LNO	1732	1730	1746	1745	-	1726	1730	1742	1746	1745	1751
ΔBIC	Roughhead Grenadier	3LNO	5	4	20	19	-	0	3	15	20	18	24
AIC	Silver Hake	3NOPs	2614	2126	2575	2115	-	2099	2011	2089	2085	2008	1982
ΔAIC	Silver Hake	3NOPs	632	144	593	133	-	117	29	107	103	26	0
BIC	Silver Hake	3NOPs	2619	2136	2590	2135	-	2109	2027	2109	2115	2034	2017
ΔBIC	Silver Hake	3NOPs	602	118	573	118	-	91	9	92	98	16	0
AIC	Thorny Skate	3LNO	2302	2242	2290	2231	2260	2268	2224	2259	2263	2216	2219
ΔAIC	Thorny Skate	3LNO	87	26	75	15	45	52	8	44	48	0	3
BIC	Thorny Skate	3LNO	2309	2256	2311	2259	2308	2281	2245	2287	2305	2250	2267
ΔBIC	Thorny Skate	3LNO	64	11	66	14	64	36	0	42	60	5	22
AIC	Toad Crab	3LNO	1020	945	1008	941	-	965	925	961	961	922	921
ΔAIC	Toad Crab	3LNO	98	24	87	20	-	44	4	40	39	1	0
BIC	Toad Crab	3LNO	1026	957	1027	966	-	978	944	987	999	954	966
ΔBIC	Toad Crab	3LNO	82	13	83	22	-	34	0	42	54	10	21
AIC	White Hake	3NOPs	599	580	601	584	-	595	581	598	NA	585	-
ΔAIC	White Hake	3NOPs	19	0	21	4	-	15	1	18	NA	5	-
BIC	White Hake	3NOPs	605	592	619	608	-	606	599	622	NA	615	-
ΔBIC	White Hake	3NOPs	13	0	27	16	-	15	7	30	NA	23	-
AIC	Witch Flounder	3LNO	764	744	768	747	-	763	744	766	NA	748	-
ΔAIC	Witch Flounder	3LNO	20	0	24	3	-	18	0	22	NA	4	-
BIC	Witch Flounder	3LNO	770	756	786	771	-	775	762	790	NA	778	-

Value	Species	NAFO Divisions	BI0	BI1	BI2	BI3	BI4	BB0	BB1	BB2	BB3	BB4	BB5
ΔBIC	Witch Flounder	3LNO	14	0	30	15	-	18	6	34	NA	22	-
AIC	Witch Flounder	3NO	498	489	498	485	-	496	488	500	497	-	489
ΔAIC	Witch Flounder	3NO	13	4	13	0	-	11	3	15	12	-	4
BIC	Witch Flounder	3NO	503	500	515	507	-	507	504	522	530	-	527
ΔBIC	Witch Flounder	3NO	4	0	15	7	-	8	5	23	31	-	28
AIC	Yellowtail Flounder	3LNO	2459	2304	2431	2264	-	2276	2214	2279	2245	-	2155
ΔAIC	Yellowtail Flounder	3LNO	304	149	276	109	-	121	59	124	90	-	0
BIC	Yellowtail Flounder	3LNO	2464	2315	2447	2285	-	2287	2230	2301	2277	-	2193
ΔBIC	Yellowtail Flounder	3LNO	271	122	255	93	-	94	37	108	85	-	0

Table 4. P-values associated with tests for a smooth effect of depth, and time of day, as well as fixed effects of Northwest Atlantic Fisheries Organization (NAFO) Division, and diurnal period (day/night) on the normalized quantile residuals from the length-disaggregated selected best model.

Common Name	Region	Model	s(Depth)	s(Time)	NAFO Division	Diurnal Period
American Plaice	3LNO	BB1	0.47	0.61	0.26	0.91
Greenland Halibut	3LNO	BI1	0.45	0.66	0.96	0.71
Redfish	3LNO	BB1	0.84	0.21	0.72	0.55
Roughhead Grenadier	3LNO	BB0	0.84	0.49	0.05	0.74
Silver Hake	3NOPs	BB5	0.43	0.64	0.92	0.82
Thorny Skate	3LNO	BB1	0.10	0.70	0.54	0.86
Thorny Skate	3LNO	BB4	0.26	0.22	0.63	0.38
Toad Crab	3LNO	BB1	0.74	0.67	0.87	0.73
Toad Crab	3LNO	BB4	0.89	0.98	0.97	0.83
White Hake	3NOPs	BI1	0.72	0.66	0.24	0.96
Witch Flounder	3LNO	BI1	0.69	0.50	0.31	0.95
Witch Flounder	3NO	BI1	0.92	0.78	0.09	0.62
Yellowtail Flounder	3LNO	BB5	0.97	0.93	0.89	0.96

Table 5. Summary of recommendations for species for which length-disaggregated conversion factor models were applied. For species where length was not determined to be significant, rho ± standard error (SE) estimates are provided here. "n.s." indicates a non-significant conversion where the 95% confidence intervals overlap with a constant conversion between vessels, and no conversion factor is recommended for these species. For the species where a length-based conversion was found, the percentiles at which a constant conversion is to be applied is also provided. Full conversion factor tables by length can be found in Appendix 1, and corresponding table numbers are provided.

Species	Region	Model	Determination	Details	Rho	SE Rho	Percentile Lengths
American Plaice	3LNO	BB1	No conversion	N/A	0.94 (n.s.)	0.07	-
Greenland Halibut	3LNO	BI1	No conversion	N/A	0.95 (n.s.)	0.09	-
Redfish	3LNO	BB1	No conversion	N/A	0.99 (n.s.)	0.12	-
Roughhead Grenadier	3LNO	BB0	No conversion	N/A	0.96 (n.s.)	0.05	-
Silver Hake	3NOPs	BB5	No conversion	Length-based	Not significant		-
Thorny Skate	3LNO	BB4	Conversion required	Length-based	See Appendix 1, Table 1		13, 89 cm (0.5-99.5 percentile)
Toad Crab	3LNO	BB4	Conversion required	Length-based	See Appendix 1, Table 2		11, 81 cm (0.5-99.5 percentile)
White Hake	3NOPs	BI1	No conversion	N/A	1.05 (n.s.)	0.15	-
Witch Flounder	3LNO	BI1	No conversion	N/A	1.12 (n.s.)	0.17	-
Witch Flounder	3NO	BI1	No conversion	N/A	1.22 (n.s.)	0.21	-
Yellowtail Flounder	3LNO	BB5	No conversion	Length-based	Not significant		-

Table 6. Relative evidence for size-aggregated binomial and beta-binomial models for the CCGS Teleost and CCGS John Cabot/Capt. Jacques Cartier spring catch counts based on Aikaike's Information Criterion (AIC) and the Bayesian Information Criterion (BIC) values, and estimates of the conversion factor Rho, and approximate 95% confidence intervals, for catches in numbers and in weights for taxa for which length-disaggregated analyses were also undertaken. Recall that a single model was used for catch weights (Tweedie distribution) and thus AIC and BIC values are not shown. Entries with '-' indicate models that did not converge. All conversions are applicable to NAFO Divisions 3LNO, except for White Hake and Silver Hake, where the NAFO Divisions are 3NOPs.

Species	Code	BI1 (AIC)	BB0 (AIC)	BB1 (AIC)	BI1 (BIC)	BB0 (BIC)	BB1 (BIC)	Model Selected	Rho (CI), numbers	p-value, numbers	Rho (CI), weights	p-value, weights	Recommendation
Alligatorfish and Poachers	836	111.52	107.80	109.76	113.79	110.07	113.16	BB0	0.85 (0.43-1.71)	0.66	0.55 (0.23-1.3)	0.17	No conversion
American Plaice	889	470.80	469.59	471.56	475.49	474.28	478.59	BB0	0.92 (0.8-1.06)	0.25	0.9 (0.77-1.04)	0.16	No conversion
Atlantic Argentine	193	66.21	66.23	68.19	67.63	67.64	70.32	B1	1.35 (0.88-2.06)	0.16	1.61 (1.06-2.46)	0.03	Biomass conversion
Atlantic Herring	150	68.73	67.79	69.79	70.27	69.34	72.11	BB0	0.97 (0.44-2.14)	0.95	0.7 (0.35-1.4)	0.31	No conversion
Barracudina And Lancetfish	316	189.24	186.97	188.94	192.30	190.02	193.52	BB0	0.98 (0.63-1.53)	0.94	0.98 (0.6-1.6)	0.93	No conversion
Boa Dragonfish	230	58.36	57.12	59.09	60.15	58.90	61.76	BB0	0.96 (0.45-2.06)	0.91	1.15 (0.57-2.34)	0.69	No conversion

Species	Code	BI1 (AIC)	BB0 (AIC)	BB1 (AIC)	BI1 (BIC)	BB0 (BIC)	BB1 (BIC)	Model Selected	Rho (CI), numbers	p-value, numbers	Rho (CI), weights	p-value, weights	Recommendation
Broadhead (Northern) Wolffish	699	61.34	61.34	-	64.00	64.00	-	BB0	1.21 (0.75-1.98)	0.43	1.29 (0.72-2.3)	0.39	No conversion
Capelin	187	474.72	465.19	463.83	478.46	468.93	469.44	BB0	0.9 (0.62-1.33)	0.61	0.97 (0.77-1.23)	0.79	No conversion
Eelpouts	726	218.47	215.91	217.55	222.21	219.65	223.16	BB0	0.83 (0.62-1.12)	0.21	1.02 (0.76-1.36)	0.92	No conversion
Greenland Halibut	892	310.07	309.94	311.94	314.12	313.99	318.02	BB0	0.94 (0.78-1.12)	0.48	0.92 (0.78-1.09)	0.34	No conversion
Grenadiers	470	267.10	265.19	266.30	270.43	268.51	271.29	BB0	1.08 (0.84-1.38)	0.56	1.16 (0.97-1.38)	0.11	No conversion
Lanternfishes	272	320.23	318.34	320.25	323.66	321.77	325.39	BB0	0.95 (0.72-1.26)	0.72	1.14 (0.87-1.5)	0.34	No conversion
Longfin Hake	444	188.39	187.57	189.54	191.19	190.37	193.75	BB0	1.25 (0.91-1.73)	0.17	1.17 (0.84-1.62)	0.36	No conversion
Longnose Eel	373	155.77	155.37	157.36	158.29	157.89	161.14	BB0	1.29 (0.96-1.73)	0.10	1.29 (1.07-1.55)	0.01	Biomass conversion
Redfish	794	551.27	549.04	550.95	555.17	552.94	556.80	BB0	0.92 (0.75-1.13)	0.44	0.91 (0.75-1.11)	0.34	No conversion
Rocklings	453	96.79	96.36	98.36	99.15	98.72	101.89	BB0	1.5 (0.82-2.72)	0.19	0.8 (0.45-1.43)	0.45	No conversion
Roughhead Grenadier	474	199.96	199.97	201.97	203.07	203.08	206.63	B1	0.96 (0.84-1.08)	0.48	1.01 (0.86-1.19)	0.89	No conversion
Sand Lance	694	466.21	458.02	457.21	469.69	461.49	462.42	BB0	0.89 (0.57-1.4)	0.63	0.97 (0.72-1.29)	0.81	No conversion
Sculpins	810	440.98	436.94	438.49	445.10	441.06	444.68	BB0	1.06 (0.8-1.42)	0.67	0.95 (0.69-1.31)	0.76	No conversion
Silver Hake	449	256.27	256.18	258.11	258.54	258.45	261.51	BB0	0.9 (0.65-1.24)	0.51	0.83 (0.65-1.07)	0.15	No conversion
Spotted Wolffish	701	35.07	35.05	37.05	36.85	36.83	39.72	BB0	-	-	-	-	Insufficient data
Striped Wolffish	700	89.11	89.16	-	91.91	91.96	-	BI1	0.7 (0.52-0.96)	0.03	0.75 (0.45-1.27)	0.29	Abundance conversion
Thorny Skate	90	370.09	368.22	370.07	374.75	372.88	377.06	BB0	0.83 (0.69-0.99)	0.04	0.88 (0.71-1.09)	0.25	See length-disaggregated results
White Hake	447	121.91	121.82	123.82	124.57	124.48	127.82	BB0	1.02 (0.77-1.36)	0.85	1.14 (0.82-1.57)	0.43	No conversion
Witch Flounder	890	193.97	193.49	195.49	197.87	197.39	201.34	BB0	1.1 (0.84-1.44)	0.49	1 (0.73-1.35)	0.98	No conversion
Yellowtail Flounder	891	240.85	240.35	242.33	243.59	243.09	246.43	BB0	0.92 (0.73-1.16)	0.48	1.19 (0.96-1.46)	0.11	No conversion
Bivalves	3995	55.15	61.23	63.22	57.33	63.41	66.50	BI1	-	-	-	-	Insufficient data
Gastropods	3175	317.92	311.07	312.91	321.74	314.89	318.64	BB0	0.93 (0.62-1.4)	0.74	0.63 (0.4-0.99)	0.04	Biomass conversion
Iceland Scallop	4167	61.12	60.05	61.93	63.11	62.04	64.91	BB0	0.91 (0.48-1.76)	0.79	0.78 (0.48-1.28)	0.33	No conversion
Sea Stars (all grouped)	8390	575.49	567.37	568.47	580.30	572.18	575.69	BB0	0.7 (0.53-0.93)	0.01	0.54 (0.42-0.7)	0.00	Abundance and biomass conversion
Cushion Sea Star	8479	112.12	110.60	112.60	114.86	113.34	116.70	BB0	1.14 (0.64-2.03)	0.67	1.28 (0.74-2.23)	0.38	No conversion

Species	Code	BI1 (AIC)	BB0 (AIC)	BB1 (AIC)	BI1 (BIC)	BB0 (BIC)	BB1 (BIC)	Model Selected	Rho (CI), numbers	p-value, numbers	Rho (CI), weights	p-value, weights	Recommendation
Mud Sea Star	8407	82.66	79.74	81.32	84.08	81.16	83.45	BB0	2.46 (1.05-5.76)	0.04	0.71 (0.4-1.28)	0.26	Abundance conversion
Henricia Sea Star	8483	125.80	121.31	123.28	128.79	124.30	127.77	BB0	0.84 (0.46-1.54)	0.58	0.8 (0.42-1.52)	0.49	No conversion
Sand Dollar	8370	536.68	529.22	530.53	540.94	533.47	536.91	BB0	1.04 (0.75-1.44)	0.80	0.78 (0.54-1.13)	0.19	No conversion
Sea Anemone	2165	335.37	330.02	331.76	339.27	333.93	337.62	BB0	0.58 (0.39-0.87)	0.01	0.77 (0.53-1.1)	0.14	Abundance conversion
Sea Cucumbers	8290	177.47	176.19	178.19	180.34	179.06	182.49	BB0	0.81 (0.47-1.39)	0.44	0.52 (0.24-1.11)	0.09	No conversion
Sea Urchins	8360	362.01	354.35	355.45	365.87	358.21	361.25	BB0	0.65 (0.43-0.98)	0.04	0.63 (0.42-0.95)	0.03	Abundance and biomass conversion
Northern Shrimp	8111	353.65	348.47	349.63	356.82	351.64	354.38	BB0	1.33 (0.86-2.03)	0.20	1.04 (0.78-1.37)	0.80	No conversion
Striped Shrimp	8112	217.66	213.02	214.56	220.25	215.61	218.45	BB0	1.37 (0.77-2.45)	0.29	1.14 (0.59-2.2)	0.69	No conversion
Shrimp (Benthic)	8120	222.82	217.93	219.62	225.75	220.87	224.02	BB0	0.76 (0.45-1.29)	0.31	0.83 (0.57-1.22)	0.35	No conversion
Shrimp (Benthopelagic)	8010	377.11	365.51	366.77	381.30	369.69	373.06	BB0	0.87 (0.58-1.29)	0.48	0.61 (0.39-0.94)	0.03	Biomass conversion
Shrimp (Pelagic)	8040	270.18	266.16	267.54	273.05	269.03	271.84	BB0	1.56 (0.94-2.6)	0.08	1.19 (0.97-1.46)	0.09	No conversion
Toad Crab	8216	252.81	250.74	252.65	256.71	254.64	258.50	BB0	0.8 (0.57-1.11)	0.18	0.61 (0.42-0.89)	0.01	See length-disaggregated results
Tunicates	8680	53.66	52.63	54.60	56.39	55.37	58.70	BB0	-	-	-	-	Insufficient data
Soft Corals	8904	-	-	-	-	-	-	-	-	-	0.62 (0.42-0.91)	0.02	Biomass conversion
Brittle Stars	8530	-	-	-	-	-	-	-	-	-	1.04 (0.67-1.63)	0.85	No conversion
Sponge	1101	-	-	-	-	-	-	-	-	-	0.86 (0.57-1.3)	0.48	No conversion
Jellyfish	2040	-	-	-	-	-	-	-	-	-	1.21 (0.82-1.8)	0.33	No conversion
Basket Stars	8540	-	-	-	-	-	-	-	-	-	0.96 (0.56-1.64)	0.88	No conversion

10. APPENDIX 1: LENGTH-BASED CONVERSIONS

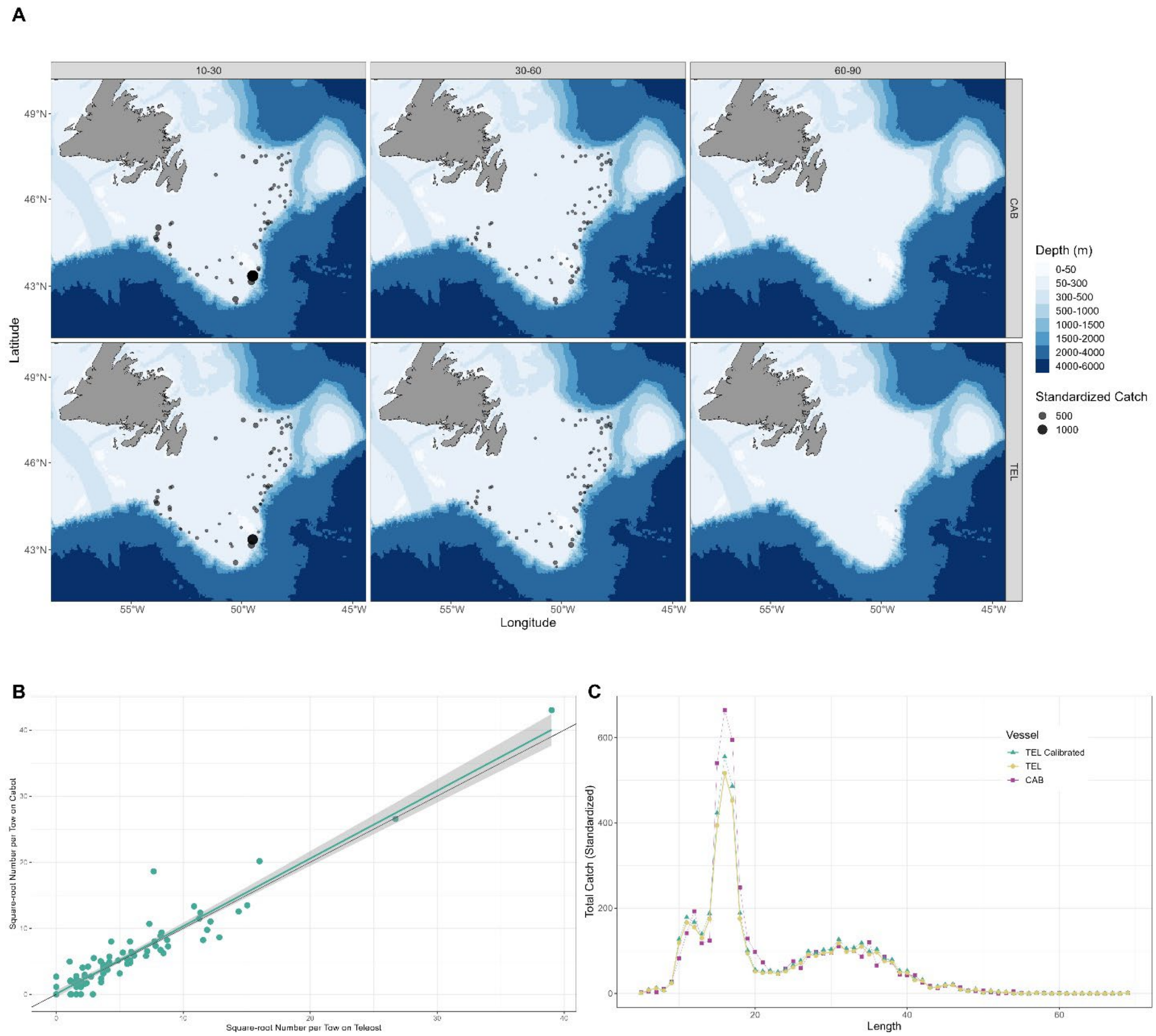


Figure A1- 1. Results for length-disaggregated comparative fishing analyses for American Plaice between the CCGS Teleost ("TEL") and CCGS John Cabot ("CAB") for spring NAFO Divisions 3LNO. (A) map of catches by length group (length in cm specified in top panel) by the CCGS John Cabot (top) and the CCGS Teleost (bottom) in comparative fishing sets, where circle size is proportional catch weight. (B) Biplot of the square-root of CCGS John Cabot catch numbers against the square-root of CCGS Teleost catch numbers. (C) Total length frequencies for catches made by the CCGS Teleost (yellow), by the CCGS John Cabot (purple), and CCGS Teleost catches with the conversion factor applied (green).

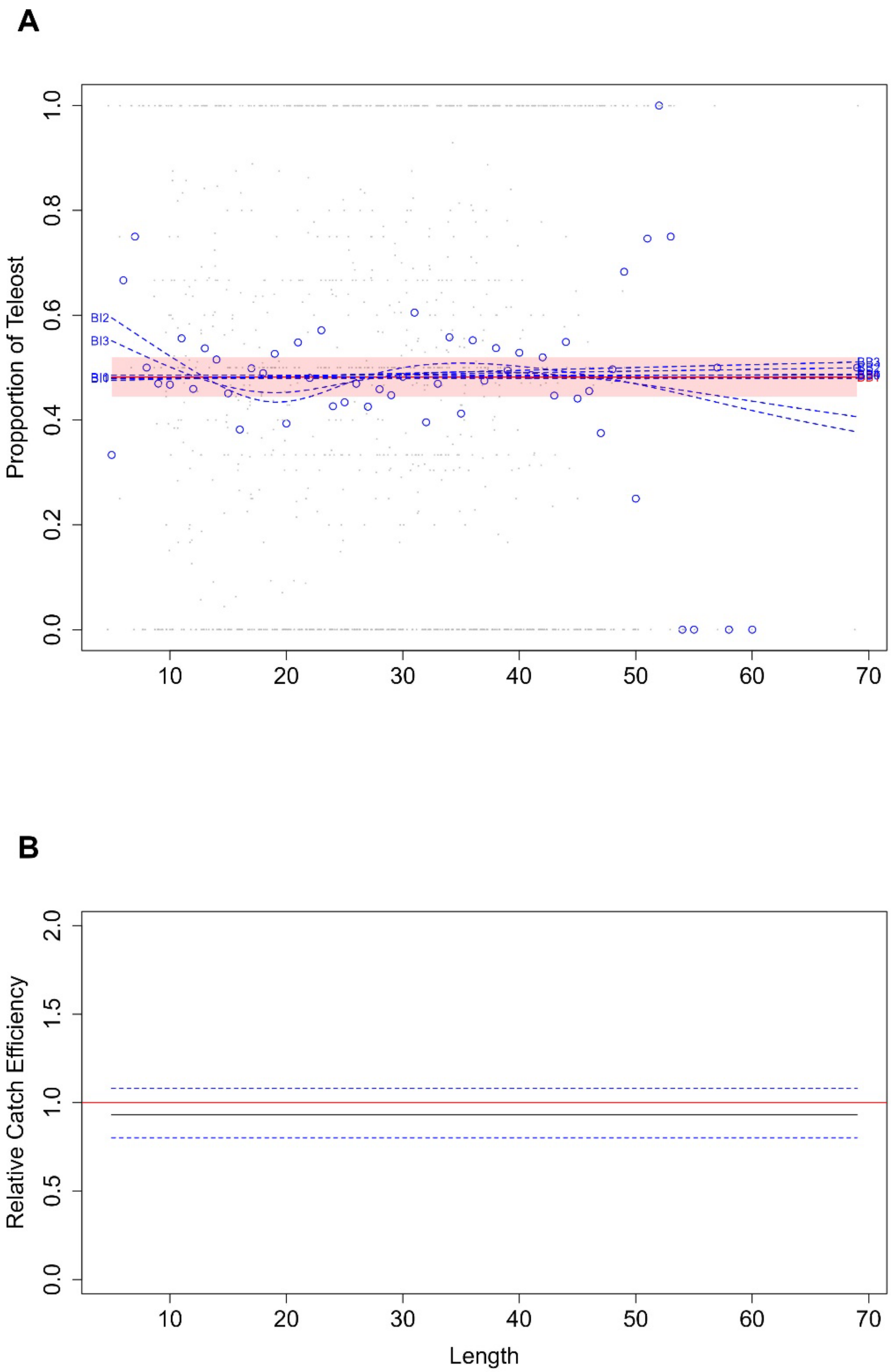


Figure A1- 2. American Plaice conversion factor between the CCGS Teleost and CCGS John Cabot for spring NAFO Divisions 3LNO. (A) Estimated length-specific catch proportion functions, $logit(p_{Ai}(l))$, for each converged model, with the selected model plotted using a red line along with its approximate 95% confidence intervals (CI; shaded area), as well as the length class-specific mean empirical proportion of total catch in a pair made by the CCGS Teleost (blue dots). (B) Estimated relative catch efficiency (conversion factor) function from the best model (black line) with 95% CI (dashed blue lines). The horizontal red line indicates equivalent efficiency between vessels.

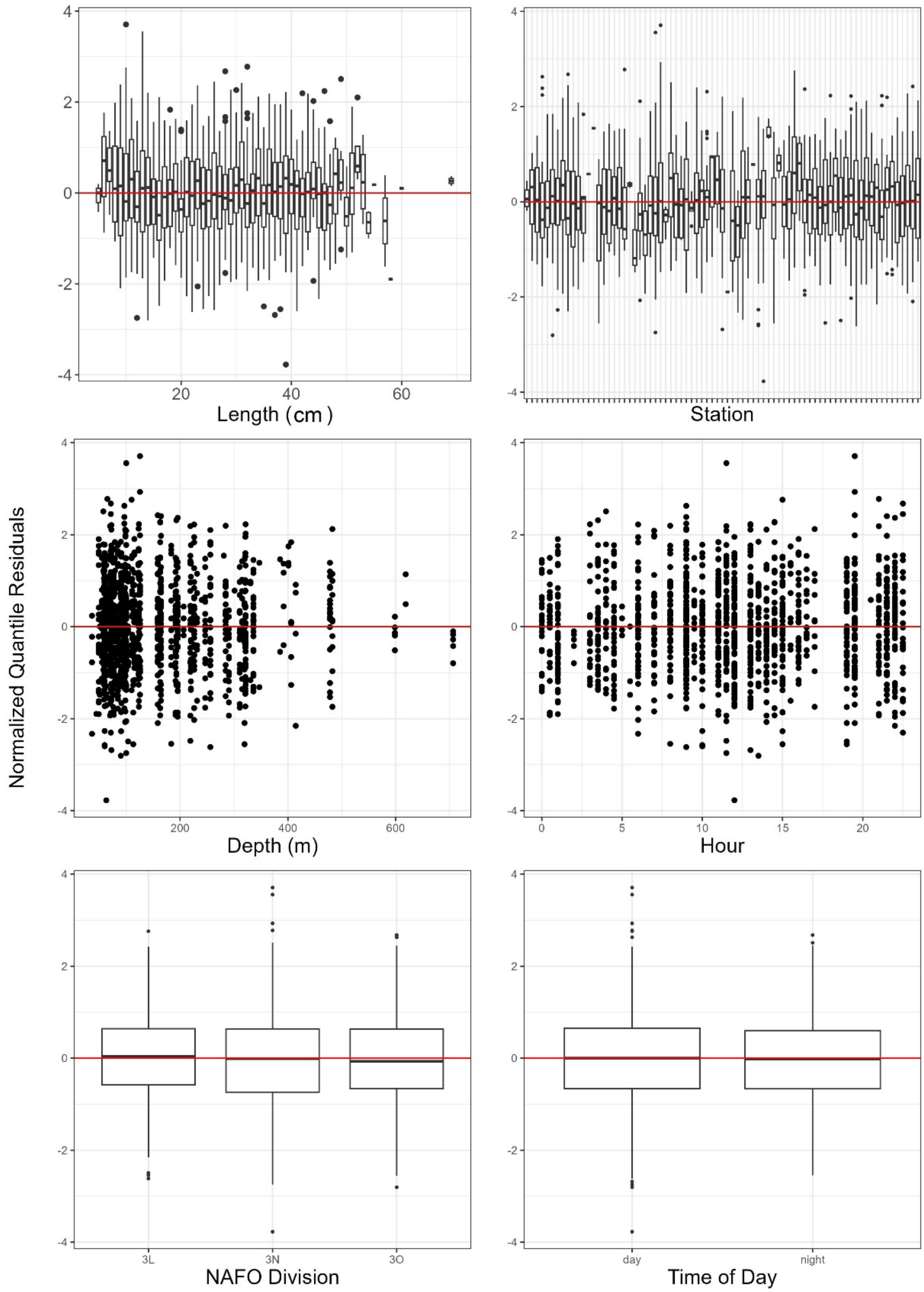


Figure A1- 3. Normalized quantile residuals as a function of length, station, depth, hour, NAFO Division, and diel period for American Plaice, best model selected for length-disaggregated conversion factor analysis for the CCGS Teleost and CCGS John Cabot for spring NAFO Divisions 3LNO.

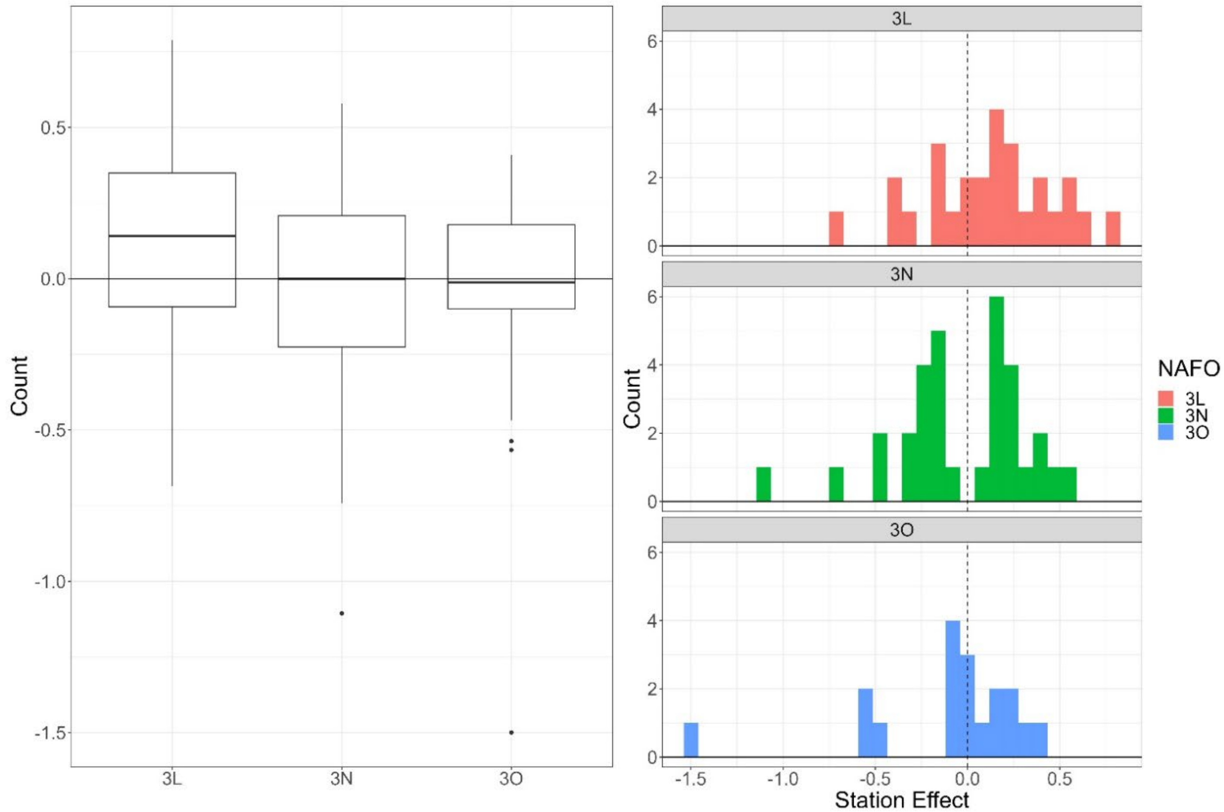


Figure A1- 4. Boxplot (left) and histogram (right) of station effect by NAFO Division for best model selected for American Plaice conversion factor analysis between the CCGS Teleost and CCGS John Cabot in spring NAFO Divisions 3LNO.

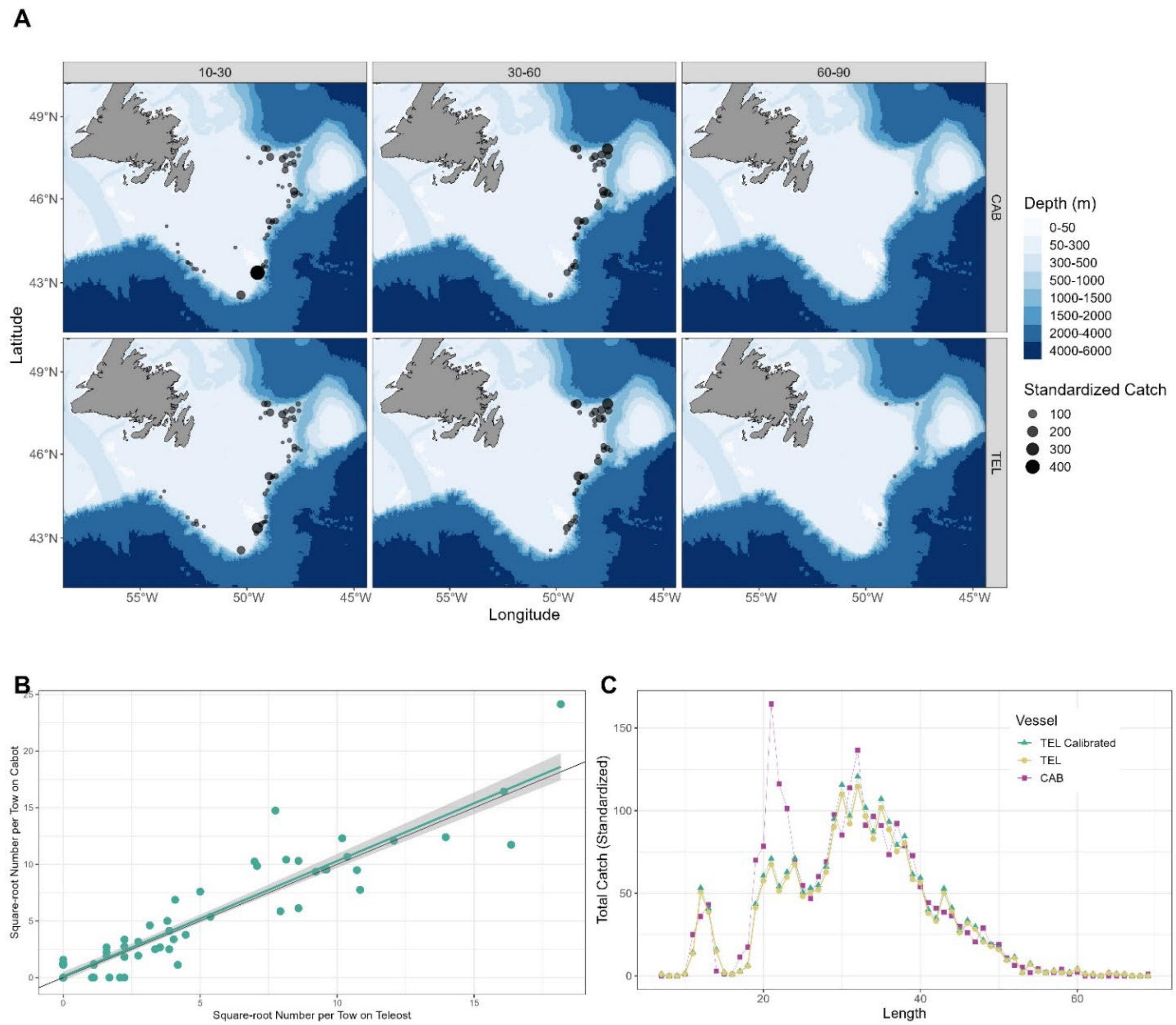


Figure A1- 5. Results for length-disaggregated comparative fishing analyses for Greenland Halibut between the CCGS Teleost ("TEL") and CCGS John Cabot ("CAB") for spring NAFO Divisions 3LNO. (A) map of catches by length group (length in cm specified in top panel) by the CCGS John Cabot (top) and the CCGS Teleost (bottom) in comparative fishing sets, where circle size is proportional catch weight. (B) Biplot of the square-root of CCGS John Cabot catch numbers against the square-root of CCGS Teleost catch numbers. (C) Total length frequencies for catches made by the CCGS Teleost (yellow), by the CCGS John Cabot (pink), and CCGS Teleost catches with the conversion factor applied (green).

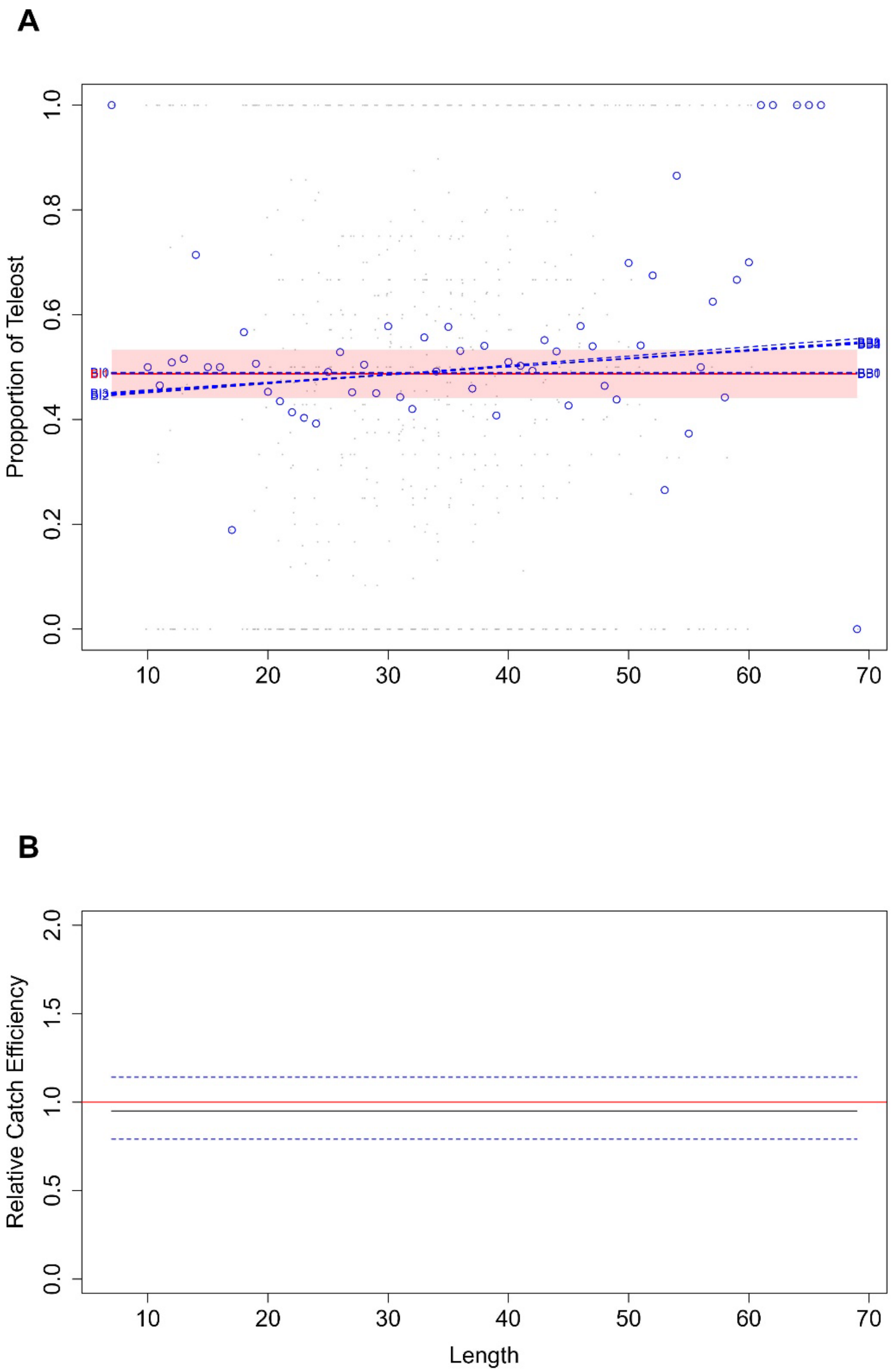


Figure A1- 6. Greenland Halibut conversion factor between the CCGS Teleost and CCGS John Cabot for spring NAFO Divisions 3LNO. (A) Estimated length-specific catch proportion functions, $logit(p_{Ai}(l))$, for each converged model, with the selected model plotted using a red line along with its approximate 95% confidence intervals (CI; shaded area), as well as the length class-specific mean empirical proportion of total catch in a pair made by the CCGS Teleost (blue dots). (B) Estimated relative catch efficiency (conversion factor) function from the best model (black line) with 95% CI (dashed blue lines). The horizontal red line indicates equivalent efficiency between vessels.

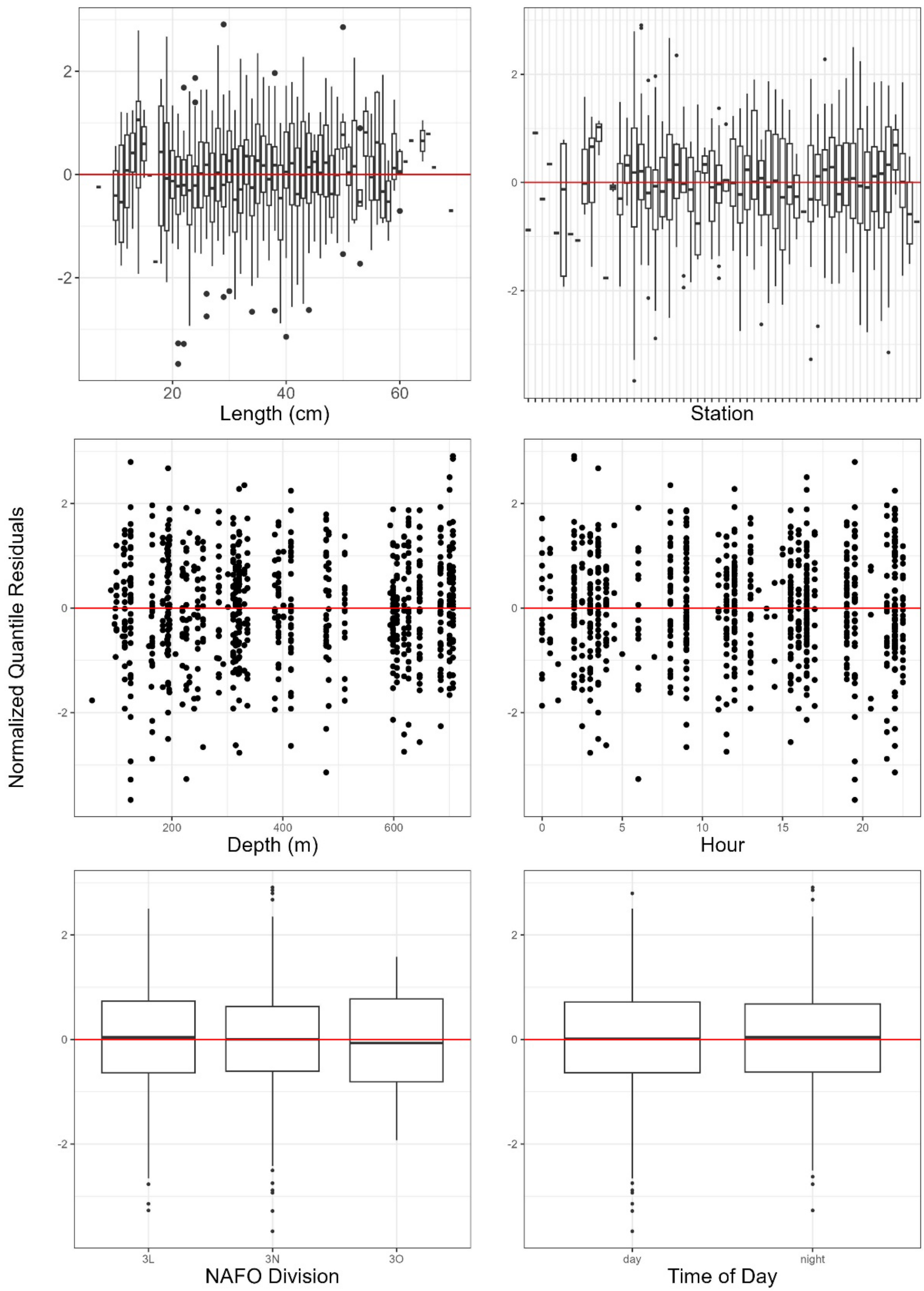


Figure A1- 7. Normalized quantile residuals as a function of length, station, depth, hour, NAFO Division, and diel period for Greenland Halibut, best model selected for length-disaggregated conversion factor analysis for the CCGS Teleost and CCGS John Cabot for spring NAFO Divisions 3LNO.

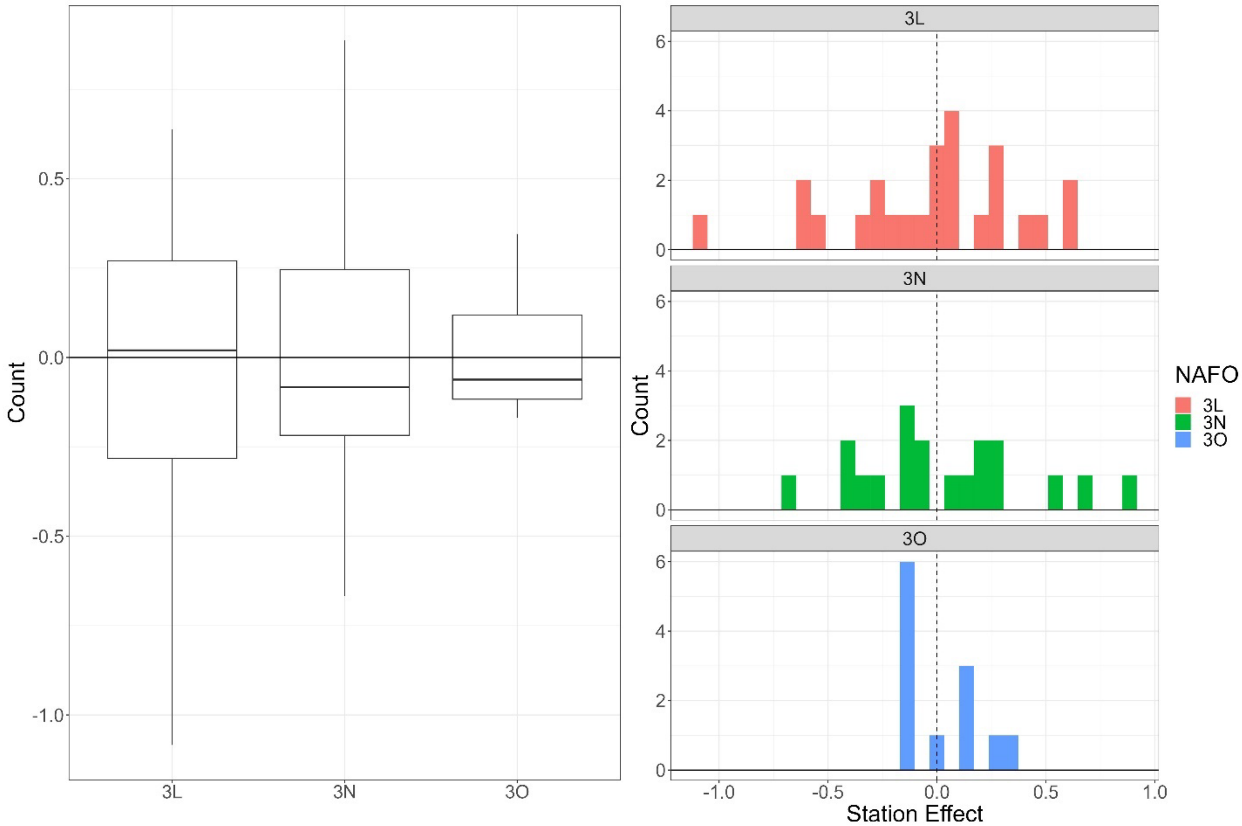


Figure A1- 8. Boxplot (left) and histogram (right) of station effect by NAFO Division for best model selected for Greenland Halibut conversion factor analysis between the CCGS Teleost and CCGS John Cabot in spring NAFO Divisions 3LNO.

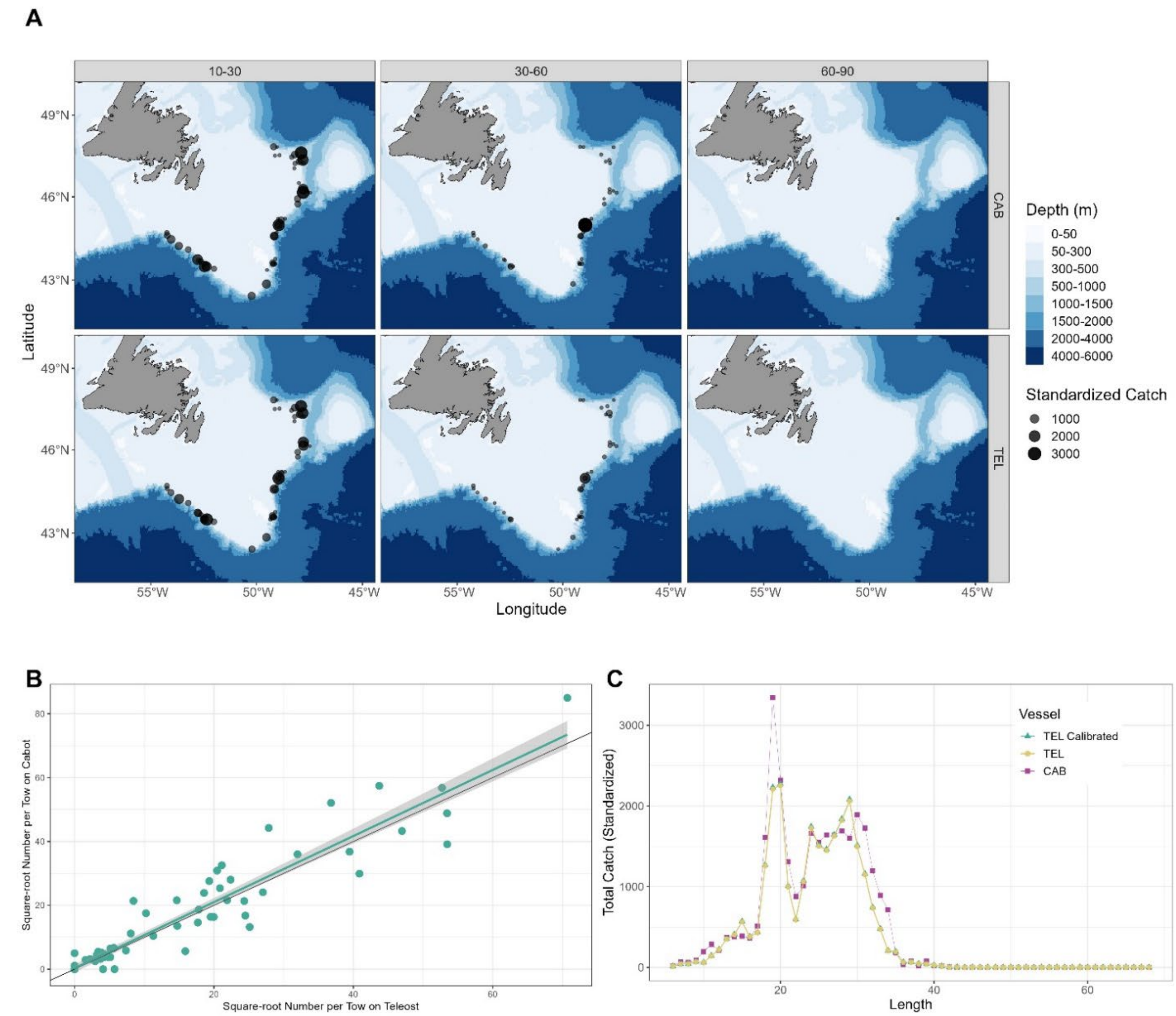
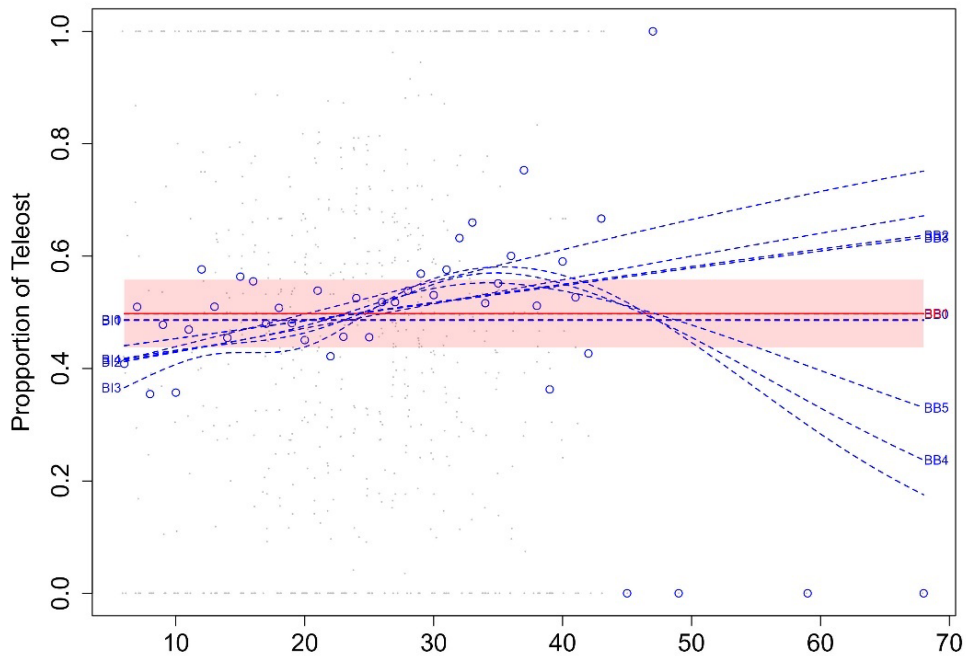


Figure A1- 9. Results for length-disaggregated comparative fishing analyses for redfish between the CCGS Teleost ("TEL") and CCGS John Cabot ("CAB") for spring NAFO Divisions 3LNO. (A) map of catches by length group (length in cm specified in top panel) by the CCGS John Cabot (top) and the CCGS Teleost (bottom) in comparative fishing sets, where circle size is proportional catch weight (B) Biplot of the square-root of CCGS John Cabot catch numbers against the square-root of CCGS Teleost catch numbers. (C) Total length frequencies for catches made by the CCGS Teleost (yellow), by the CCGS John Cabot (pink), and CCGS Teleost catches with the conversion factor applied (green).

A



B

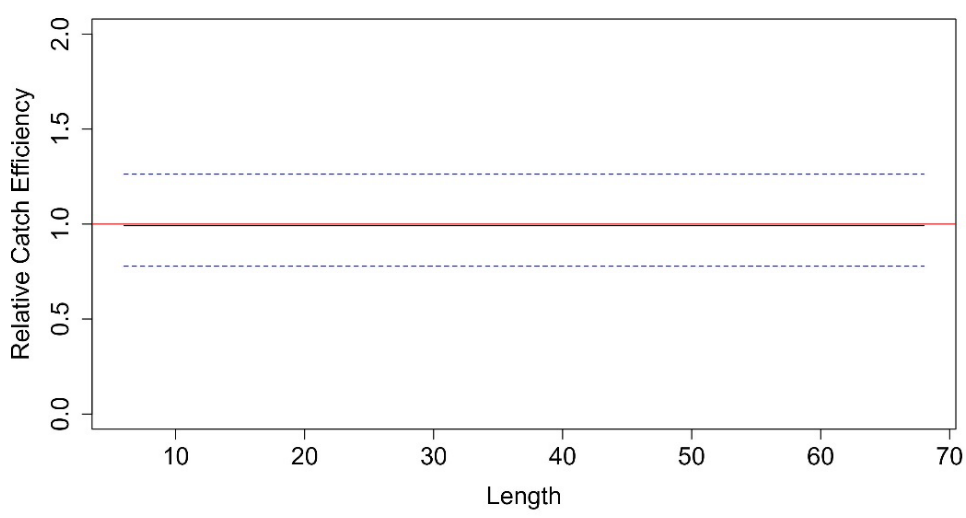


Figure A1- 10. Redfish conversion factor between the CCGS Teleost and CCGS John Cabot for spring NAFO Divisions 3LNO. (A) Estimated length-specific catch proportion functions, $logit(p_{Ai}(l))$, for each converged model, with the selected model plotted using a red line along with its approximate 95% confidence intervals (CI; shaded area), as well as the length class-specific mean empirical proportion of total catch in a pair made by the CCGS Teleost (blue dots). (B) Estimated relative catch efficiency (conversion factor) function from the best model (black line) with 95% CI (dashed blue lines). The horizontal red line indicates equivalent efficiency between vessels.

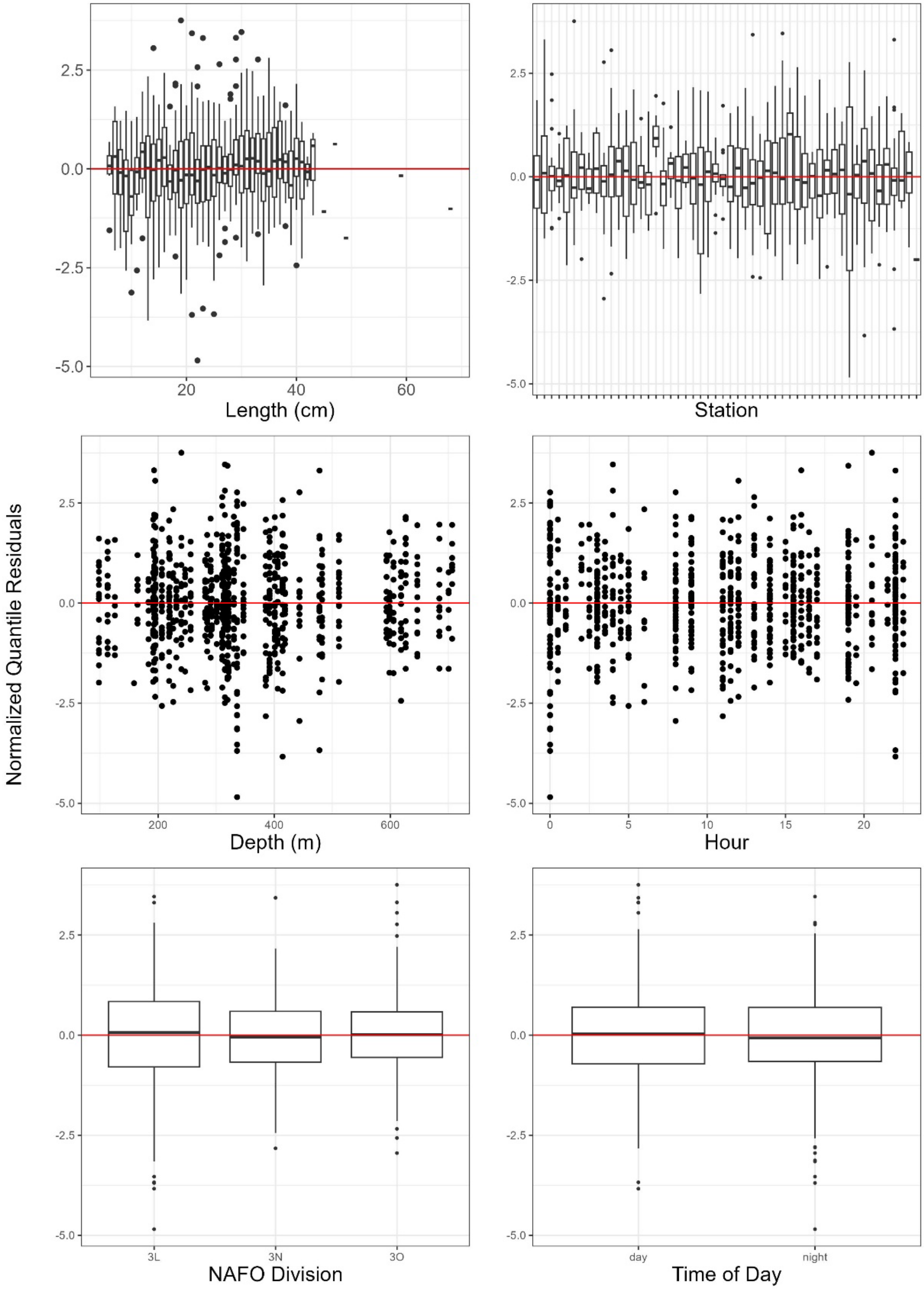


Figure A1- 11. Normalized quantile residuals as a function of length, station, depth, hour, NAFO Division, and diel period for redfish, best model selected for length-disaggregated conversion factor analysis for the CCGS Teleost and CCGS John Cabot for spring NAFO Divisions 3LNO.

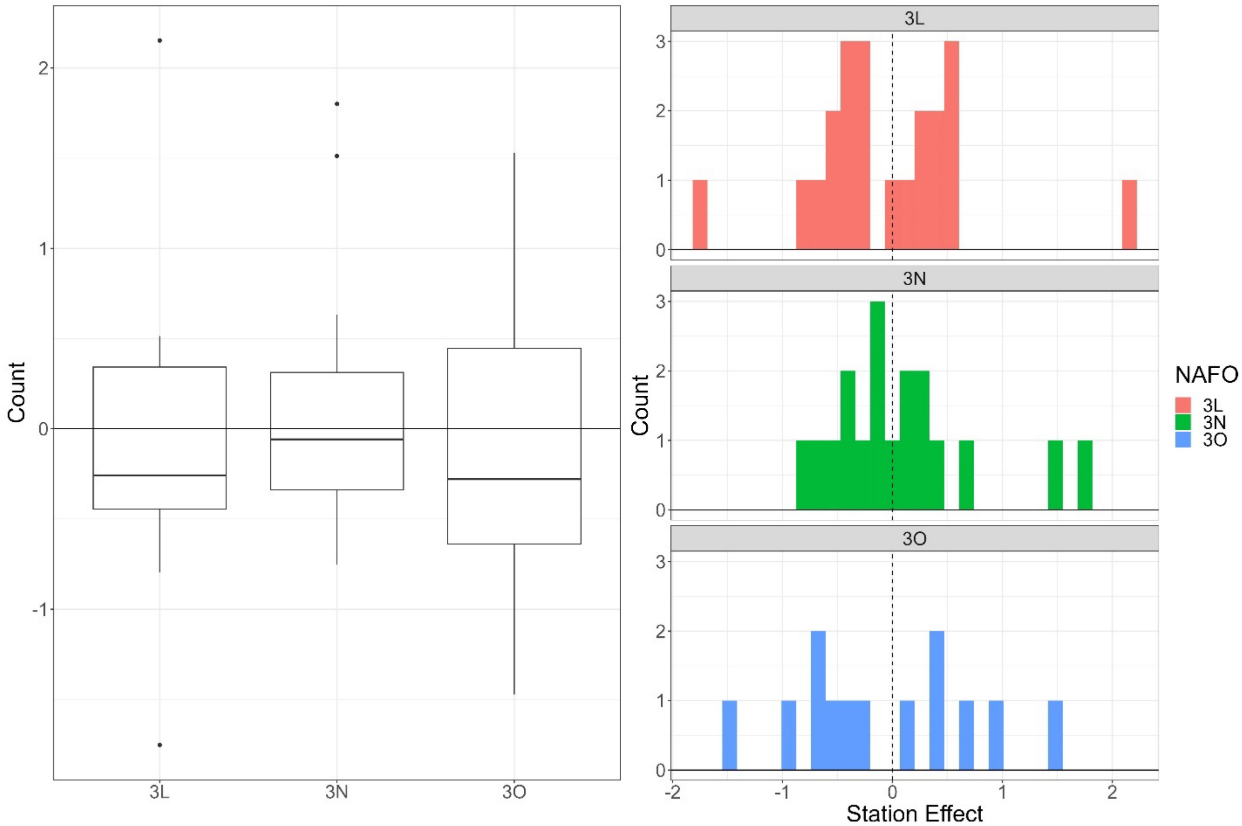


Figure A1- 12. Boxplot (left) and histogram (right) of station effect by NAFO Division for best model selected for redfish, conversion factor analysis between the CCGS Teleost and CCGS John Cabot in spring NAFO Divisions 3LNO.

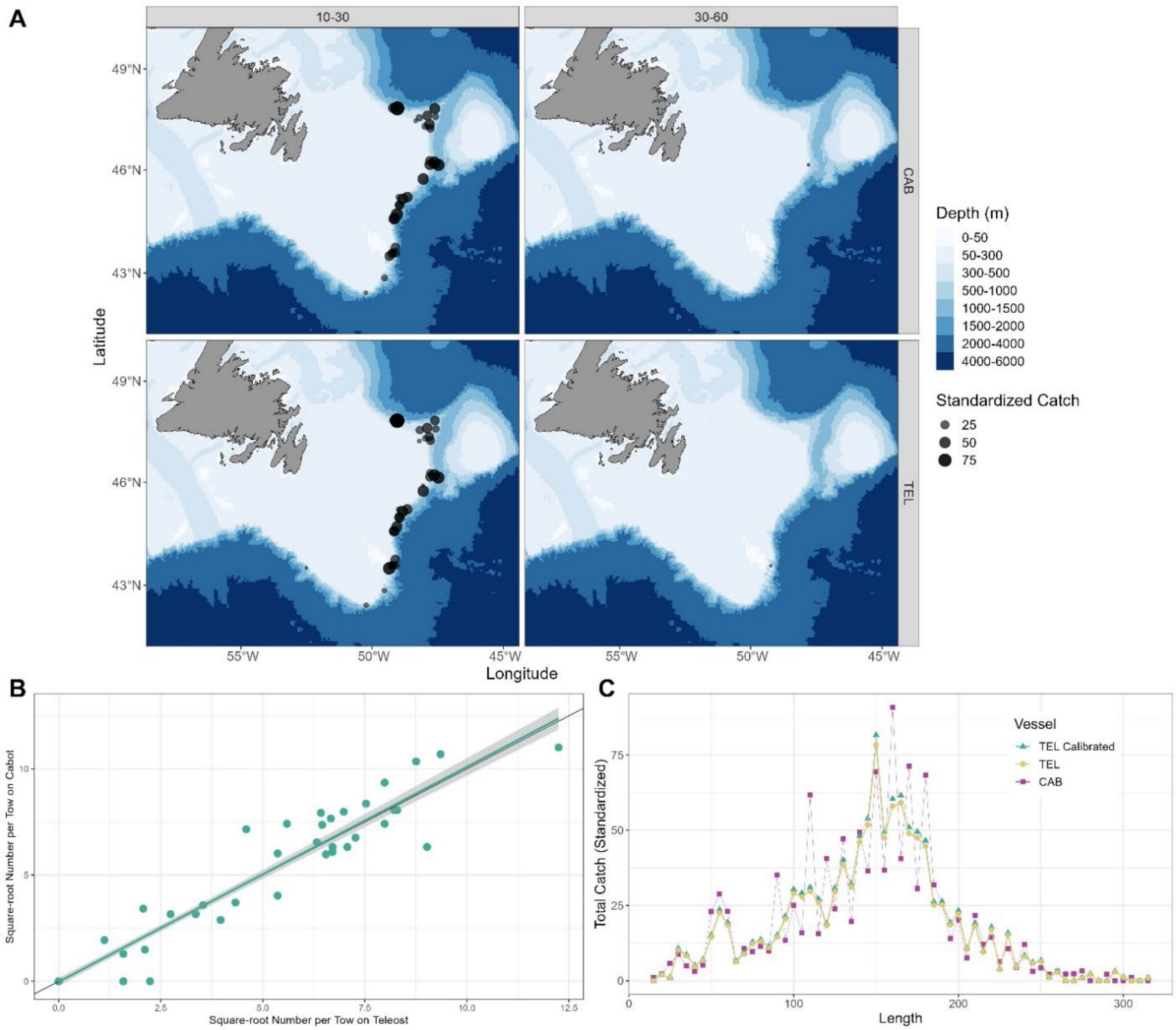
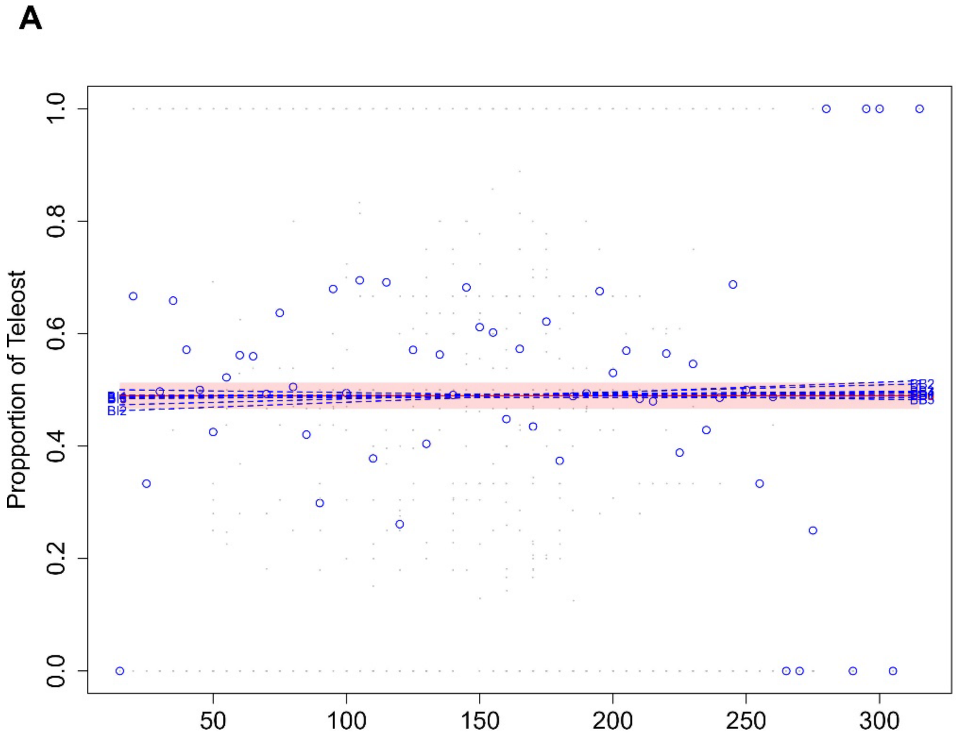


Figure A1- 13. Results for length-disaggregated comparative fishing analyses for Roughhead Greandier between the CCGS Teleost ("TEL") and CCGS John Cabot ("CAB") for spring NAFO Divisions 3LNO. (A) map of catches by length group (length in cm specified in top panel) by the CCGS John Cabot (top) and the CCGS Teleost (bottom) in comparative fishing sets, where circle size is proportional catch weight (B) Biplot of the square-root of CCGS John Cabot catch numbers against the square-root of CCGS Teleost catch numbers. (C) Total length frequencies for catches made by the CCGS Teleost (yellow), by the CCGS John Cabot (pink), and CCGS Teleost catches with the conversion factor applied (green).



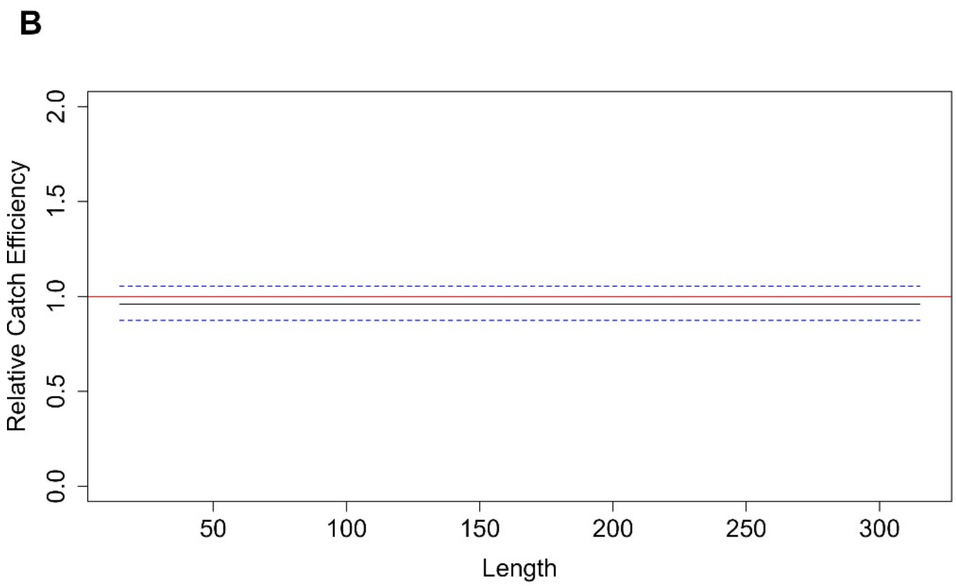


Figure A1- 14. Roughhead Grenadier conversion factor between the CCGS Teleost and CCGS John Cabot for spring NAFO Divisions 3LNO. (A) Estimated length-specific catch proportion functions, $logit(p_{Ai}(l))$, for each converged model, with the selected model plotted using a red line along with its approximate 95% confidence intervals (CI; shaded area), as well as the length class-specific mean empirical proportion of total catch in a pair made by the CCGS Teleost (blue dots). (B) Estimated relative catch efficiency (conversion factor) function from the best model (black line) with 95% CI (dashed blue lines). The horizontal red line indicates equivalent efficiency between vessels.

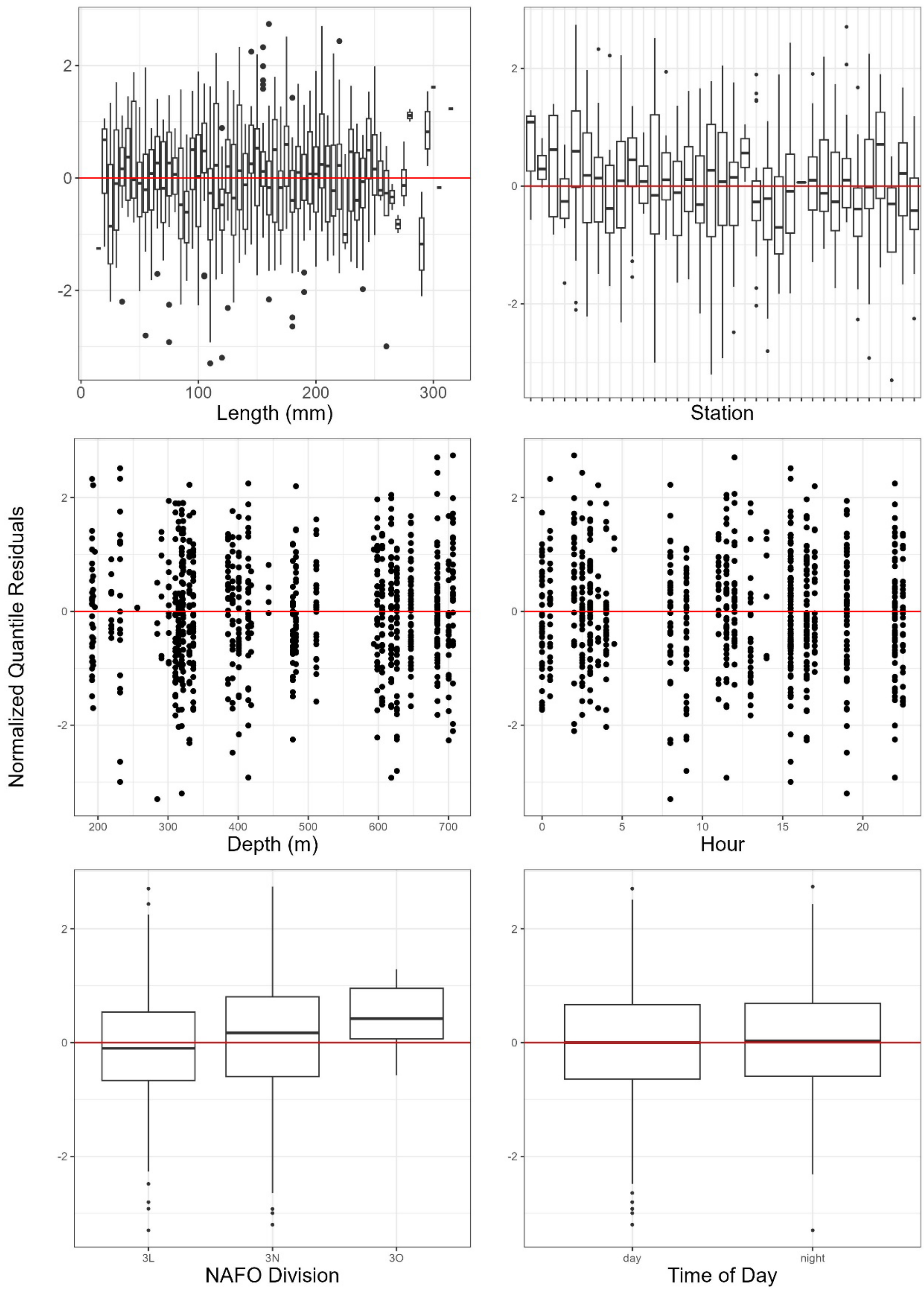


Figure A1- 15. Normalized quantile residuals as a function of length, station, depth, hour, NAFO Division, and diel period for Roughhead Grenadier, best model selected for length-disaggregated conversion factor analysis for the CCGS Teleost and CCGS John Cabot for spring NAFO Divisions 3LNO.

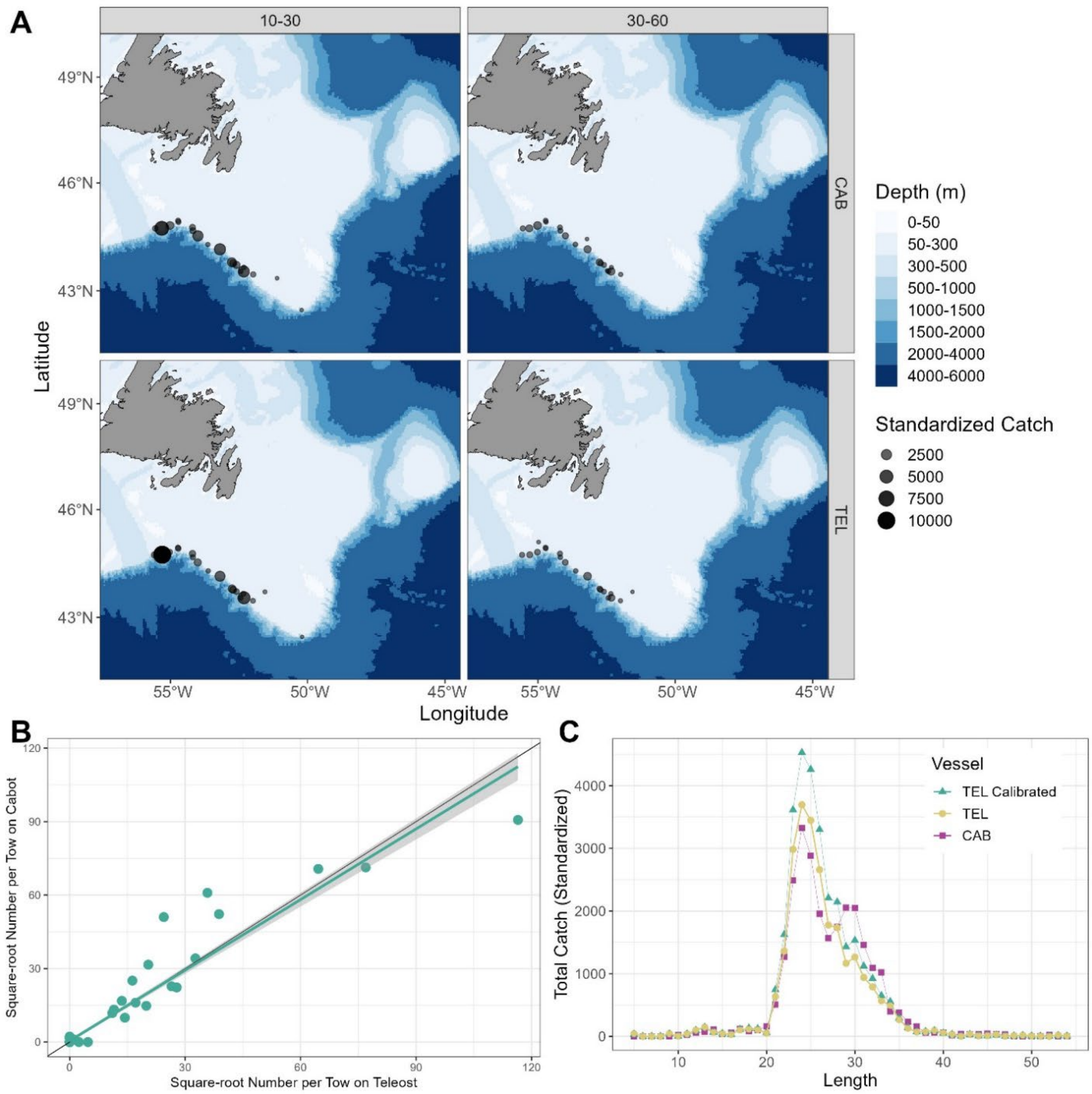


Figure A1- 16. Results for length-disaggregated comparative fishing analyses for Silver Hake between the CCGS Teleost ("TEL") and CCGS John Cabot ("CAB") for spring NAFO Divisions 3NOPs. (A) map of catches by length group (length in cm specified in top panel) by the CCGS John Cabot (top) and the CCGS Teleost (bottom) in comparative fishing sets, where circle size is proportional catch weight (B) Biplot of the square-root of CCGS John Cabot catch numbers against the square-root of CCGS Teleost catch numbers. (C) Total length frequencies for catches made by the CCGS Teleost (yellow), by the CCGS John Cabot (pink), and CCGS Teleost catches with the conversion factor applied (green).

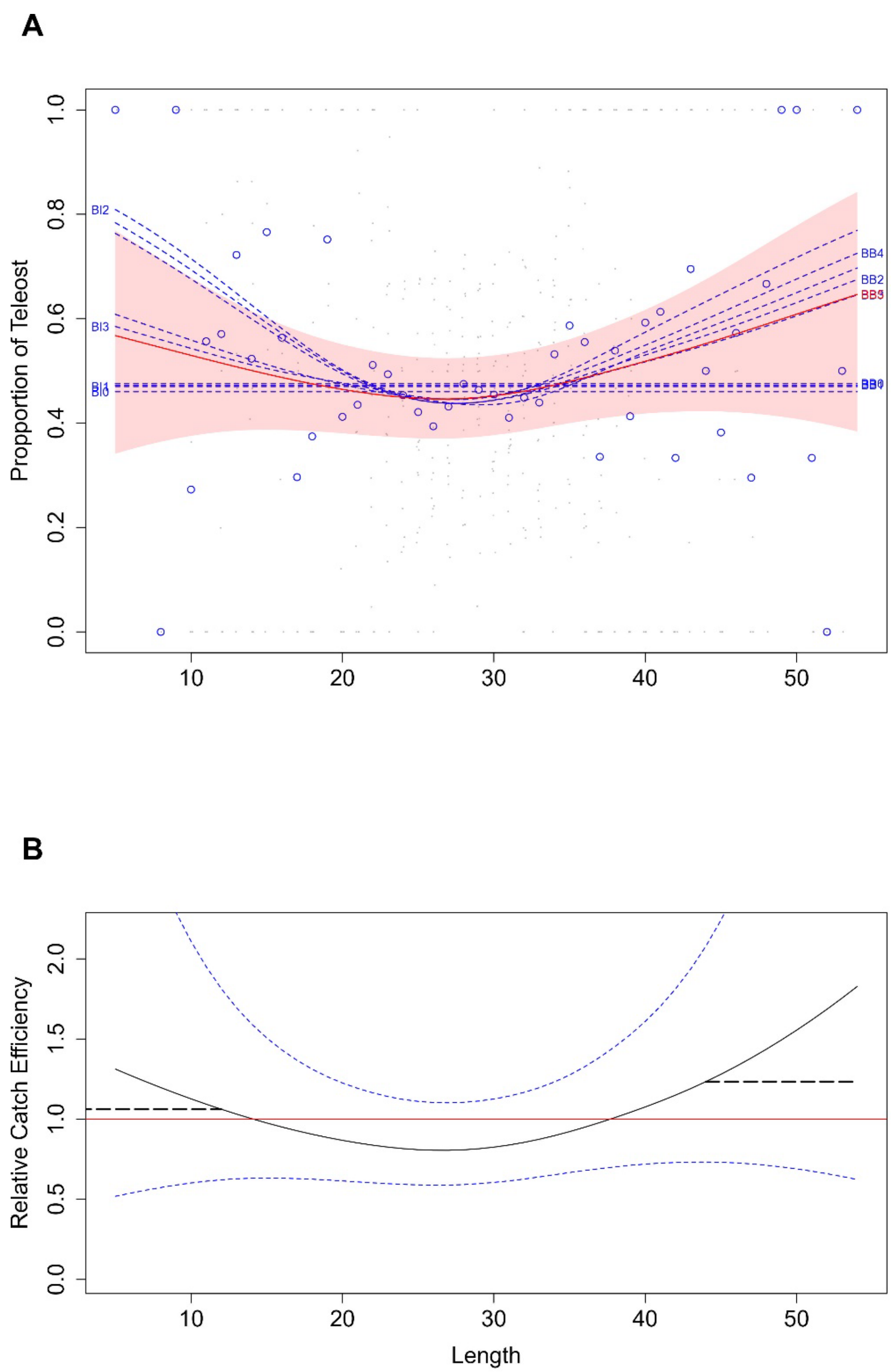


Figure A1- 17. Silver Hake conversion factor between the CCGS Teleost and CCGS John Cabot for spring NAFO Divisions 3NOPs. (A) Estimated length-specific catch proportion functions, $logit(p_{Ai}(l))$, for each converged model, with the selected model plotted using a red line along with its approximate 95% confidence intervals (CI; shaded area), as well as the length class-specific mean empirical proportion of total catch in a pair made by the CCGS Teleost (blue dots). (B) Estimated relative catch efficiency (conversion factor) function from the best model (black line) with 95% CI (dashed blue lines). The horizontal red line indicates equivalent efficiency between vessels.

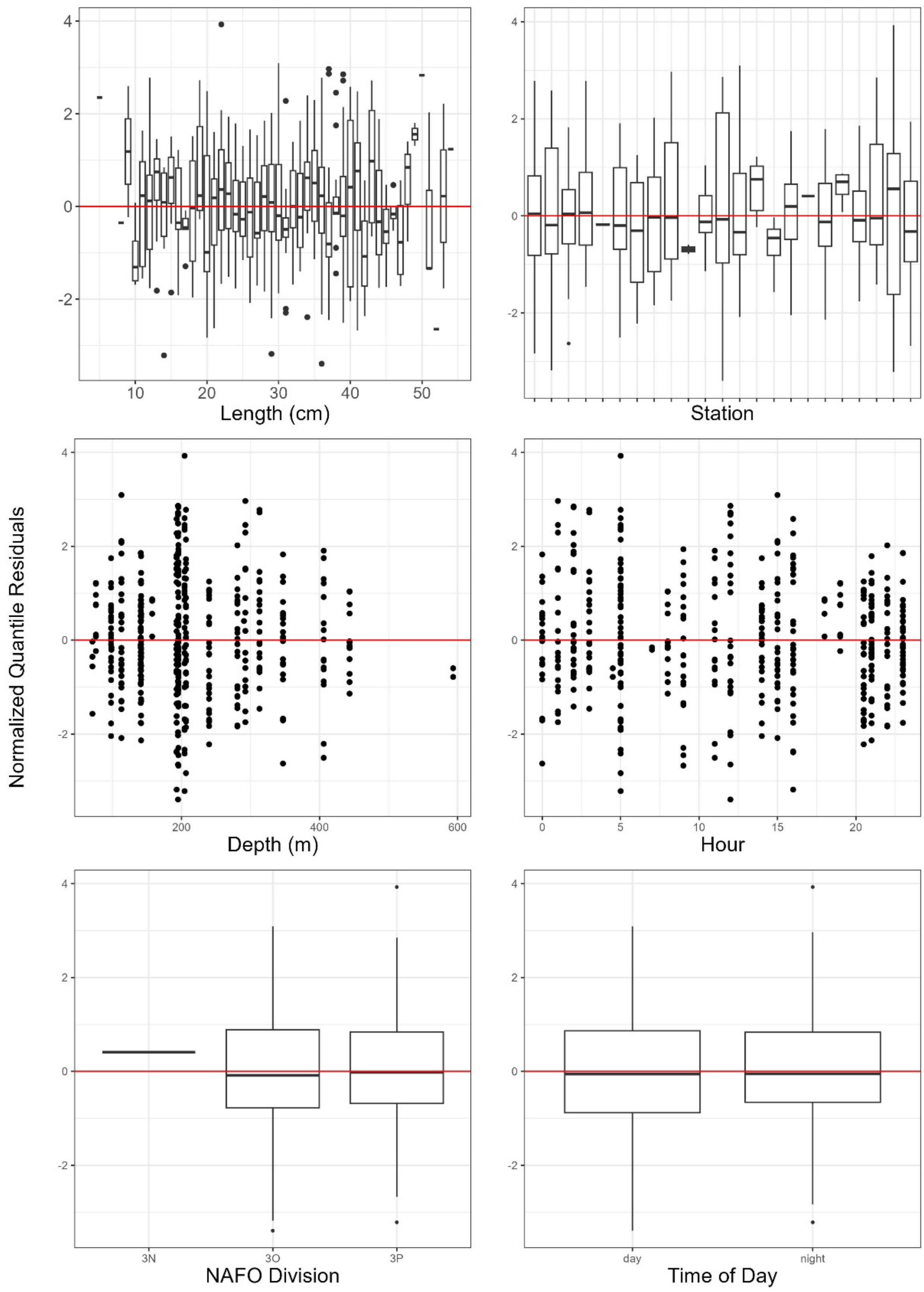


Figure A1- 18. Normalized quantile residuals as a function of length, station, depth, hour, NAFO Division, and diel period for Silver Hake, best model selected for length-disaggregated conversion factor analysis for the CCGS Teleost and CCGS John Cabot for spring NAFO Divisions 3NOPs.

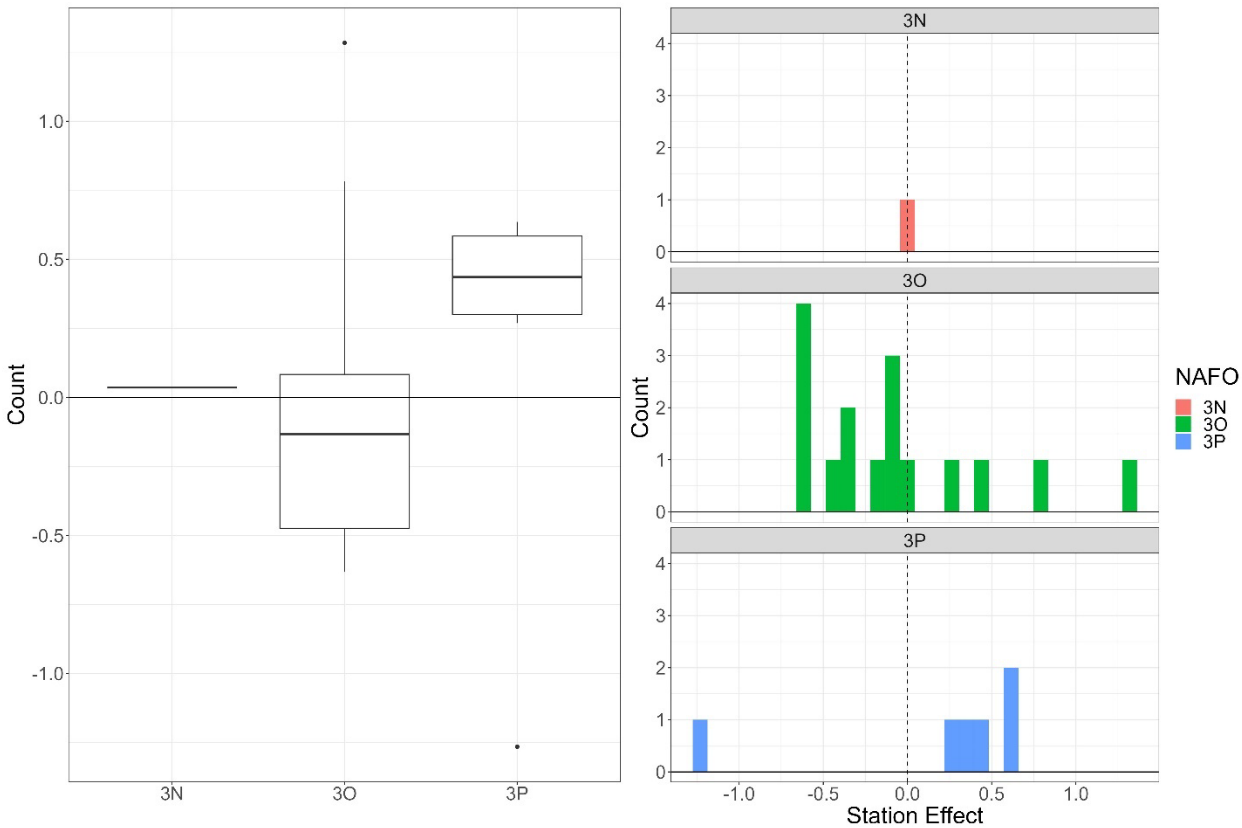


Figure A1- 19. Boxplot (left) and histogram (right) of station effect by NAFO Division for best model selected for Silver Hake, conversion factor analysis between the CCGS Teleost and CCGS John Cabot in spring NAFO Divisions 3NOPs.

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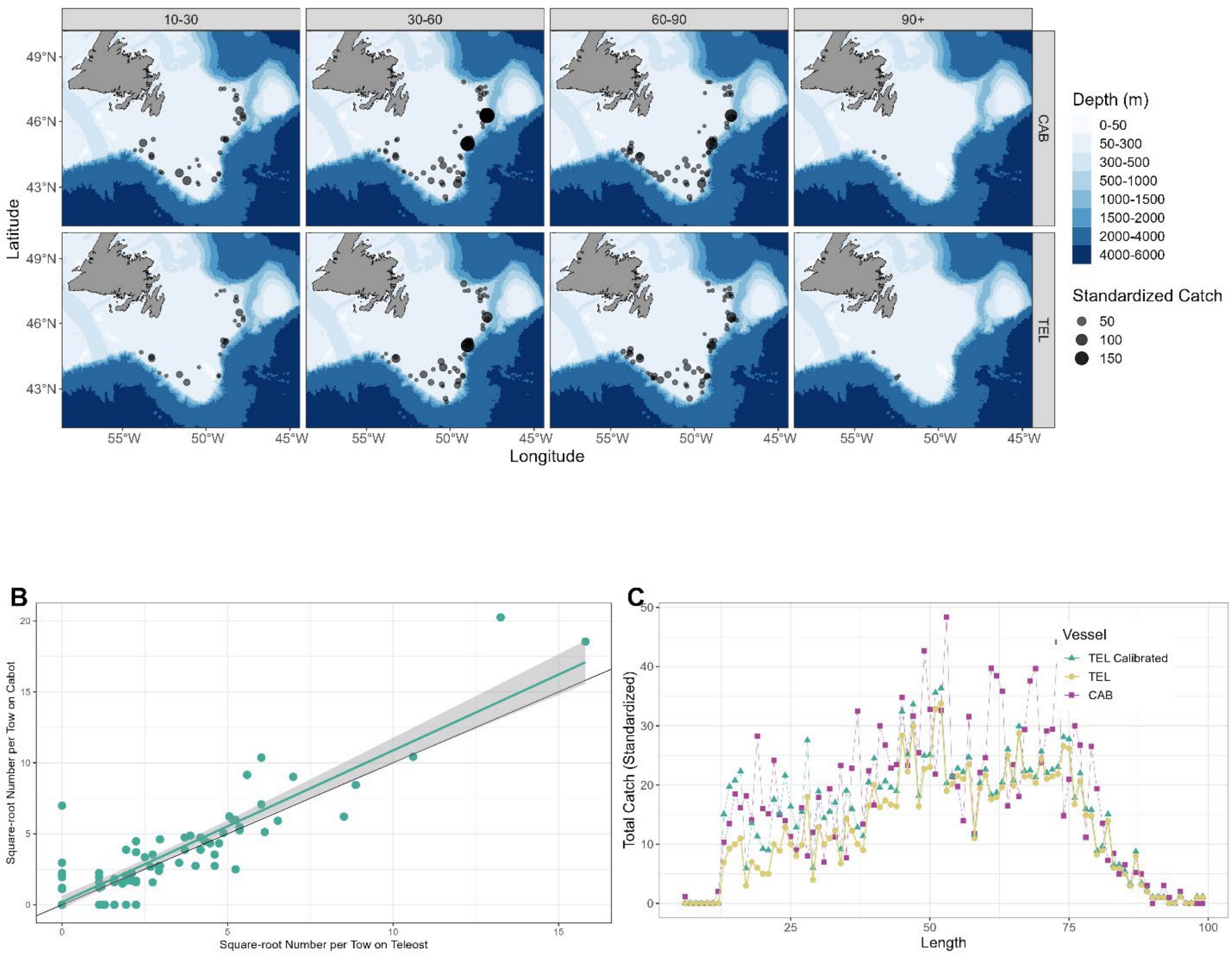


Figure A1- 20. Results for length-disaggregated comparative fishing analyses for Thorny Skate between the CCGS Teleost ("TEL") and CCGS John Cabot ("CAB") for spring NAFO Divisions 3LNO. (A) map of catches by length group (length in cm specified in top panel) by the CCGS John Cabot (top) and the CCGS Teleost (bottom) in comparative fishing sets, where circle size is proportional catch weight (B) Biplot of the square-root of CCGS John Cabot catch numbers against the square-root of CCGS Teleost catch numbers. (C) Total length frequencies for catches made by the CCGS Teleost (yellow), by the CCGS John Cabot (pink), and CCGS Teleost catches with the conversion factor applied (green).

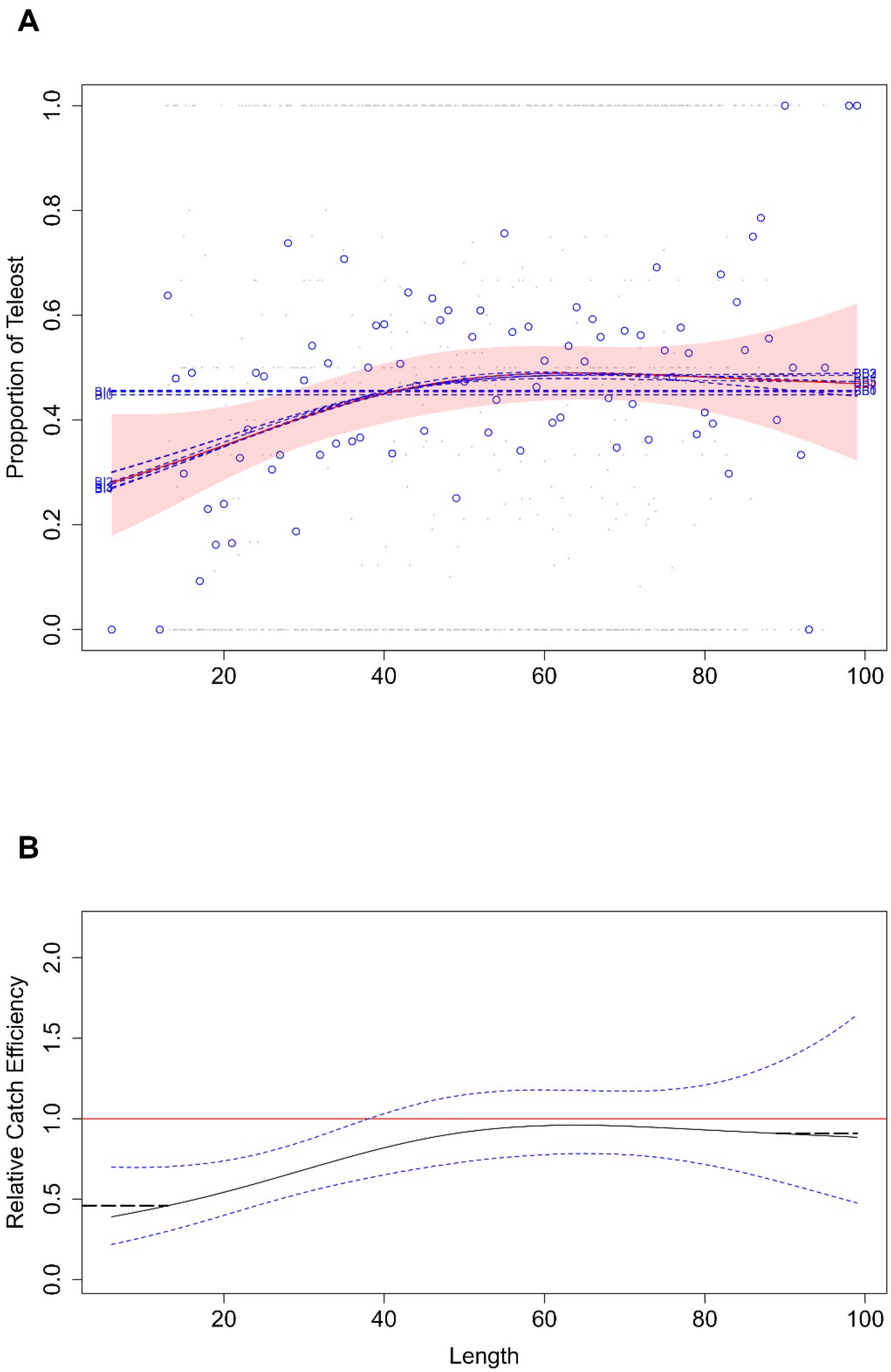


Figure A1- 21. Thorny Skate conversion factor between the CCGS Teleost and CCGS John Cabot for spring NAFO Divisions 3LNO. (A) Estimated length-specific catch proportion functions, $logit(p_{Ai}(l))$, for each converged model, with the selected model plotted using a red line along with its approximate 95% confidence intervals (CI; shaded area), as well as the length class-specific mean empirical proportion of total catch in a pair made by the CCGS Teleost (blue dots). (B) Estimated relative catch efficiency (conversion factor) function from the best model (black line) with 95% CI (dashed blue lines). The horizontal red line indicates equivalent efficiency between vessels.

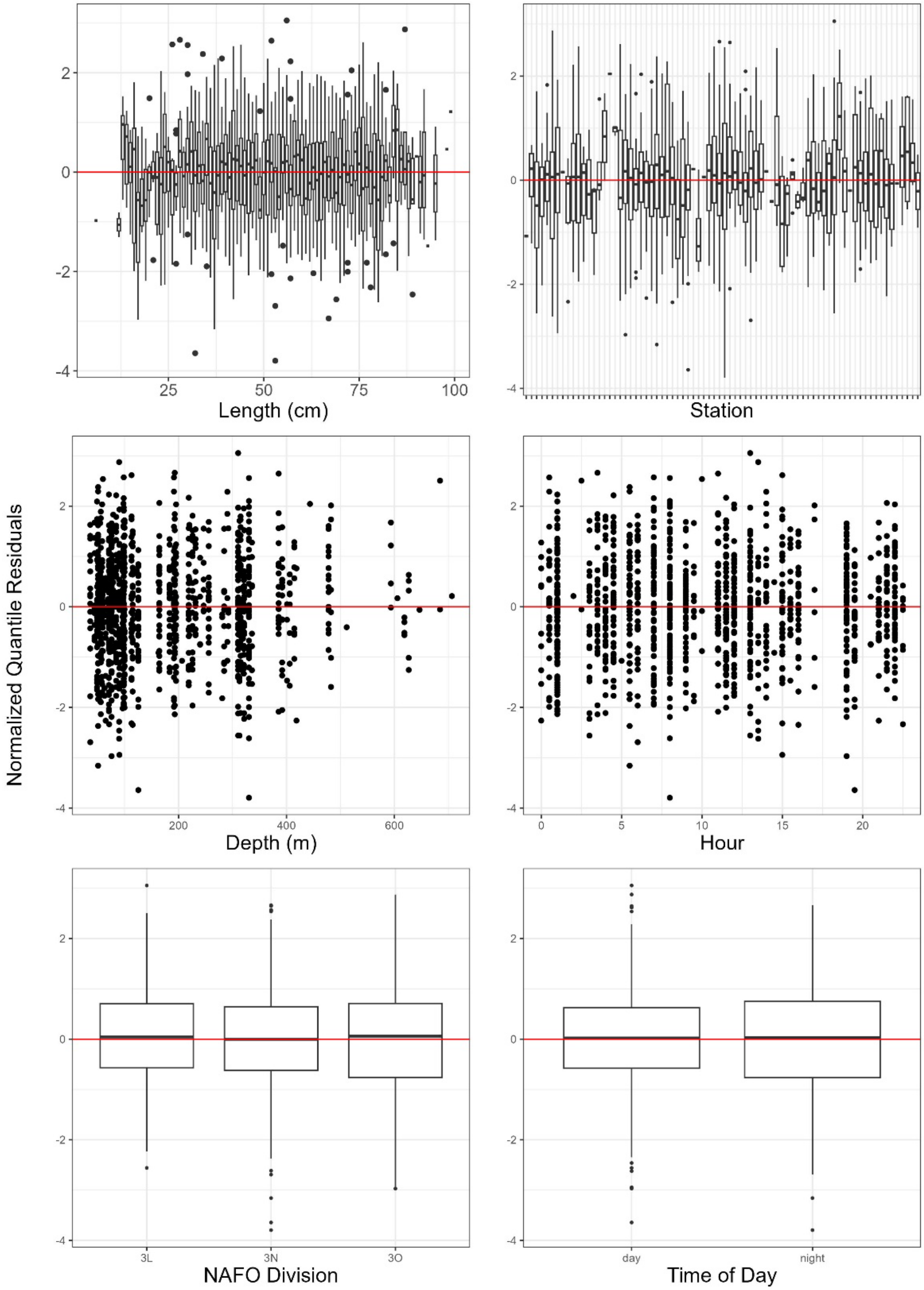


Figure A1- 22. Normalized quantile residuals as a function of length, station, depth, hour, NAFO Division, and diel period for Thorny Skate, best model selected for length-disaggregated conversion factor analysis for the CCGS Teleost and CCGS John Cabot for spring NAFO Divisions 3LNO.

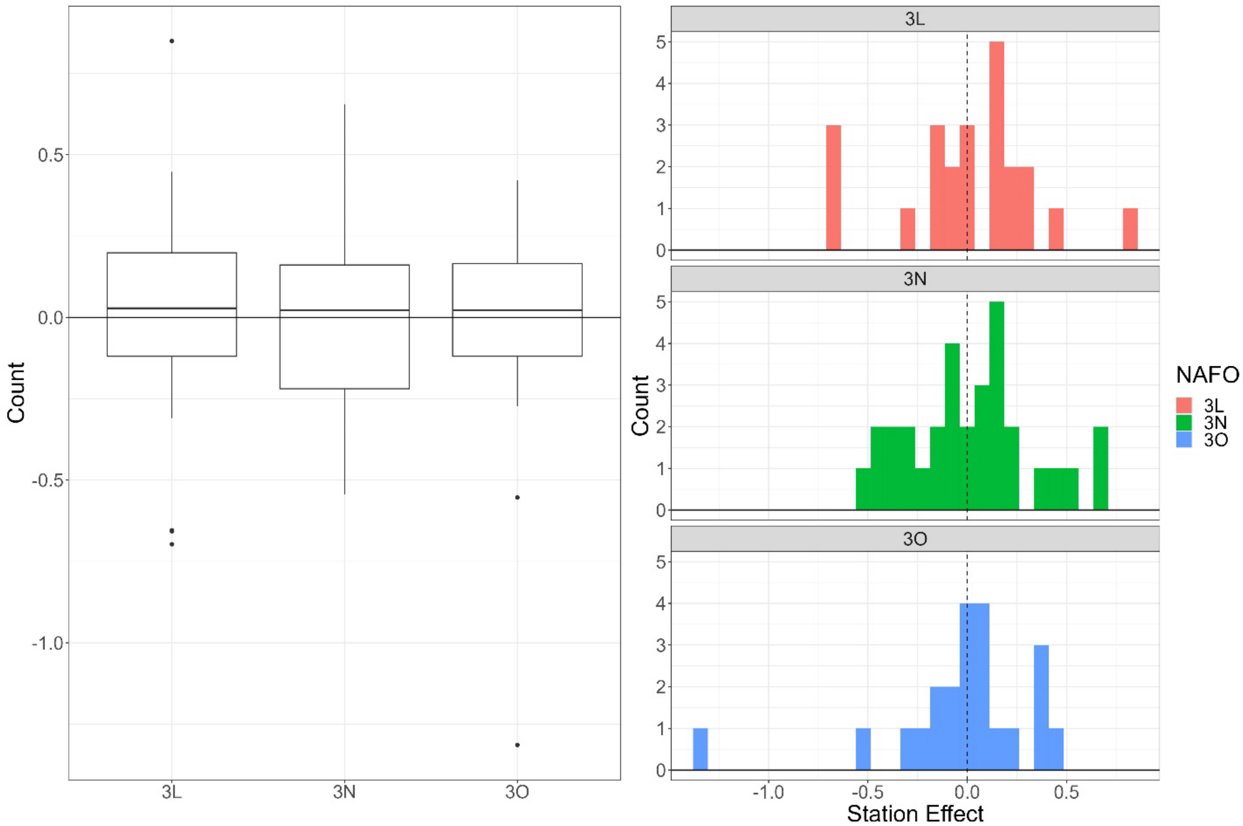


Figure A1- 23. Boxplot (left) and histogram (right) of station effect by NAFO Division for best model selected for Thorny Skate, conversion factor analysis between the CCGS Teleost and CCGS John Cabot in spring NAFO Divisions 3LNO.

Table A1- 1. Conversions (± Standard Error [SE]) required for Thorny Skate to be used for the CCGS Teleost and CCGS John Cabot for spring NAFO Divisions 3LNO. Length (cm) range displayed is for the 0.5 and 99.5 percentile range, and conversions below 13 cm should be applied at 0.46 ± 0.10 and above 89 cm at 0.91 ± 0.18.

Length (cm)	Conversion	SE
13	0.46	0.10
14	0.47	0.10
15	0.48	0.09
16	0.49	0.09
17	0.50	0.09
18	0.52	0.09
19	0.53	0.09
20	0.54	0.08
21	0.56	0.08
22	0.57	0.08
23	0.58	0.08
24	0.60	0.08
25	0.61	0.08
26	0.62	0.08
27	0.64	0.08
28	0.65	0.08
29	0.67	0.08
30	0.68	0.08
31	0.70	0.08
32	0.71	0.08
33	0.73	0.08
34	0.74	0.09
35	0.75	0.09
36	0.77	0.09
37	0.78	0.09
38	0.79	0.09
39	0.81	0.09
40	0.82	0.10
41	0.83	0.10
42	0.84	0.10
43	0.85	0.10
44	0.86	0.10
45	0.87	0.10
46	0.88	0.10

Length (cm)	Conversion	SE
47	0.89	0.10
48	0.90	0.11
49	0.91	0.11
50	0.92	0.11
51	0.92	0.11
52	0.93	0.11
53	0.93	0.11
54	0.94	0.11
55	0.94	0.10
56	0.95	0.10
57	0.95	0.10
58	0.95	0.10
59	0.95	0.10
60	0.96	0.10
61	0.96	0.10
62	0.96	0.10
63	0.96	0.10
64	0.96	0.10
65	0.96	0.10
66	0.96	0.10
67	0.96	0.10
68	0.96	0.10
69	0.96	0.10
70	0.95	0.10
71	0.95	0.10
72	0.95	0.10
73	0.95	0.10
74	0.95	0.10
75	0.94	0.11
76	0.94	0.11
77	0.94	0.11
78	0.94	0.12
79	0.93	0.12
80	0.93	0.12
81	0.93	0.13
82	0.93	0.13
83	0.92	0.14

Length (cm)	Conversion	SE
84	0.92	0.15
85	0.92	0.15
86	0.92	0.16
87	0.91	0.17
88	0.91	0.17
89	0.91	0.18

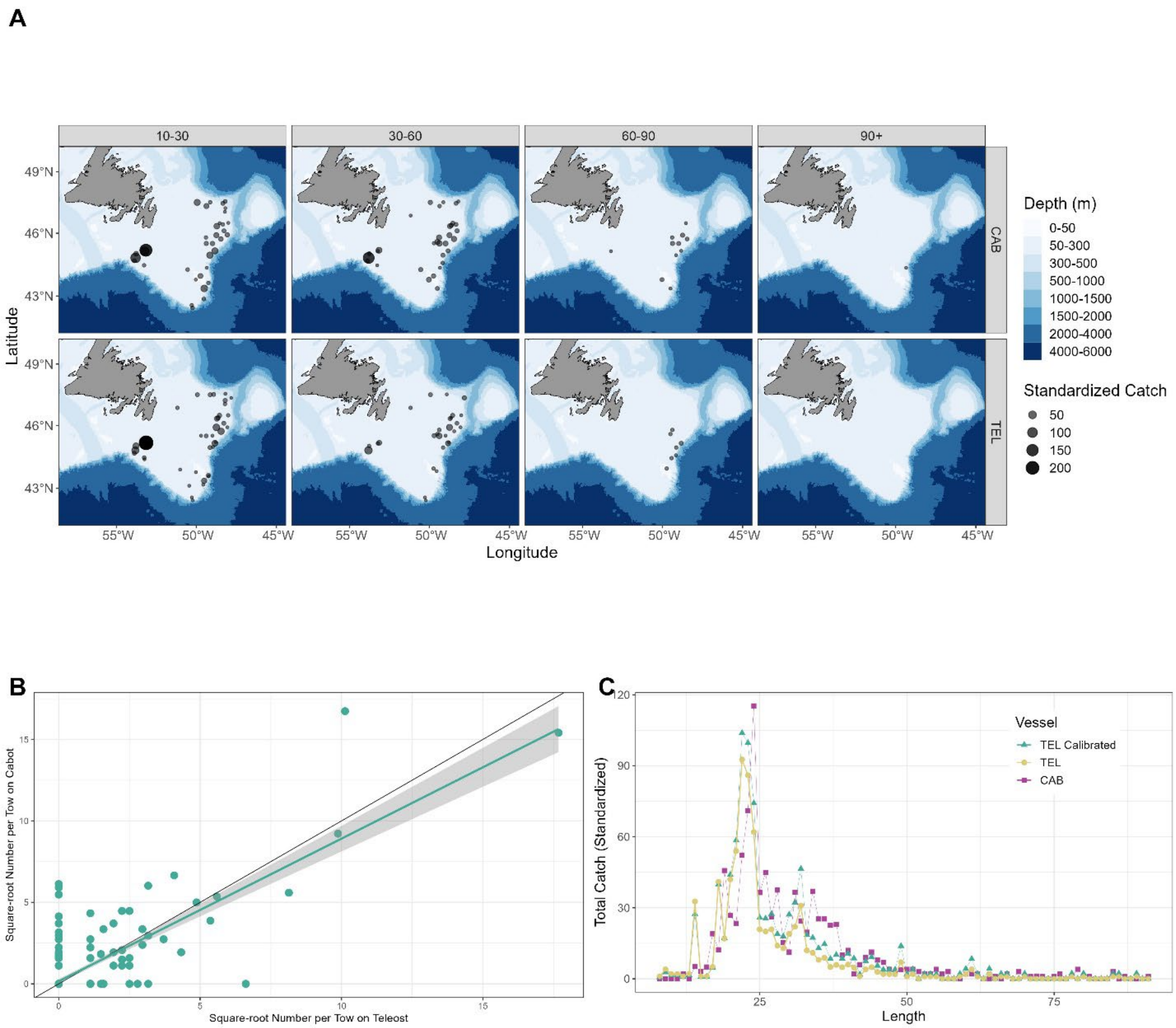
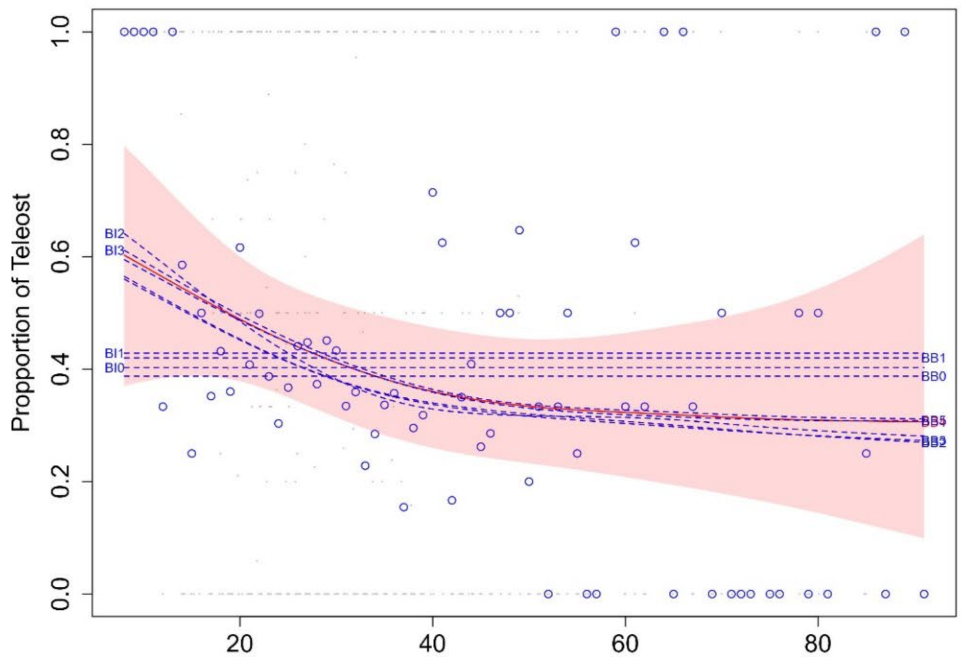


Figure A1- 24. Results for length-disaggregated comparative fishing analyses for Toad Crab between the CCGS Teleost ("TEL") and CCGS John Cabot ("CAB") for spring NAFO Divisions 3LNO. (A) map of catches by length group (length in cm specified in top panel) by the CCGS John Cabot (top) and the CCGS Teleost (bottom) in comparative fishing sets, where circle size is proportional catch weight (B) Biplot of the square-root of CCGS John Cabot catch numbers against the square-root of CCGS Teleost catch numbers. (C) Total length frequencies for catches made by the CCGS Teleost (yellow), by the CCGS John Cabot (pink), and CCGS Teleost catches with the conversion factor applied (green).

A



B

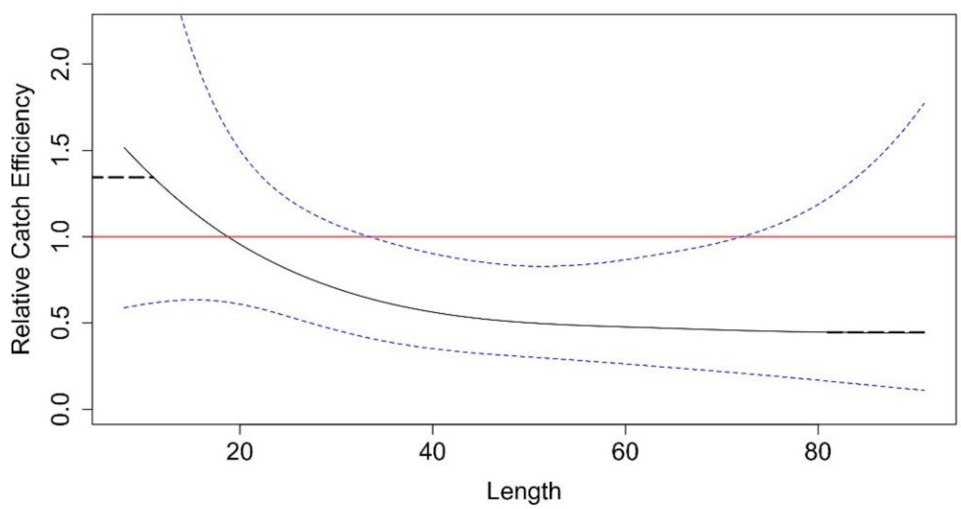


Figure A1- 25. Toad Crab conversion factor between the CCGS Teleost and CCGS John Cabot for spring NAFO Divisions 3LNO. (A) Estimated length-specific catch proportion functions, $logit(p_{Ai}(l))$, for each converged model, with the selected model plotted using a red line along with its approximate 95% confidence intervals (CI; shaded area), as well as the length class-specific mean empirical proportion of total catch in a pair made by the CCGS Teleost (blue dots). (B) Estimated relative catch efficiency (conversion factor) function from the best model (black line) with 95% CI (dashed blue lines). The horizontal red line indicates equivalent efficiency between vessels.

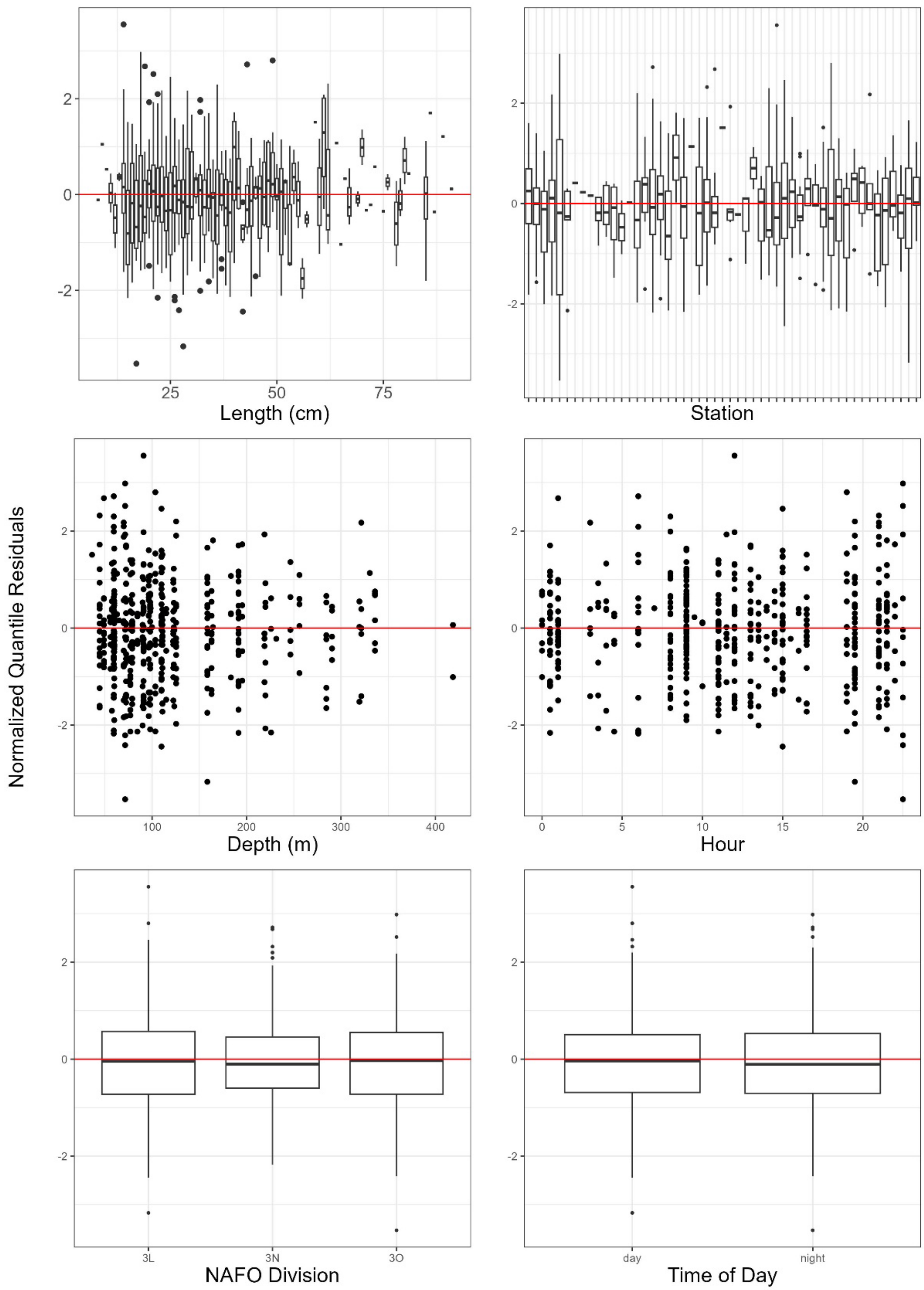


Figure A1- 26. Normalized quantile residuals as a function of length, station, depth, hour, NAFO Division, and diel period for Toad Crab, best model selected for length-disaggregated conversion factor analysis for the CCGS Teleost and CCGS John Cabot for spring NAFO Divisions 3LNO.

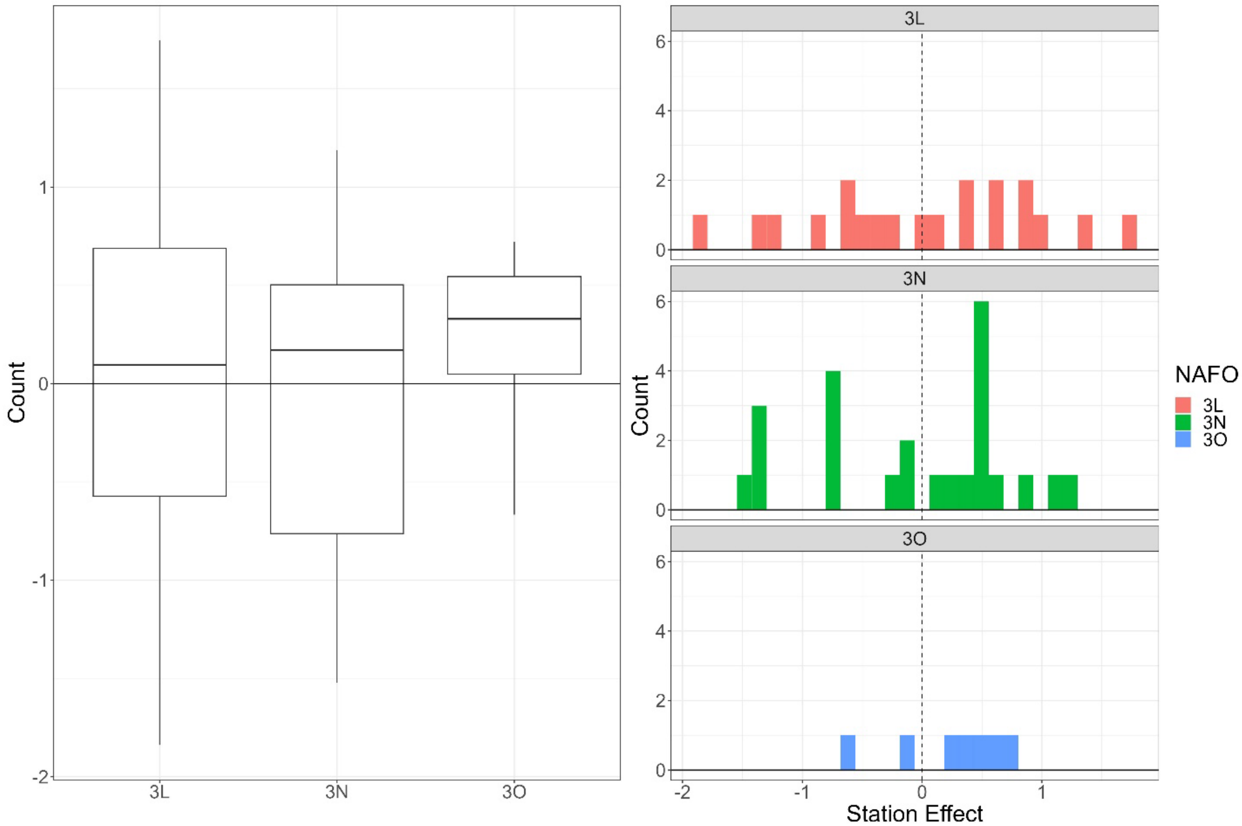


Figure A1- 27. Boxplot (left) and histogram (right) of station effect by NAFO Division for best model selected for Toad Crab, conversion factor analysis between the CCGS Teleost and CCGS John Cabot in spring NAFO Divisions 3LNO.

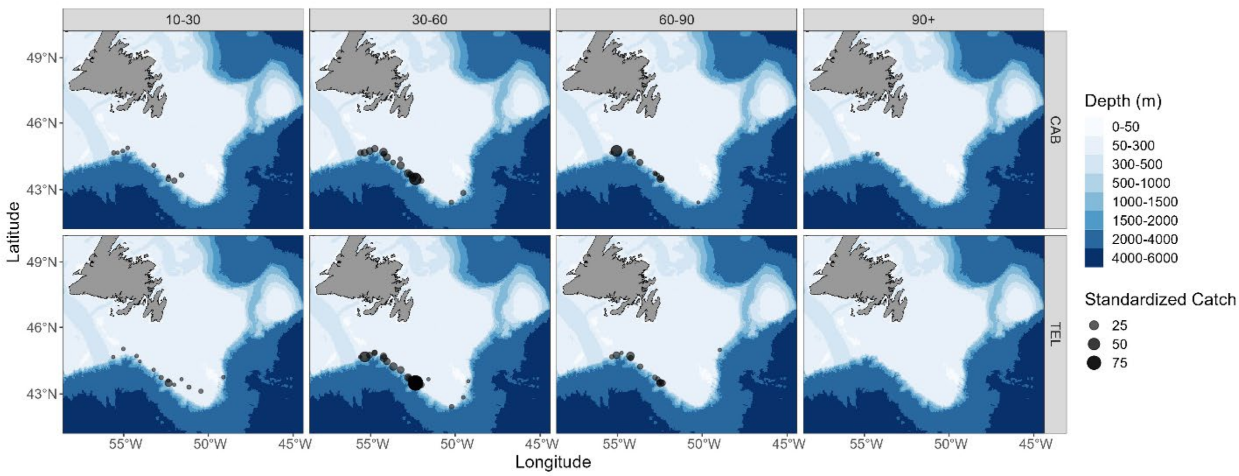
Table A1- 2. Conversions (± Standard Error [SE]) required for Toad Crab to be used for the CCGS Teleost, and CCGS John Cabot for spring NAFO Divisions 3LNO. Length (mm) range displayed is for the 0.5 and 99.5 percentile range, and conversions below 11 mm should be applied at 1.34 ± 0.54 and above 85 mm at 0.44 ± 0.26.

Length (mm)	Conversion	SE
11	1.34	0.54
12	1.29	0.48
13	1.24	0.43
14	1.19	0.39
15	1.15	0.35
16	1.11	0.31
17	1.07	0.28
18	1.03	0.26
19	0.99	0.24
20	0.96	0.22
21	0.92	0.20
22	0.89	0.19
23	0.86	0.18
24	0.84	0.17
25	0.81	0.17
26	0.78	0.16
27	0.76	0.16
28	0.74	0.16
29	0.72	0.15
30	0.70	0.15
31	0.68	0.15
32	0.66	0.15
33	0.65	0.15
34	0.63	0.14
35	0.62	0.14
36	0.61	0.14
37	0.59	0.14
38	0.58	0.14
39	0.57	0.14
40	0.56	0.14
41	0.55	0.13
42	0.55	0.13
43	0.54	0.13
44	0.53	0.13

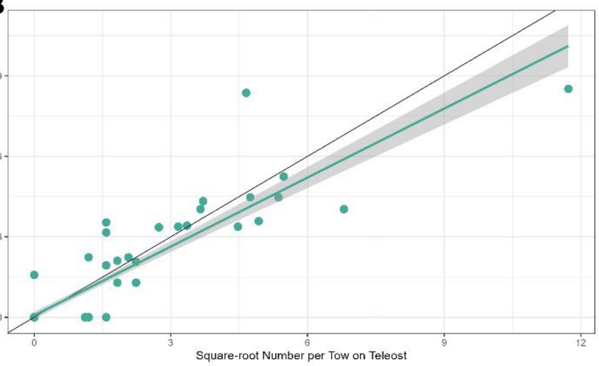
Length (mm)	Conversion	SE
45	0.52	0.13
46	0.52	0.13
47	0.51	0.13
48	0.51	0.13
49	0.51	0.13
50	0.50	0.13
51	0.50	0.13
52	0.49	0.13
53	0.49	0.13
54	0.49	0.13
55	0.49	0.13
56	0.48	0.14
57	0.48	0.14
58	0.48	0.14
59	0.48	0.14
60	0.48	0.15
61	0.48	0.15
62	0.47	0.15
63	0.47	0.15
64	0.47	0.16
65	0.47	0.16
66	0.47	0.16
67	0.46	0.17
68	0.46	0.17
69	0.46	0.17
70	0.46	0.17
71	0.46	0.18
72	0.46	0.18
73	0.46	0.19
74	0.45	0.19
75	0.45	0.20
76	0.45	0.20
77	0.45	0.21
78	0.45	0.21
79	0.45	0.22
80	0.45	0.22
81	0.45	0.23

Length (mm)	Conversion	SE
82	0.45	0.24
83	0.45	0.24
84	0.44	0.25
85	0.44	0.26

A



B



C

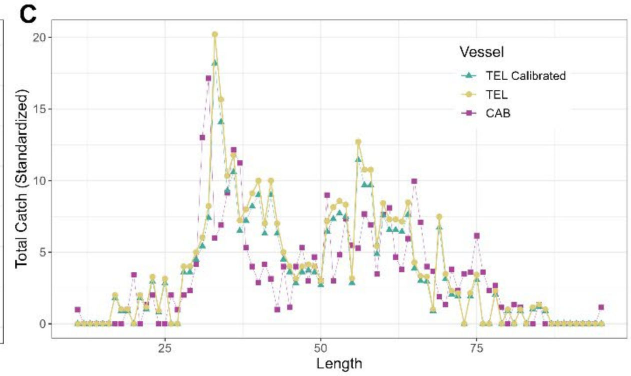
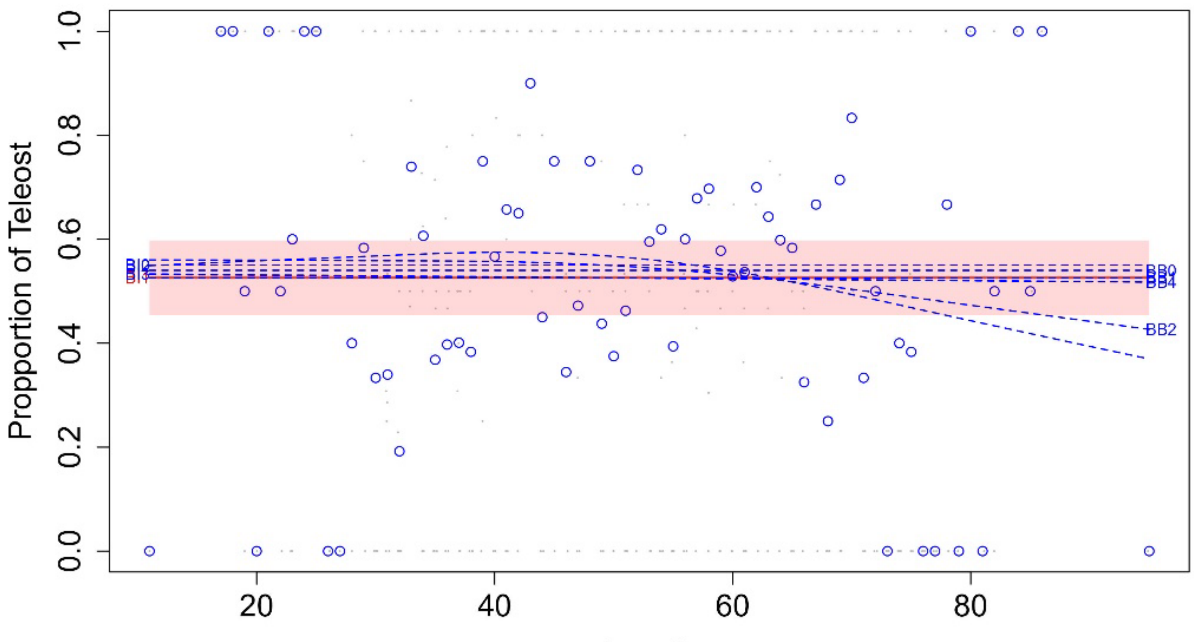


Figure A1- 28. Results for length-disaggregated comparative fishing analyses for White Hake between the CCGS Teleost ("TEL") and CCGS John Cabot ("CAB") for spring NAFO Divisions 3NOPs. (A) map of catches by length group (length in cm specified in top panel) by the CCGS John Cabot (top) and the CCGS Teleost (bottom) in comparative fishing sets, where circle size is proportional catch weight (B) Biplot of the square-root of CCGS John Cabot catch numbers against the square-root of CCGS Teleost catch numbers. (C) Total length frequencies for catches made by the CCGS Teleost (yellow), by the CCGS John Cabot (pink), and CCGS Teleost catches with the conversion factor applied (green).

A



B

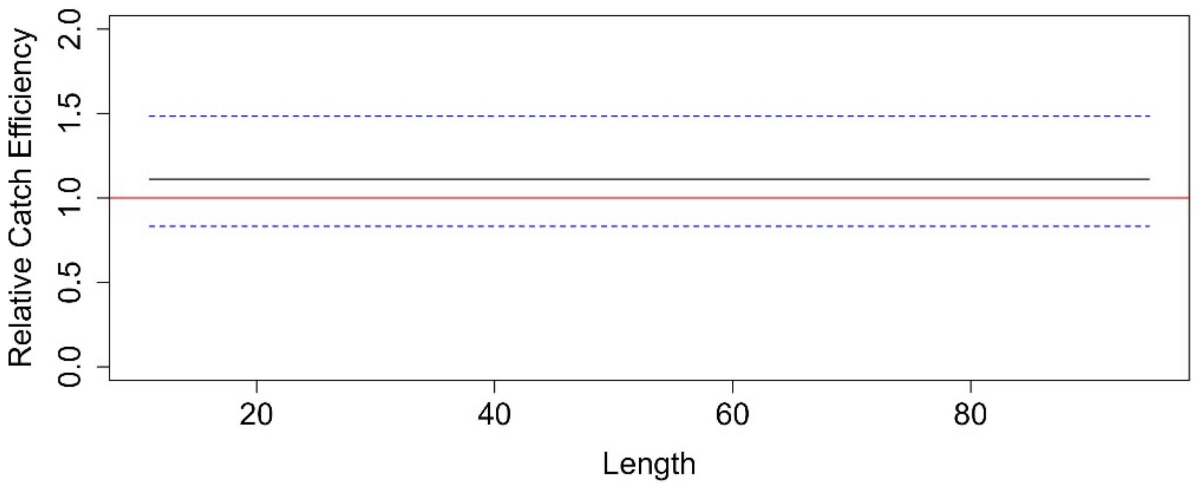


Figure A1- 29. White Hake conversion factor between the CCGS Teleost and CCGS John Cabot for spring NAFO Divisions 3NOPs. (A) Estimated length-specific catch proportion functions, $logit(p_{Ai}(l))$, for each converged model, with the selected model plotted using a red line along with its approximate 95% confidence intervals (CI; shaded area), as well as the length class-specific mean empirical proportion of total catch in a pair made by the CCGS Teleost (blue dots). (B) Estimated relative catch efficiency (conversion factor) function from the best model (black line) with 95% CI (dashed blue lines). The horizontal red line indicates equivalent efficiency between vessels.

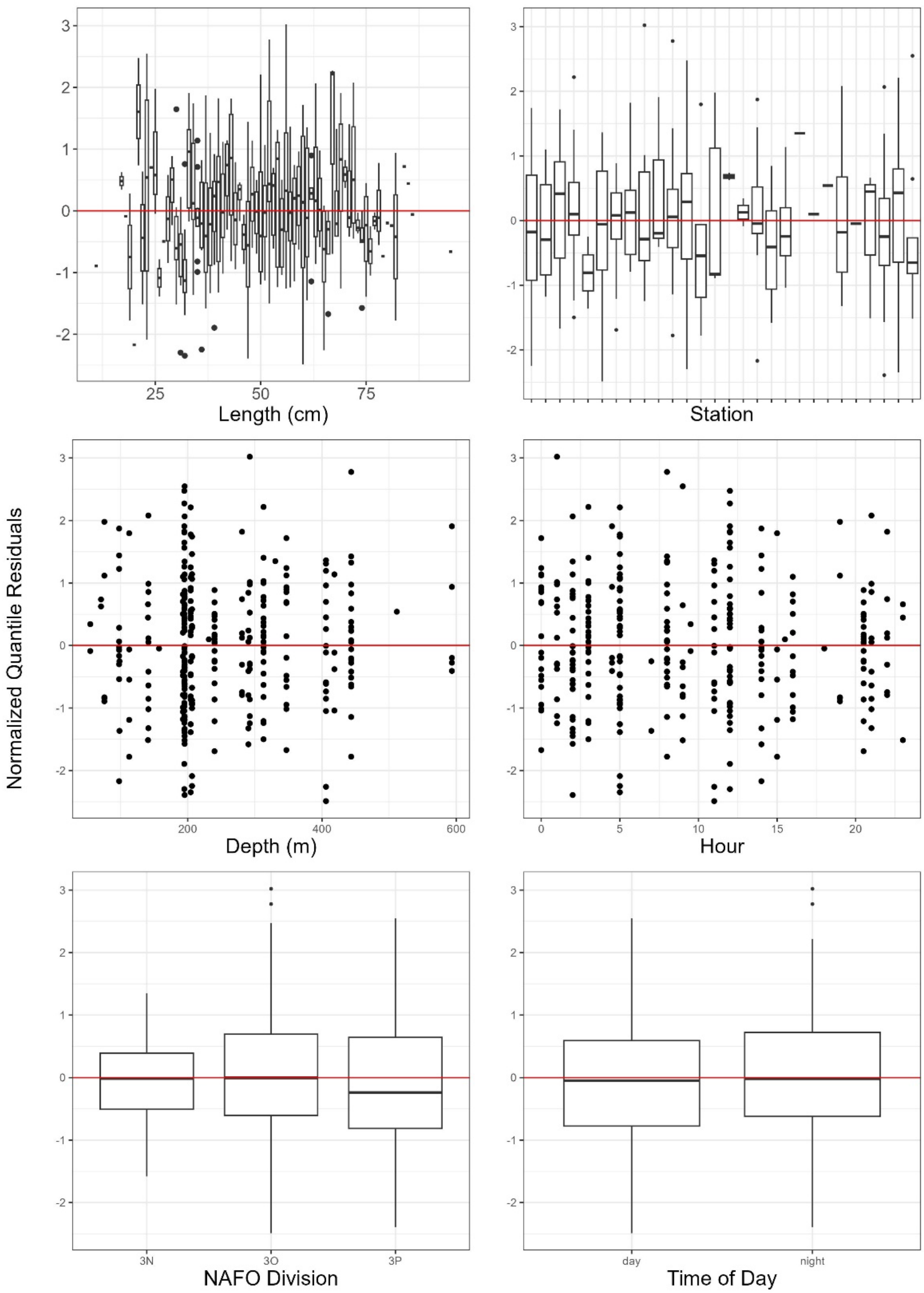


Figure A1- 30. Normalized quantile residuals as a function of length, station, depth, hour, NAFO Division, and diel period for White Hake, best model selected for length-disaggregated conversion factor analysis for the CCGS Teleost and CCGS John Cabot for spring NAFO Divisions 3NOPs.

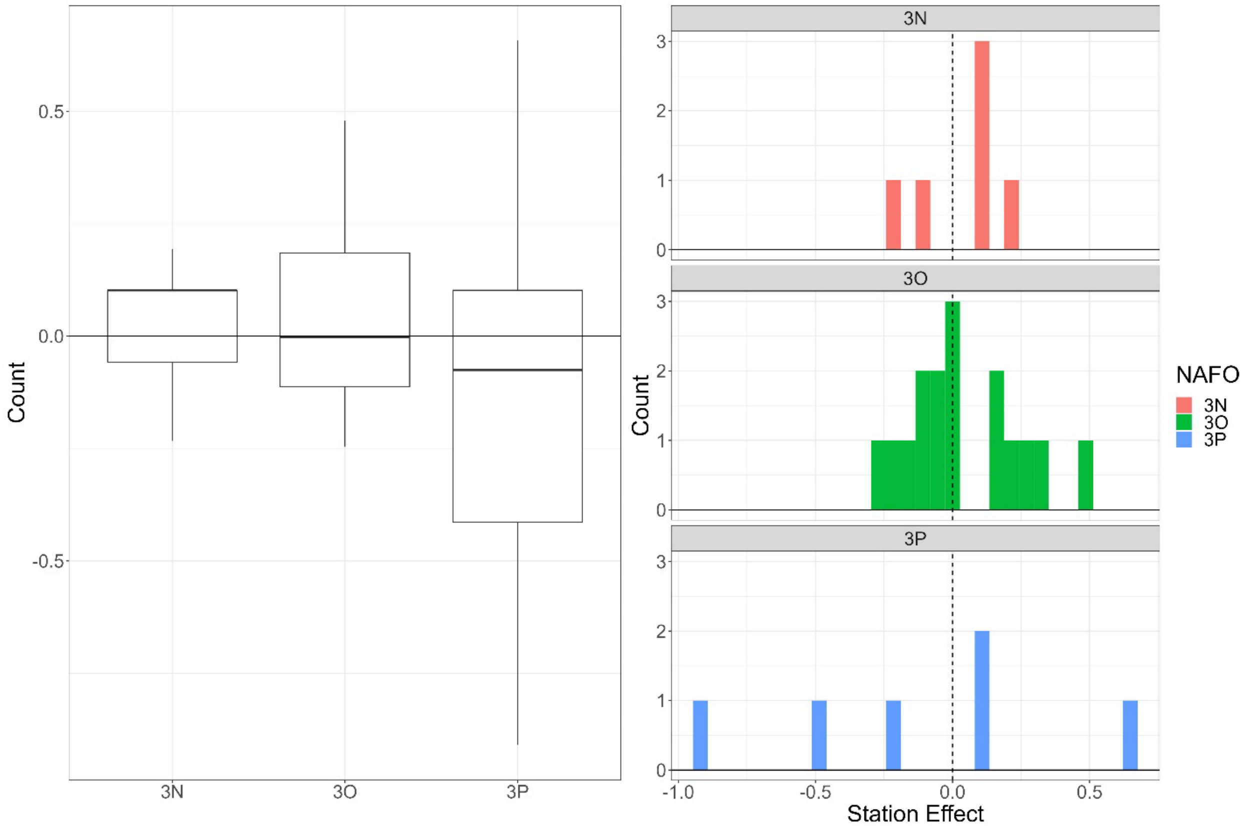


Figure A1- 31. Boxplot (left) and histogram (right) of station effect by NAFO Division for best model selected for White Hake, conversion factor analysis between the CCGS Teleost and CCGS John Cabot in spring NAFO Divisions 3NOPs.

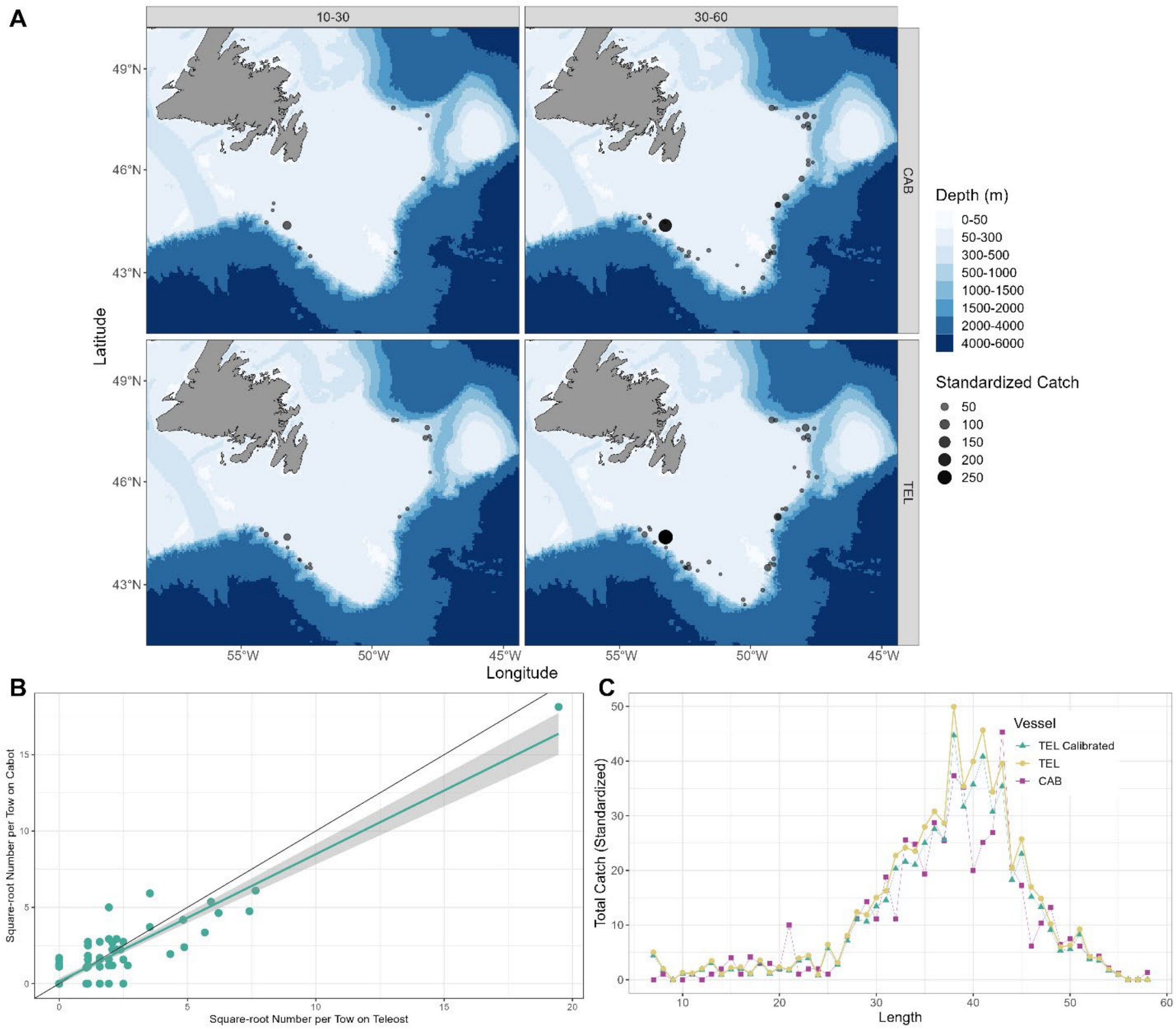


Figure A1- 32. Results for length-disaggregated comparative fishing analyses for Witch Flounder between the CCGS Teleost ("TEL") and CCGS John Cabot ("CAB") for spring NAFO Divisions 3LNO. (A) map of catches by length group (length in cm specified in top panel) by the CCGS John Cabot (top) and the CCGS Teleost (bottom) in comparative fishing sets, where circle size is proportional catch weight (B) Biplot of the square-root of CCGS John Cabot catch numbers against the square-root of CCGS Teleost catch numbers. (C) Total length frequencies for catches made by the CCGS Teleost (yellow), by the CCGS John Cabot (pink), and CCGS Teleost catches with the conversion factor applied (green).

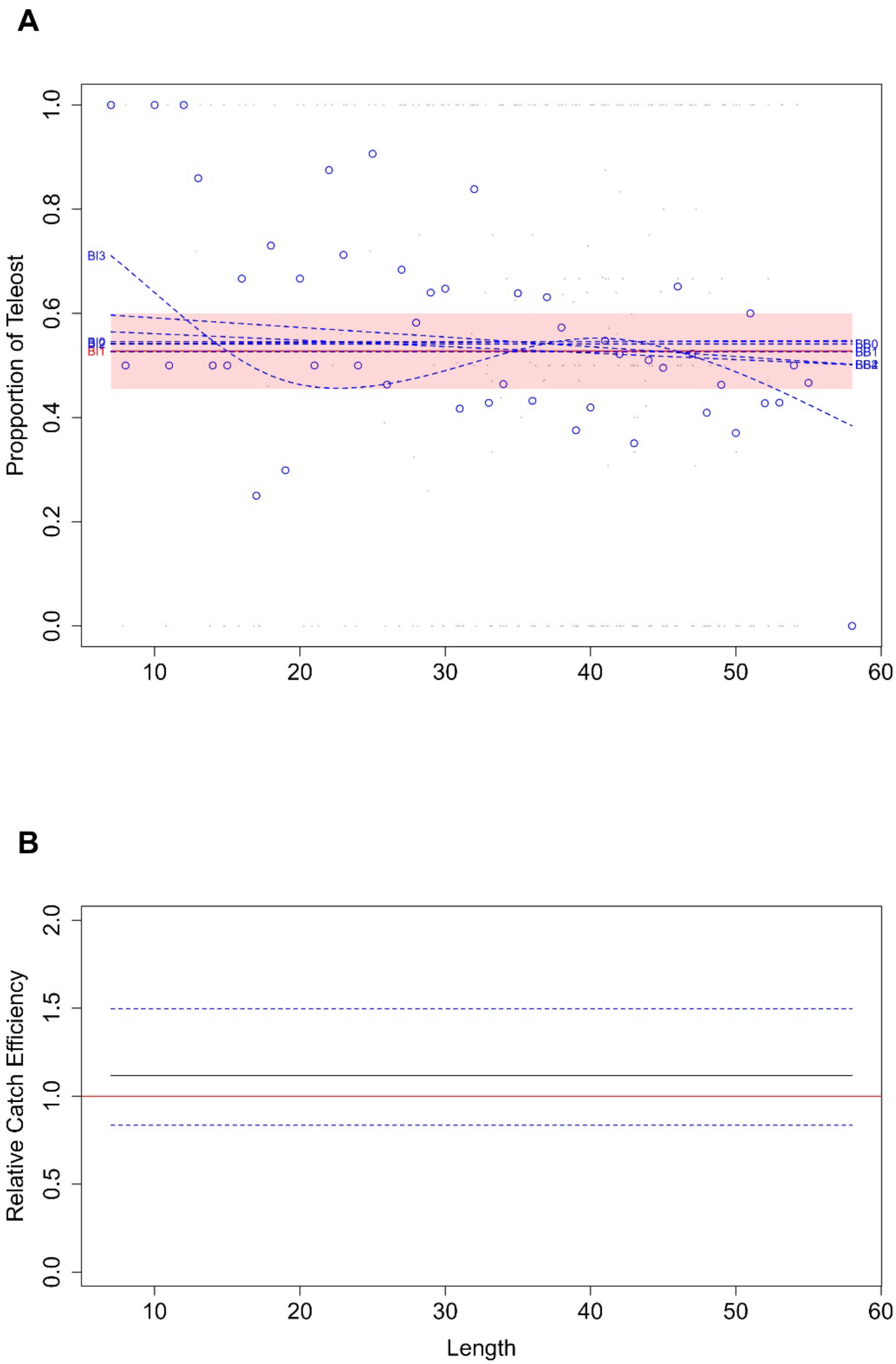


Figure A1- 33. Witch Flounder conversion factor between the CCGS Teleost and CCGS John Cabot for spring NAFO Divisions 3LNO. (A) Estimated length-specific catch proportion functions, $logit(p_{Ai}(l))$, for each converged model, with the selected model plotted using a red line along with its approximate 95% confidence intervals (CI; shaded area), as well as the length class-specific mean empirical proportion of total catch in a pair made by the CCGS Teleost (blue dots). (B) Estimated relative catch efficiency (conversion factor) function from the best model (black line) with 95% CI (dashed blue lines). The horizontal red line indicates equivalent efficiency between vessels.

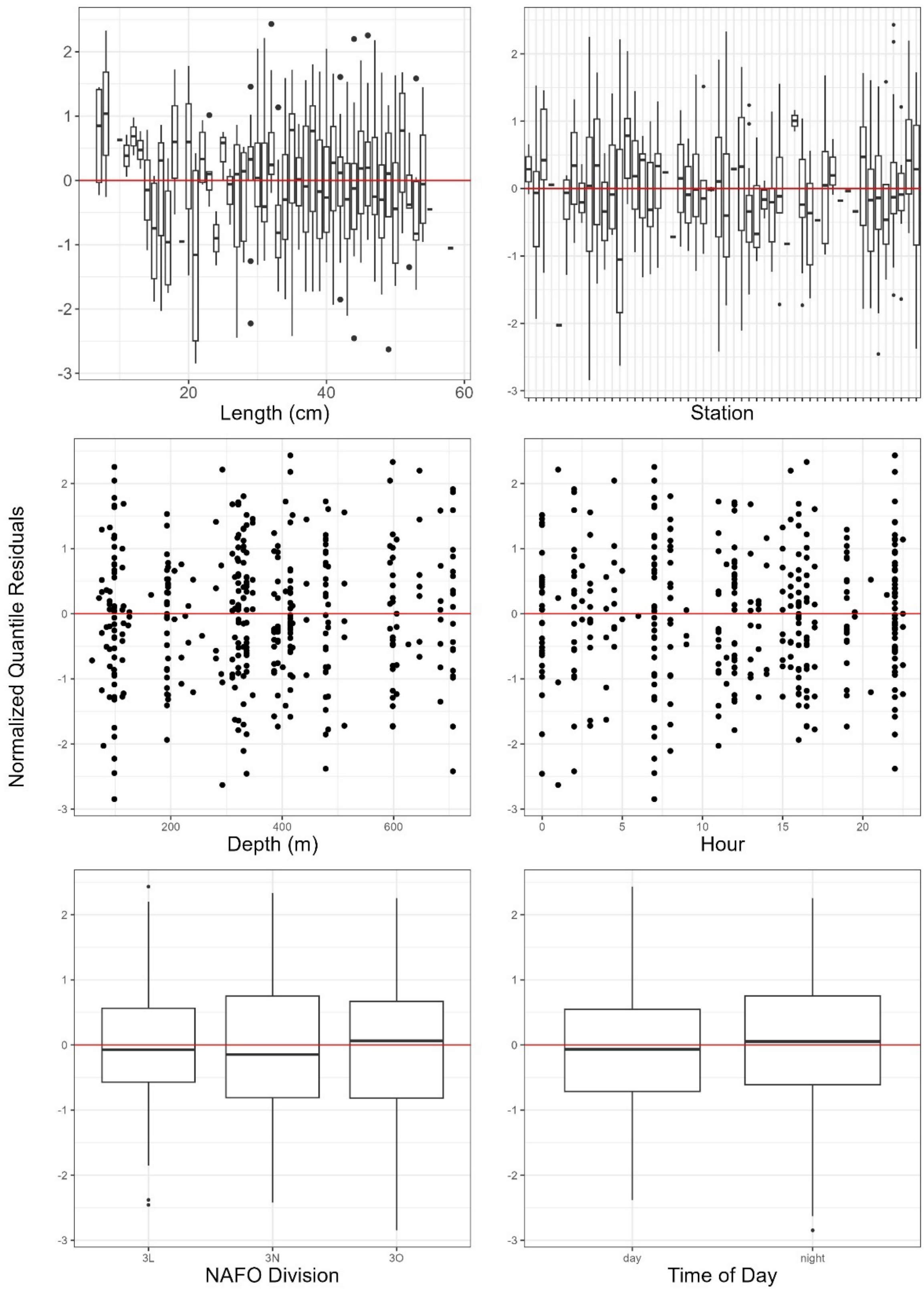


Figure A1- 34. Normalized quantile residuals as a function of length, station, depth, hour, NAFO Division, and diel period for Witch Flounder, best model selected for length-disaggregated conversion factor analysis for the CCGS Teleost and CCGS John Cabot for spring NAFO Divisions 3LNO.

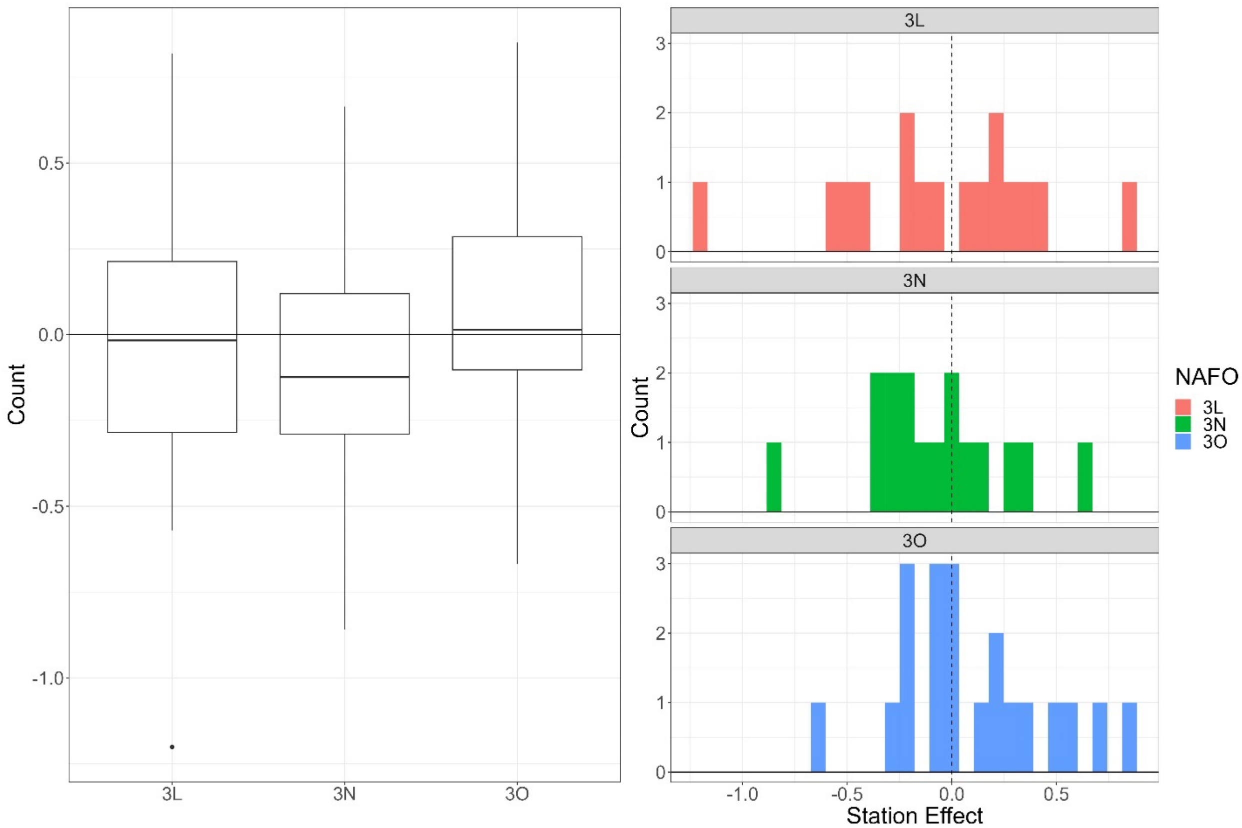


Figure A1- 35. Boxplot (left) and histogram (right) of station effect by NAFO Division for best model selected for Witch Flounder, conversion factor analysis between the CCGS Teleost and CCGS John Cabot in spring NAFO Divisions 3LNO.

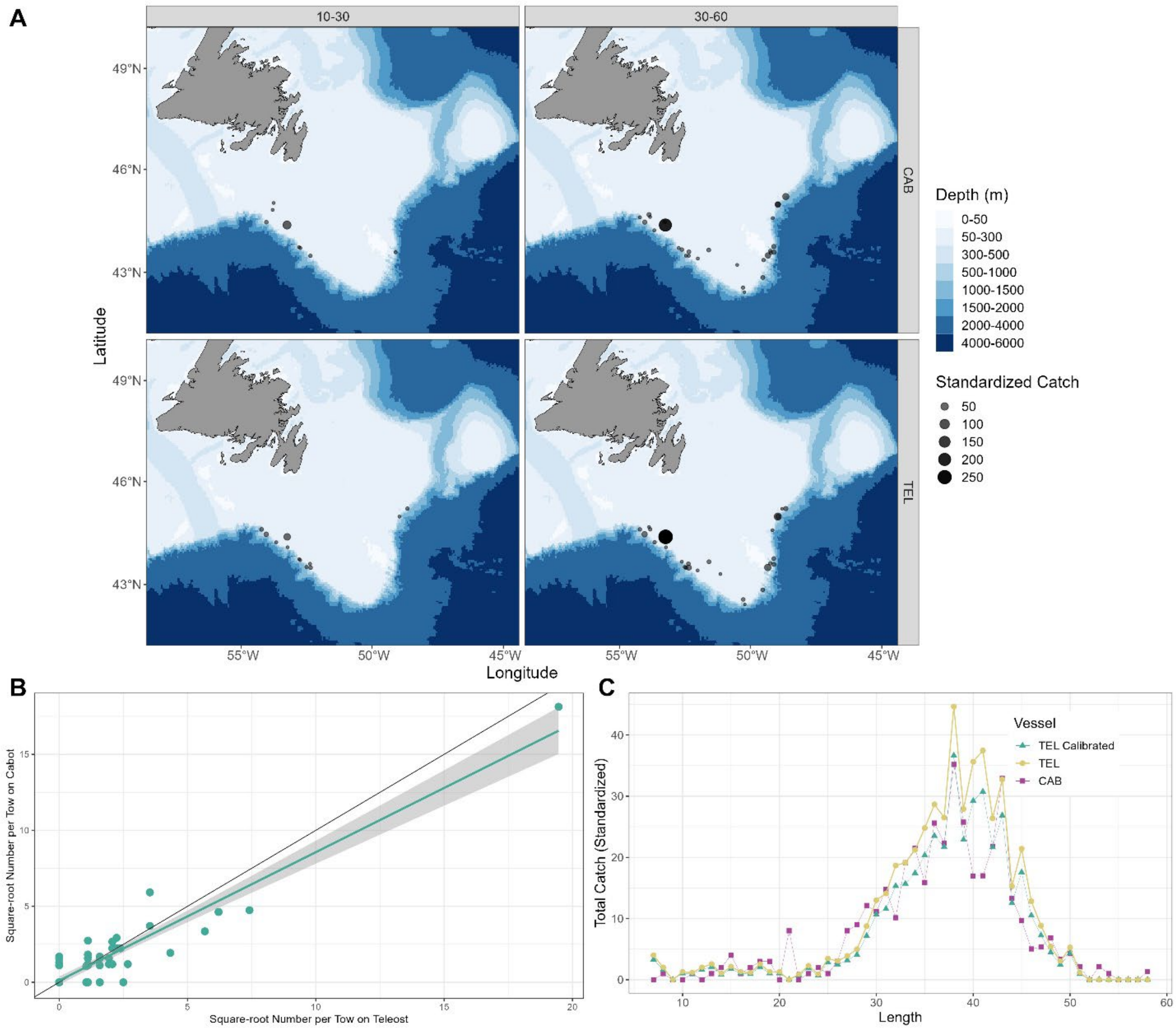


Figure A1- 36. Results for length-disaggregated comparative fishing analyses for Witch Flounder between the CCGS Teleost ("TEL") and CCGS John Cabot ("CAB") for spring NAFO Divisions 3NO. (A) map of catches by length group (length in cm specified in top panel) by the CCGS John Cabot (top) and the CCGS Teleost (bottom) in comparative fishing sets, where circle size is proportional catch weight (B) Biplot of the square-root of CCGS John Cabot catch numbers against the square-root of CCGS Teleost catch numbers. (C) Total length frequencies for catches made by the CCGS Teleost (yellow), by the CCGS John Cabot (pink), and CCGS Teleost catches with the conversion factor applied (green).

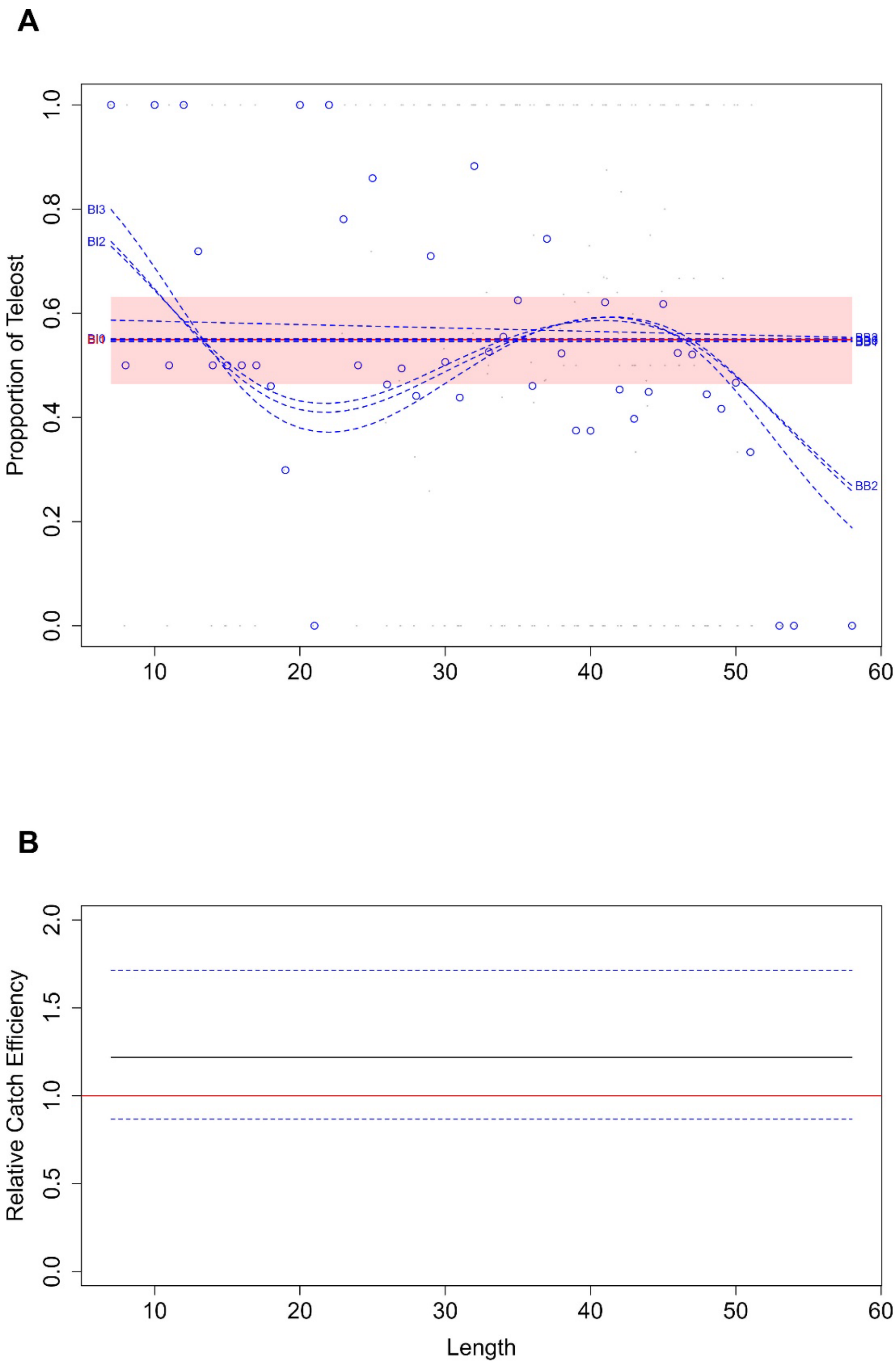


Figure A1- 37. Witch Flounder conversion factor between the CCGS Teleost and CCGS John Cabot for spring NAFO Divisions 3NO. (A) Estimated length-specific catch proportion functions, $logit(p_{Ai}(l))$, for each converged model, with the selected model plotted using a red line along with its approximate 95% confidence intervals (CI; shaded area), as well as the length class-specific mean empirical proportion of total catch in a pair made by the CCGS Teleost (blue dots). (B) Estimated relative catch efficiency (conversion factor) function from the best model (black line) with 95% CI (dashed blue lines). The horizontal red line indicates equivalent efficiency between vessels.

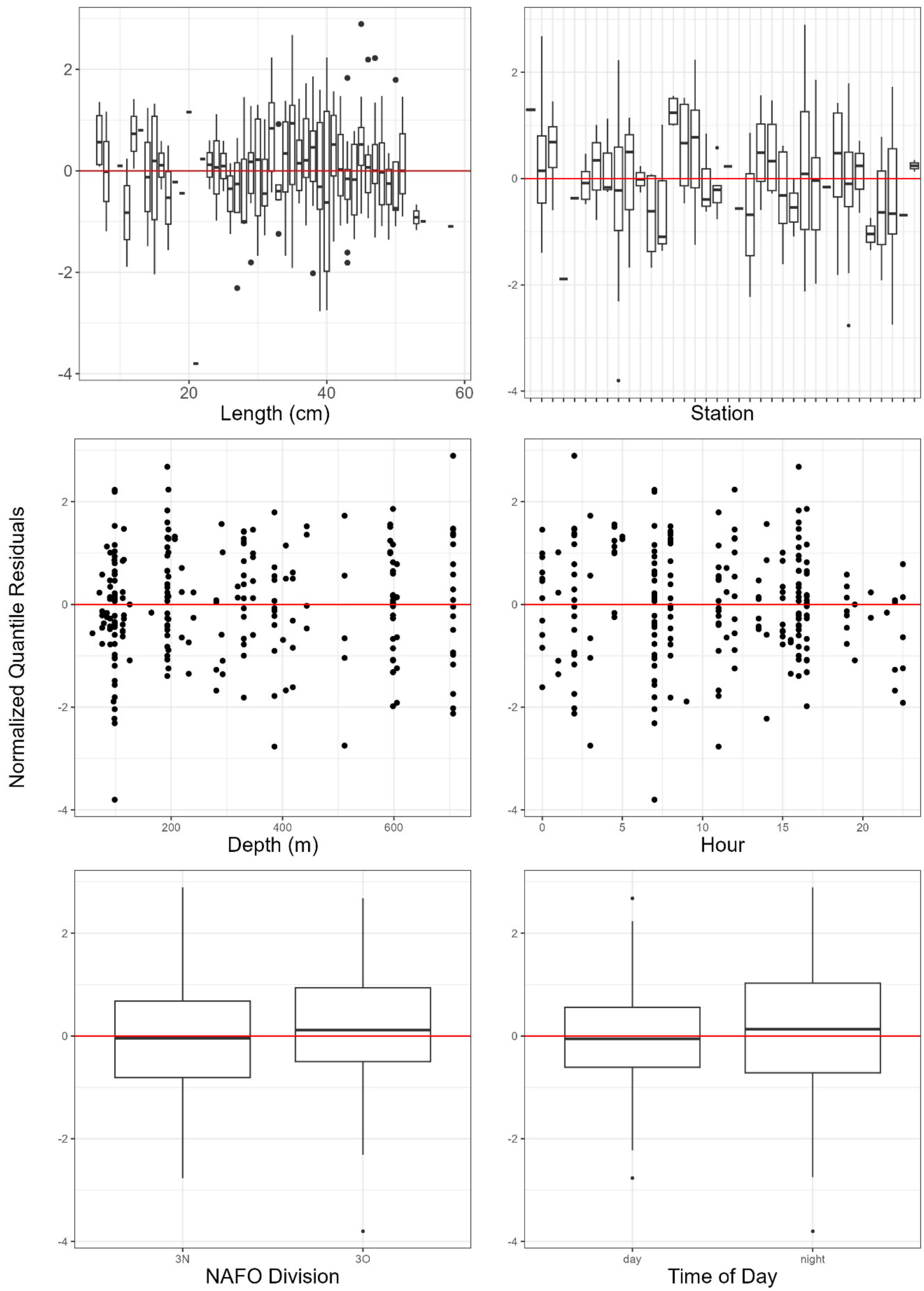


Figure A1- 38. Normalized quantile residuals as a function of length, station, depth, hour, NAFO Division, and diel period for Witch Flounder, best model selected for length-disaggregated conversion factor analysis for the CCGS Teleost and CCGS John Cabot for spring NAFO Divisions 3NO.

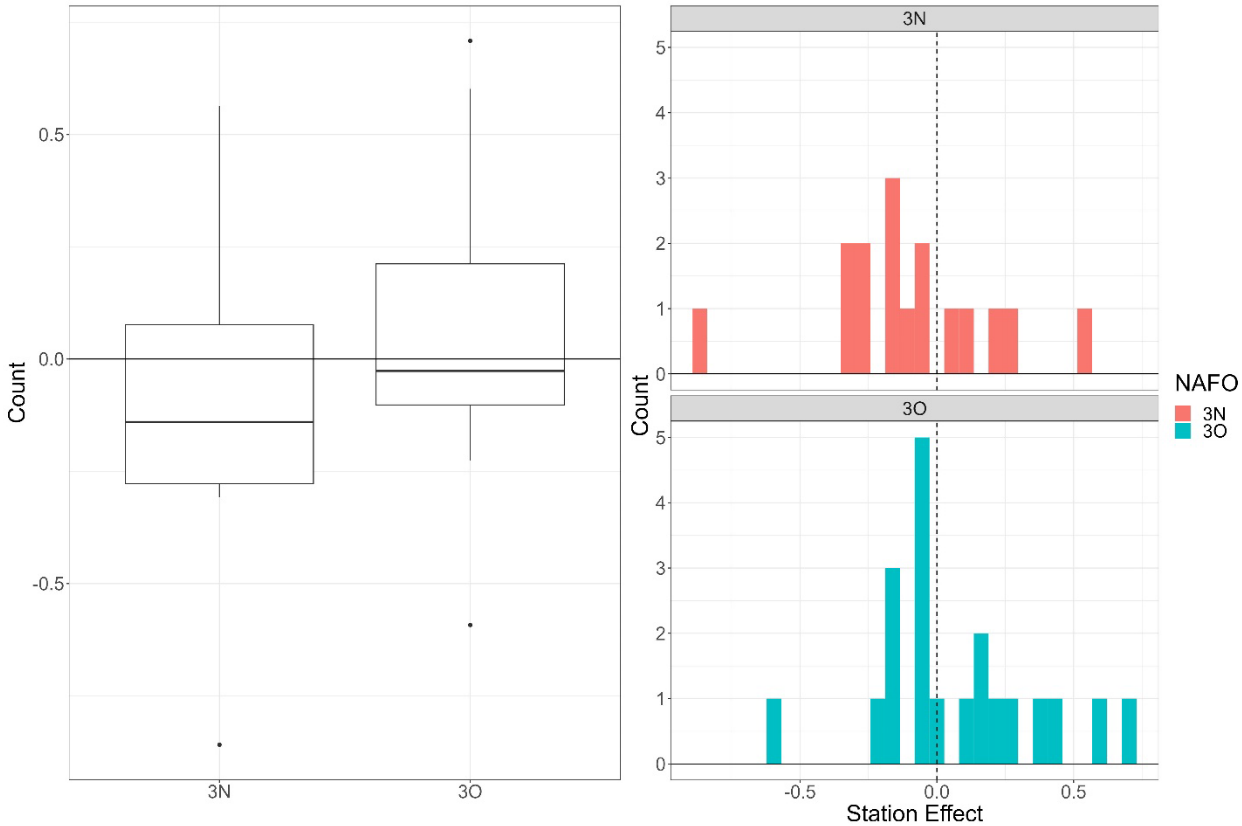


Figure A1- 39. Boxplot (left) and histogram (right) of station effect by NAFO Division for best model selected for Witch Flounder, conversion factor analysis between the CCGS Teleost and CCGS John Cabot in spring NAFO Divisions 3NO.

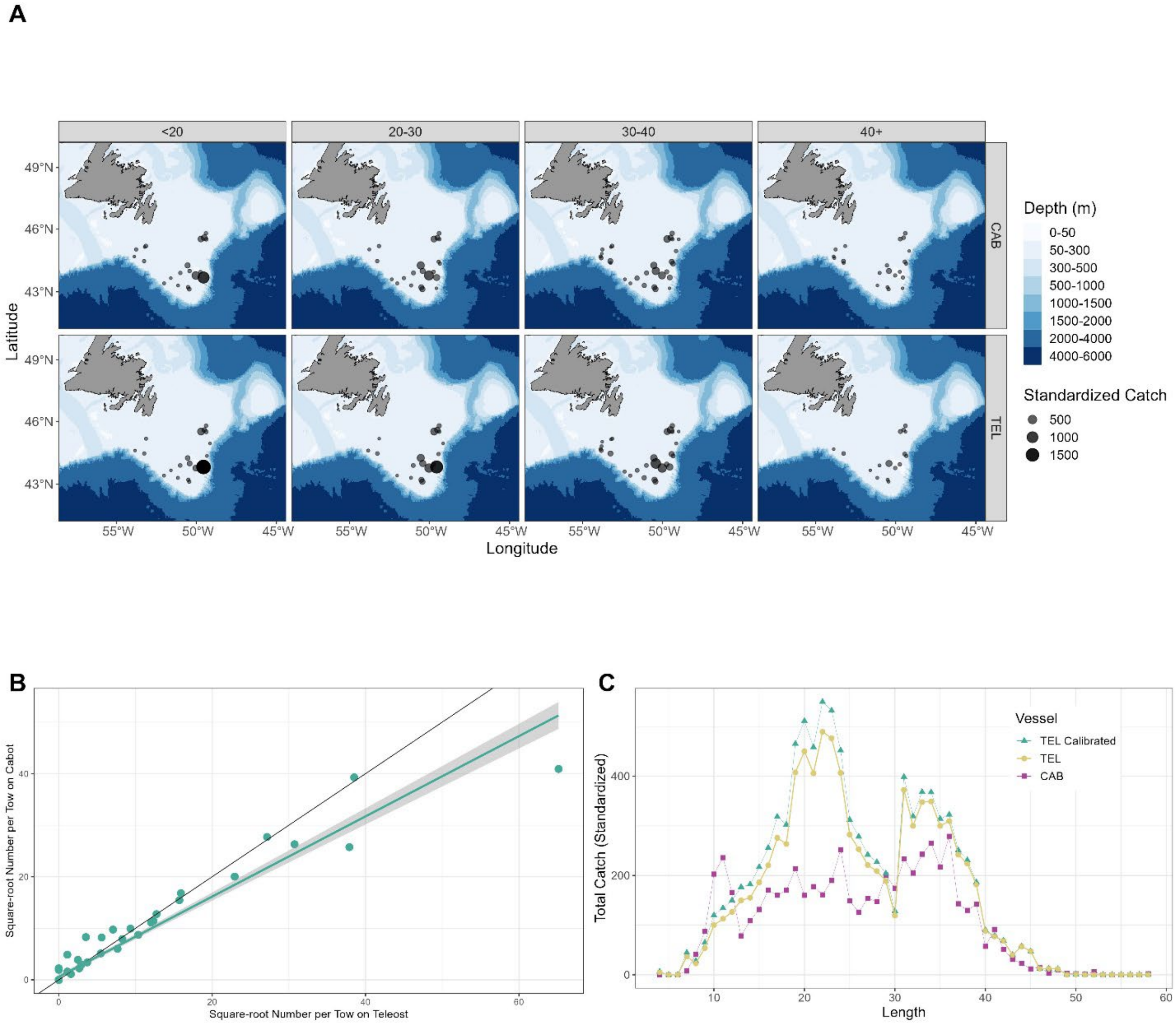


Figure A1- 40. Results for length-disaggregated comparative fishing analyses for Yellowtail Flounder between the CCGS Teleost ("TEL") and CCGS John Cabot ("CAB") for spring NAFO Divisions 3LNO. (A) map of catches by length group (length in cm specified in top panel) by the CCGS John Cabot (top) and the CCGS Teleost (bottom) in comparative fishing sets, where circle size is proportional catch weight (B) Biplot of the square-root of CCGS John Cabot catch numbers against the square-root of CCGS Teleost catch numbers. (C) Total length frequencies for catches made by the CCGS Teleost (yellow), by the CCGS John Cabot (pink), and CCGS Teleost catches with the conversion factor applied (green).

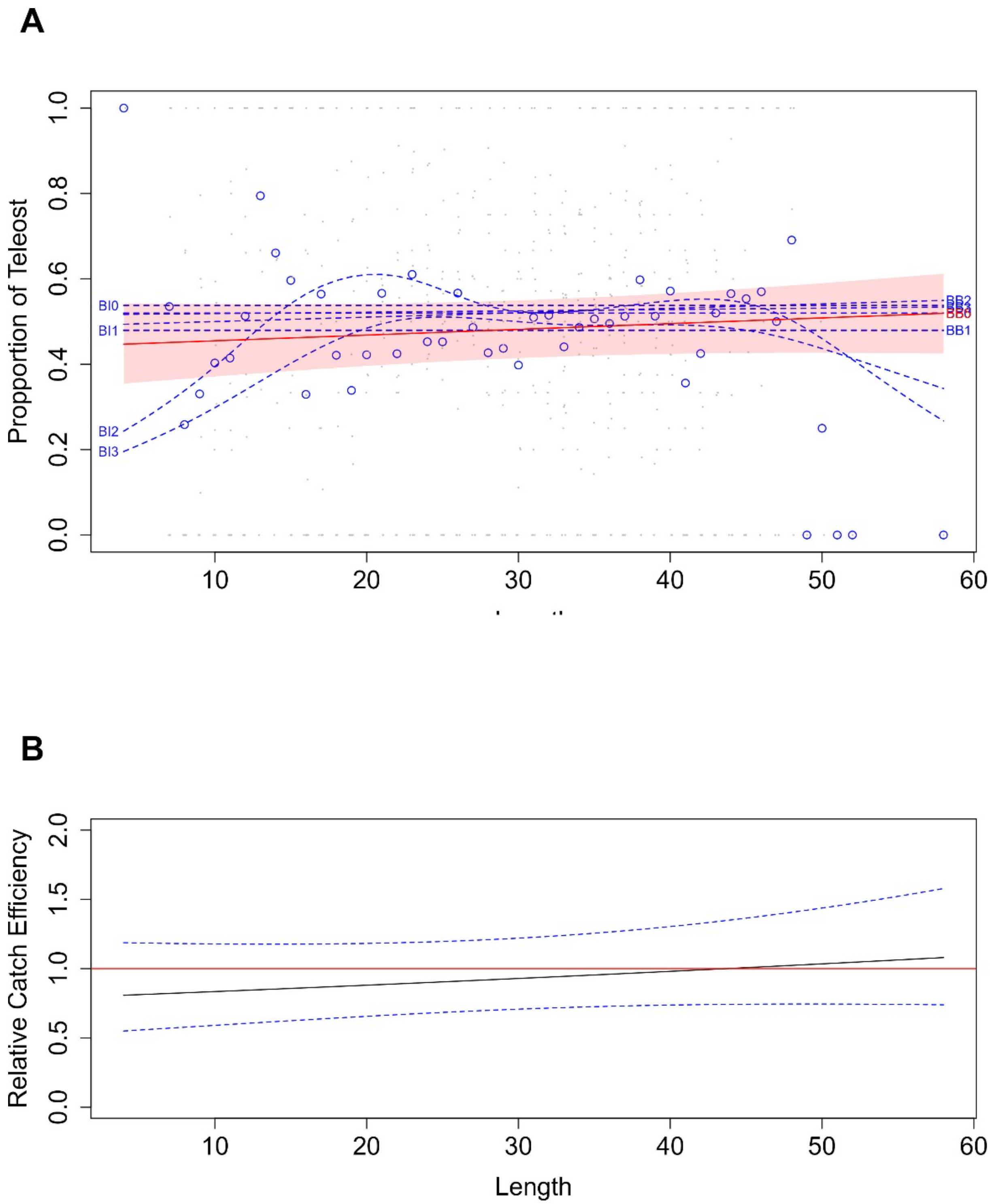


Figure A1- 41. Yellowtail Flounder conversion factor between the CCGS Teleost and CCGS John Cabot for spring NAFO Divisions 3LNO. (A) Estimated length-specific catch proportion functions, $logit(p_{Ai}(l))$, for each converged model, with the selected model plotted using a red line along with its approximate 95% confidence intervals (CI; shaded area), as well as the length class-specific mean empirical proportion of total catch in a pair made by the CCGS Teleost (blue dots). (B) Estimated relative catch efficiency (conversion factor) function from the best model (black line) with 95% CI (dashed blue lines). The horizontal red line indicates equivalent efficiency between vessels.

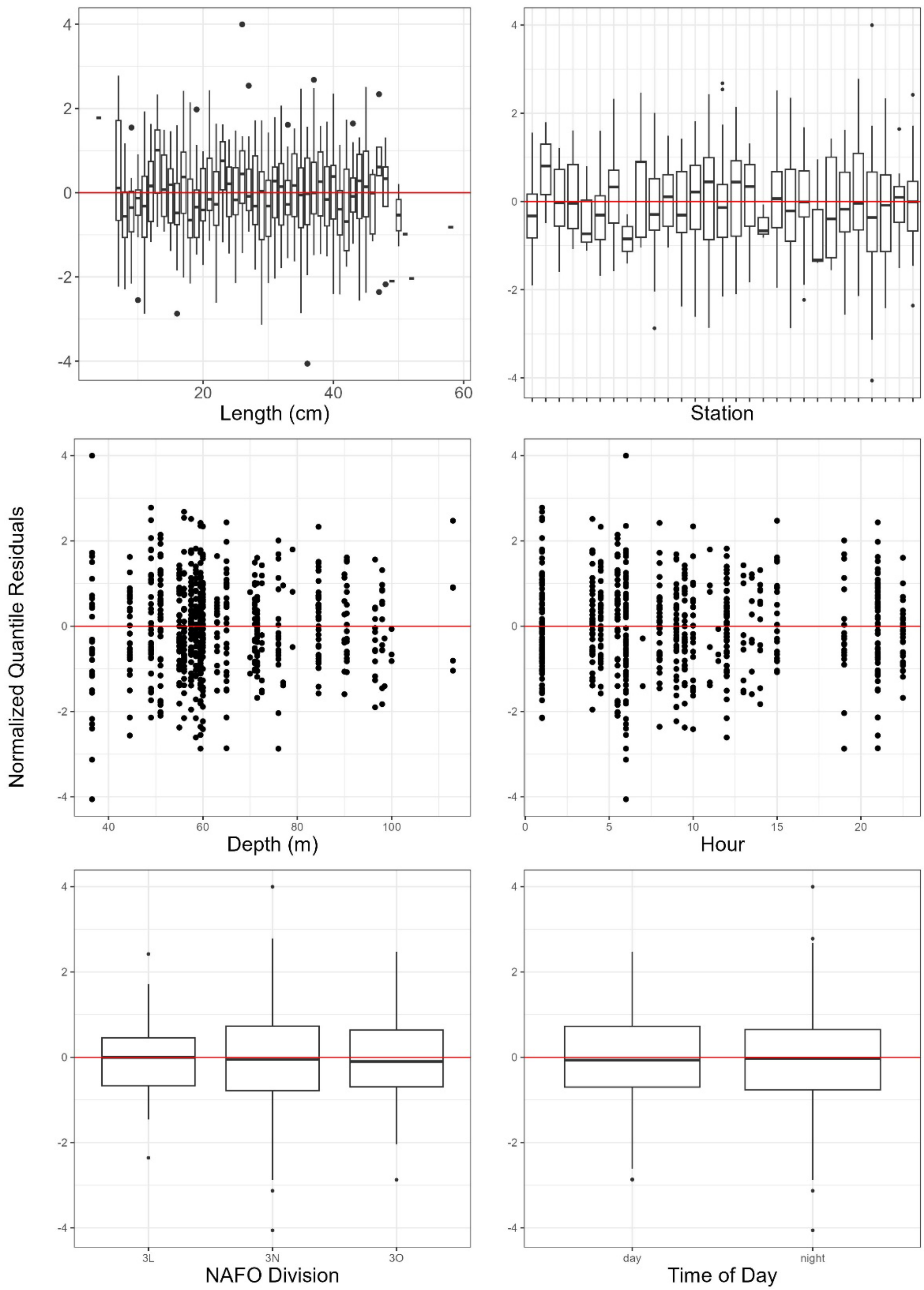


Figure A1- 42. Normalized quantile residuals as a function of length, station, depth, hour, NAFO Division, and diel period for Yellowtail Flounder, best model selected for length-disaggregated conversion factor analysis for the CCGS Teleost and CCGS John Cabot for spring NAFO Divisions 3LNO.

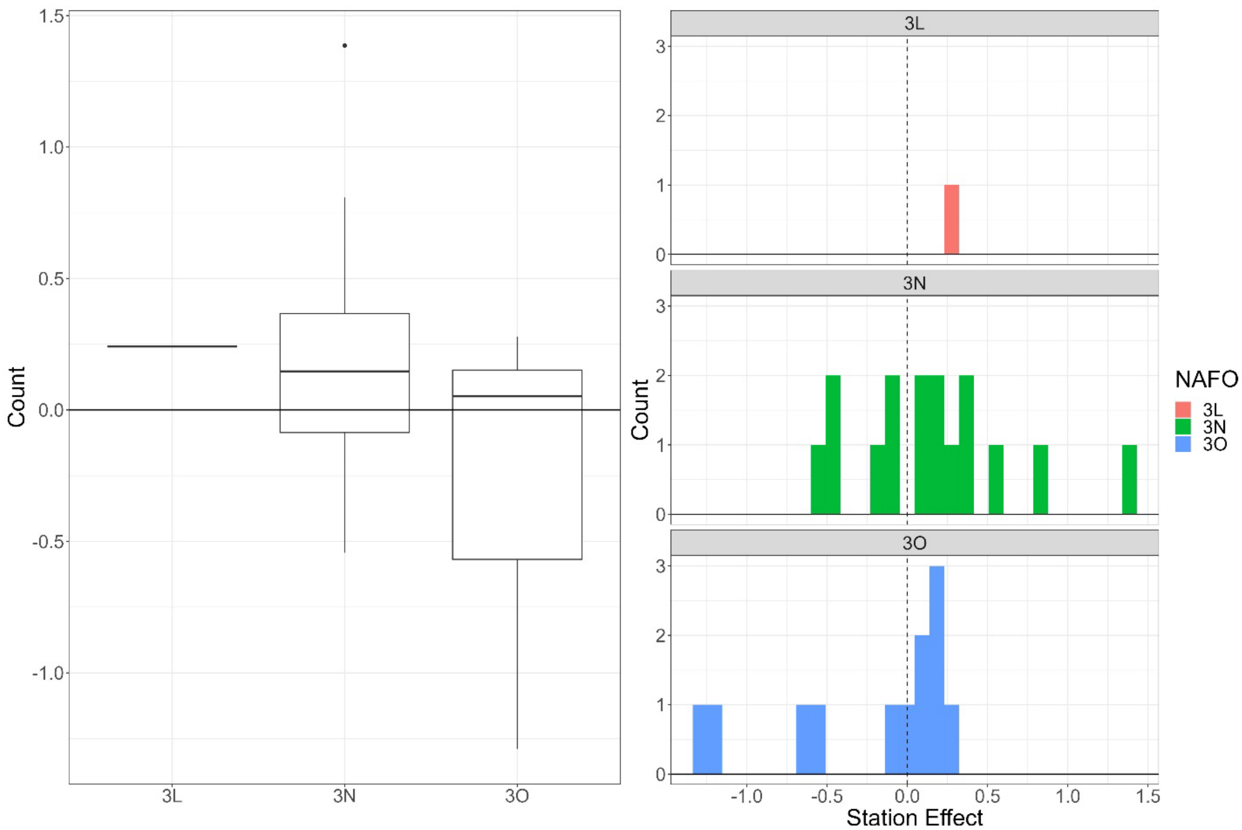


Figure A1- 43. Boxplot (left) and histogram (right) of station effect by NAFO Division for best model selected for Yellowtail Flounder, conversion factor analysis between the CCGS Teleost and CCGS John Cabot in spring NAFO Divisions 3LNO.

11. APPENDIX 2: SIZE-AGGREGATED CONVERSIONS

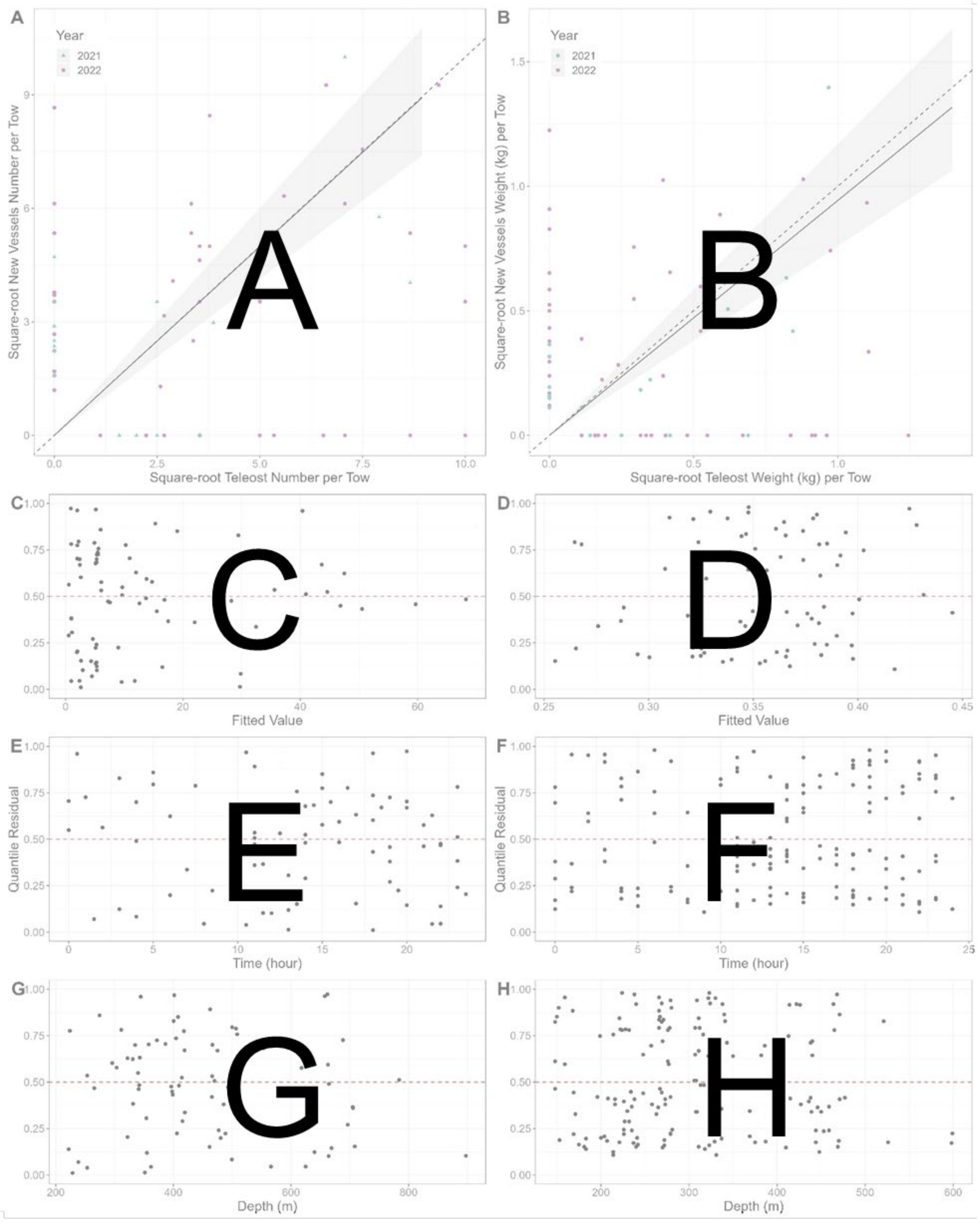


Figure A2- 1. An outline for the interpretation of the figures presenting the data and results for taxa where size-aggregated analyses were completed. Panel A is the biplot of the square-root of CCGS John Cabot catch numbers against the square-root of CCGS Teleost catch numbers, where the solid black line and shaded interval show the estimated conversion and approximate 95%CI from the best size-aggregated model. Panel B is the same as A except for catch weights. Below A and B are the quantile residuals from the analysis of catch numbers, and weights plotted as a function of the fitted values (panels C and D, respectively), time (panels E and F, respectively), and depth (panels G and H, respectively). Captions for the individual taxa figures only state the species and vessel pairing visualized in the figure.

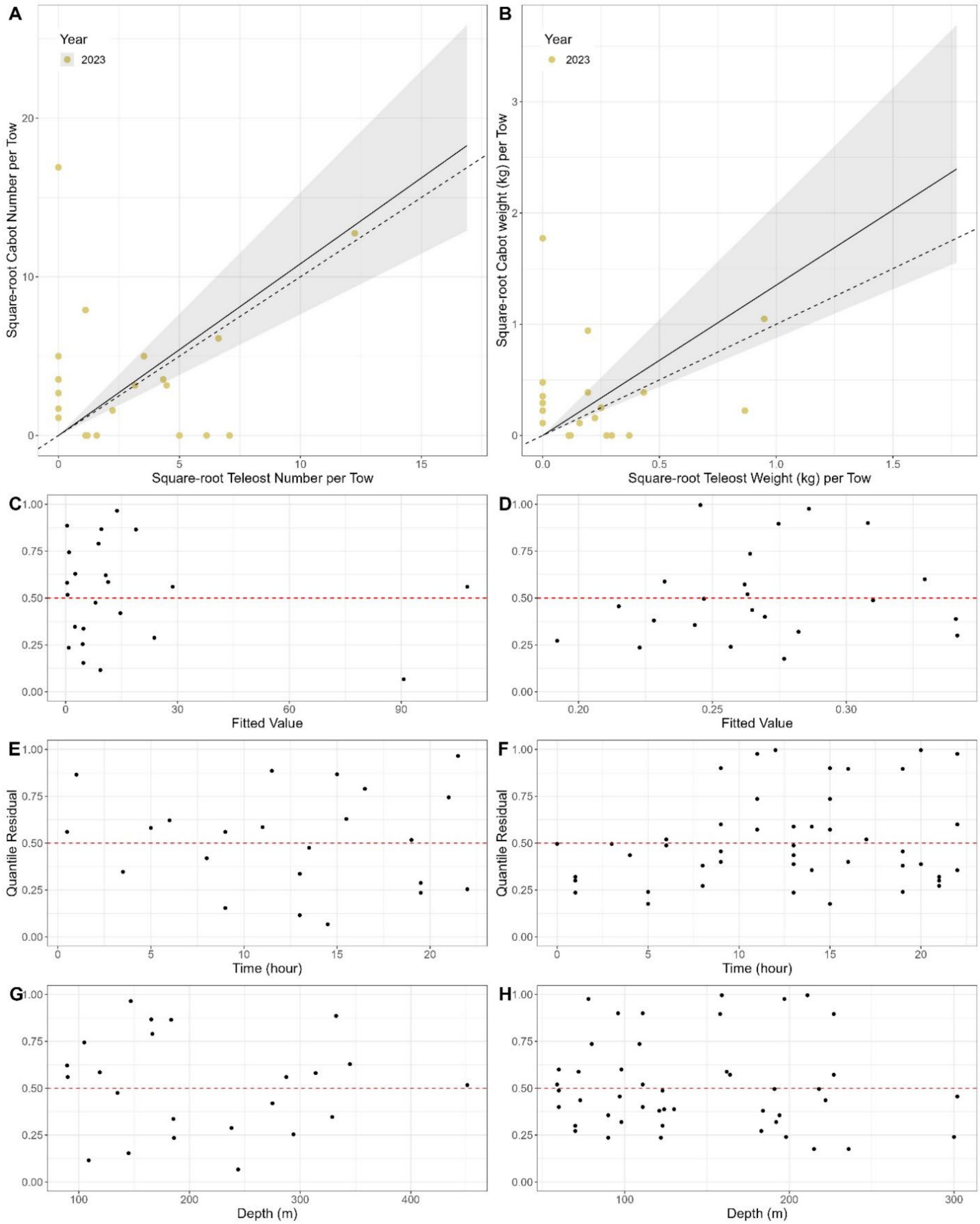


*Figure A2- 2. Results of size-aggregated analysis for the CCGS Teleost and CCGS John Cabot for catch of alligatorfishes and poachers (*Agonus *sp.,* Eumicrotremus *sp.), spring 3LNO.*

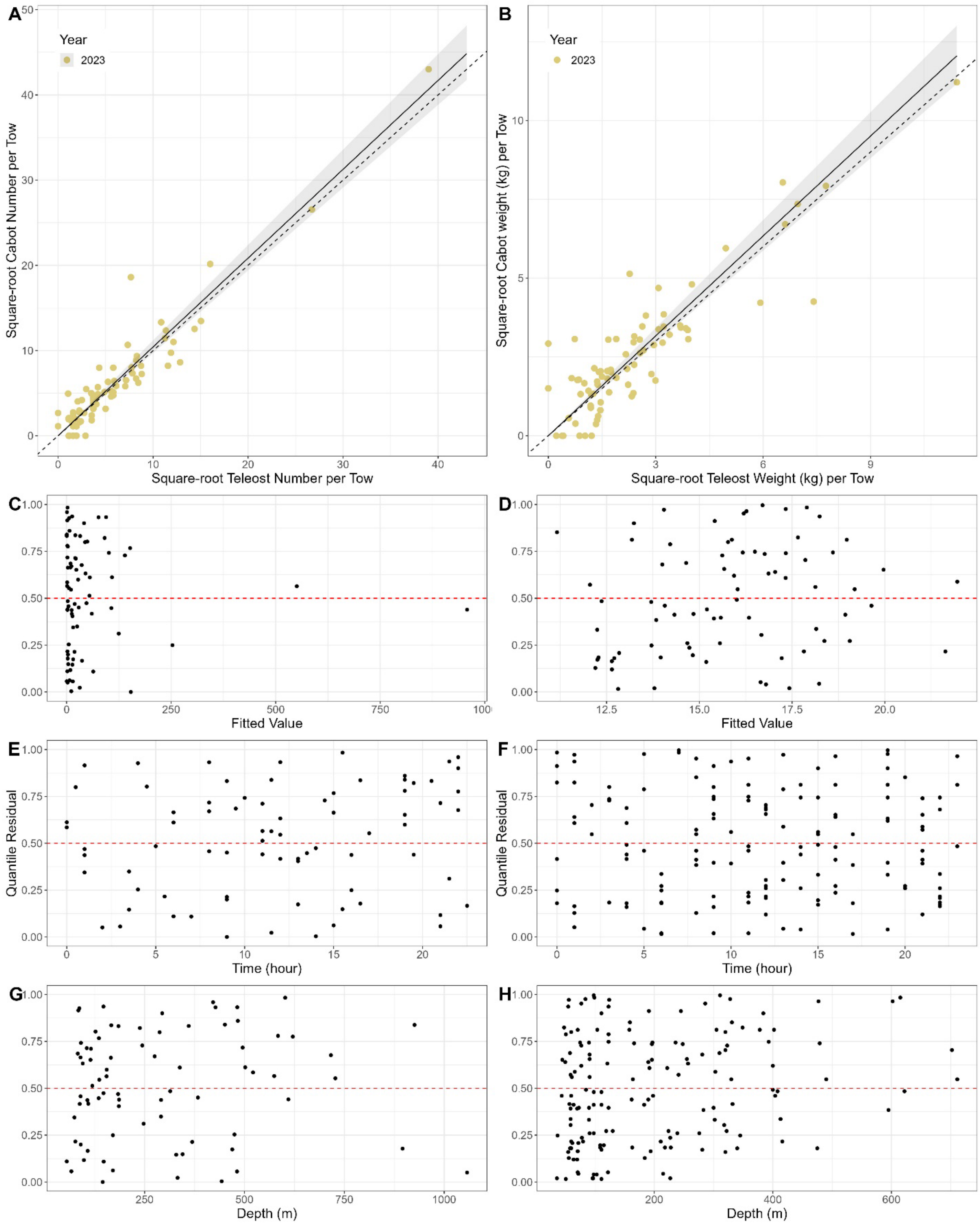


Figure A2- 3. Results of size-aggregated analysis for the CCGS Teleost and CCGS John Cabot for catch of American Plaice, spring 3LNO.

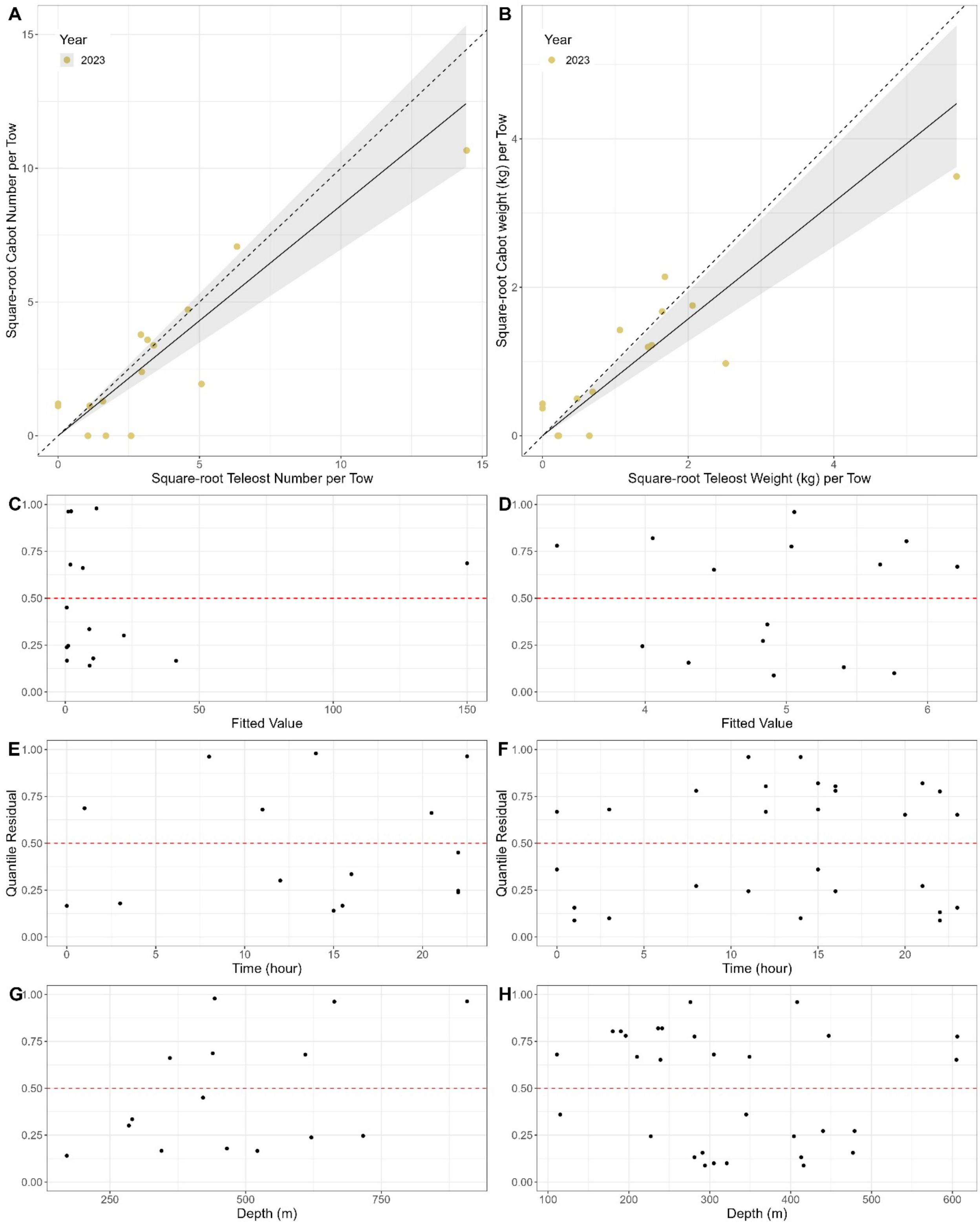


*Figure A2- 4. Results of size-aggregated analysis for the CCGS Teleost and CCGS John Cabot for catch of Atlantic Argentine (*Argentina silus*), spring 3LNO.*

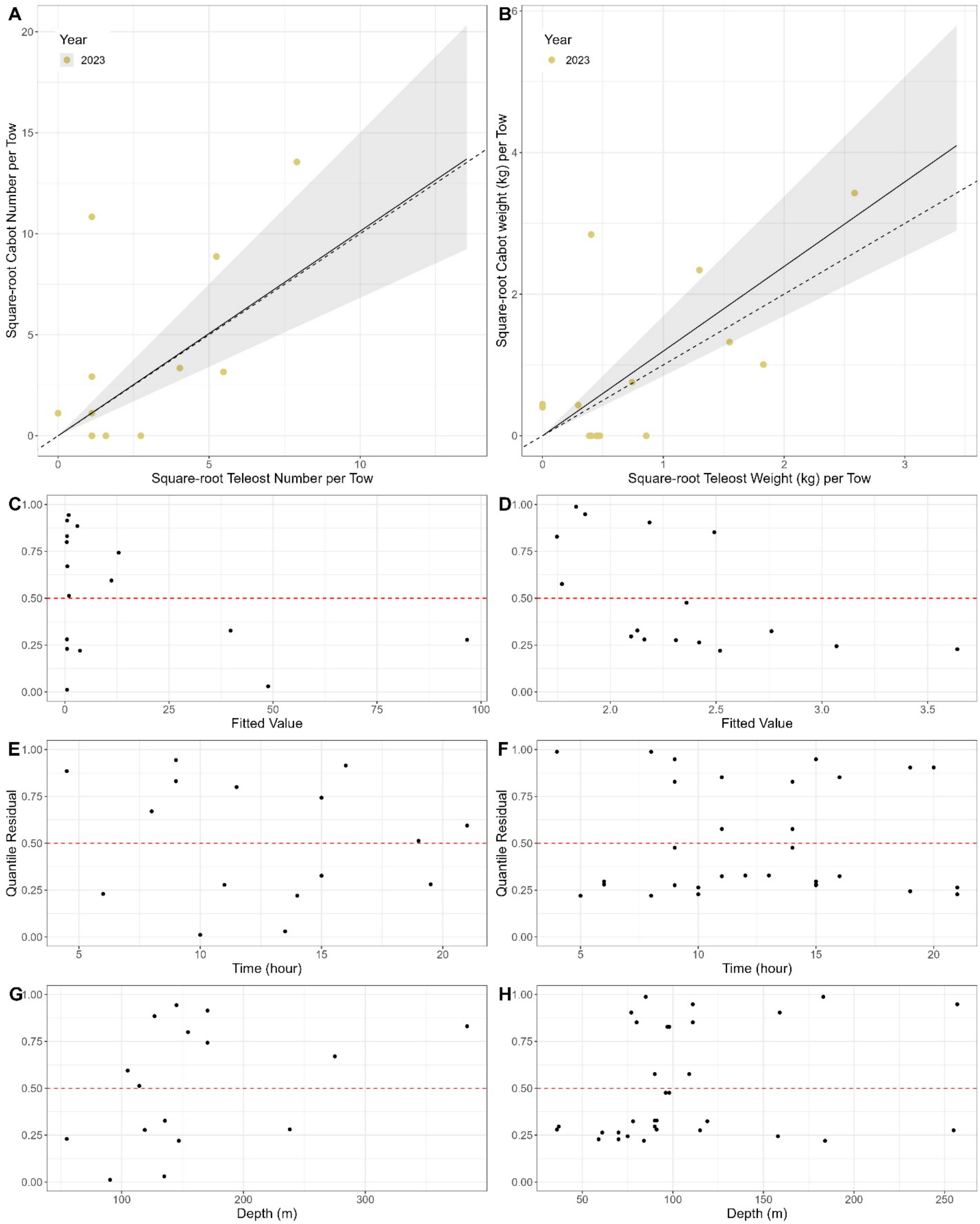


*Figure A2- 5. Results of size-aggregated analysis for the CCGS Teleost and CCGS John Cabot for catch of Atlantic Herring (*Clupea harengus*), spring 3LNO.*

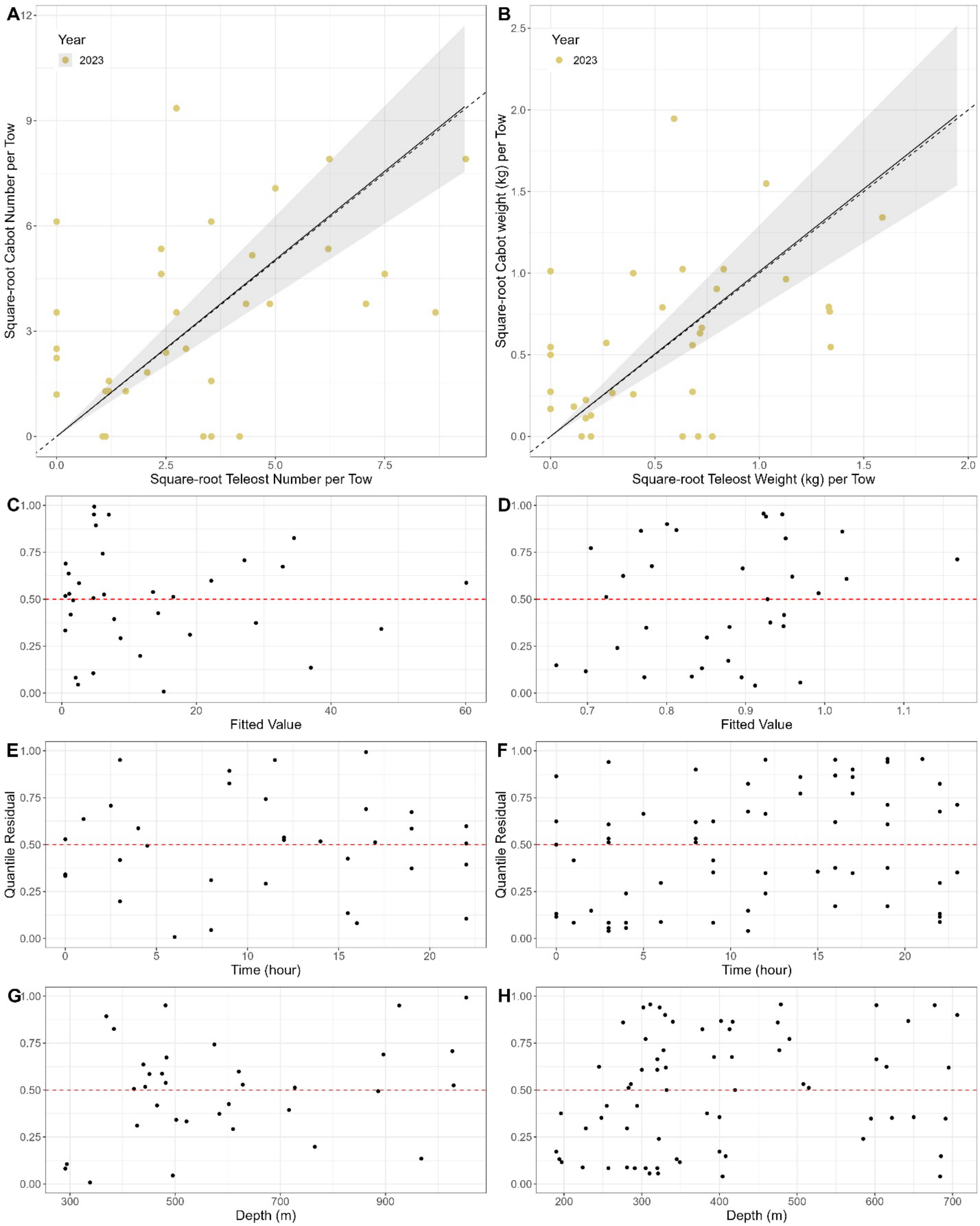


*Figure A2- 6. Results of size-aggregated analysis for the CCGS Teleost and CCGS John Cabot for catch of barracudina and lancetfish (*Paralepididae*), spring 3LNO.*

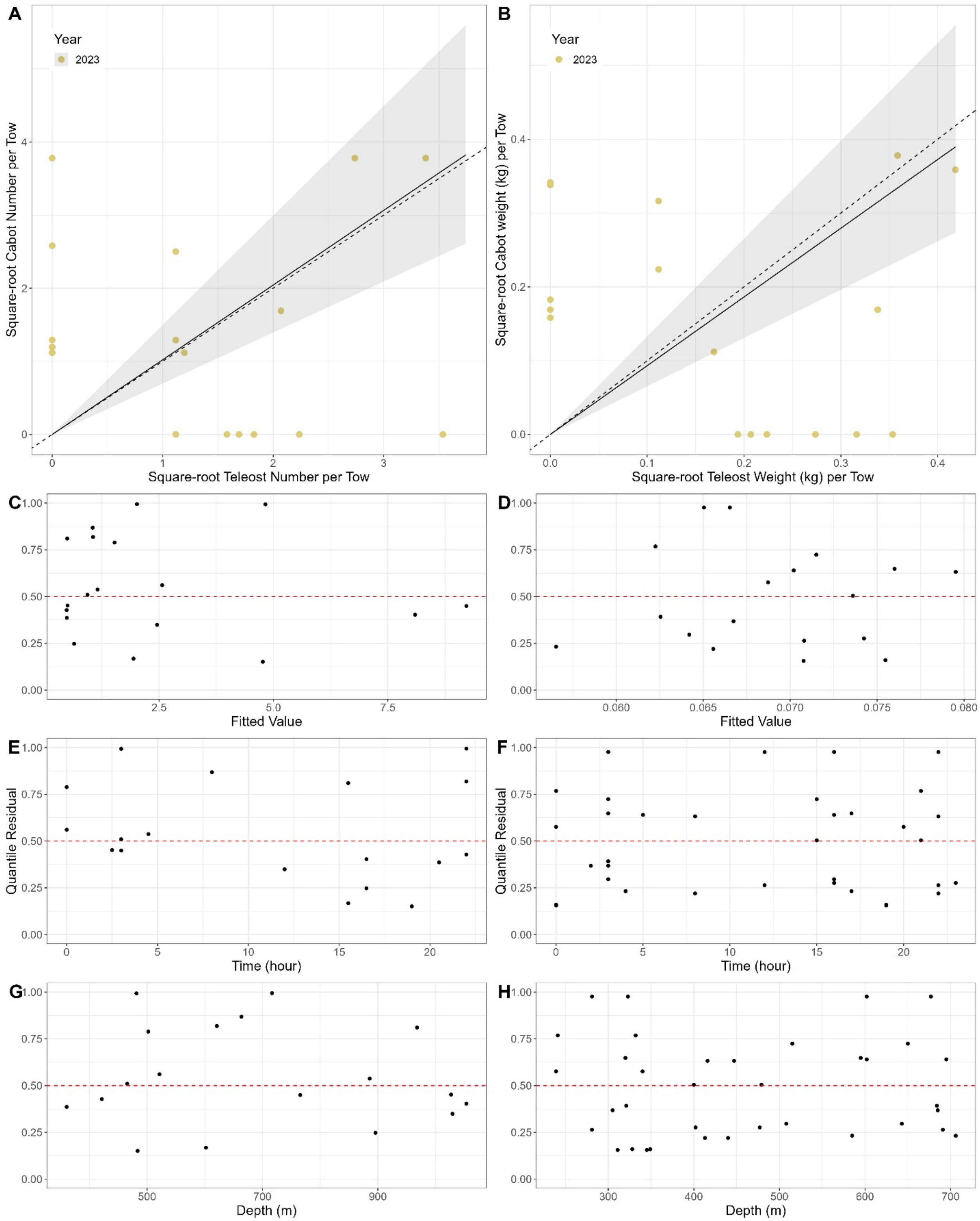


*Figure A2- 7. Results of size-aggregated analysis for the CCGS Teleost and CCGS John Cabot for catch of Boa Dragonfish (*Stomias boa boa*), spring 3LNO.*

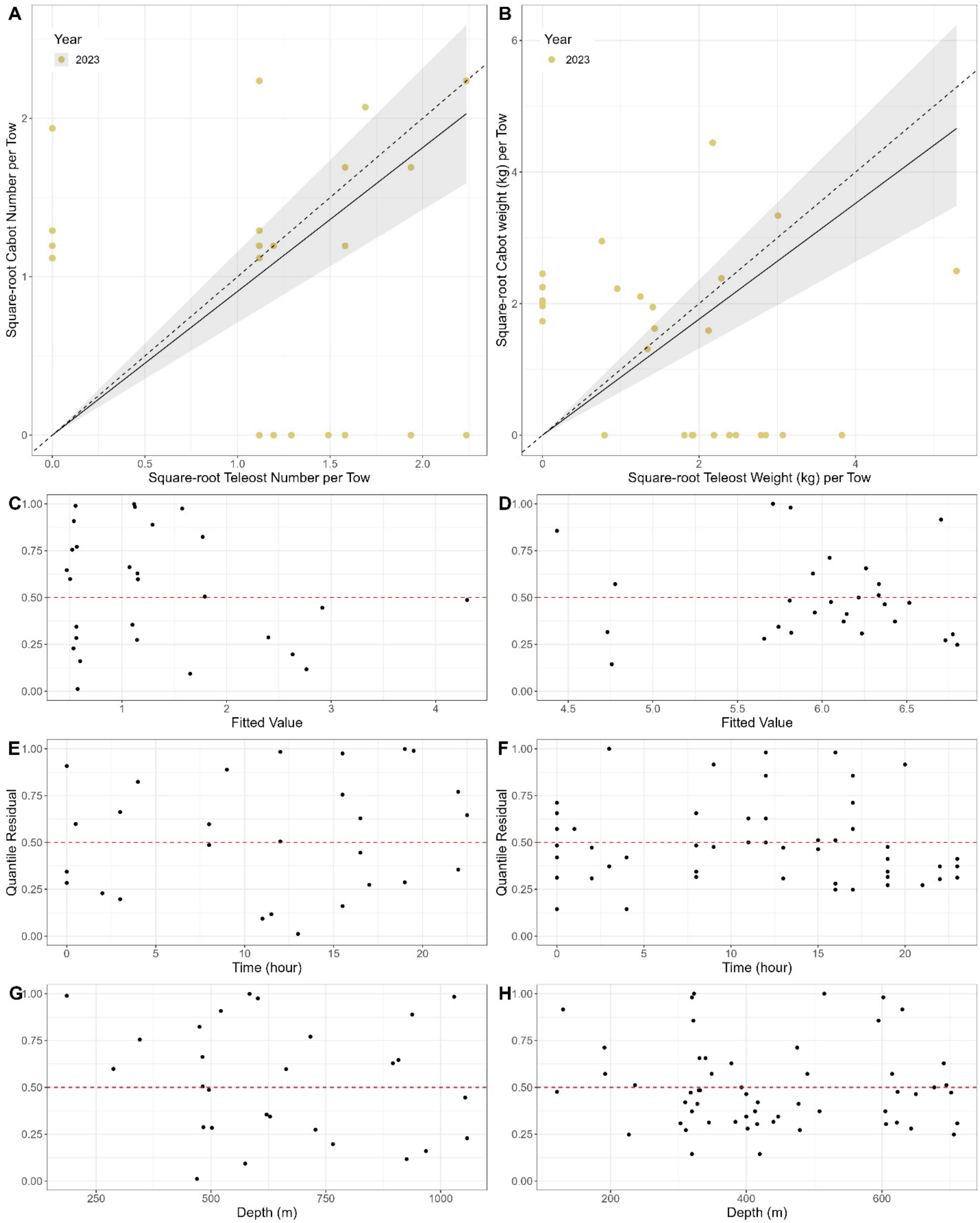


*Figure A2- 8. Results of size-aggregated analysis for the CCGS Teleost and CCGS John Cabot for catch of Broadhead (Northern) Wolffish (*Anarhichas denticulatus*), spring 3LNO.*

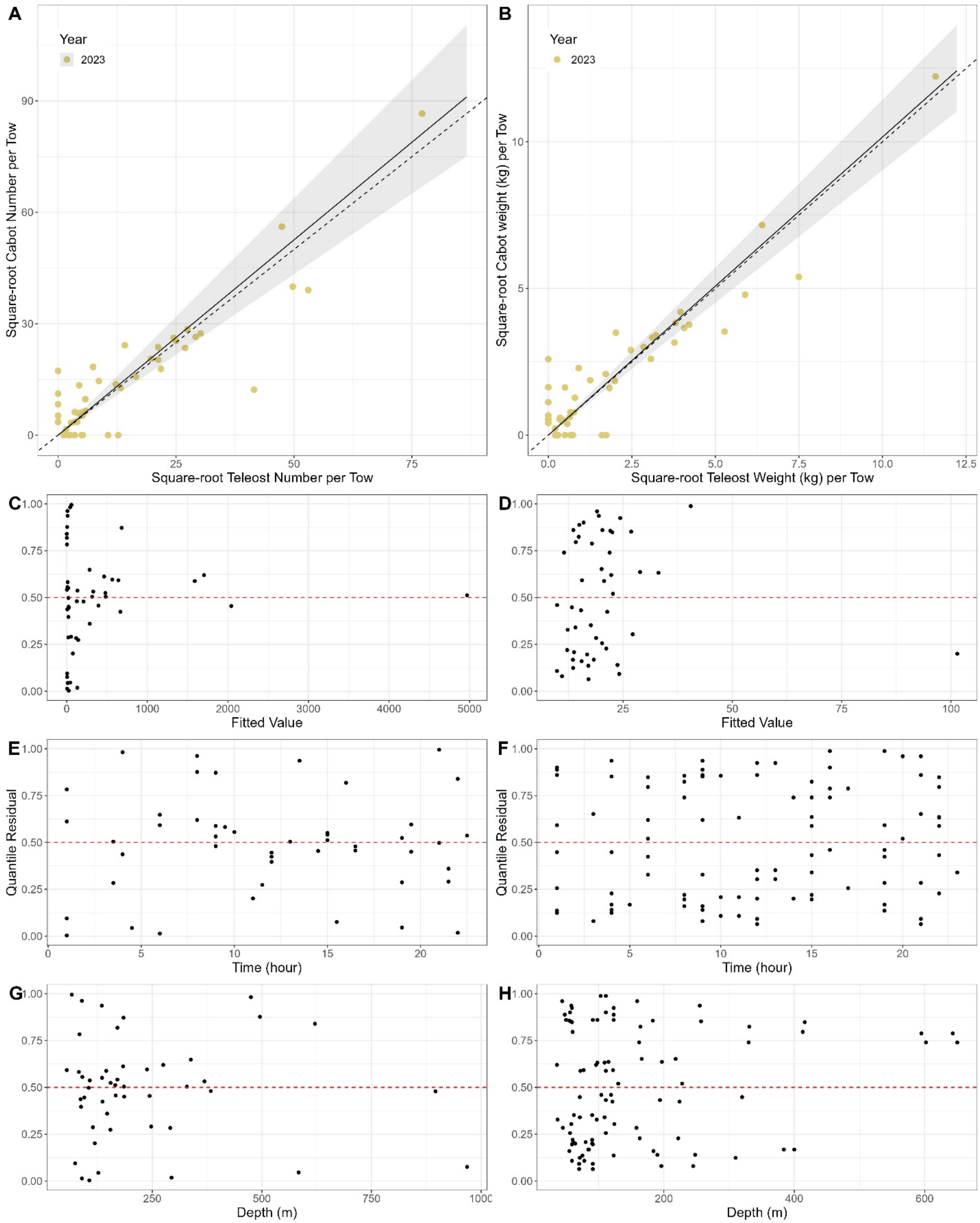


*Figure A2- 9. Results of size-aggregated analysis for the CCGS Teleost and CCGS John Cabot for catch of Capelin (*Mallotus villosus*), spring 3LNO.*

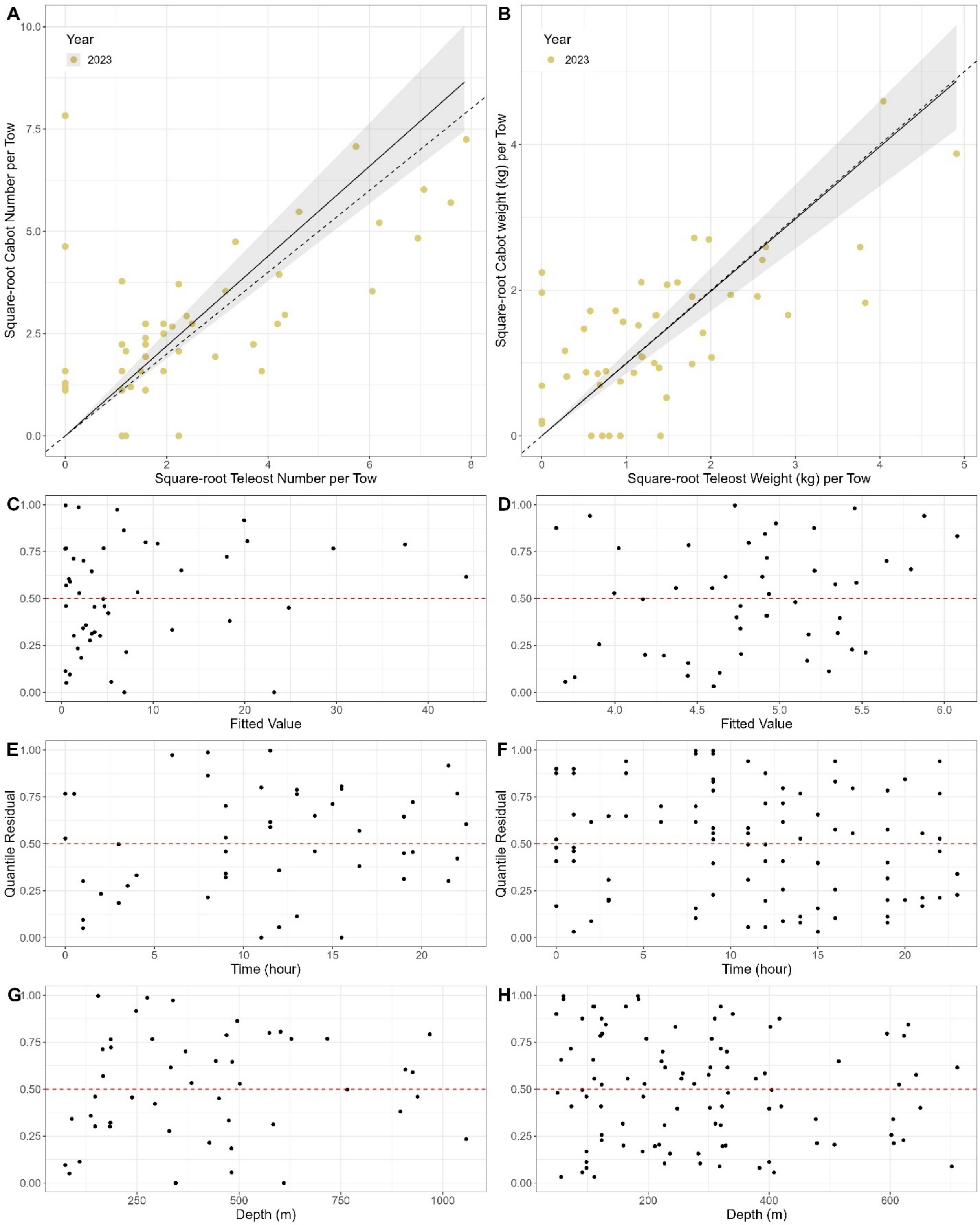


*Figure A2- 10. Results of size-aggregated analysis for the CCGS Teleost and CCGS John Cabot for catch of eelpouts (*Lycodes *sp.), spring 3LNO.*

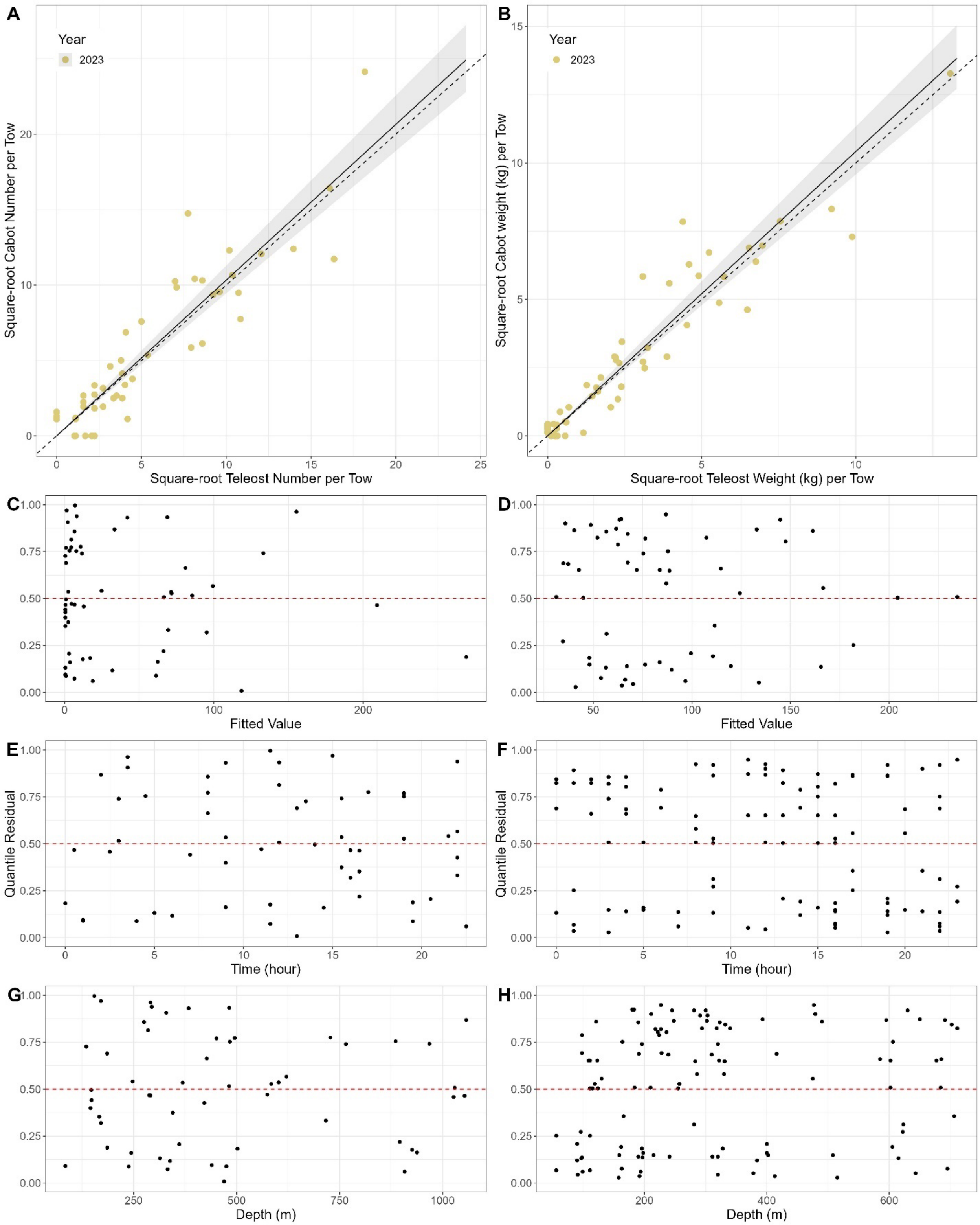


Figure A2- 11. Results of size-aggregated analysis for the CCGS Teleost and CCGS John Cabot for catch of Greenland Halibut, spring 3LNO.

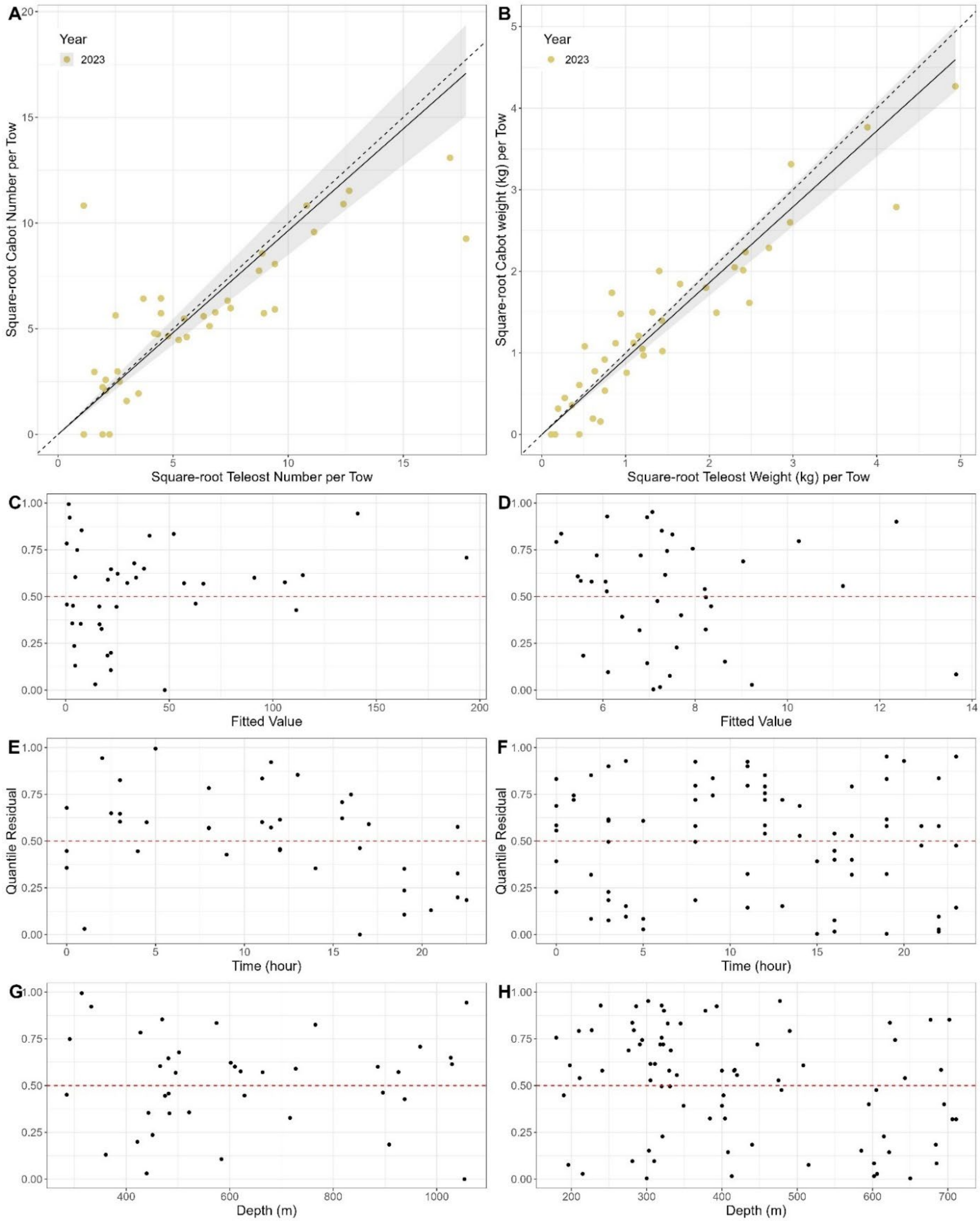


*Figure A2- 12. Results of size-aggregated analysis for the CCGS Teleost and CCGS John Cabot for catch of other grenadiers (*Nezumia *sp.,* Trachyrhynchus *sp.,* Coryphaenoides *sp.,* Coelorhynchus *sp.), spring 3LNO.*

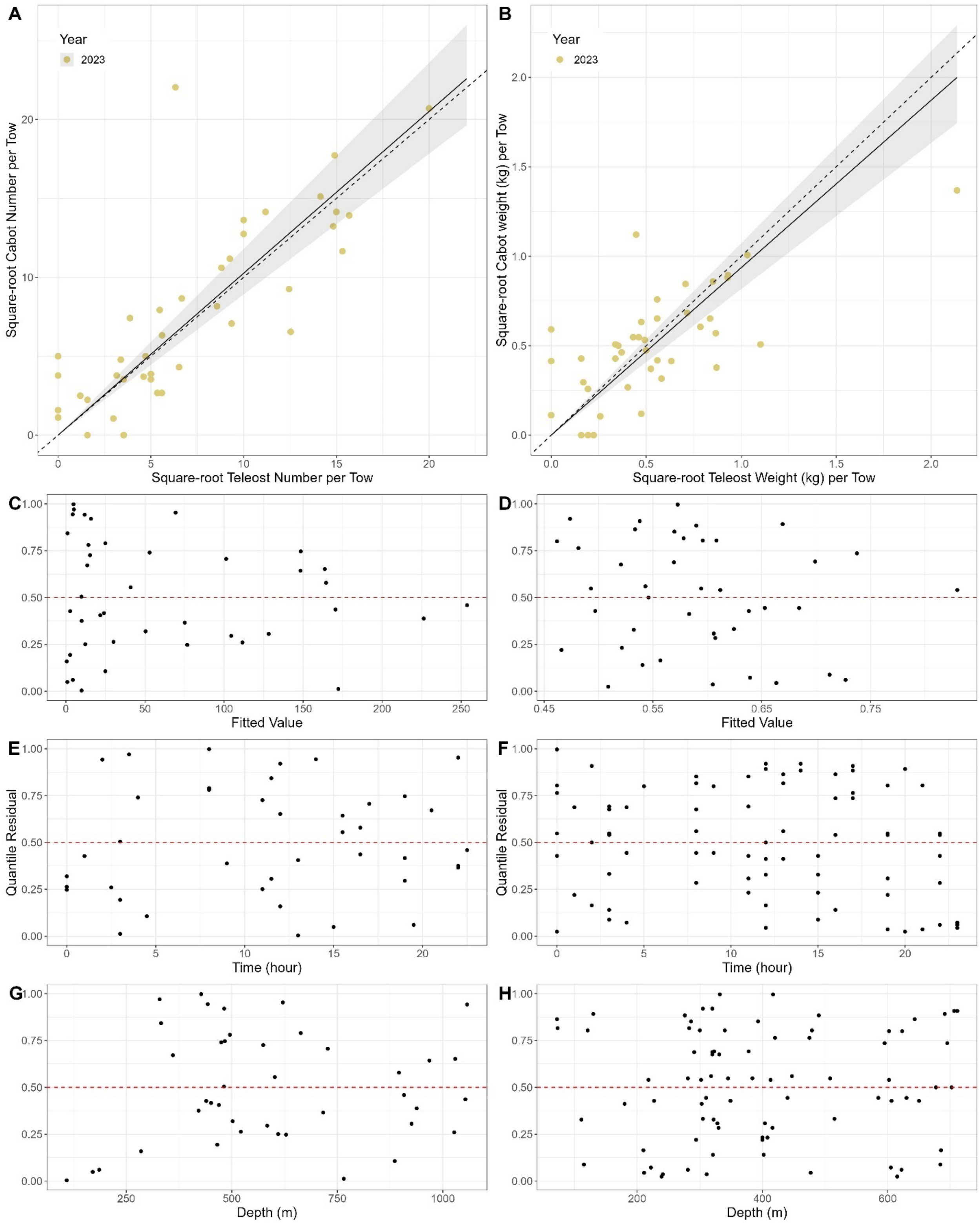


*Figure A2- 13. Results of size-aggregated analysis for the CCGS Teleost and CCGS John Cabot for catch of lanternfishes (*Myctophidae*), spring 3LNO.*

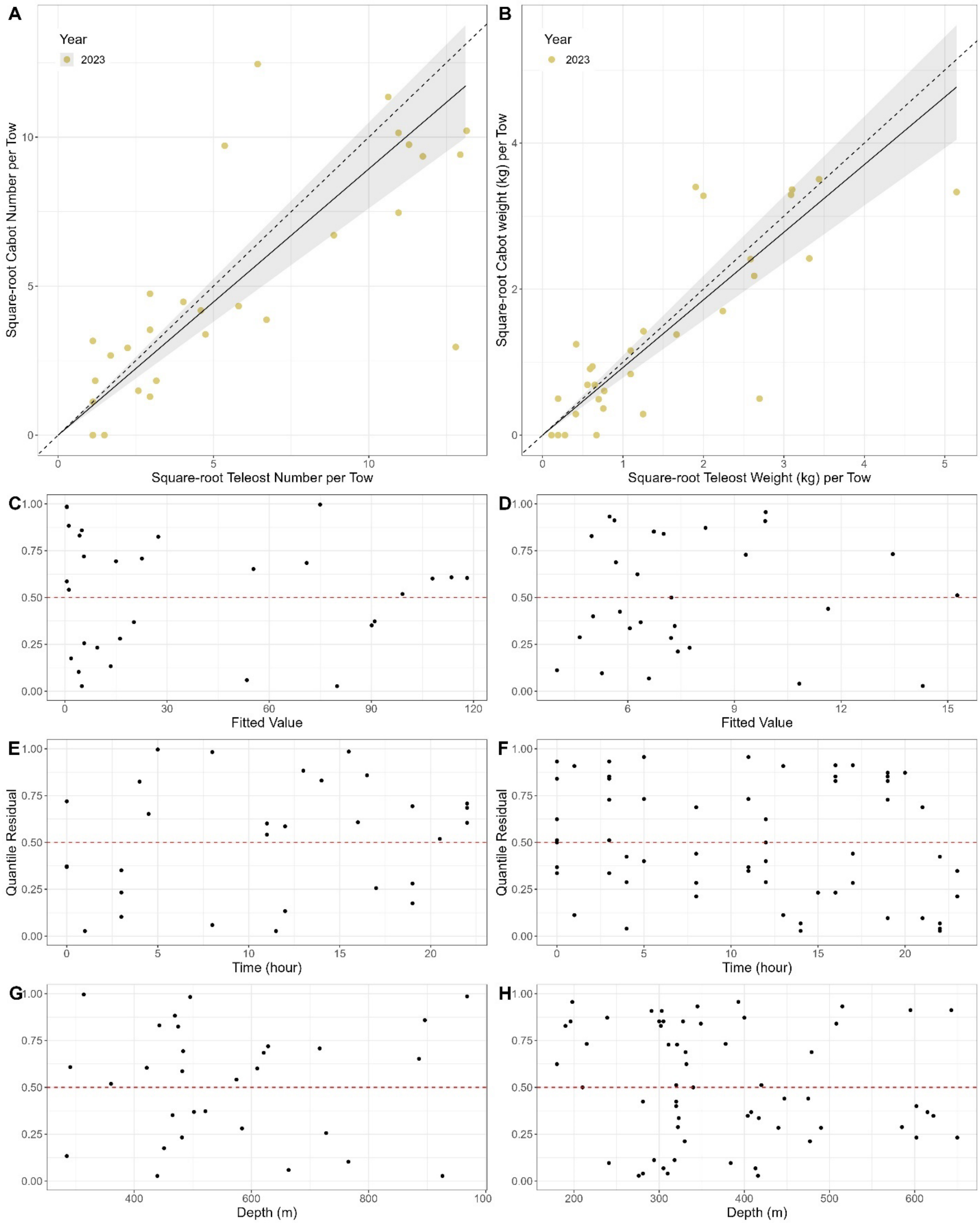


*Figure A2- 14. Results of size-aggregated analysis for the CCGS Teleost and CCGS John Cabot for catch of Longfin Hake (*Phycis chesteri*), spring 3LNO.*

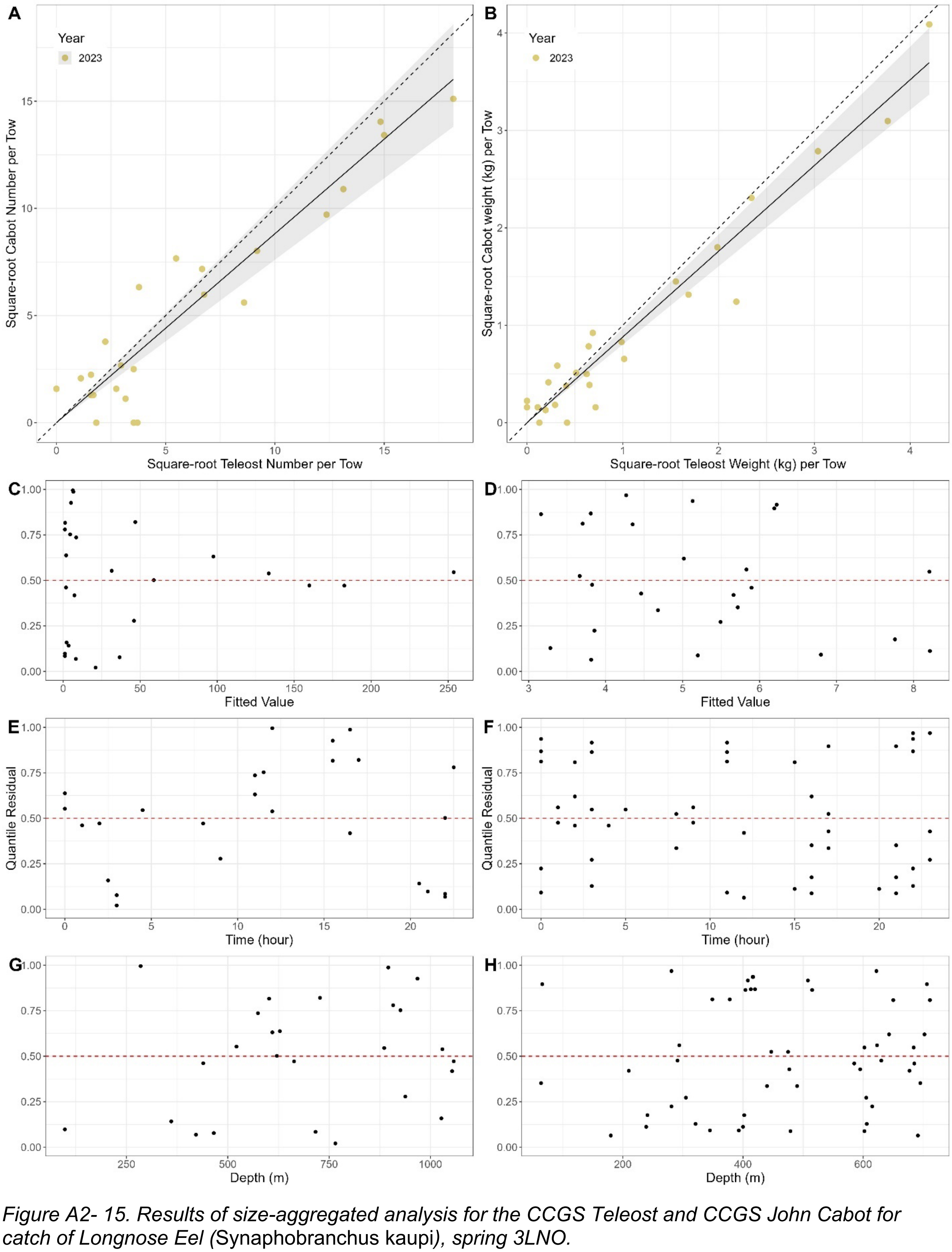


*Figure A2- 15. Results of size-aggregated analysis for the CCGS Teleost and CCGS John Cabot for catch of Longnose Eel (*Synaphobranchus kaupi*), spring 3LNO.*

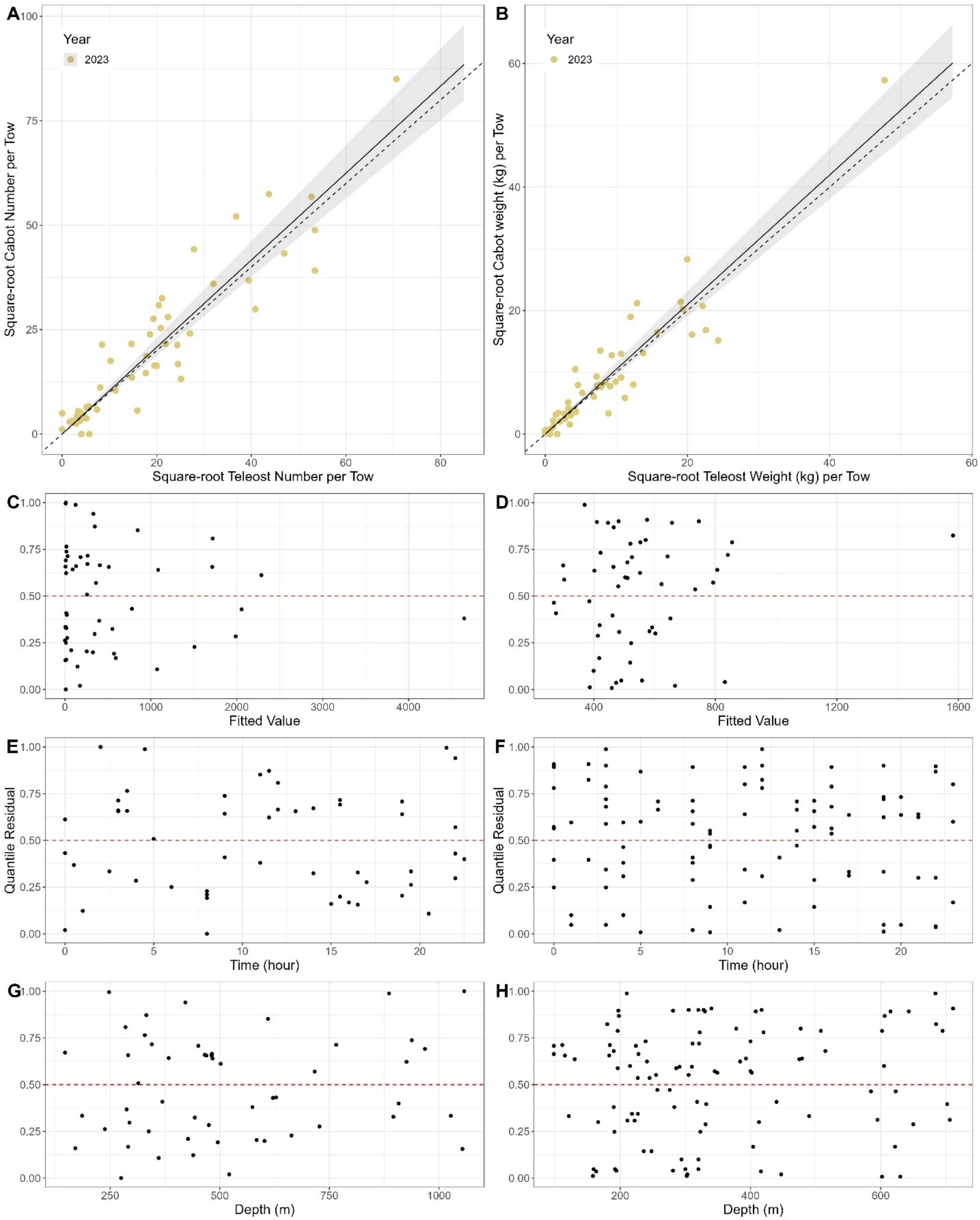


Figure A2- 16. Results of size-aggregated analysis for the CCGS Teleost and CCGS John Cabot for catch of redfish, spring 3LNO.

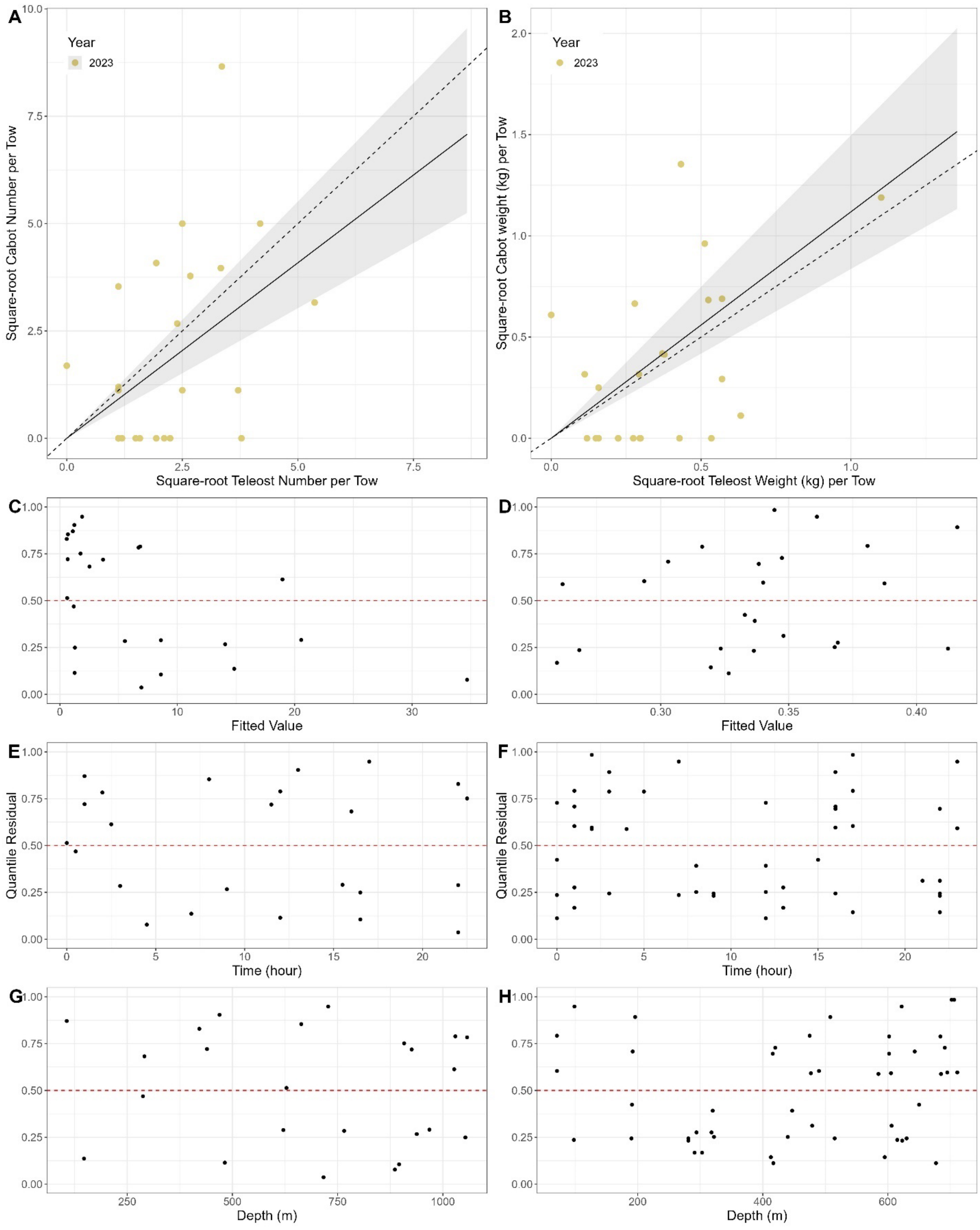


*Figure A2- 17. Results of size-aggregated analysis for the CCGS Teleost and CCGS John Cabot for catch of rocklings (*Gaidropsarus *sp.,* Enchelyopus *sp), spring 3LNO.*

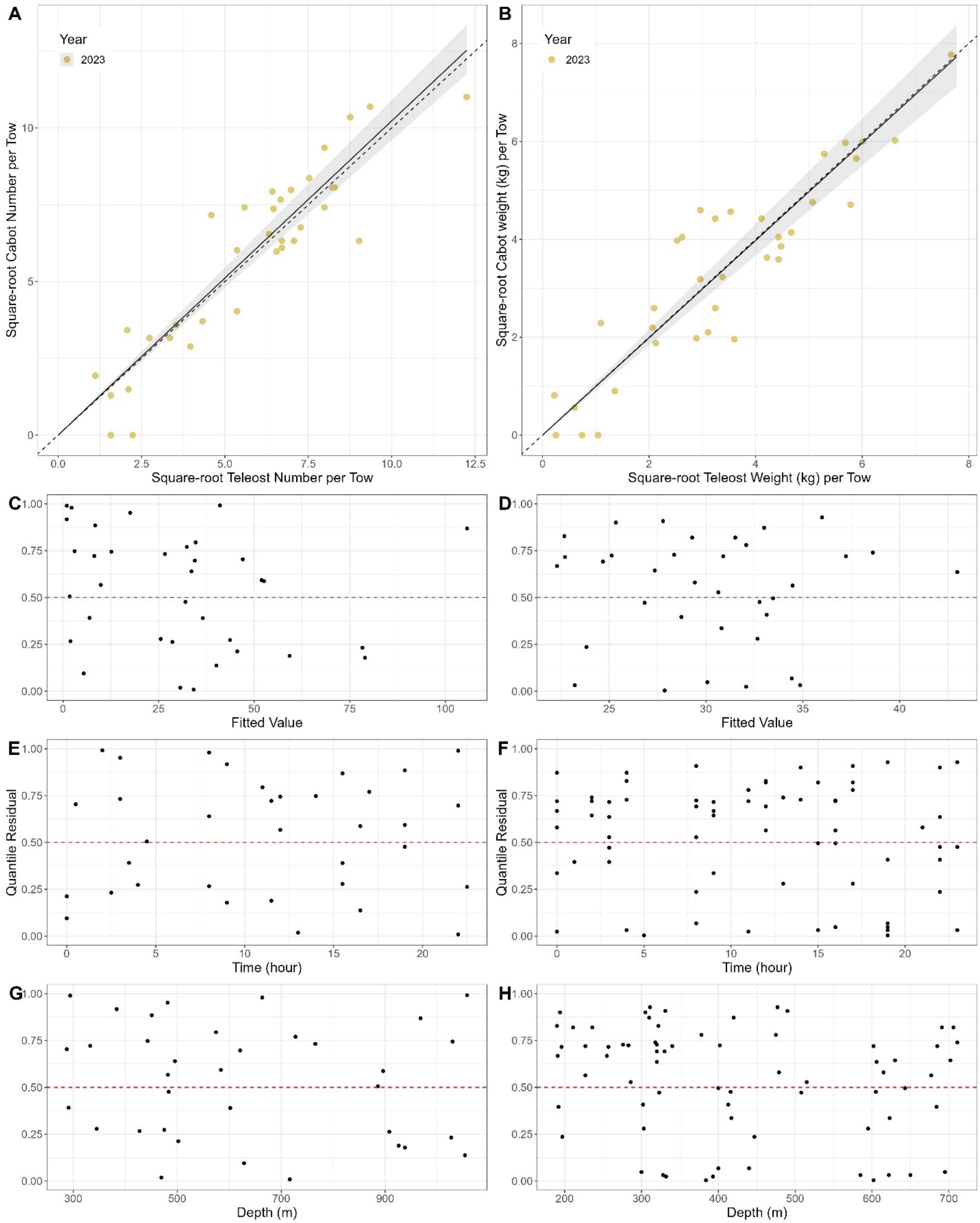


Figure A2- 18. Results of size-aggregated analysis for the CCGS Teleost and CCGS John Cabot for catch of Roughhead Grenadier, spring 3LNO.

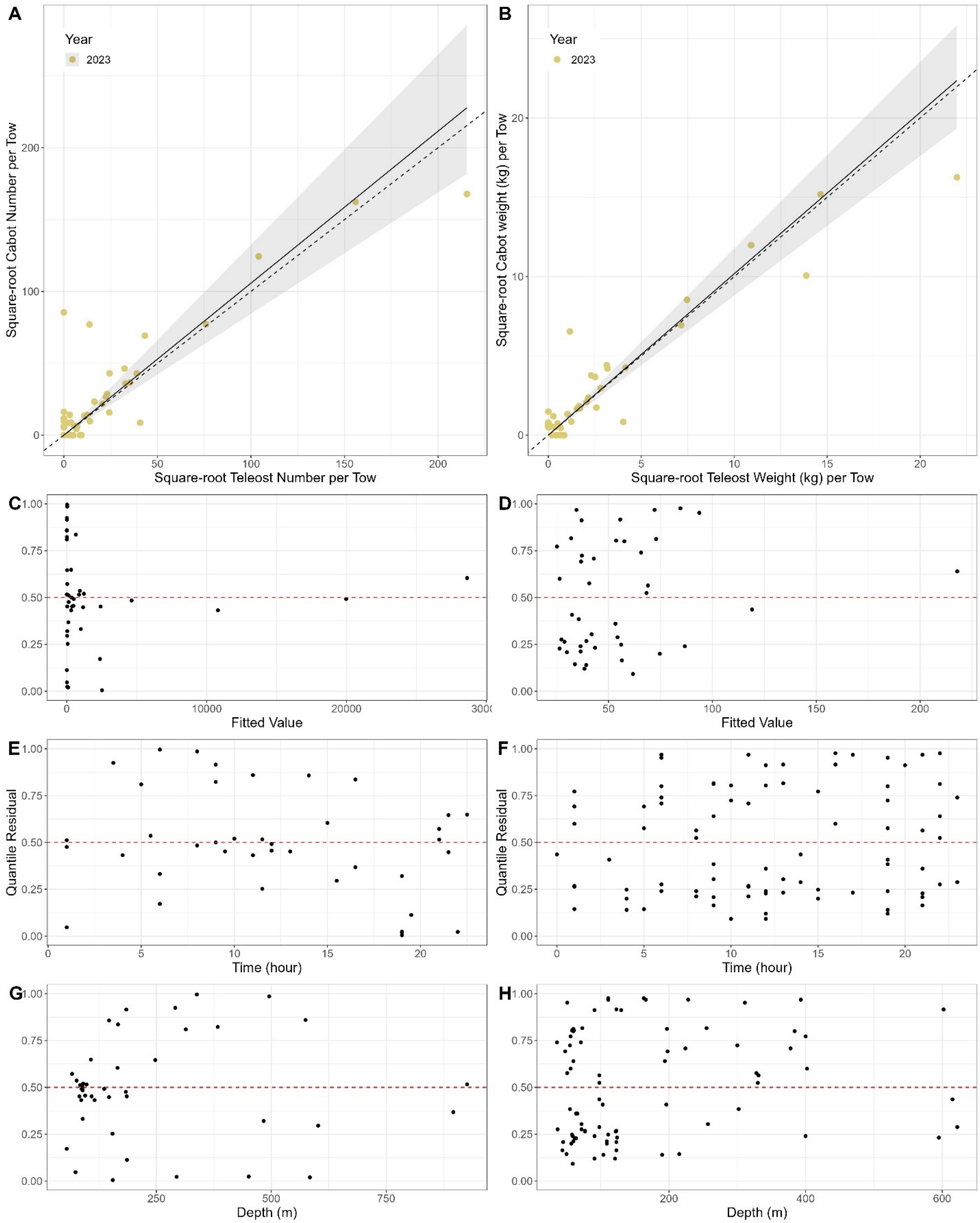


*Figure A2- 19. Results of size-aggregated analysis for the CCGS Teleost and CCGS John Cabot for catch of sand lance (*Ammodytes *sp.), spring 3LNO.*

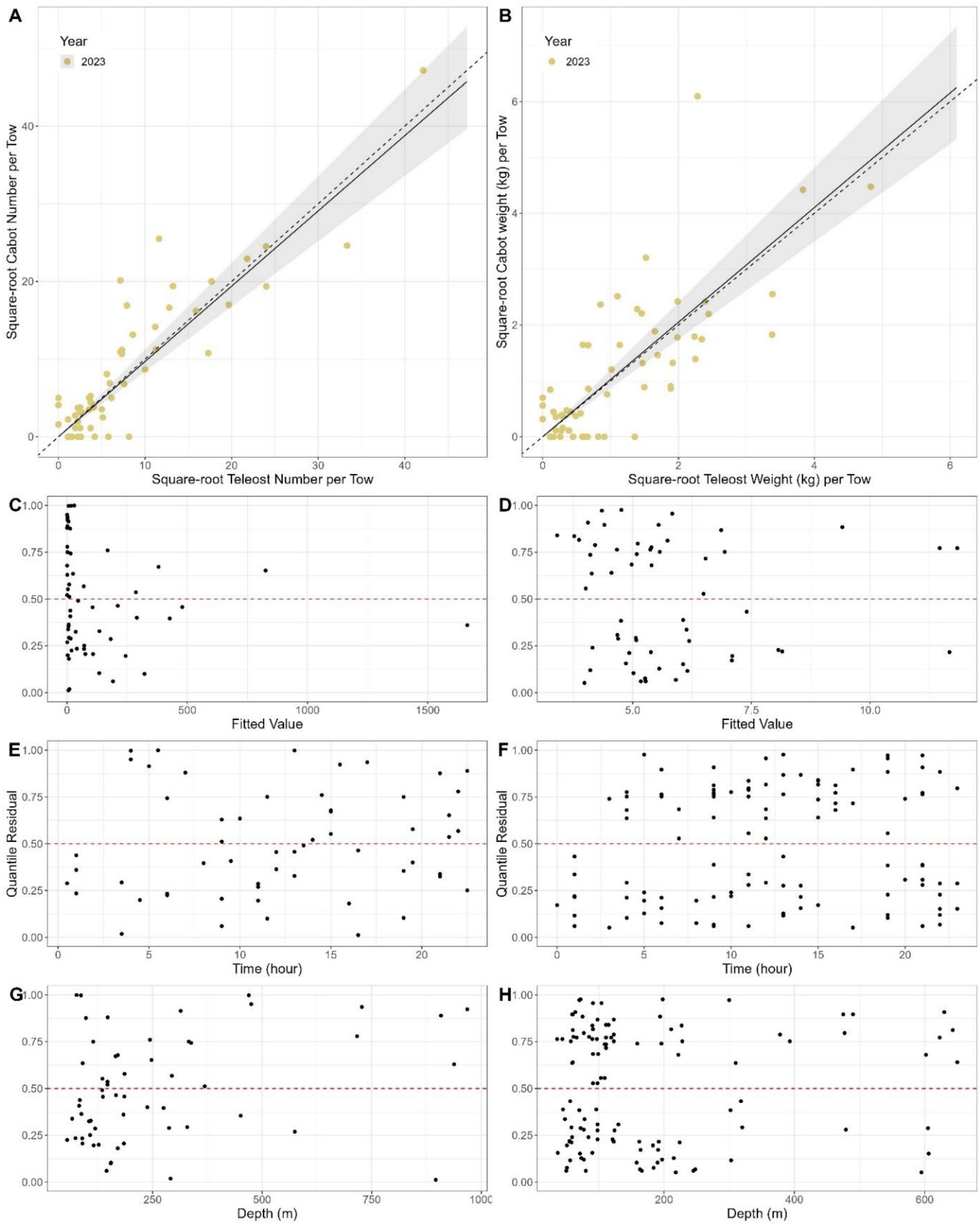


*Figure A2- 20. Results of size-aggregated analysis for the CCGS Teleost and CCGS John Cabot for catch of sculpins (*Artediellus *sp.,* Triglops *sp.,* Myoxocephalus *sp.,* Gymnocanthu *sp.,* Cottunculus *sp.,* Icelus *sp.,* Myoxocephalus *sp.,* Hemitripterus americanus*), spring 3LNO.*

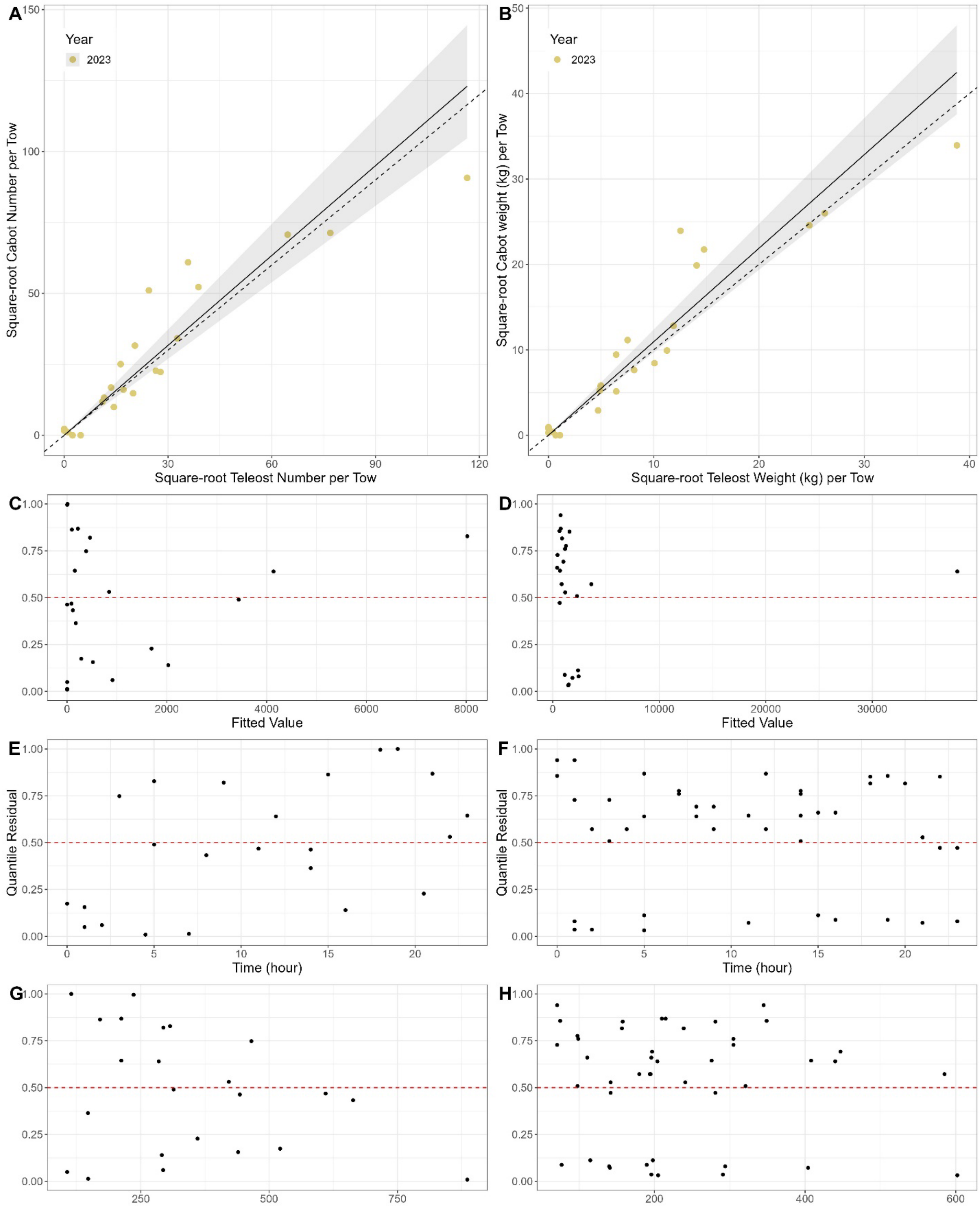


Figure A2- 21. Results of size-aggregated analysis for the CCGS Teleost and CCGS John Cabot for catch of Silver Hake, spring 3NOPs.

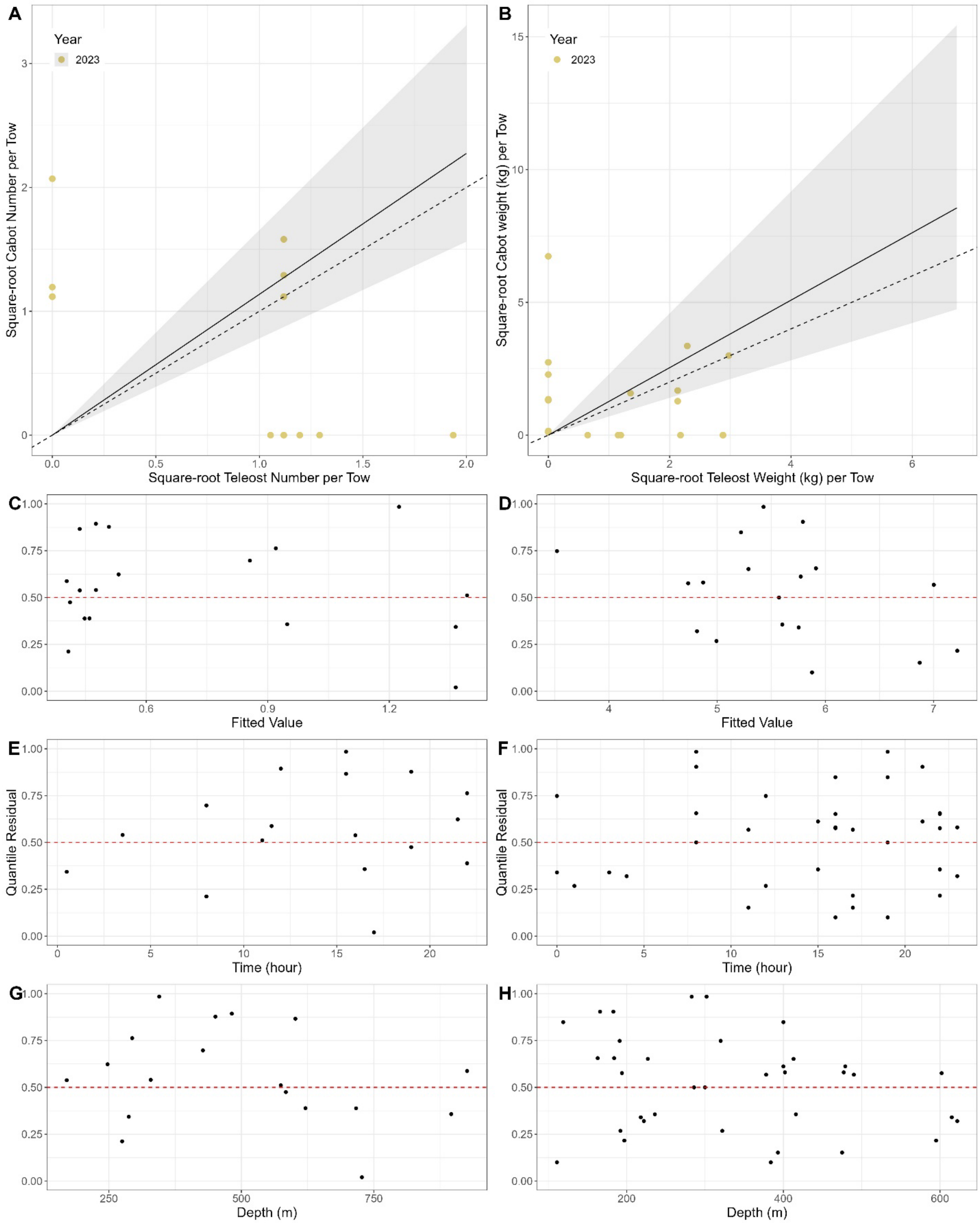


*Figure A2- 22. Results of size-aggregated analysis for the CCGS Teleost and CCGS John Cabot for catch of Spotted Wolffish (*Anarhichas minor*), spring 3LNO.*

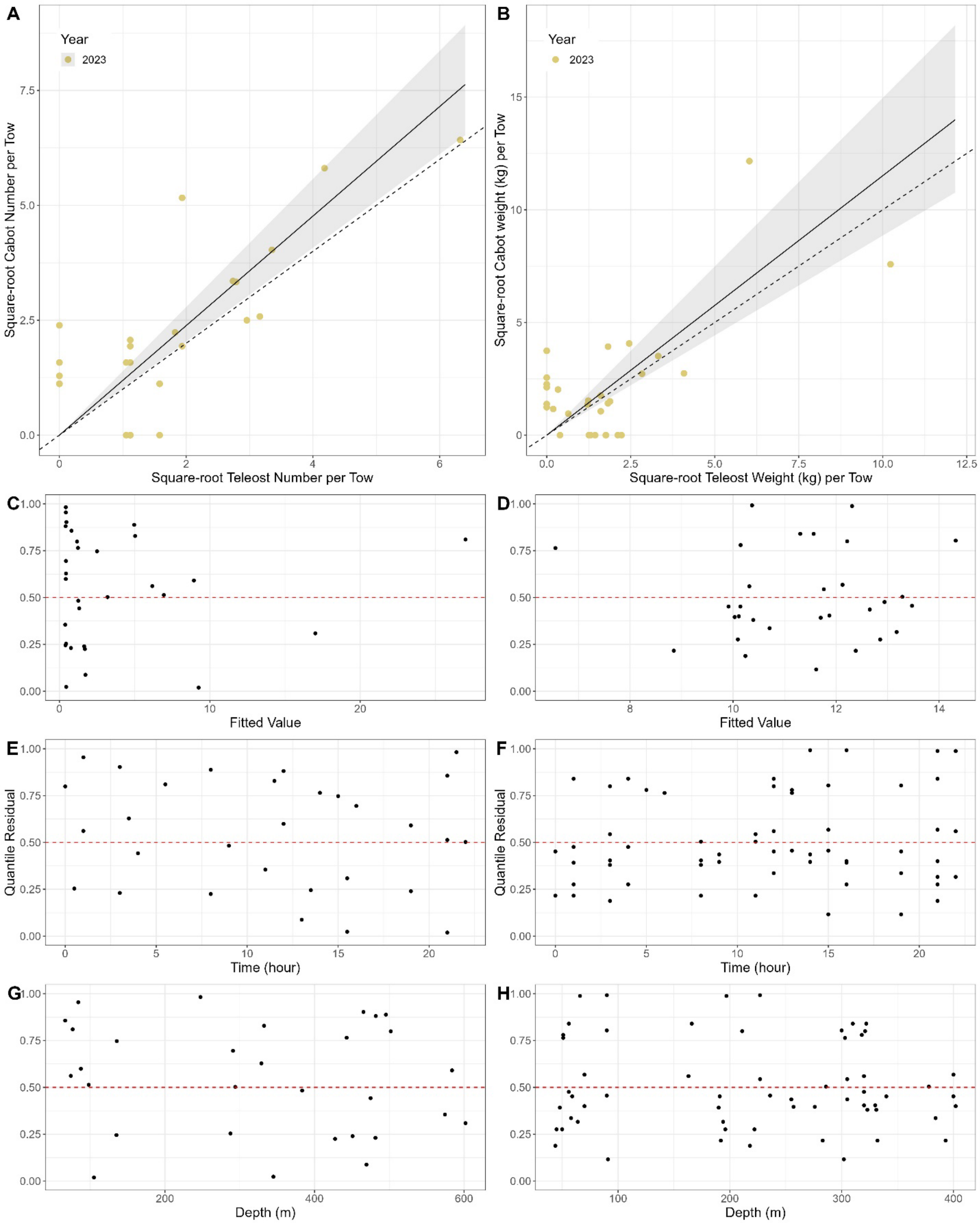


*Figure A2- 23. Results of size-aggregated analysis for the CCGS Teleost and CCGS John Cabot for catch of Striped Wolffish (*Anarhichas lupus*), spring 3LNO.*

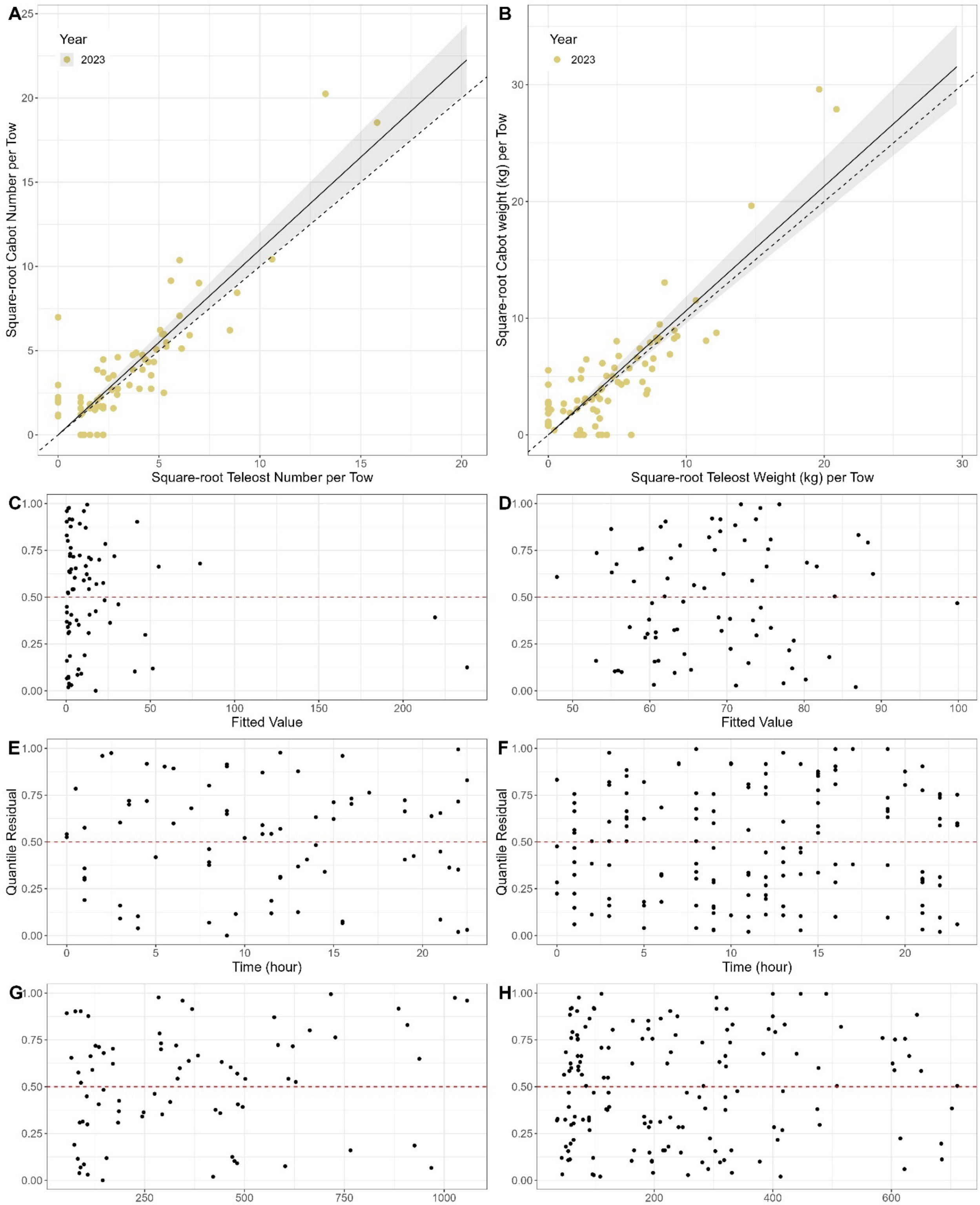


Figure A2- 24. Results of size-aggregated analysis for the CCGS Teleost and CCGS John Cabot for catch of Thorny Skate, spring 3LNO.

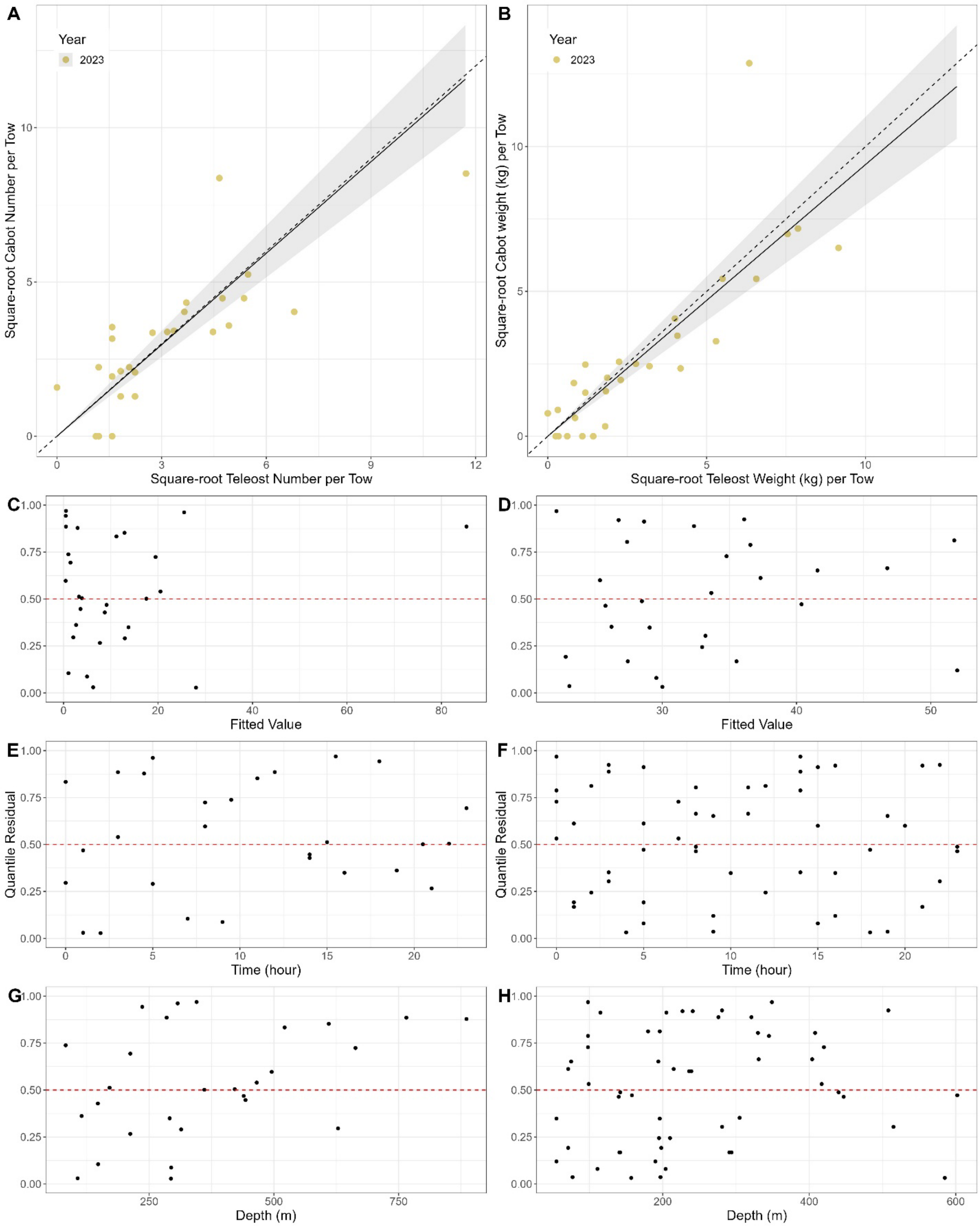


Figure A2- 25. Results of size-aggregated analysis for the CCGS Teleost and CCGS John Cabot for catch of White Hake, spring 3NOPs.

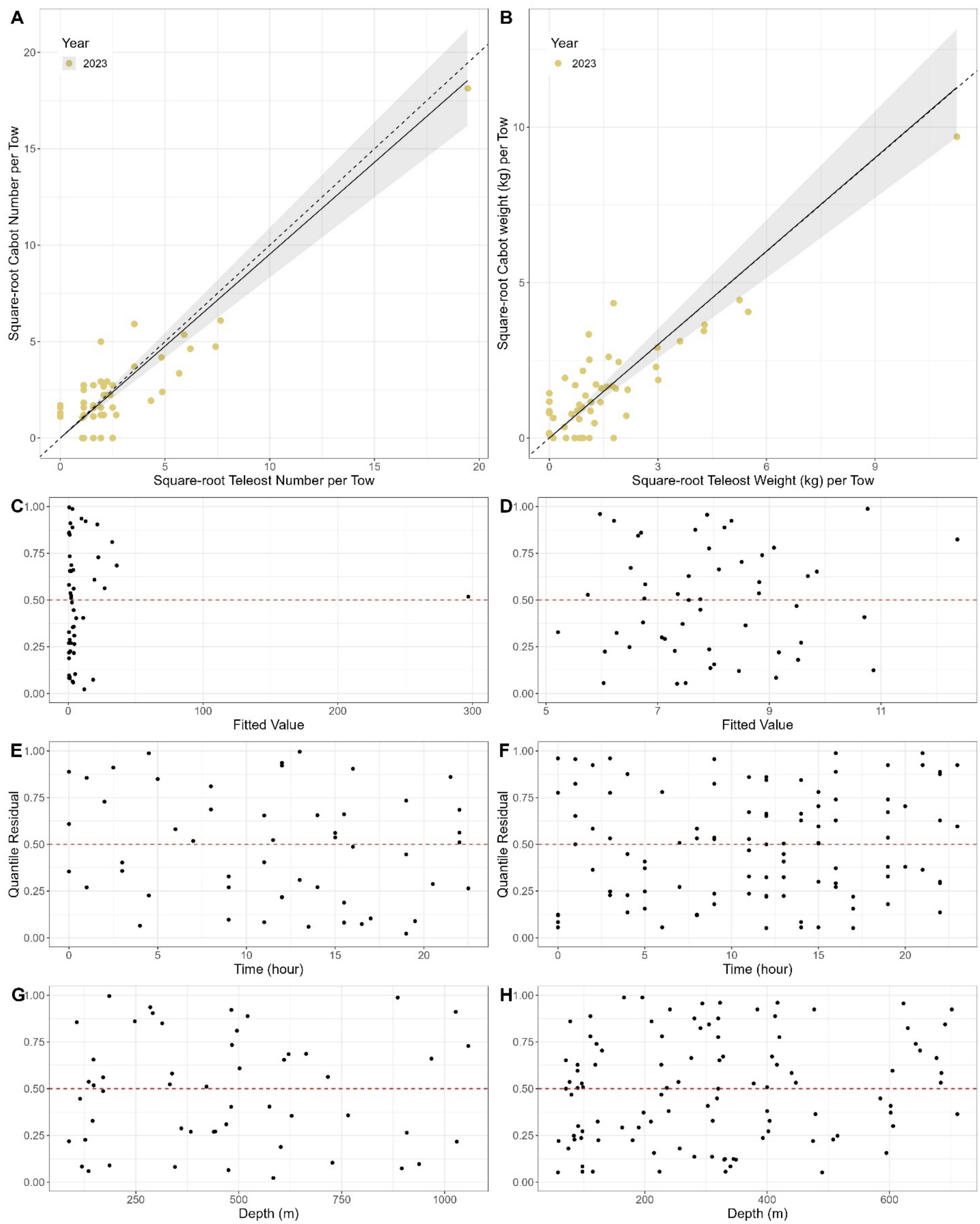


Figure A2- 26. Results of size-aggregated analysis for the CCGS Teleost and CCGS John Cabot for catch of Witch Flounder, spring 3LNO.

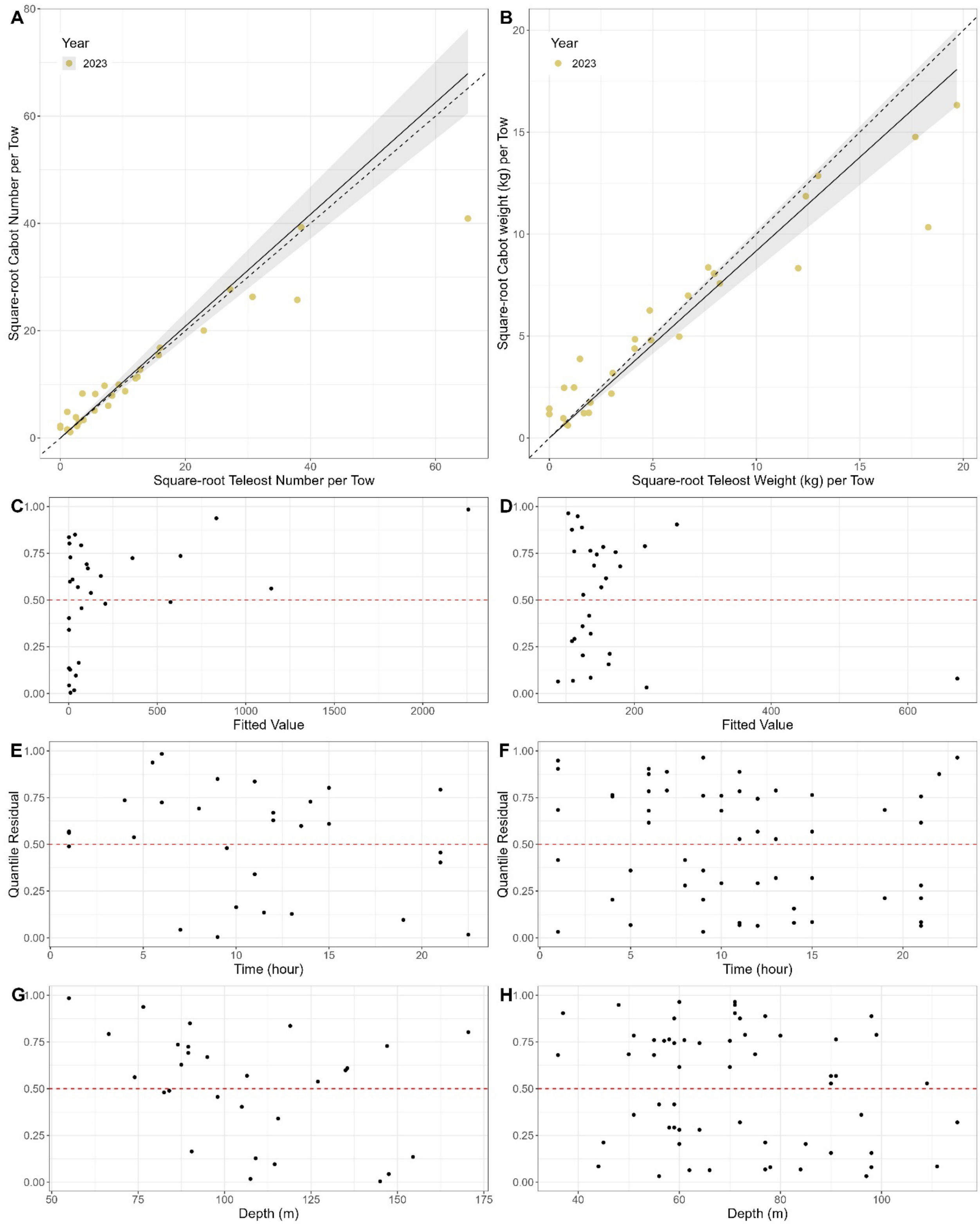


Figure A2- 27. Results of size-aggregated analysis for the CCGS Teleost and CCGS John Cabot for catch of Yellowtail Flounder, spring 3LNO.

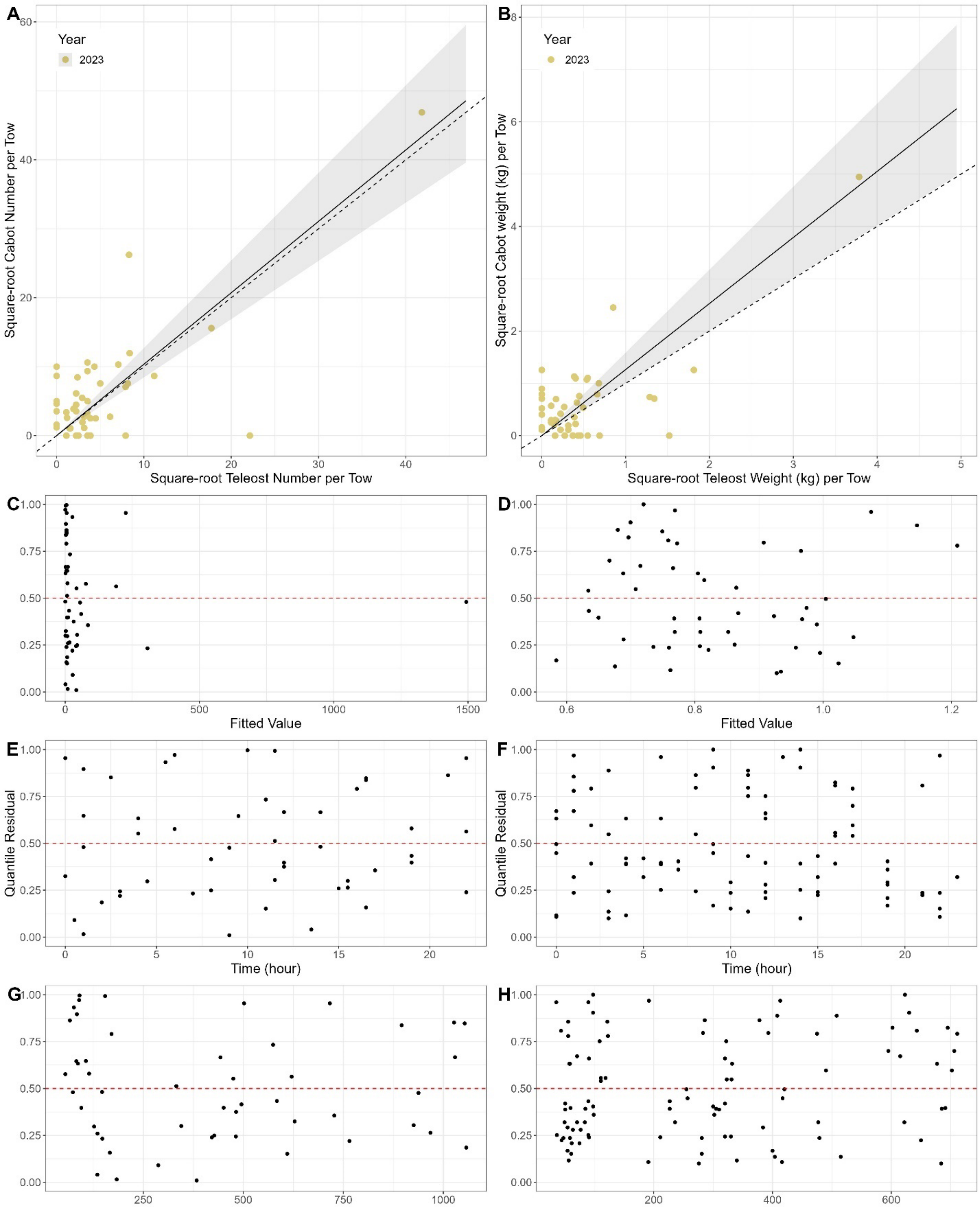


*Figure A2- 28. Results of size-aggregated analysis for the CCGS Teleost and CCGS John Cabot for catch of gastropods (*Gastropoda*, excluding* Nudibranchia*), spring 3LNO.*

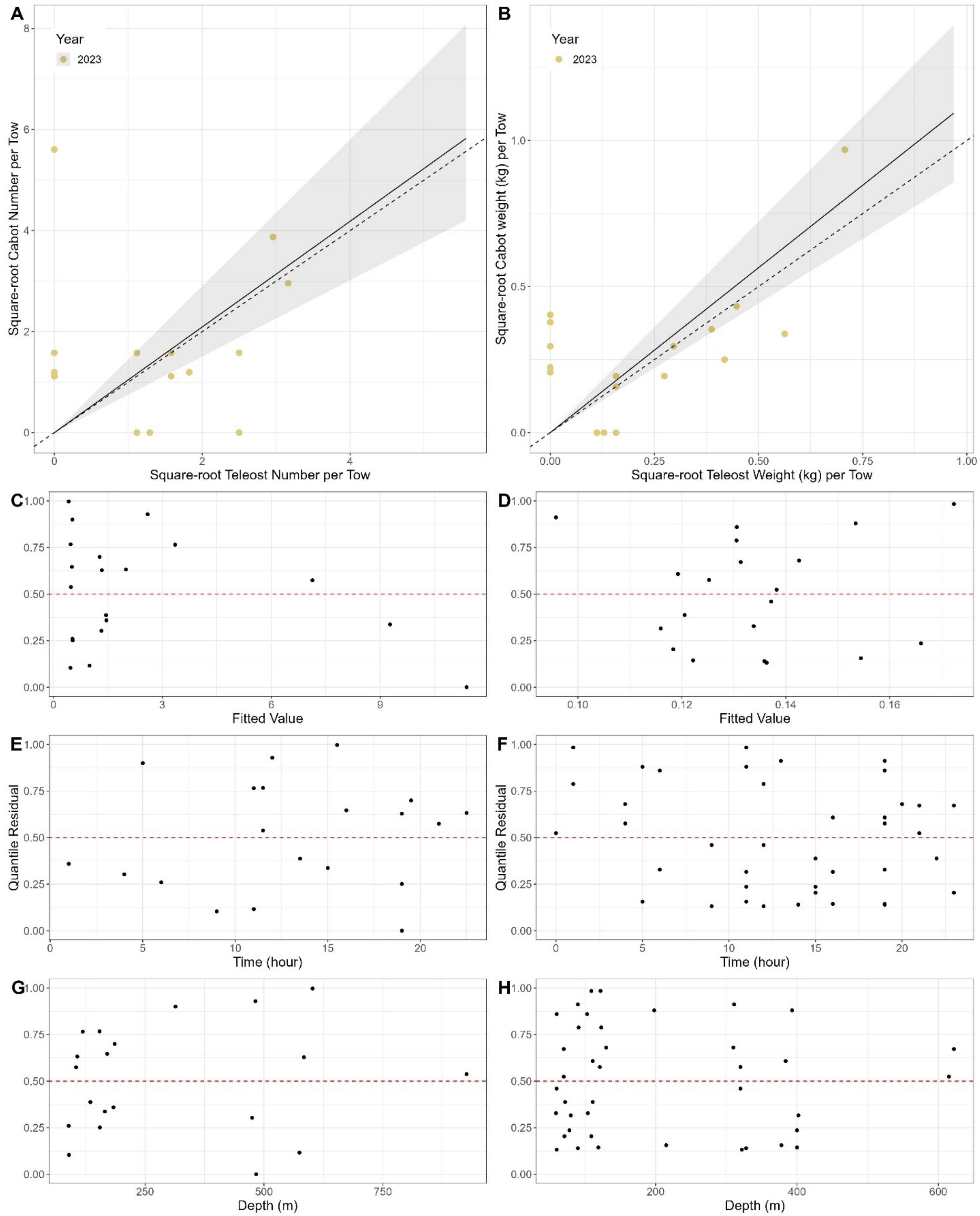


*Figure A2- 29. Results of size-aggregated analysis for the CCGS Teleost and CCGS John Cabot for catch of Iceland Scallop (*Chlamys islandica*), spring 3LNO.*

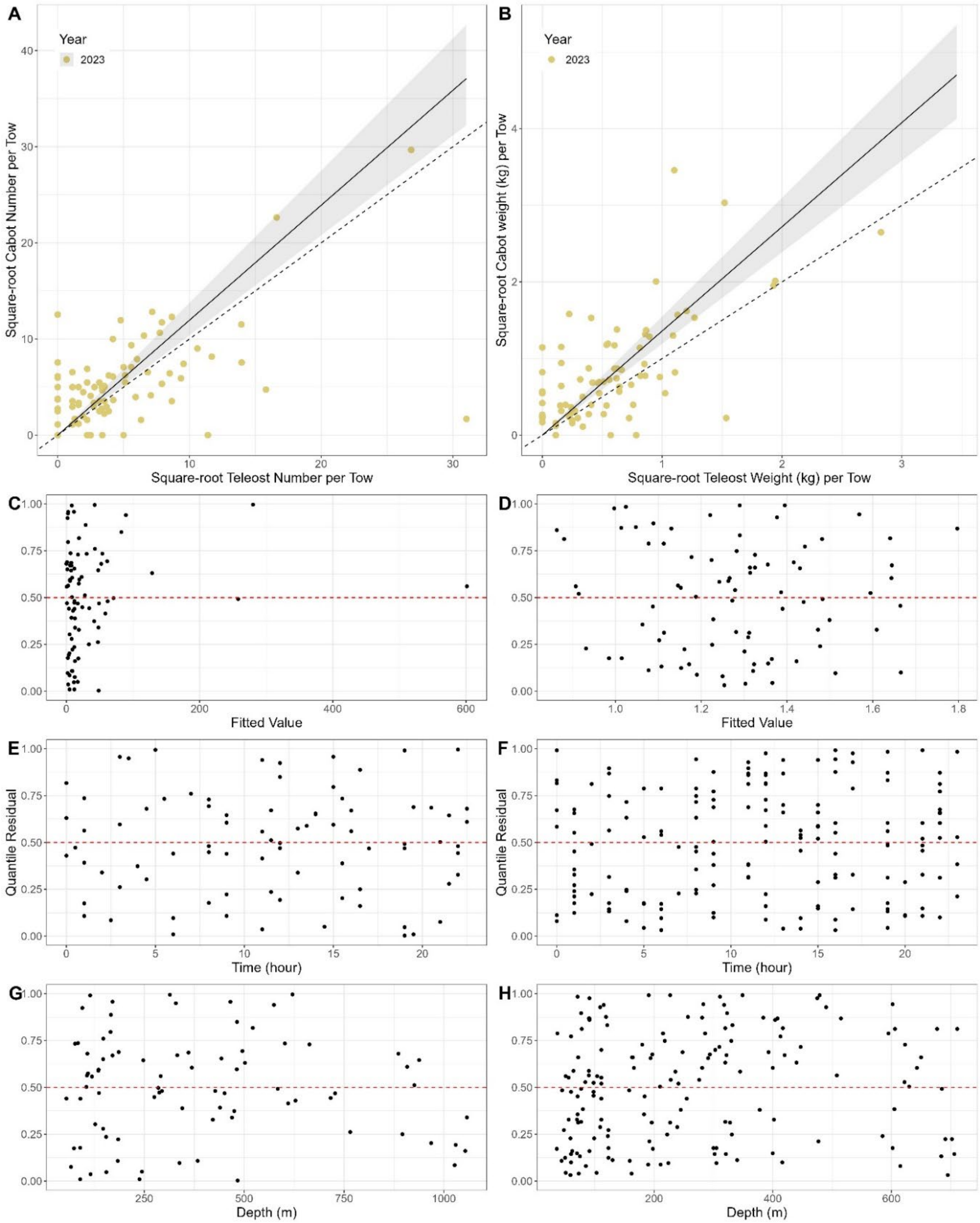


Figure A2- 30. Results of size-aggregated analysis for the CCGS Teleost and CCGS John Cabot for catch of sea stars (all grouped, including: Asteroidea, Pteraster *sp.,* Pseudoarchaster *sp.,* Solaster *sp.,* Crossaster papposus*,* Astropecten americanus*,* Porania pulvillus*,* Asterias rubens*,* Leptasterias *sp.,* Urasterias lincki*,* Tremaster mirabilis*,* Diplopteraster multipes*,* Psilaster andromeda*,* Poraniomorpha *sp.,* Ceramaster granularis*,* Hippasteria phrygiana*,* Henricia *sp.), spring 3LNO.*

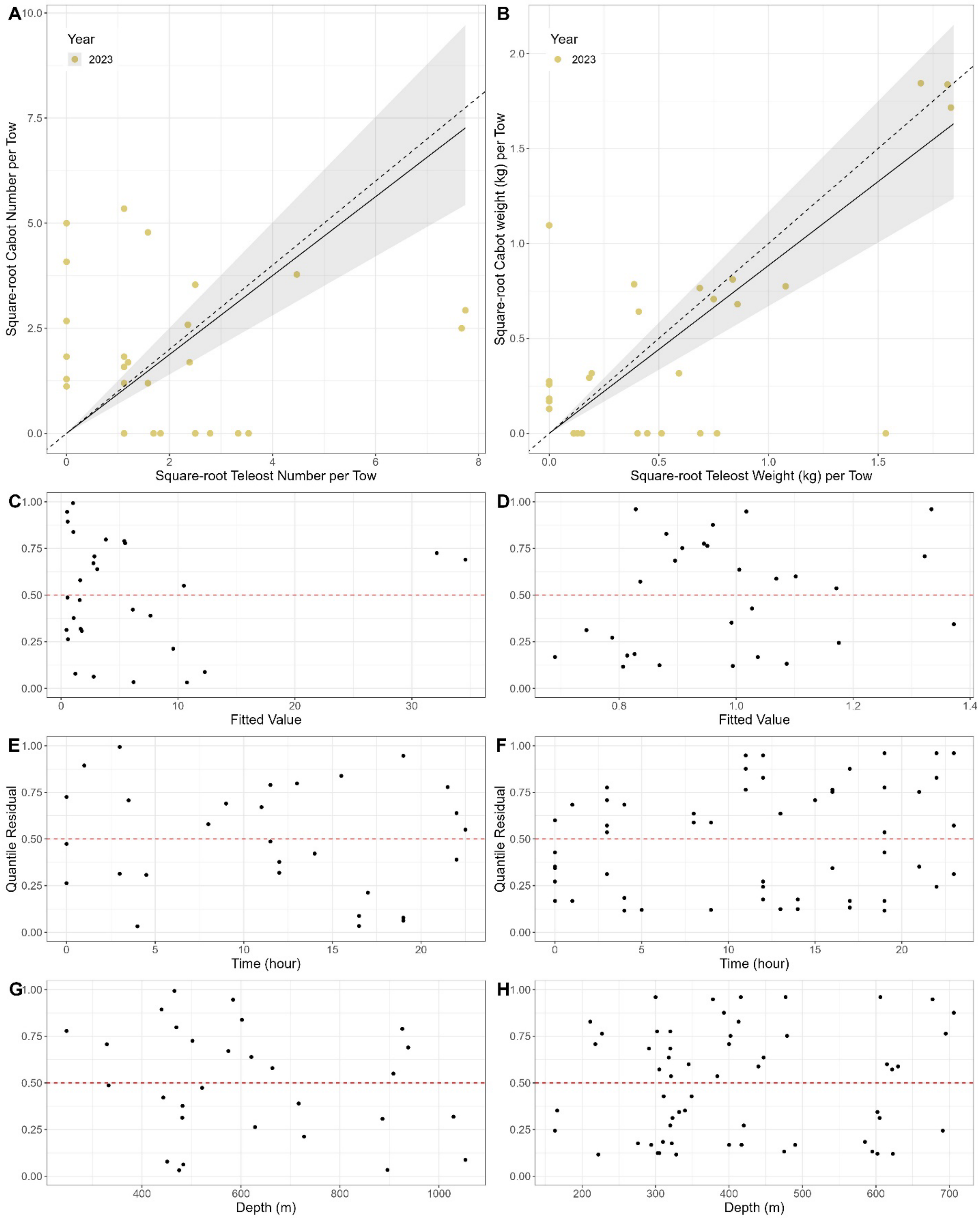


*Figure A2- 31. Results of size-aggregated analysis for the CCGS Teleost and CCGS John Cabot for catch of cushion and Rigid Cushion Star (*Ceramaster granularis, Hippasteria phrygiana*), spring 3LNO.*

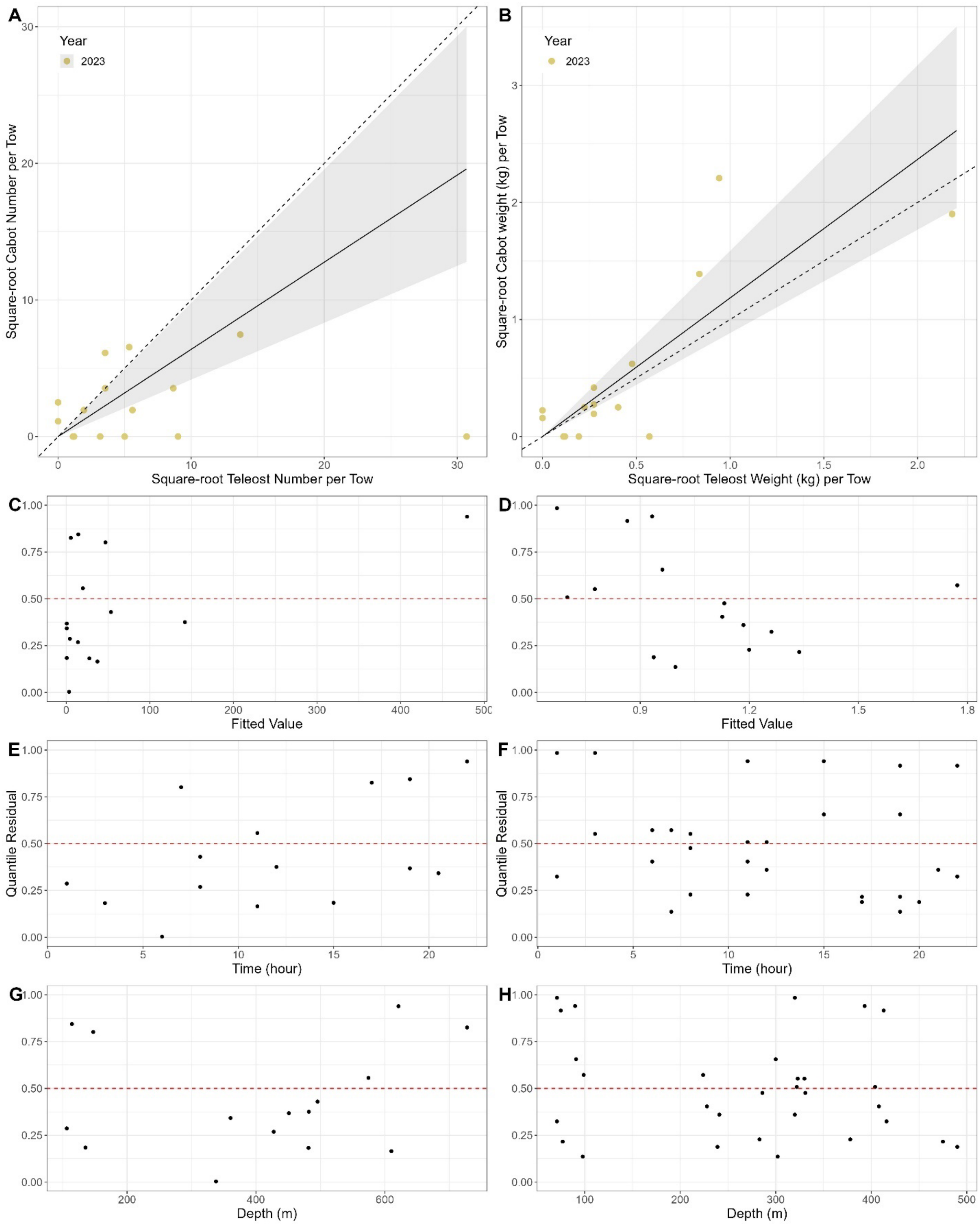


*Figure A2- 32. Results of size-aggregated analysis for the CCGS Teleost and CCGS John Cabot for catch of Common Mud Star (*Ctenodiscus crispatus*), spring 3LNO.*

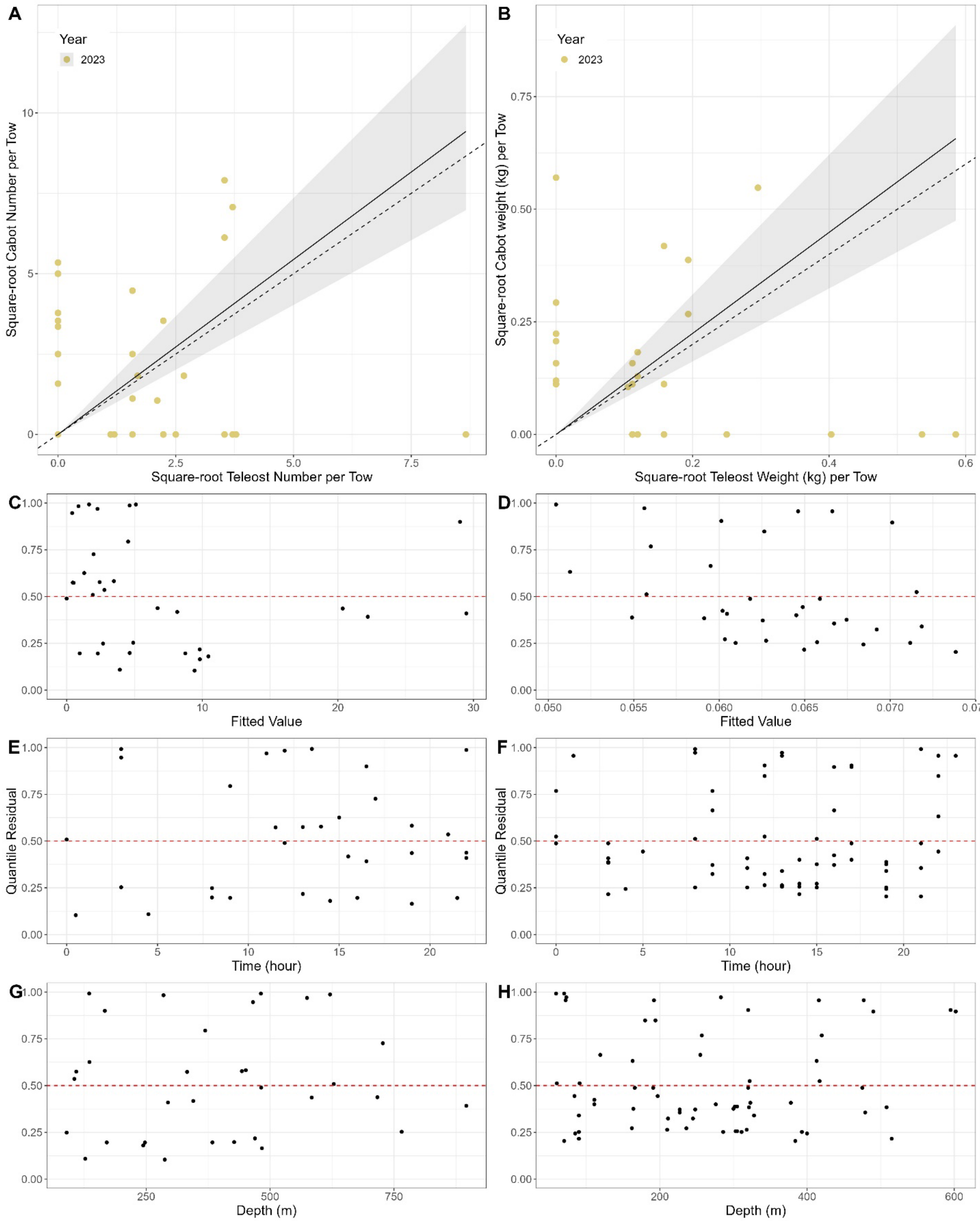


*Figure A2- 33. Results of size-aggregated analysis for the CCGS Teleost and CCGS John Cabot for catch of Henricia sea stars (*Henricia sp.*), spring 3LNO.*

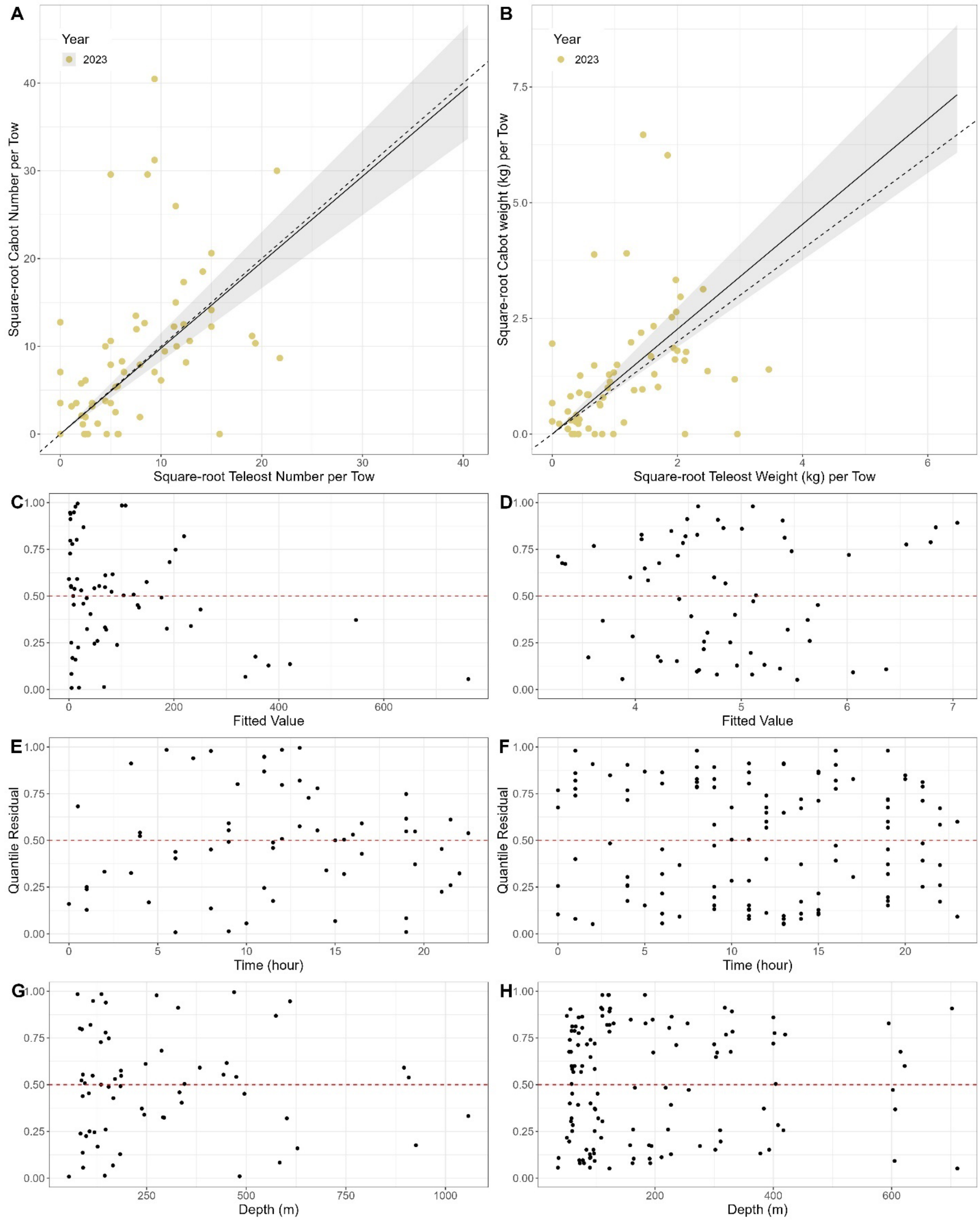


*Figure A2- 34. Results of size-aggregated analysis for the CCGS Teleost and CCGS John Cabot for catch of sand dollars (*Clypeasteroida*), spring 3LNO.*

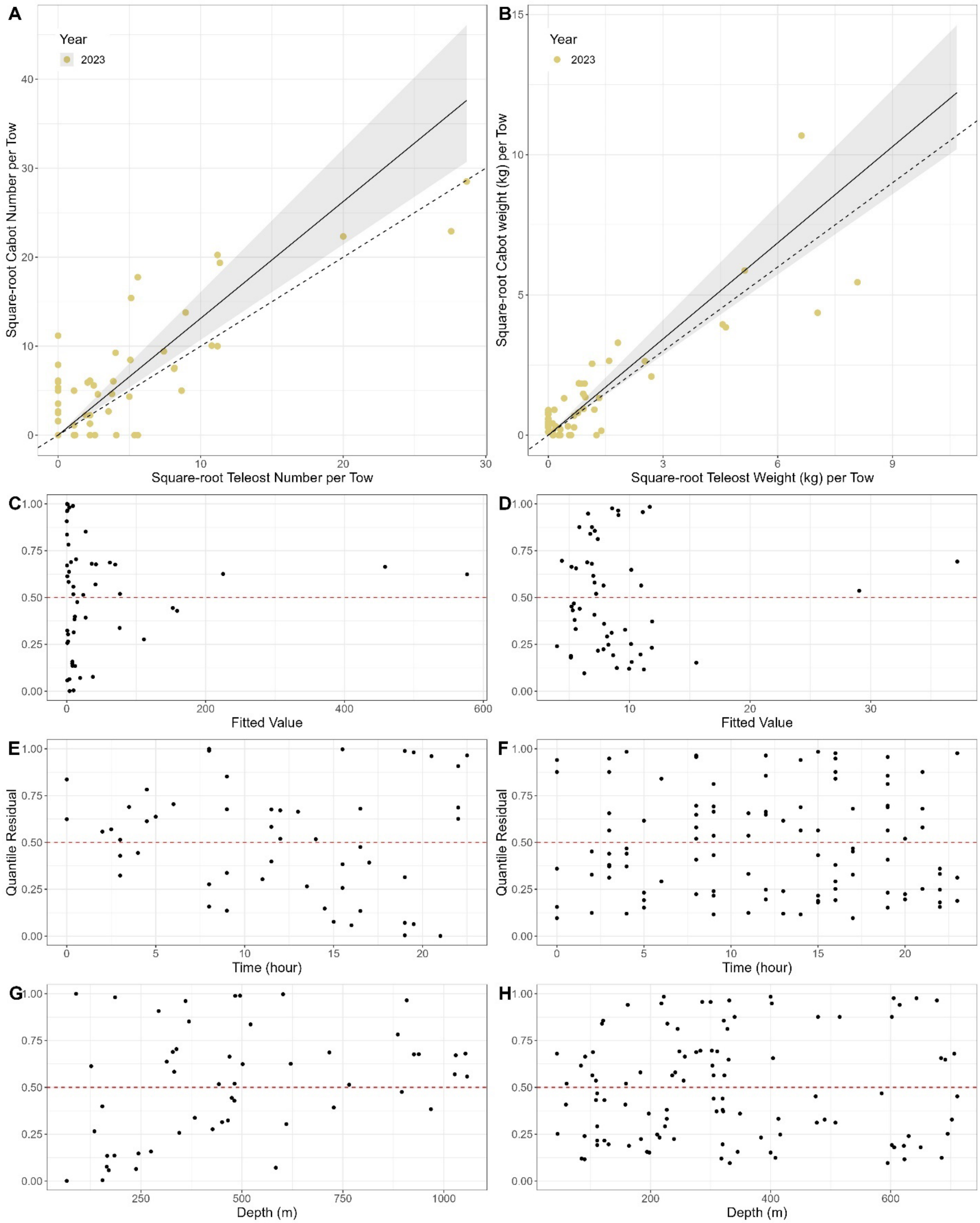


*Figure A2- 35. Results of size-aggregated analysis for the CCGS Teleost and CCGS John Cabot for catch of sea anemones (*Actinaria*), spring 3LNO.*

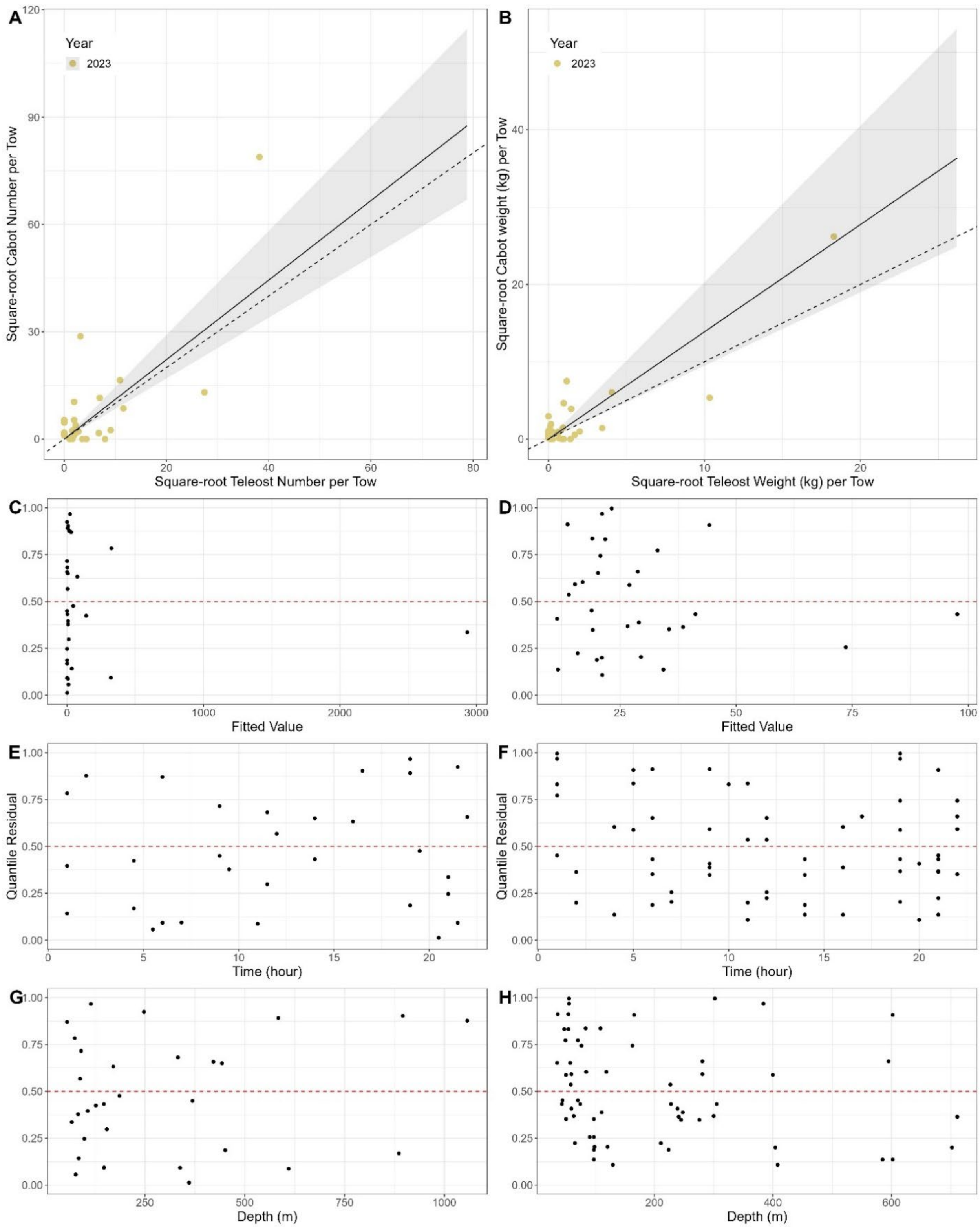


*Figure A2- 36. Results of size-aggregated analysis for the CCGS Teleost and CCGS John Cabot for catch of sea cucumbers (*Molpadia *sp.,* Stereoderma *sp.,* Phyllophoridae*,* Psolus *sp.,* Cucumaria *sp.,* Pentamera *sp.), spring 3LNO.*

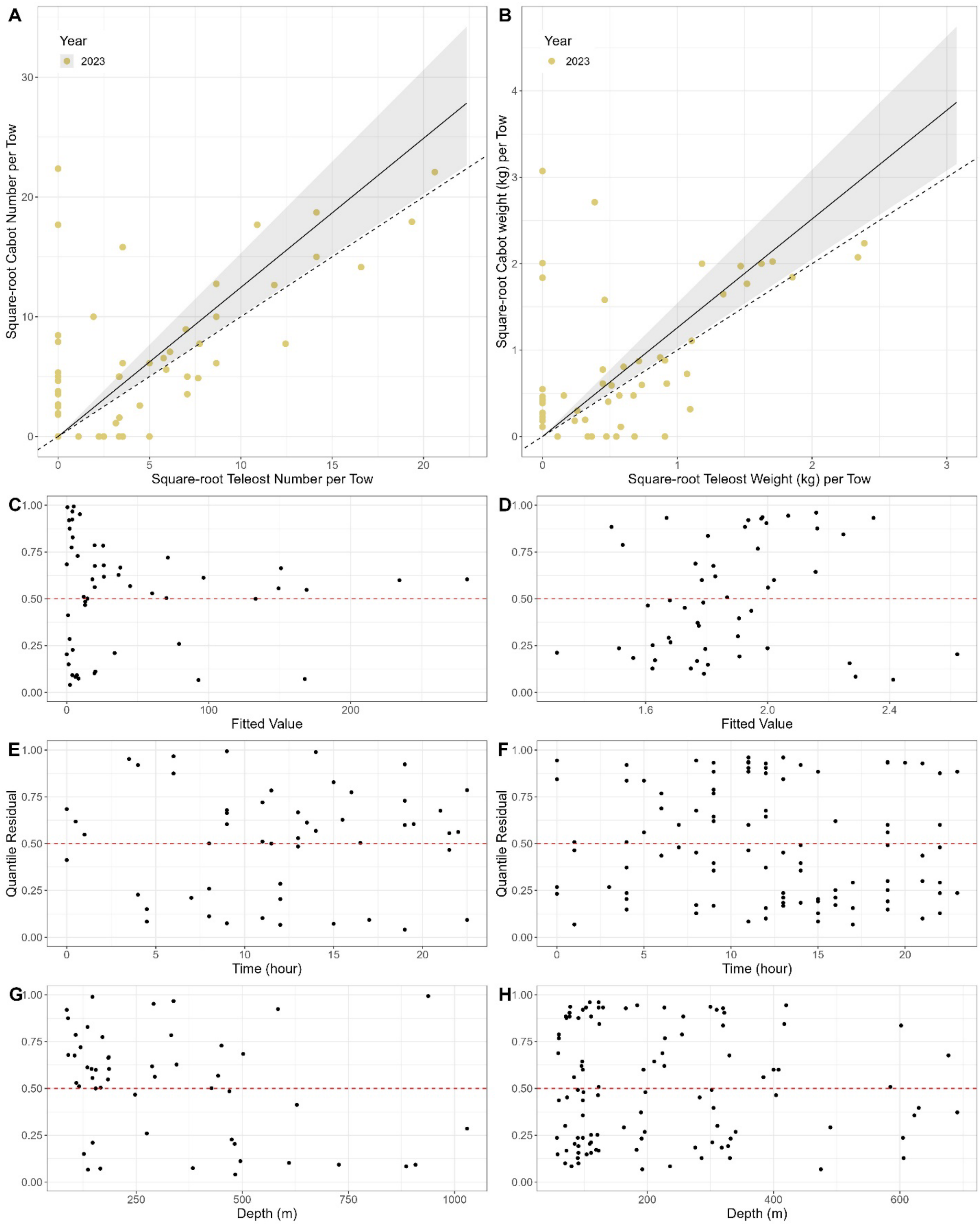


*Figure A2- 37. Results of size-aggregated analysis for the CCGS Teleost and CCGS John Cabot for catch of sea urchins (*Strongylocentrotus *sp.,* Brisaster *sp.,* Phormosoma *sp.), spring 3LNO.*

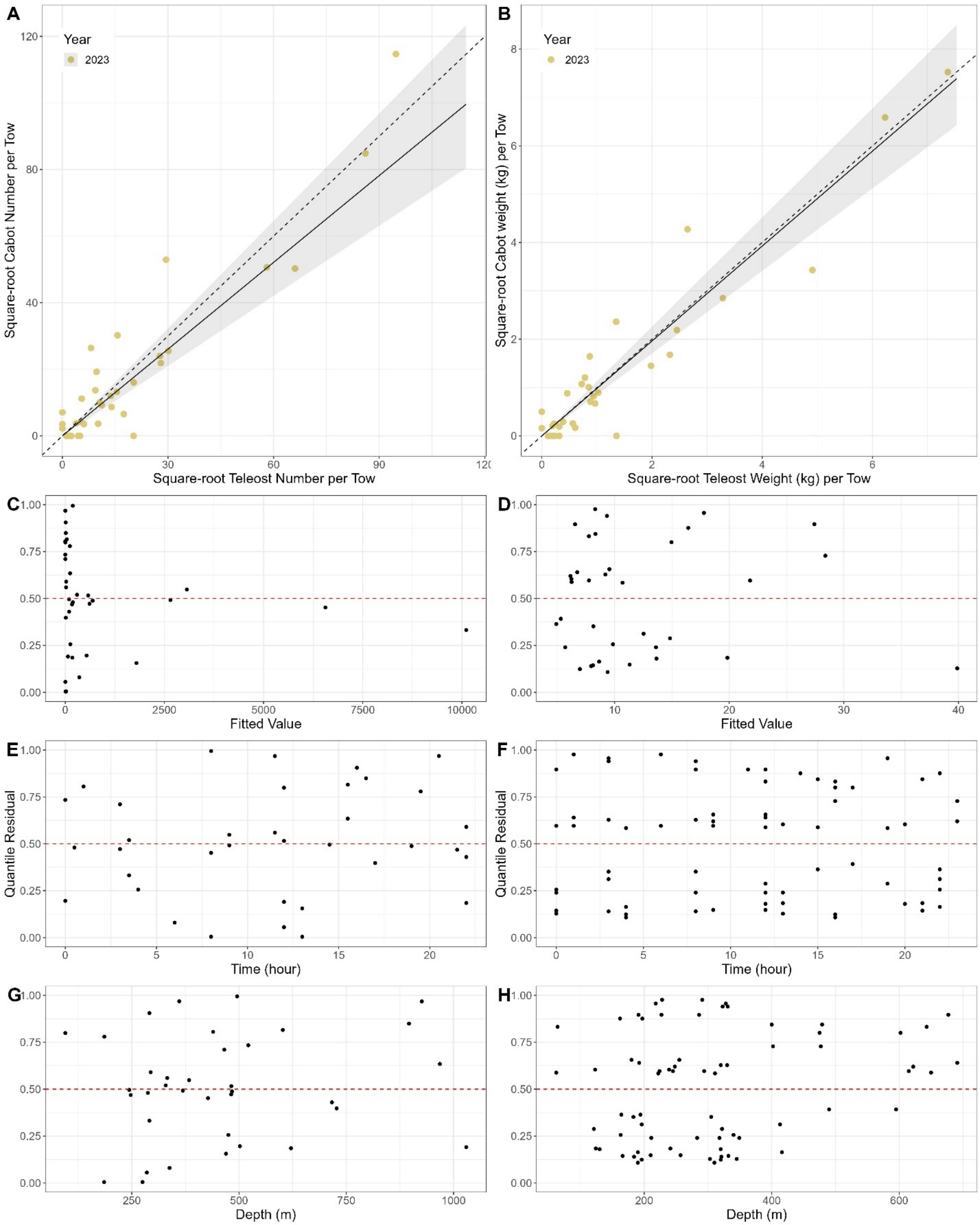


Figure A2- 38. Results of size-aggregated analysis for the CCGS Teleost and CCGS John Cabot for catch of Northern Shrimp, spring 3LNO.

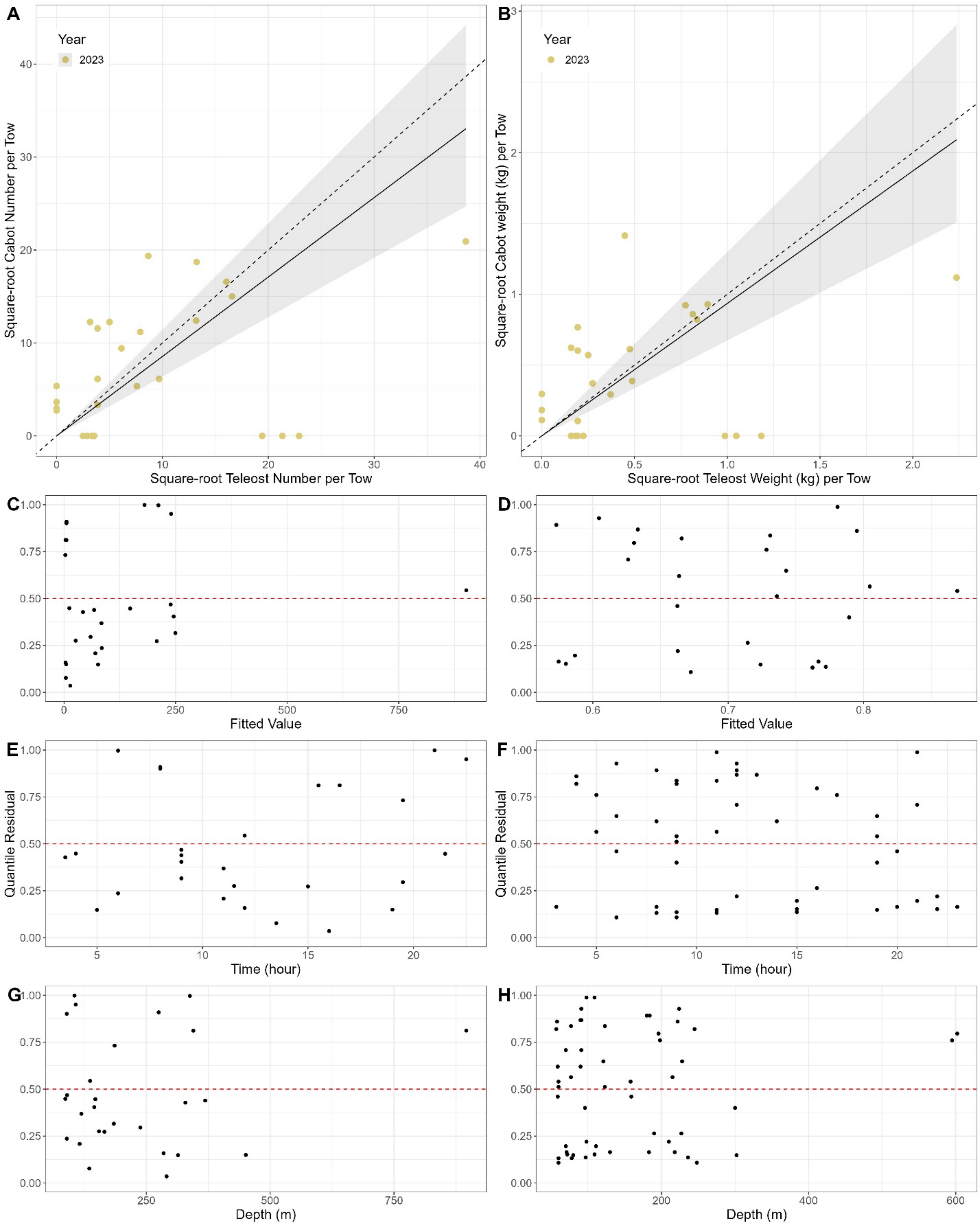


*Figure A2- 39. Results of size-aggregated analysis for the CCGS Teleost and CCGS John Cabot for catch of Striped Shrimp (*Pandalus montagui*), spring 3LNO.*

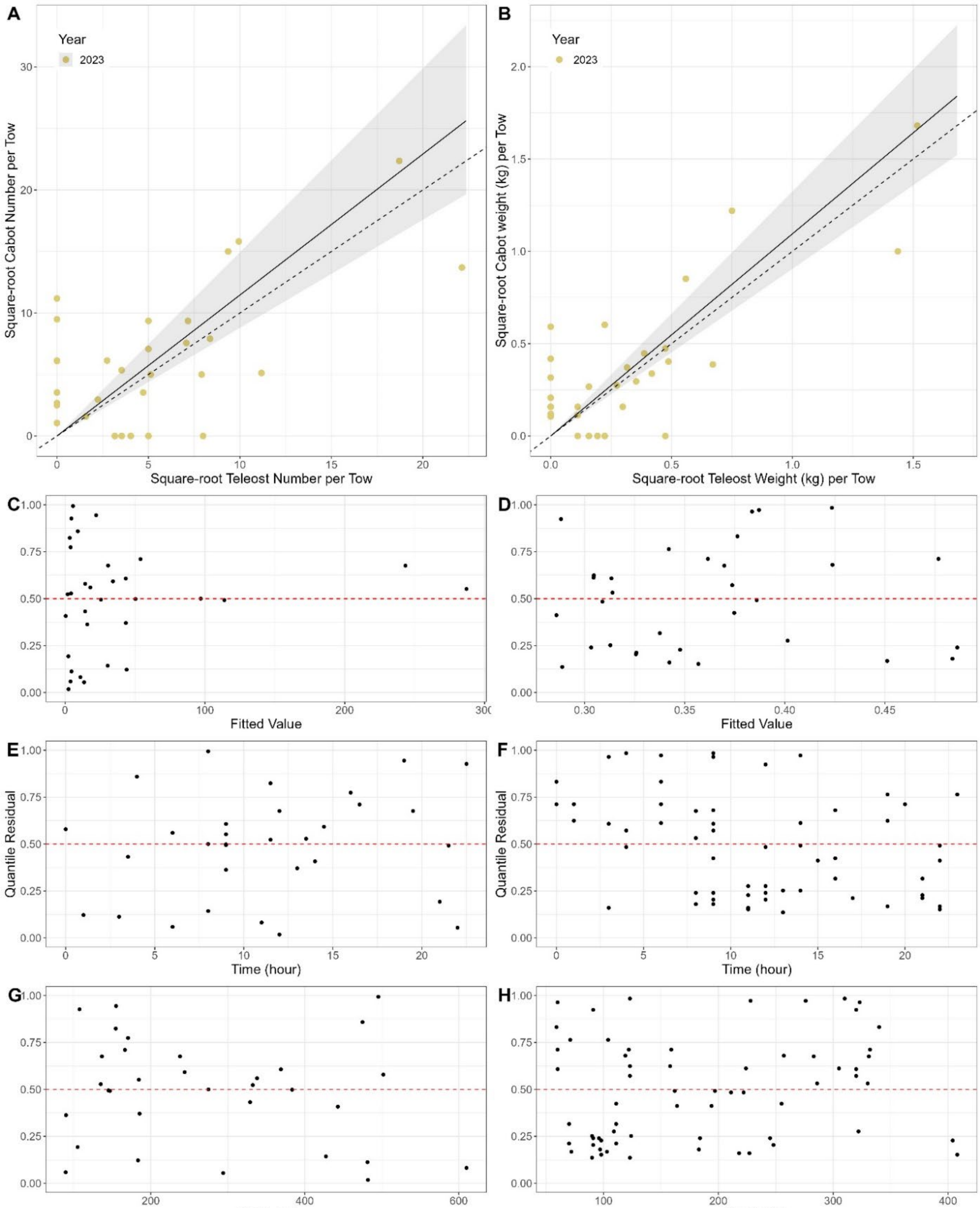


*Figure A2- 40. Results of size-aggregated analysis for the CCGS Teleost and CCGS John Cabot for catch of benthic shrimp (*Eualus belcheri*,* Sclerocrangon *sp.,* Sabinea septemcarinata, Sabinea sarsi*,* Argis *sp.), spring 3LNO.*

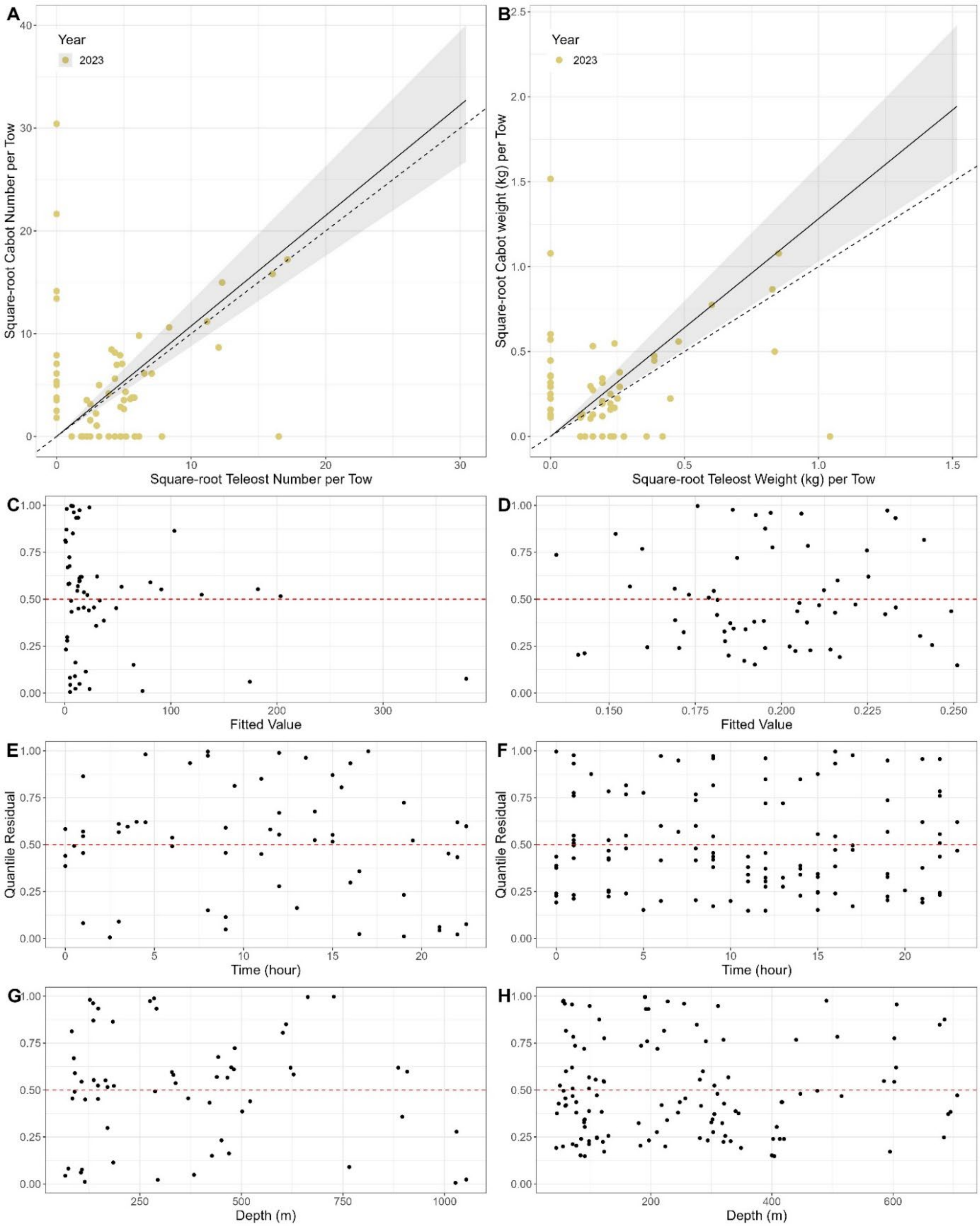


Figure A2- 41. Results of size-aggregated analysis for the CCGS Teleost and CCGS John Cabot for catch of benthopelagic shrimp (Benthesicymus *sp.,* Aristeus *sp.,* Eualus fabricii, Eualus macilentus, Eualus gaimardii, Spirontocaris *sp.,* Lebbeus *sp.,* Dichelopandalus *sp.,* Atlantopandalus *sp.,* Sabinea hystrix*,* Pontophilus *sp.), spring 3LNO.*

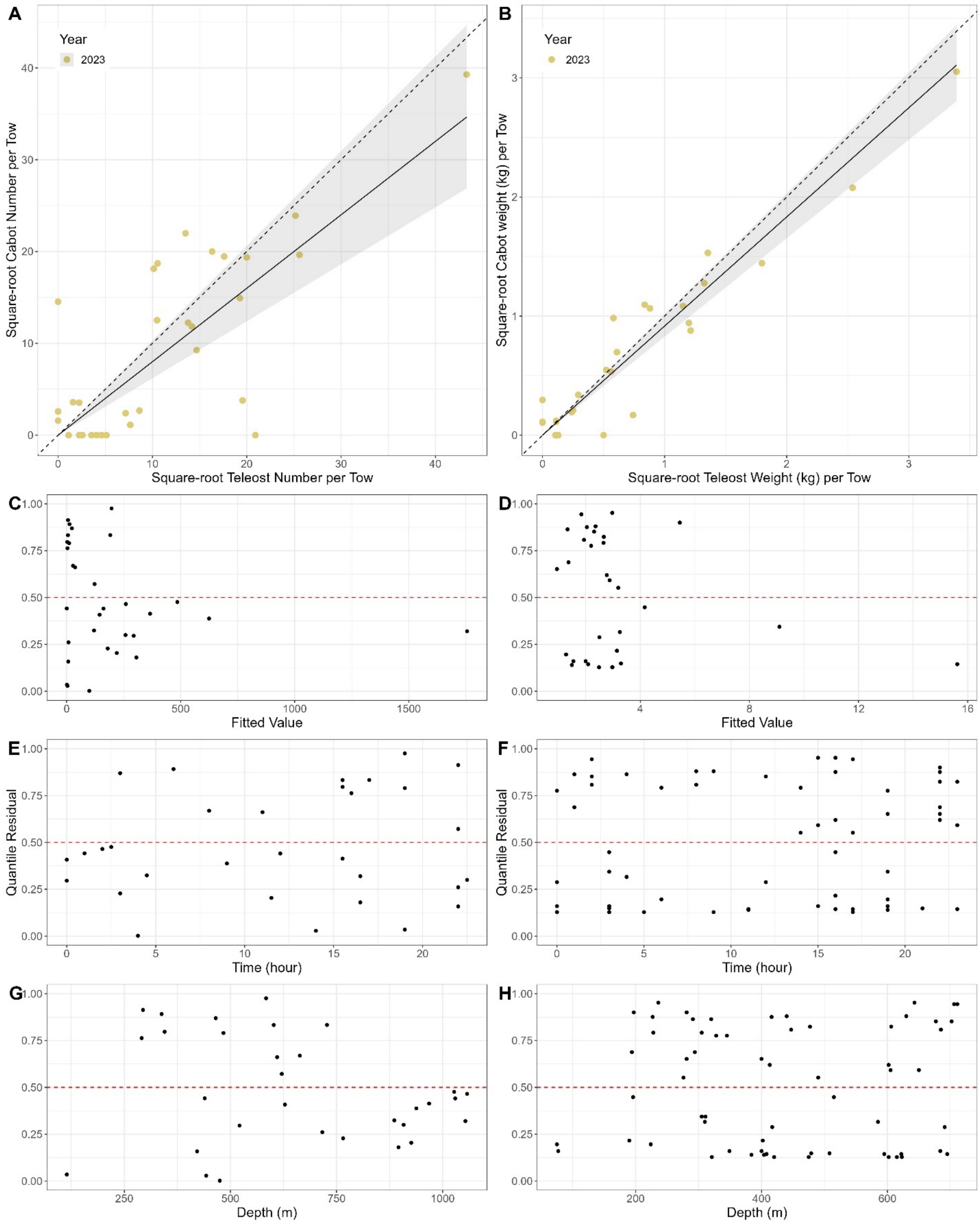


*Figure A2- 42. Results of size-aggregated analysis for the CCGS Teleost and CCGS John Cabot for catch of pelagic shrimp (*Aristaeopsis *sp.,* Gennadas *sp.,* Sergestes *sp.,* Sergia *sp.,* Acanthephyra *sp.,* Pasiphaea *sp.,* Parapasiphae *sp.), spring 3LNO.*

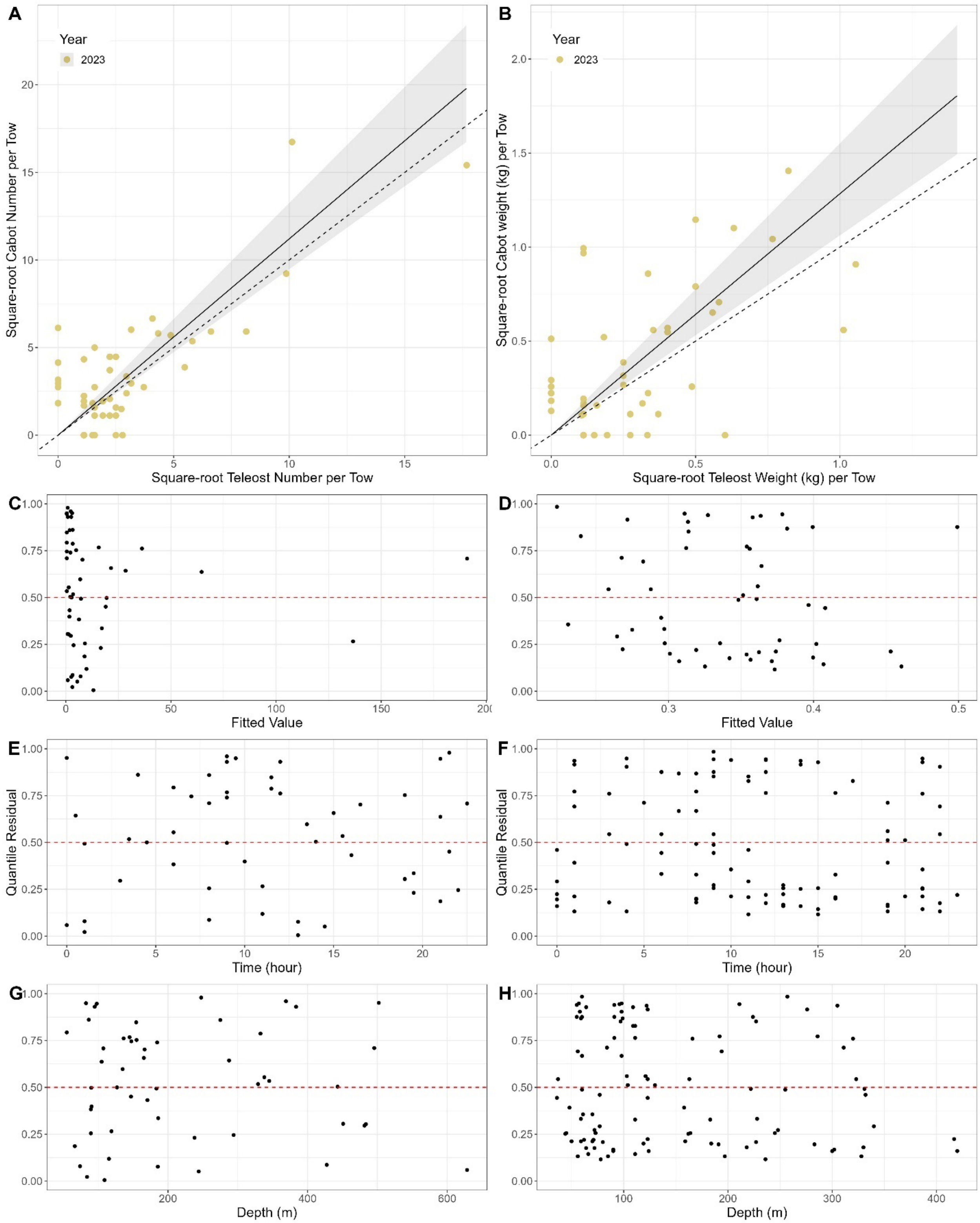


Figure A2- 43. Results of size-aggregated analysis for the CCGS Teleost and CCGS John Cabot for catch of Toad Crab, spring 3LNO.

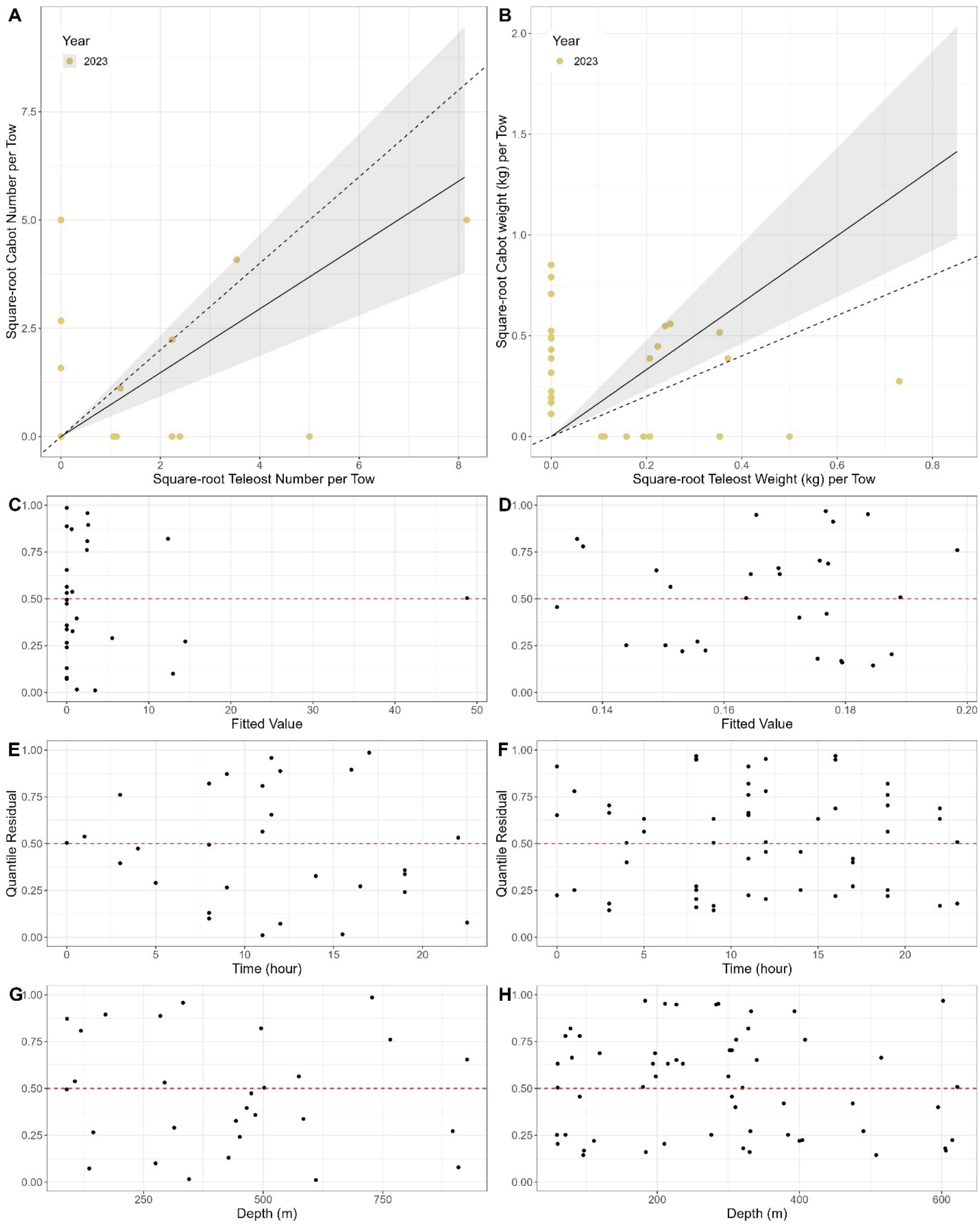


*Figure A2- 44. Results of size-aggregated analysis for the CCGS Teleost and CCGS John Cabot for catch of tunicates (*Ascidiacea*,* Ascidiidae*,* Ascidia *sp.,* Pelonaia *sp.,* Pyuridae*,* Thaliacea*), spring 3LNO.*

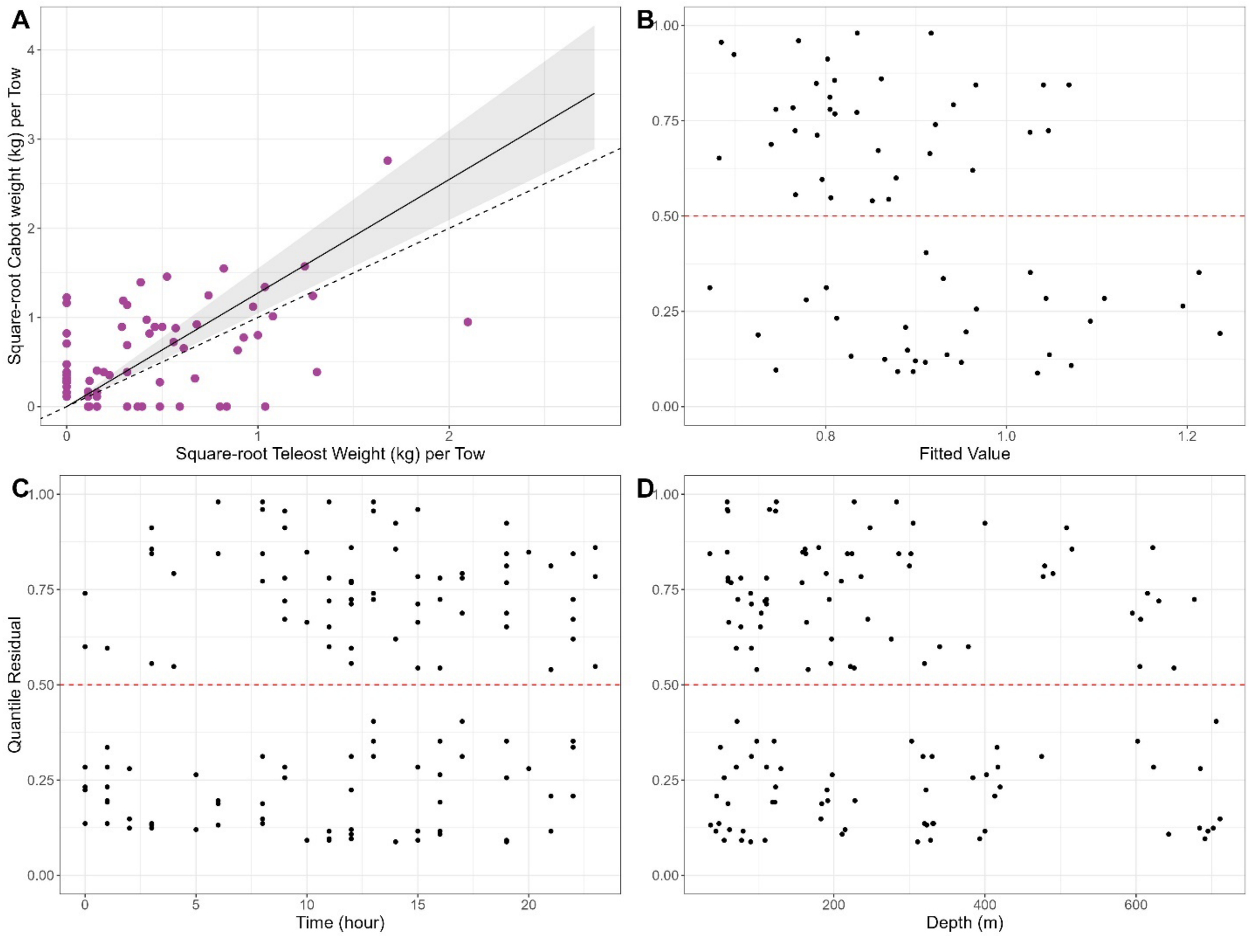


*Figure A2- 45. Results of size-aggregated analysis for the CCGS Teleost and CCGS John Cabot for catch of soft corals (*Duva florida*,* Gersemia rubiformis, Gersemia *sp.,* Nephtheidae *sp.), spring 3LNO.*

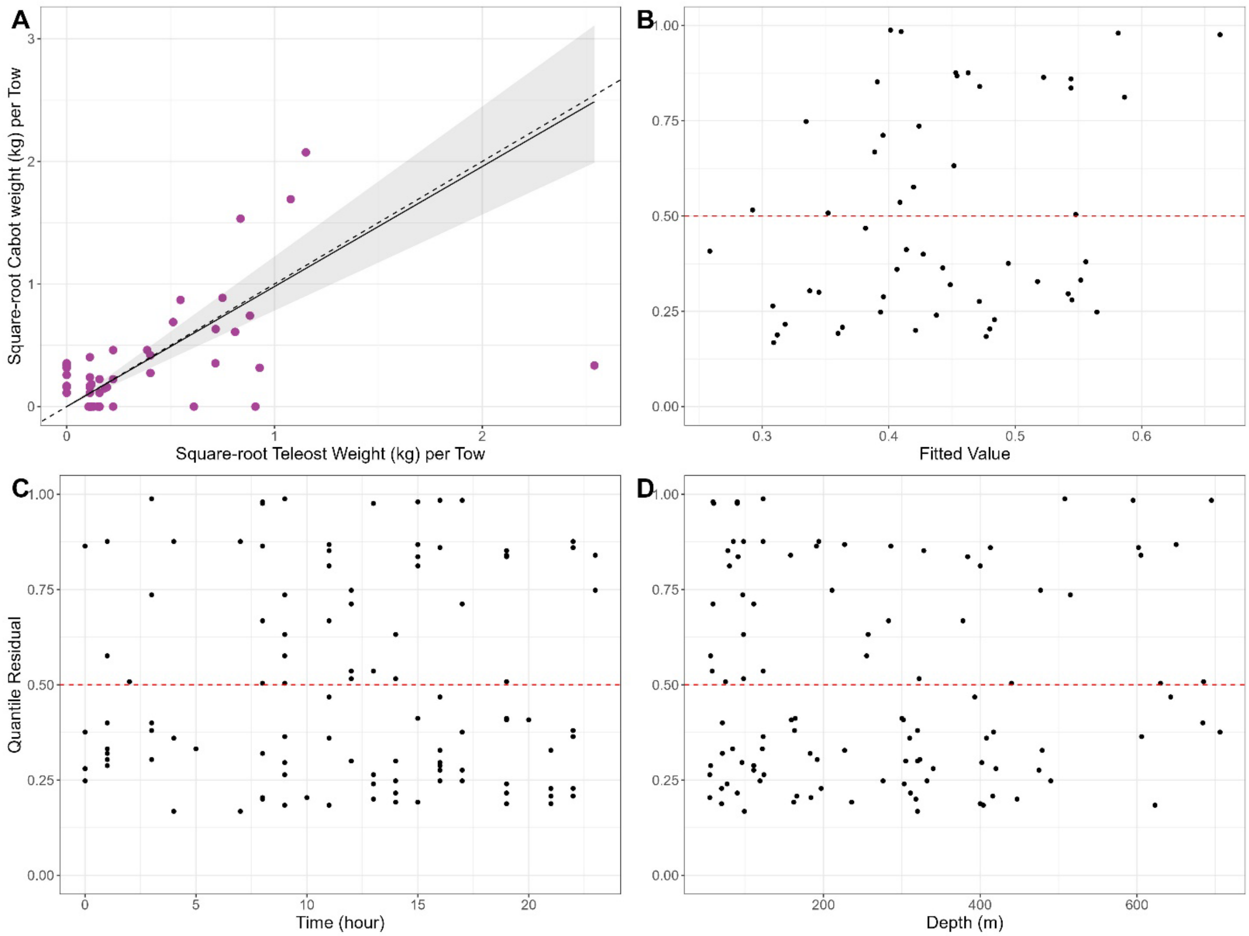


*Figure A2- 46. Results of size-aggregated analysis for the CCGS Teleost and CCGS John Cabot for catch of brittle stars (*Ophiuroidea *except* Gorgonocephalus*), spring 3LNO.*

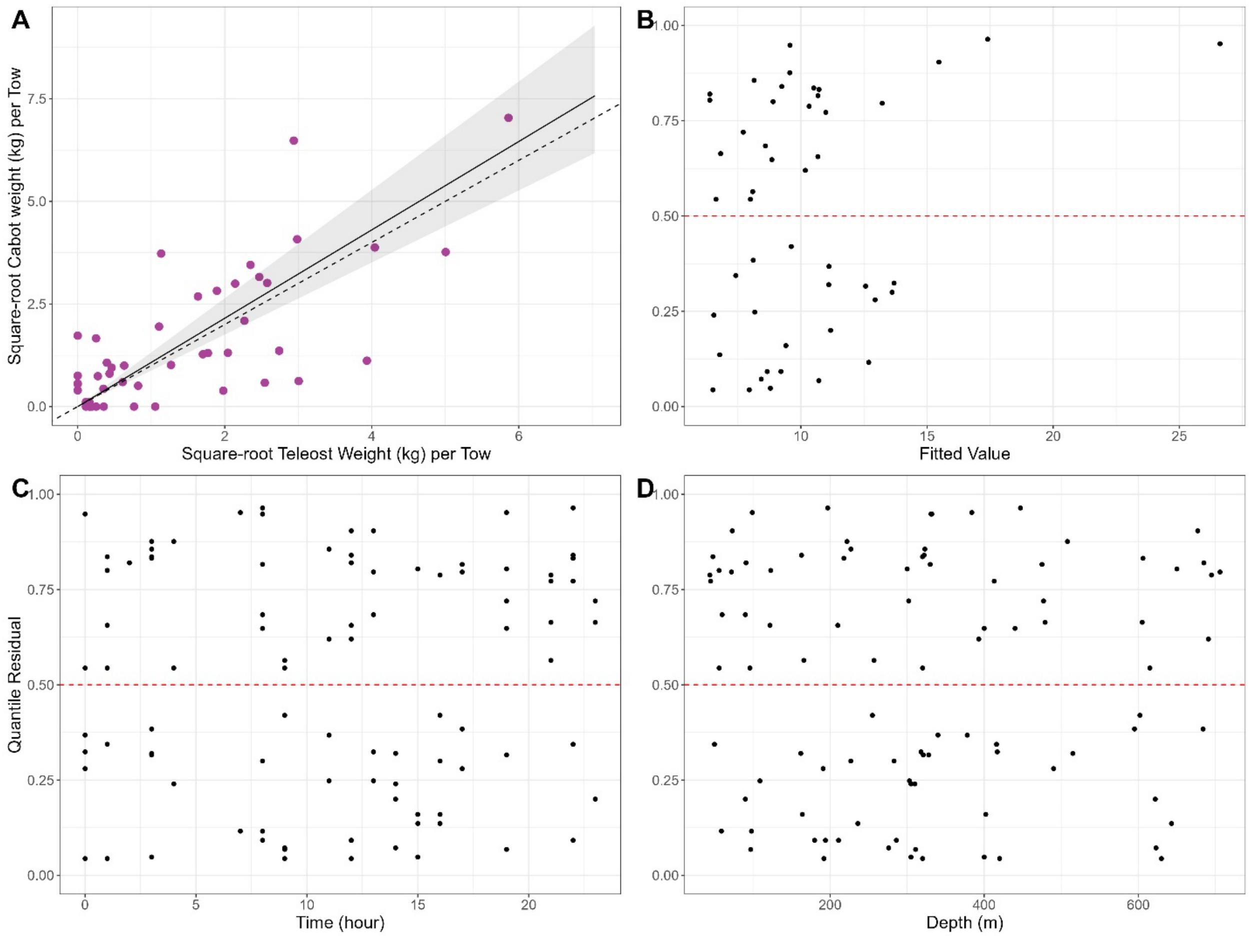


*Figure A2- 47. Results of size-aggregated analysis for the CCGS Teleost and CCGS John Cabot for catch of sponges (*Porifera*), spring 3LNO.*

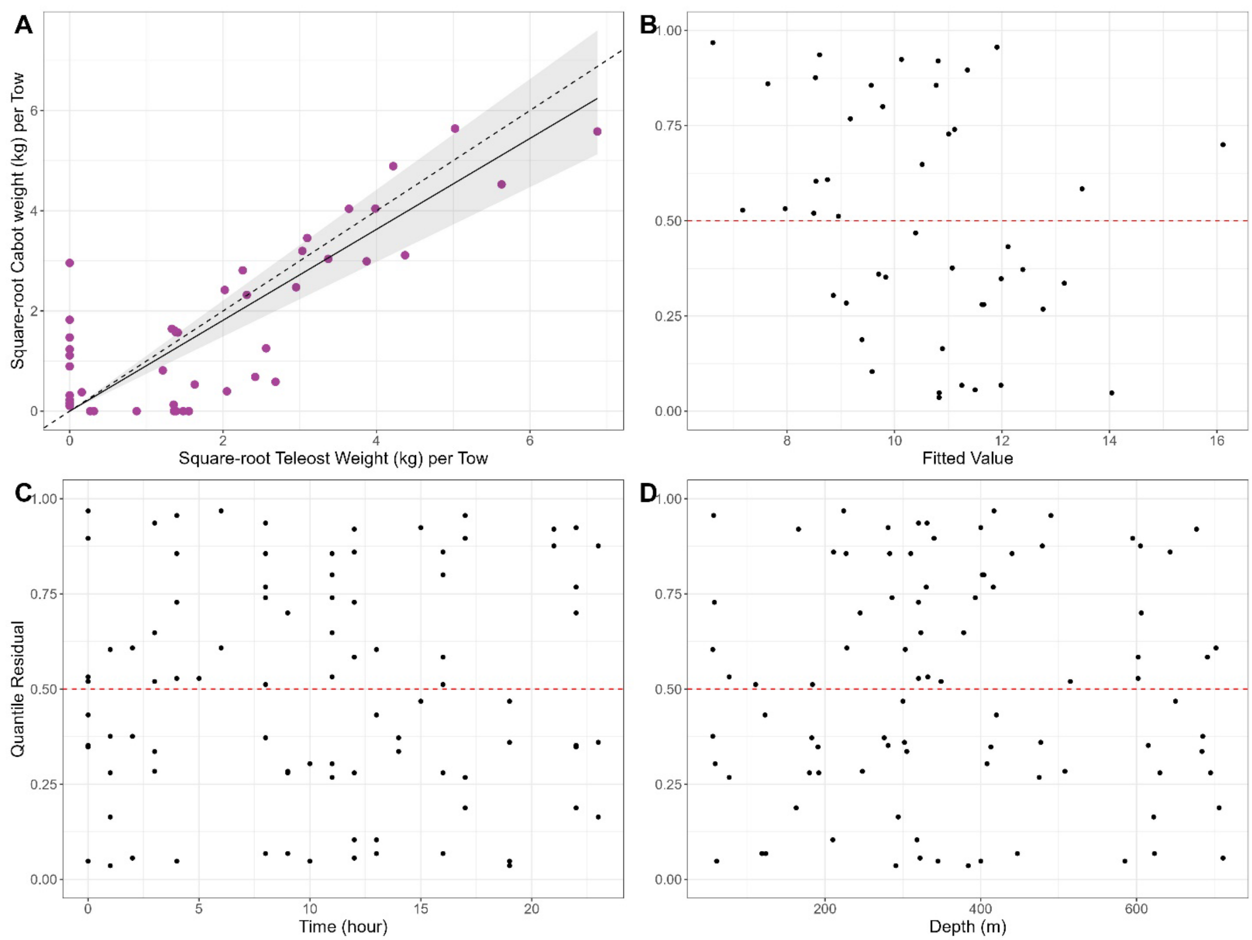


*Figure A2- 48. Results of size-aggregated analysis for the CCGS Teleost and CCGS John Cabot for catch of jellyfish (*Scyphzoa*), spring 3LNO.*

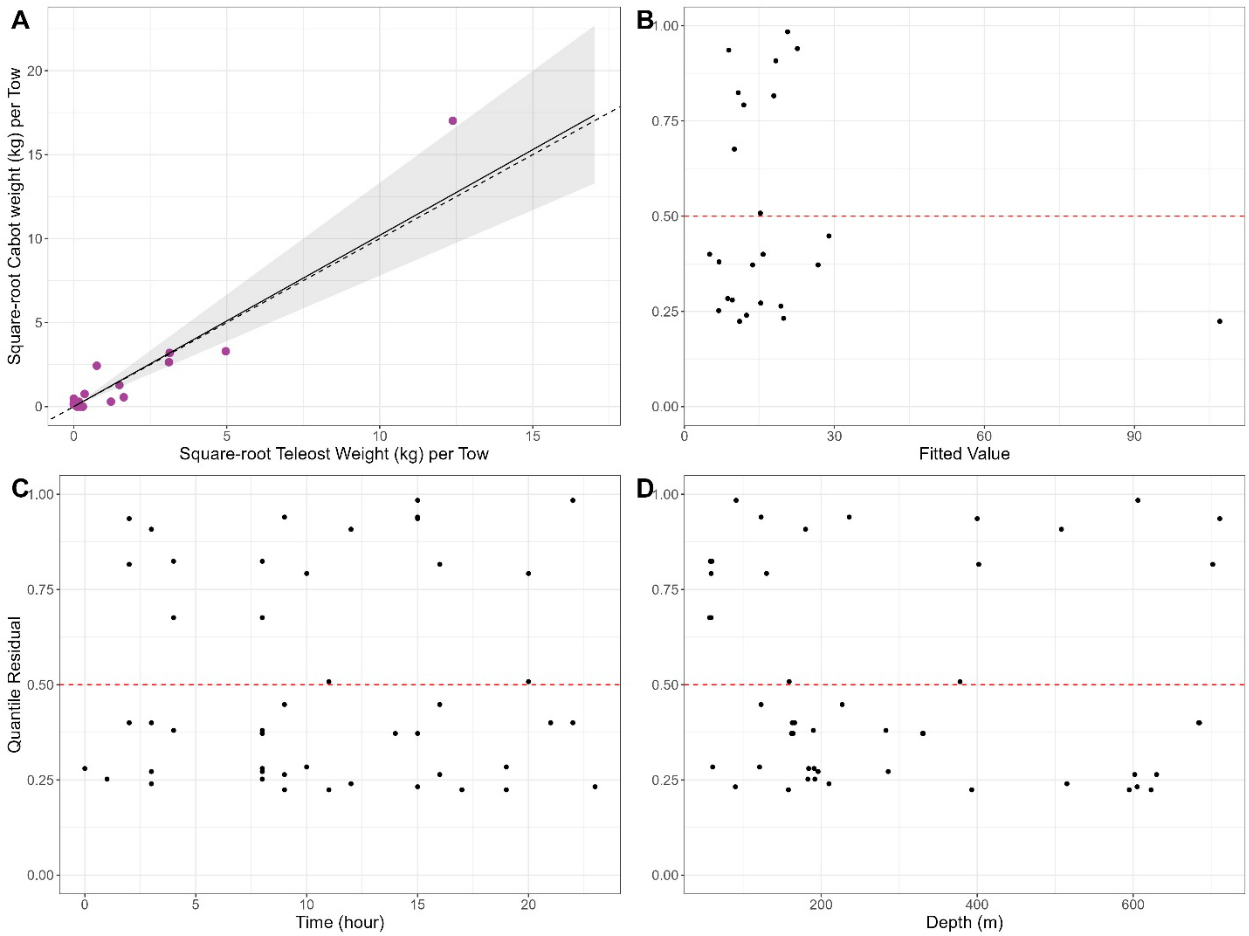


*Figure A2- 49. Results of size-aggregated analysis for the CCGS Teleost and CCGS John Cabot for catch of basket stars (*Gorgonocephalus *sp.), spring 3LNO.*