Spatial variability of Calanus spp. size and lipid content in the northwest Atlantic – Compilation and brief summary of historical observations, 1977-2020

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ABSTRACT

Helenius, L.K., Head, E.J.H., Jekielek, P., Orphanides, C.D., Pepin, P., Perrin, G., Plourde, S., Ringuette, M., Runge, J.A., Walsh, H.J., Johnson, C.L. 2023. Spatial variability of *Calanus* spp. size and lipid content in the northwest Atlantic – Compilation and brief summary of historical observations, 1977-2020. Can. Tech. Rep. Fish. Aquat. Sci. 3549: iv + 58 p.

Marine copepods belonging to the genus *Calanus* are an important trophic link in ecosystems of the Atlantic Ocean, and contribute a substantial proportion of the total copepod biomass in these ecosystems. Measurements of *Calanus* spp. (*C. hyperboreus, C. glacialis and C. finmarchicus*) size and lipid content (individual prosome length, dry weight, oil sac area, and oil sac volume) have been collected over several decades for various projects from regions of the northwest Atlantic. Main areas of collections include the Gulf of Maine, Scotian Shelf, Gulf of Saint Lawrence, and the Newfoundland Shelf. This report documents the merging and processing of these data to compile a multi-regional and multi-decadal *Calanus* spp. size dataset for publication. It also briefly summarizes the overall characteristics of the data, listing the main regional differences in size and lipid metrics, and presenting the relationships between the central size metrics. Additionally, the report outlines the limitations involved in utilizing the dataset, including the influence of different methodologies in sample collection and processing. This report was produced in conjunction with a separate manuscript characterizing the spatial variability of *C. finmarchicus* size and lipid content in feeding grounds of the endangered North Atlantic right whale (*Eubalaena glacialis*).

RÉSUMÉ

Helenius, L.K., Head, E.J.H., Jekielek, P., Orphanides, C.D., Pepin, P., Perrin, G., Plourde, S., Ringuette, M., Runge, J.A., Walsh, H.J., Johnson, C.L. 2023. Spatial variability of *Calanus* spp. size and lipid content in the northwest Atlantic – Compilation and brief summary of historical observations, 1977-2020. Can. Tech. Rep. Fish. Aquat. Sci. 3549: iv + 58 p.

Les copépodes marins appartenant au genre *Calanus* constituent un lien trophique important dans les écosystèmes de l'océan Atlantique et contribuent à une part importante de la biomasse totale de copépodes dans ces écosystèmes. Des mesures de la taille et du contenu lipidique de *Calanus* spp. (*C*. *hyperboreus*, *C*. *glacialis* et *C*. *finmarchicus*) (longueur des prosomes individuels, poids sec et contenu en lipides) ont été recueillies sur plusieurs décennies pour divers projets dans les régions de l'Atlantique Nord-Ouest. Les principales régions de collections comprennent le golfe du Maine, le platier néo-écossais, le golfe du Saint-Laurent, et le platier de Terre-Neuve. Ce rapport documente la fusion et le traitement de ces données pour compiler un ensemble de données de taille *Calanus* spp. multi-régional et multi-décennal. Il résume également brièvement les caractéristiques générales des données, énumérant les principales différences régionales des paramètres de taille et de lipides, et présentant les relations entre les paramètres centraux de taille. En outre, le rapport décrit les limites de l'utilisation de l'ensemble de données, y compris l'influence des différences méthodologiques dans la collecte et le traitement des échantillons. Ce rapport a été produit conjointement avec un manuscrit caractérisant la variabilité spatiale de la taille et du contenu lipidique de *C*. *finmarchicus* dans les aires d'alimentation de la baleine noire de l'Atlantique Nord (*Eubalaena glacialis*).

1. Introduction

Calanoid copepods of the genus *Calanus* are an important link between primary producers and zooplanktivorous consumers in marine food webs in the North Atlantic, often contributing more than half of the total copepod biomass of the area (Planque et al., 2000). *Calanus finmarchicus* and *Calanus hyperboreus*, and to a lesser extent *Calanus glacialis*, are the dominant copepod species of the boreal North Atlantic waters, from the Gulf of Maine east to the Atlantic entrance to the Arctic basin (Head et al., 2003; Runge and Jones, 2012; Pepin et al., 2015), with spatial variations in relative abundance and biomass across the region (Sorochan et al., 2019; 2021). Species of *Calanus* ingest, convert and accumulate large amounts of lipids in a visible membrane-bound oil sac along the midline of their prosome (Lee et al., 2006). These lipids sustain them through a non-feeding diapause period, and are used for growth and reproduction following diapause (Irigoien, 2004), while also rendering calanoids an energy-rich prey to zooplanktivorous organisms including fish and whales (Baumgartner and Mate, 2003; Michaud and Taggart, 2007; McKinstry et al., 2013; Pershing and Stamieszkin, 2020).

The North Atlantic right whale (NARW), *Eubalaena glacialis*, is an endangered species with traditional summer and autumn feeding grounds in regions of the Gulf of Maine and the Scotian Shelf in the North Atlantic Ocean (Baumgartner et al., 2007; Kraus and Rolland, 2007), and more recently identified feeding grounds in the Gulf of Saint Lawrence (Simard et al., 2019; Meyer-Gutbrod et al., 2022). *Calanus finmarchicus* is a significant prey item for NARW (Stone et al., 1988), and zooplankton communities in NARW feeding grounds are often dominated by its lipid-rich late copepodite (C4-C5) and adult (C6) stages (Kann and Wishner, 1995; Woodley and Gaskin, 1996; Baumgartner and Mate, 2003). The Arctic-associated species *C. hyperboreus* and *C. glacialis* are also potential prey for NARW, but their relative importance as such is currently not known. Regime shifts in decreased biomass of *Calanus* spp. coinciding with warmer ocean temperatures have been detected in 2010 and 2011 in the Gulf of Maine and Scotian Shelf areas respectively, and are thought to have resulted in recent changes in spatial distribution and reduced calving rate of NARW (Sorochan et al., 2019; Meyer-Gutbrod et al., 2021). In addition to prey biomass, prey energy content, which can be measured directly or inferred from lipid, is an important measurement of prey quality. In the lower Bay of Fundy, energy content of *Calanus* spp. has been shown to exhibit large spatial (Michaud and Taggart, 2007; 2011) and temporal (McKinstry et al., 2013) variations.

Measurements of *Calanus* spp. size and lipid content (e.g., size in prosome length [PL], dry weight [DW], and lipid content metrics such as oil sac area [OSA] and oil sac volume [OSV]) have been collected for >20 years from the Scotian Shelf (SS), Gulf of Saint Lawrence (GSL), Gulf of Maine-Georges Bank-Nantucket Shoals (GoM) areas, and Newfoundland shelf (NFL) by Fisheries and Oceans Canada (DFO) and the National Oceanic and Atmospheric Administration (NOAA) for various projects and purposes. To compile a multi-regional and multi-decadal *Calanus* size dataset, relevant data have been extracted from these historical observations and collected here into a merged dataset. This report documents the processing of these data, describes the overall characteristics of these data, and notes the limitations and caveats involved with the merged dataset. It summarizes a portion of these data from the years 1977-2020, and documents the methods involved in the collation and formatting of the data. It also provides a minimal description of the merged dataset, to support a separate manuscript characterizing the spatial variability of *C. finmarchicus* size and lipid content in and around NARW feeding grounds. It also records the procedures used to merge the dataset to facilitate additions of data and future analyses. A major focus is to evaluate large-scale spatial differences in lipid content of the fifth copepodite stage (C5) of *C. finmarchicus* in terms of oil sac metrics because of the high energy content related to storing lipid in this diapausing stage. Metrics on the *C. hyperboreus* diapausing stages C4, C5 and C6 have also been included. As a result of the paucity of individual-species-specific data for *C. glacialis* in some of the main areas of interest for comparison (GoM, SS), metrics on *C. glacialis* have not been examined here in detail. Nevertheless, all *C. glacialis* data are retained in the merged dataset.

A public link to the complete merged dataset of the available data (Helenius et al., 2022) is provided in this report (https://open.canada.ca/data/en/dataset/72e6d3a1-06e7-4f41-acec-e0f1474b555b). The original source files listed in section 2.2 have been locally archived as a folder (Calanus_Size_Data) by DFO Maritimes Region data management, and are available on request. A copy of the accompanying data management file (Appendix I) is also attached to this report. There are slight discrepancies between the published dataset and the dataset used for analyses in this report, and they are separately accounted for in footnotes of this report. The data can be analyzed in parallel with a set of standard seasonal and annual environmental indices produced since 1999 by the Atlantic Zone Monitoring Program (AZMP).

Abbreviations:

D/WW: dry/wet weight
GoM: Gulf of Maine
GSL: Gulf of Saint Lawrence
LS: Labrador Sea
NARW: North Atlantic right whale
NS: Nantucket Shoals
NFL: Newfoundland Shelf
PL: prosome length
OSA: oil sac area
OSF: oil sac fullness
OSL: oil sac length
OSV: oil sac volume
OSW: oil sac width
SD: standard deviation
SLE: Saint Lawrence Estuary
SS: Scotian Shelf

C. fin/*glac*/*hyp*: *Calanus finmarchicus*/*glacialis*/*hyperboreus*

2. Methods

2.1 Summary of areas

The data presented in this report have been collected over the years 1977-2020 during several different monitoring program surveys (Fisheries and Oceans Canada Atlantic Zone Monitoring Program [AZMP], Gulf of Maine Ocean Observing System [GoMOOS] and USA National Oceanic and Atmospheric Administration Marine Resources Monitoring, Assessment and Prediction and Ecosystem Monitoring [MARMAP and EcoMon] surveys) as well as through opportunistic sampling of fixed stations and along sections in the main areas for comparison (Gulf of Maine [GoM] including Nantucket Shoals, Scotian Shelf [SS]), Gulf of Saint Lawrence [GSL] including the Saint Lawrence Estuary [SLE], and additionally in the Newfoundland Shelf [NFL] and Labrador Sea [LS]) (Fig 1). It should be noted that sampling locations in the Cabot Strait (CSL stations) were included in both SS and GSL datasets. Therefore, comparisons made in this report represent conservative estimates of differences between these areas, with Cabot Strait as a transition zone between the two.

Sampling in the general areas is summarized as follows:

Area	***Sub-regions***	***Years sampled***	***No. stations sampled***	***Species***	***Stages***	***Max depth (m)***
GoM	Georges Bank (GLOBEC), Jeffrey's Ledge, Wilkinson Basin	1995, 2003-2013, 2016	23	*C. finmarchicus*	C1-C6	225
	Nantucket Shoals	1977-1979, 1999, 2009-2010, 2017, 2020	45			216
SS	AZMP lines: Halifax, Browns Bank, Louisbourg	1995-1999; 2008-2011	87	*C. finmarchicus, C. hyperboreus*	C1-C6	800
GSL	Estuary, Gulf, N Gulf, NW Gulf, SW Gulf, Gaspé Current, Anticosti Gyre	1991; 1993-2019	133	*C. finmarchicus, C. glacialis, C. finmarchicus/glacialis, C. hyperboreus, Calanus spp. Metridia longa*	C1-C6	465
NFL + LS	Grand Banks, Labrador Sea	1994-2010; 2014-2016	92	*C. finmarchicus, C. glacialis, C. hyperboreus*	C5-C6	1000

2.2 List of original data files

AREA	SOURCE DATASET #	SOURCE DATASET # IN PUBLISHED DATASET[1]	FILE NAME	DATE RECEIVED	PROVIDED BY	DESCRIPTION
GULF OF MAINE	**1**	1	Cape Hatteras Data Sep-Oct 2012.xlsx	12/05/2020	Jeffrey Runge	*C. finmarchicus* C4/C5 individual dry weights from Wilkinson Basin stations from R/V Cape Hatteras Sept 2012
	2	2	Prosome_lipid_working_transfer_Dec2016.xlsx	12/05/2020	Jeffrey Runge	*C. finmarchicus* prosome lengths from station S (2003-2005, 2007) and WB-7 (2006); Prosome lengths and oil sac data for stations DMC (2008-2011), WB-3 (2016), WB-7 (2012-2013, 2016) and from mission CH0712 (2012). **NB** Overlap with dataset **3**
	3	2	LipidAnalysis_2012_March2014.xlsx	12/05/2020	Jeffrey Runge	*C. finmarchicus* prosome lengths, dry weights (ltd), oil sac metrics from missions 2012-2013: CH0712 (Cape Hatteras), GC080712, GC010313, GC012813WB7, GC061112, GC070312, GC091412, GC111912WB7 (all station WB-7), IC08022012, IC06122012, IC09182012 (all station DMC-2). **NB** Overlap with dataset **2**.
	4	4	USGLOBEC_1995_CfinC6f_PL-DW-CHN.xlsx	12/05/2020	Jeffrey Runge	*C. finmarchicus* C6f prosome lengths, dry weights, carbon content, C/N from 1995 US GLOBEC program cruises

[1] Source dataset numbers used in this report differ from those listed in the published dataset.

	SOURCE DATASET #	SOURCE DATASET# IN PUBLISHED DATASET	FILE NAME	DATE RECEIVED	PROVIDED BY	DESCRIPTION
	5A	5	CalFin_measurementdata_Sept2019.xlsx	22/07/2020	Harvey Walsh	*C. finmarchicus* prosome lengths from 1977-2017 in Nantucket Shoals, spring data
	5B		CalfinZooStage_1977to2018_v2.xlsx	22/07/2020	Harvey Walsh	Metadata for dataset **5A**.
	6	7	EcoMon_CalFin_AugtoNov.xlsx	22/12/2020	Harvey Walsh	*C. finmarchicus* prosome lengths from 1977-2017 in Nantucket Shoals, fall data
	7	7+	Nantucket Shoals_CalFin_OilSac_Data	14/04/2021	Harvey Walsh	*C. finmarchicus* C5 prosome lengths and oil sac (length, width, perimeter) data sampled Feb-Mar 2020
SCOTIAN SHELF	**8**	14	SIZESWGTSAT STAGEAPR95.xlsx	24/04/2020	Erica Head	*Calanus* spp. size and weight by stage (C1-C6) Apr 1995
	9	15	SIZESWGTSAT STAGEJUL95.xlsx	24/04/2020	Erica Head	*Calanus* spp. size and weight by stage (C1-C6) Jul 1995
	10	16	SIZESWGTSAT STAGEMAY96.xlsx	24/04/2020	Erica Head	*Calanus finmarchicus* size and weight by stage (C1-C6) May 1996
	11	17	SIZESWGTSAT STAGEJUNE96.xlsx	24/04/2020	Erica Head	*Calanus finmarchicus* size and weight by stage (C1-C6) Jun 1996
	12	18	SIZESWGTSAT STAGEAPR97003.xlsx	24/04/2020	Erica Head	*Calanus* spp. size and weight by stage (C1-C6) Apr 1997; associated environmental data
	13	19	SIZESWGTSAT STAGEMAY97009.xlsx	24/04/2020	Erica Head	*Calanus* spp. size and weight by stage (C1-C6) May 1997 – HUD97-009
	14	20	SIZESWGTSAT STAGEAPR98002.xlsx	24/04/2020	Erica Head	*C. finmarchicus* size and weight by stage (C1-C6) Apr 1998
	15	21	SIZESWGTSAT STAGEJUJU98028.xlsx	24/04/2020	Erica Head	*Calanus* spp. size and weight by stage (C1-C6) Jun/Jul 1998

SOURCE DATASET #	SOURCE DATASET# IN PUBLISHED DATASET	FILE NAME	DATE RECEIVED	PROVIDED BY	DESCRIPTION
16	22	SIZESWGTSAT STAGEOCT98050.xlsx	24/04/2020	Erica Head	*C. finmarchicus* size and weight by stage (C1-C6) Oct 1998 – HUD98-050
17	23	SIZESWGTSAT STAGEAPR99003.xlsx	24/04/2020	Erica Head	*Calanus* spp. size and weight by stage (C1-C6) Apr 1999
18	24	SIZESWGTSAT STAGEJUJU99022.xlsx	24/04/2020	Erica Head	*Calanus* spp. size and weight by stage (C1-C6) Jun/Jul 1999
19	26	AllCalPLs98002.xlsx	04/09/2020	Erica Head	*Calanus* (*finmarchicus*, *glacialis*, *hyperboreus*) C6 females prosome lengths, from HUD98002 (Apr 1998)
20A	27	Catherine Johnson-C. Fin lipid analysis.xlsx	06/04/2020	Catherine Johnson	*C. finmarchicus* C4/C5 lipid data for HUD2008-004
20B		lipid_HUD2008004 (3).pdf	06/04/2020	Catherine Johnson	Sample lists and metadata for lipid analysis individuals, HUD2008-004 (dataset **20A**)
21A	31	lipid_2008_037.xlsx	28/05/2020	Catherine Johnson	Prosome lengths, oil sac area/volume for C5 *C. finmarchicus* collected on HUD2008-037
21B		LipidImageInventory_ HUD2008_037.xlsx	06/04/2020	Catherine Johnson	Metadata for HUD2008-037 (dataset **21A**)
21C		HUD2008_037_lipid _datasheets(1).pdf	06/04/2020	Catherine Johnson	Sample lists and metadata for lipid analysis individuals, HUD2008-037 (dataset **21A**)
22A	33	Lipid_Sampling_ Fall2009.xlsx	08/04/2020	Marc Ringuette	Metadata, oil sac, dry weight, and prosome length data for HUD2009-048
22B	35	hud2009-048 individual weight.xlsx	28/05/2020	Catherine Johnson	Dry weight (DW) C and N for *C. finmarchicus* collected on HUD2009-048
22C		Summary lipids (OCT 2010).xlsx	28/05/2020	Catherine Johnson	Summaries/metadata for cruises HUD2009-048, HUD2010-006, HUD2010-01 (datasets **22A**&**22B**)

	SOURCE DATASET #	SOURCE DATASET# IN PUBLISHED DATASET	FILE NAME	DATE RECEIVED	PROVIDED BY	DESCRIPTION
	23	37	Lipid_Sampling_ Spring 2010.xlsx	08/04/2020	Marc Ringuette	Oil sac, dry weight and prosome length data for HUD2010-009 and HUD2010-014; Metadata for HUD2010-009
	24A	40	OSV_Spring2011_ All added_MR.xlsx	23/09/2020	Marc Ringuette	Oil sac, dry weight, prosome length data and metadata for HUD2011-004
	24B		Lipid_Sampling_Plan _Spring2011.xlsx	06/04/2020	Catherine Johnson	Metadata for HUD2011-004 (dataset **24A**)
	25A	41	HUD2011_009_HL2.xlsx	11/05/2020	Marc Ringuette	Oil sac, C/N and prosome length data for HUD2011-009, Station HL2 only
	25B		Hud2011-009_Plankton EventHeaders.xlsx	08/04/2020	Marc Ringuette	Metadata for HUD2011-009 (dataset **25A**)
GULF OF SAINT LAWRENCE	**26**	8	GoStLawrence_ Calanus_CI-VI_PL_extraction _Marsh2020.txt	28/03/2020	Stéphane Plourde	Prosome lengths by stage (C1-C6) and by species (*C. finmarchicus*/*C. glacialis*, *Calanus* sp., *C. hyperboreus*, *Metridia longa*) from 81 missions 1996-2019
	27	9	GoStLawrence_Calanus_ CI-VI_PL-DW-CHN_ extraction_May2020.txt	07/05/2020	Stéphane Plourde	Prosome lengths, dry weights, C/N from missions 1991-2014 (*C. finmarchicus*/*glacialis*/*hyperboreus*, *Metridia longa*)
	28	10	GoStLawrence_Calanus_ Oilsac_extraction _Marsh2020.txt	07/05/2020	Stéphane Plourde	*C. finmarchicus* and *C. glacialis* length metrics, oil sac data for missions 1999-2009
	29	12	COR2019002_ Calanus DW and image analysis_04-08-2020.xlsx	04/09/2020	Stéphane Plourde	Prosome length, oil sac data for *C. finmarchicus* /*hyperboreus* Aug 2019 cruise COR2019002 (complete)

	SOURCE DATASET #	SOURCE DATASET# IN PUBLISHED DATASET	FILE NAME	DATE RECEIVED	PROVIDED BY	DESCRIPTION
NEWFOUNDLAND SHELF AND LABRADOR SEA	**30**	44	CFIN measurements 2006_2009 PLUS NEW For Catherine.xlsx	09/09/2020	Pierre Pepin	Prosome lengths, oil sac area/length for *C. finmarchicus* C5-C6, 2006-2016, HUD and TEL cruises combined.
	31	46	LabSeaCalanus size-stage structure.xlsx	04/09/2020	Erica Head	Prosome lengths, dry weights for *Calanus* (*finmarchicus*, *glacialis*, *hyperboreus*), stages C1-C6, 1994-2006

2.3 Merged dataset: Data extraction and processing

To create a merged dataset of the main study areas for comparison (GoM, SS, GSL, and additionally NFL where available), data on PL, DW, OSA and OSV of *C. finmarchicus* and *C. hyperboreus*, stages C4-C6 were extracted from the original datasets and merged (Calanus_NAtlantic_SizeMetrics_2022.txt). A descriptive analysis of the dataset and of the metrics included in the dataset was made, and is presented in section 5. The analysis presents information on subsets of the data focusing on the main species, stages, and metrics included in the merged dataset. Data relating to other species (*C. glacialis, Metridia longa*) and stages were also included in the merged dataset, but not included in the analysis. The merged dataset consists of the following records where available:

- Temporal and spatial details on sampling (region and sub-region, cruise/mission, year, month, day, sampling time, station, latitude, longitude, maximum station depth, tow depth, gear)
- Details on individual samples (species, stage, preservation state [live or formalin-preserved], ID number, PL, DW, OSA, OSV, oil sac length [OSL], oil sac height [OSH], carbon content [C], nitrogen content [N], and any additional individual body metrics). All OSV values have been derived from the equation (pi*OSA^2)/(4*OSL). Samples with a preservation state of "live" included individuals that had been frozen live. When not directly provided in the dataset, OSV values were calculated if OSA and OSL were available.

Seasonal divisions of sampling were defined as follows:

Winter: Dec-Feb

Spring: Mar-May

Summer: Jun-Aug

Fall: Sep-Nov

All dates presented in numeric values in this report are in the format DD/MM/(YYYY).

Several quality control procedures were conducted for each original dataset to ensure the accuracy, relevance and completeness of all data. Samples that were not identified to species level were included in the merged dataset but excluded from analyses to ensure taxonomic accuracy. Methods used to distinguish *C. finmarchicus* from *C. glacialis* could not be clarified in all cases, but in most datasets where the distinction was relevant, the bimodal distribution of PL data was used to separate the congeners. Data relating to other taxonomic groups or sampling areas that were not relevant to the study of *Calanus* spp. were likewise included in the merged dataset, but excluded from analyses (notwithstanding data related to areas closer to the Arctic Ocean, which were excluded from the merged dataset altogether). All data were checked for missing values and metadata. The merged dataset was presented in a consistent format, and these data are cross-referenceable with analyses, as well as traceable to metadata and original datasets. Each data point is traceable to the individual record in the original data source. Data were checked for abnormalities, but suspect data (i.e., outlier values) were retained in the merged dataset and data count summary, unless they were determined to be judged as data input errors. Some flagged outlier values were not included in analyses, as detailed below. These data are up to date as of October 2022. Detailed summaries showing numbers of observations of each relevant metric on an annual or mission basis per species and stage are provided for datasets that were used in full or in part for analyses in this report (Tables 1-8).

A) **Gulf of Maine data**

Data from datasets **1-7** were included in the merged dataset (Calanus_NAtlantic_SizeMetrics_2022.txt) as GoM data.

For data from datasets **1-3**, several steps were taken:

- Missing coordinates were added if samples were from known station locations.
- Where copepod life stage was not indicated, it was added as “C5” after communication with the data provider.
- There was considerable overlap in datasets 2 and 3. These were screened for duplicates and all data categorized as dataset 3. Duplicates (2755) and samples without relevant data (26) were not included in the merged dataset.
- Single PL data point was removed as an outlier (probable data input error, stage C4, PL = 0.194 mm).
- Single OSL data point modified as probable data input error (punctuation added to produce a value of OSL = 2.458 mm).

A total of 9969 observations were retained in the merged dataset, of which 9276 were stage C4-C6 *C. finmarchicus* (Table 1).

For data from dataset **4**, the following steps were taken:

- Dates were corrected from 1991 to 1995
- Dry weights were converted from µg to mg
- 347 observations remained for analysis, all of which were stage C6 *C. finmarchicus* (Table 2).

For data from datasets **5**-**7**, the following steps were taken:

- Three extreme value data points (*C. finmarchicus* C5 samples with PL>4 mm and <0.25 mm) were removed.
- In dataset **7**, oil sac length and width were provided in the source data. An oil sac area value was estimated using OSL × OSW. These OSA estimates were not included in further analyses because of methodological differences in determining OSA, but were included in the published dataset.
- 4536 observations were retained in the merged dataset, all of which were stage C4-C6 *C. finmarchicus* (Table 3).
- A data label of “NS” for Nantucket Shoals was added in the “Data_cat” column to distinguish these data from other GoM data.

B) Scotian Shelf data

Data from datasets **8-25** were incorporated into the merged dataset. Associated metadata were included from datasets **20B, 21B, 21C, 22B, 22C, 24B and 25B.** The total number of SS observations in the merged dataset was 15907 for *C. finmarchicus* and 1320 for *C. hyperboreus* (Table 4).

For these data, we applied the following steps:

- Individual DW were converted from µg to mg, and DW < 0.02 and ≥ 1 mg were removed.
- An additional OSV was calculated for all samples with data for OSA and OSL ([pi*OSA^2] /[4*OSL]).
- Datasets **8-19**: Only *C. finmarchicus* and *C. hyperboreus* C4, C5 and C6 with PL and DW metrics were included in the merged dataset. Missing coordinates for data points in older datasets (**8-19**) were added as approximate locations if they originated from known repeatedly sampled stations or from metadata in e.g. dataset **12**[2].
- Dataset **12**: C5 *C. hyperboreus* flagged due to extreme value in prosome length (PL = 9.17 mm) and excluded from analyses, but retained in dataset.
- Data for sporadic and/or uncertain *C. glacialis* species samples in datasets **20A-25A** were not retained in the merged dataset because of low sample numbers.
- Dataset **20A**: cruise HUD 2008-004 station M2 stage C4 *C. finmarchicus* flagged due to high PL values (>3 mm). However, these data were not considered outliers, so they were retained in the merged dataset and included in analyses. All 2008 station HL1 stage C4 *C. finmarchicus* flagged due to overall high station averages in prosome length (>2.6 mm) and oil sac area (>0.69 mm^2) measurements. These data were still retained in the merged dataset and included in analyses.
- Dataset **24A**: Datapoints missing crucial data (without measurements or missing stage/station) were removed. Empty dates for sampling station HL2 were added in as 08-04-11 based on metadata. Samples were removed due to developmental stage not determined or irrelevant/uncertain stage (C1-C3/C4? C5?/C6). 1 sample removed due to missing all metrics data (HUD2011-004 *C. finmarchicus* C5 Station CSL4). One data point (cruise HUD2011004, *C. finmarchicus* C4) OSA value removed due to extreme value (12.505 mm^2, probable data input error). Three data points (cruise HUD2011004, station RL1) without a specified life stage were excluded from analyses but retained in the merged dataset. Negative values in C and N measurements were removed.

C) Gulf of Saint Lawrence data

Data from datasets **26-29** were included in the merged dataset as GSL data. Dataset **26** was edited and retained in the merged dataset, but only data with species-specific identification (C6 *C. finmarchicus*, C4-C6 *C. hyperboreus*) were included in the analyses presented here. Datasets **27-29** were included in the merged dataset and in the analyses for both *C. finmarchicus* and *C. hyperboreus*. Headings and qualitative cell contents in all data sheets were translated from French to English. PL were converted from µm to mm and OSA from µm^2 to mm^2. Station

[2] Some coordinates in datasets **8-19** are missing from published dataset.

coordinates were added from DFO publications when not directly included in the dataset (datasets **26-28** where available).

For data from dataset **26** (Table 5), several steps were taken:

- Data for cruises IML-96-17, IML-06-35, IML-08-05, IML-08-10, IML-08-11, IML-08-36 were not included in the merged dataset (no relevant data).
- Data for IML-04-25 and IML-05-69 were not included in the merged dataset (region "Hudson Bay" was not included in the study area).
- Two datapoints (cruise IML-99-14, *C. finmarchicus*, stage C6f) were flagged for extreme PL values (>5 mm), and were not included in analyses but retained in the dataset.
- Coordinates for data points were taken from known station locations and are approximate. Where station number was not clearly indicated, coordinates for the fixed station of the sampling line number were added. Data points without specified year from cruise IML-1979-1980 were labeled "1979-80" and retained in the merged dataset.

No data for specifically C4-C5 *C. finmarchicus* were available in dataset **26**, since all identification of copepodites was limited to "*Calanus* spp." and "*C.fin/C. glac*". If needed, species size ranges can be determined from stage-specific size distribution of all data, or using PL data from datasets **27** and **28** for *C. finmarchicus* specifically.

For data from dataset **27** (Table 6), several additional steps were taken:

- Six samples with no species data were removed.
- 173 samples with no metrics data were removed.
- One data point (*C. finmarchicus*, stage C6f) with extreme DW value was removed (DW > 2.3 mg).
- Data category Germany-Kanada (2006, cruise IML-06-08) was flagged for anomalously low mean PL and high DW (Figs. 10C, 12C) in *C. finmarchicus* C5 but was included in analyses and in the merged dataset.
- One data point (cruise IML-96-17, *C. hyperboreus*, stage C5) flagged for extreme PL value (>8.5 mm), and not included in analyses but retained in the dataset.
- Data points labeled as stage C3+ and C4+ were not included in analyses, but were retained in the merged dataset.

For data from dataset **28** (Table 7), several additional steps were taken:

- 290 samples with no data from IML09-29 were removed, 489 samples with no data from IML09-63 were removed.
- 3 samples from stages C2-C3 were not included in the merged dataset.
- One stage C4+ sample was altered to C4 based on PL value.
- Samples with DW ≤ 0 were removed.
- Roman numerals in column "Stage" changed to Arabic numbers.
- An additional OSV (mm^3) was calculated where both OSA and OSL were available ($[pi*OSA^2]/[4*OSL]$), for 8009 datapoints of *Calanus* spp. stages C4-C6.
- Datapoints without recorded species label (513 observations) were labeled as *Calanus* sp.
- Five *C. finmarchicus* C4 data points (live) and 135 *C. finmarchicus* C6f (formalin) were flagged because of zero value OSA (empty oil sacs, without analyst's notes). Data were

converted to missing values in the merged dataset (labelled as “NA”), and were excluded from analyses.

Data from dataset **29** (Table 7) were formatted for consistency and included as provided in the merged dataset. An additional OSV (mm^3) was calculated where both OSA and OSL were available ([pi*OSA^2] /[4*OSL]), for 502 datapoints of *C. finmarchicus* stage 5 and *C*. *hyperboreus* stages 4-5.

D) Newfoundland Shelf & Labrador Sea data

Data from datasets **30-31** were included in the merged dataset.

- Data from dataset **30** (*C. finmarchicus*, stages C5-C6) were included in the merged dataset as additional Newfoundland Shelf (NFL) data. Missing coordinates were added from known station locations. Datapoints with *OSA* values of 0 (*C. finmarchicus* C5, 12 observations) were disregarded from analyses, and all remaining data were used for analyses (Table 8). An additional OSV (mm^3) was calculated where both *OSA* and *OSL* were available using the equation (pi*OSA^2)/(4*OSL) (3415 datapoints)[3]. Preservation state was identified as “live”[4].
- Data from the summary worksheet (“All the data”) in dataset **31** (*C. finmarchicus*, *C. glacialis*, *C. hyperboreus*, stages C4-C6) were included in the merged dataset as additional Labrador Sea (LS) data. It should be noted that DW values were station averages derived from measurements made for groups of individuals. Therefore, DW values from this dataset have not been used in analyses. The source data did not include sampling months; therefore, these data were not included in seasonal analyses. Datapoints without relevant data (26 *C. glacialis* stage C5) were removed[5].

[3] OSV not included in published dataset.
[4] Preservation state (variable “state”) not recorded as “live” in published dataset.
[5] Datapoints missing crucial metrics were not removed in published dataset.

3. Results and discussion

3.1 Data distribution and characteristics

The most abundant stage and species in the merged dataset was stage C5 *Calanus finmarchicus* in all areas and for all metrics (Table 9). PL was the most available size metric, across all species and life stages in all regions, and relatively equivalent numbers of PL observations were available for C5 *C. finmarchicus* from each main area of comparison (GoM, SS, GSL) (Table 9). However, the number of observations for PL data varied seasonally. For *C. finmarchicus*, most PL data were collected from spring (C4-C6) or fall (C5) (Figs. 2-4). For *C. hyperboreus* most PL data were collected in the spring in SS and in the summer in GSL (Figs. 5-7). The seasonal cumulative distributions of *C. finmarchicus* C5 PL per year in each region illustrate interannual variability in size distributions. These data can be used to identify years in which large proportions of the sampled populations deviated from the average copepod size over time (Figs. 8-11). Overall, spatial differences in the size (PL) and oil sac metrics (OSA and OSV) indicated consistently larger sizes and higher oil sac metrics in *C. finmarchicus* stages C4-C5 in the northern areas of GSL and NFL compared to the other two more southern areas (GoM and SS) (Table 10).

Data for oil sac metrics were not evenly distributed over years of observations. The earliest oil sac data available were for 1999 from GSL (Table 10). If the bulk of the data is divided into three main decades (1990-1999, 2000-2009, 2010-2020), the oil sac data for the earliest decade is limited to GSL. Hence no direct comparisons of oil sac metrics between regions are possible in the first decadal division. Overall seasonal mean, standard deviation, minimum and maximum values of the main size and lipid metrics (PL, DW and OSA) of C4-C6 *C. finmarchicus* and *C. hyperboreus* are shown in Tables 11-16. Because there are regional differences in seasonal transition timing, these statistics may not be directly comparable from the perspective of the phenological phase of the year, as a result of seasonal copepod life history and phytoplankton differences between areas. This topic is discussed further in section 3.2. Data for oil sac metrics were not evenly distributed over seasons: most of the oil sac data for *C. finmarchicus* stage C5 were collected in summer in both GoM and GSL, and spring and fall in SS (Table 13).

Relationships between the main metrics of PL, DW and OSA were explored with linear regression models for *C. finmarchicus* C4 and C5 (Figs. 12-14) and *C. hyperboreus* (Fig. 15) stages C4, C5 and C6 in the areas where data were available. Model coefficients and R^2 as a straightforward measure of goodness of fit are shown in Table 17. Measurements of body size were strongly related, as expected. The most abundant lipid metric, OSA, has an apparent PL-dependent maximum (OSA_{max}) (Miller et al., 2000). OSA generally increased with PL in both *C. finmarchicus* and *C. hyperboreus* stages C4 and C5 (Figs. 13; 15b), but a simple linear regression did not describe the relationship well, because OSA ranged from near zero to the apparent maximum at all values of PL, resulting in increasing variance in OSA with PL (Table 17; Fig. 16a). A straightforward approach to addressing this issue is to define the apparent maximum OSA (OSA_{max}) for *C. finmarchicus* C5 based on the 0.95 quantile regression model derived from all available data using the quantile regression function, *rq*, from the *quantreg* package in the R programming language (Koenker, 2018; Table 17; Fig. 16a). This allowed us to compare proportions of predetermined groups (by season /preservation state /sampling depth) that reached or exceeded the theoretical OSA_{max} (Table 18), and to calculate a size-adjusted oil sac fullness (OSF, %) for each individual as the percentage of observed OSA from predicted OSA_{max}. The OSA_{max} for *C. finmarchicus* C5 was largely driven by NFL data, where ~23% of copepods reached or exceeded OSA_{max} in the summer (Table 18). In other areas the populations had much smaller proportions of copepods reaching OSA_{max}, with GoM on average the lowest overall (1.17%). Seasonal differences were observed in this pattern, with higher proportions of GoM copepods reaching OSA_{max} in the spring compared to the SS and GSL areas (Table 18; Fig. 17b). These were largely copepods in a lower size range of PL (Fig. 17b). In the fall, higher proportions of copepods in SS (~2%) and GSL (~4%) reached OSA_{max} compared to GoM (<1%) (Table 18; Fig. 17d). In the areas with relatively continuous records of oil sac metrics (GoM and GSL), monthly variation in size-adjusted OSF coarsely reflected these regional patterns in copepod lipid accumulation, with peaks in OSF in early summer (June, July) and again in fall (September, October) in GoM. In the GSL, peaks in OSF occurred later on in the year (August – January) (Fig. 18). The overall highest mean OSF was recorded in NFL in June (Fig. 18).

The other relationships between metrics indicated that DW was a particularly useful proxy for lipid content in diapausing stages of *Calanus* spp., because OSA increased relatively consistently with DW (Figs. 13; 15c). This was expected, as up to 50-76% of dry mass in *C. finmarchicus* C5 is made up of lipids (Jónasdóttir, 1999; Vogedes et al., 2010). Seasonal variation in the relationship is possible, because initial lipid reserves obtained during active periods of feeding may not be contained in oil sacs (Jónasdóttir, 1999). During stable non-feeding phases (e.g., diapause) DW can potentially be a more accurate estimate of total energy content compared to OSA, which is determined from images of the oil sac. However, DW data are labor-intensive to acquire and therefore relatively limited in this dataset.

Data from all areas include both live (or frozen live) and formalin preserved samples, although all *C. finmarchicus* C5 oil sac metrics from SS and NFL originated from live samples. Apparent differences were observed between live and formalin-preserved samples in the relationship between PL and OSA in GoM and GSL (Fig. 17 insets), although without consistent patterns in the data. Based on a visual inspection of the relationship, we suggest that the differences were mainly size-related, rather than determined by preservation method. However, significant differences (Welch's *t*-test/ Mann Whitney U test, $p < 0.05$) in OSF between formalin and live samples within regions indicated that live samples generally had fuller oil sacs, with the exception of fall samples in GSL (Fig. 19).

Sampling depth varied in the datasets and should be considered when conducting analyses on oil sac metrics. Diapausing copepods are found at deeper depths, but the vertical distribution of co-occurring active populations is largely restricted to shallower waters. This vertical stratification of copepods at different phases of lipid accumulation was considered by separating data at the biologically relevant depth of 80 m (Krumhansl et al., 2018) to determine potential differences between deep and shallow populations where sampling depth was provided in the data (Figs. 16b; 20). Samples collected from deeper maximum depths had significantly fuller oil sacs (Welch's *t*-test/ Mann Whitney U test, $p > 0.05$) in most areas where comparison was possible, with the exception of summer samples from GSL (Fig. 20). Similarly, higher proportions of sampled copepods reached or exceeded OSA_{max} at deep (>80m) compared to shallow maximum depths in all areas (Table 18; Fig. 16b).

3.2 Data limitations and missing metadata

A crucial aspect in lipid content sampling is the method of sample preservation. There were data from both formalin-preserved and live or live-frozen samples in the datasets, and some older data were not assigned to any category. Working with live or live-frozen copepods should limit the potential rupture and leakage of the oil sac. Specimens should be sorted live prior to freezing or when partially thawed, and handled on refrigerated dishes in a frozen sea water base. Meanwhile, formalin-preserved samples are not conventionally used for energetic studies, because formalin may cause an unknown amount of lipid loss by either oil sac leakage or by exchange with the surrounding preservation solution through the anal pore, as well as degradation of lipid over significantly long periods of time in storage (Morris 1972; Davies et al., 2012). Therefore, researchers addressing energy content analysis should generally use only the animals that retain intact oil sacs regardless of preservation technique (e.g., Reiss et al., 1999). Some lipid loss in formalin-preserved samples may be acceptable as long as there are individuals that retain intact oil sacs, which was the case in the GSL datasets. There is undoubtedly lipid loss associated with preservation, but no specific correction factor can be provided here. Because most of the lipid losses present as empty oil sac cavities, these are generally quite obvious in the body during lipid analysis and imaging, and it is presumably easy for the analyst to identify a damaged oil sac (pers. comm. Stéphane Plourde). Oil droplets are often prevalent in the preservation solution in sample collections, and in the original data sheets there were sporadic analyst notes of obviously ruptured oil sacs. As a conservative approach, zero values of OSA in formalin preserved samples were regarded as missing data and excluded from analyses in this report. For more detailed analyses, it may be possible to disregard data from potentially damaged oil sacs by visual inspection of outliers of the formalin-preserved data and cross-referencing the outliers against analyst notes. This type of oil sac damage is rarely observed in freshly caught or live animals that are carefully handled, so recorded negligible oil sac values in live samples were assumed to be legitimate measurements.

Formalin-preservation effects have been found to be more significant on larger species than on smaller species (Davies et al., 2012), therefore, special caution must be taken with *C. hyperboreus* samples. Oil sac measurements from preserved samples of *C. hyperboreus* in the GSL likely include samples with damaged oil sac cavities, and caution must be used when using the GSL data for further analyses. In the present analyses, only *C. finmarchicus* C5 data have been examined for differences due to preservation, and formalin-preserved C5 samples did not stand out with respect to low oil sac values when size-related effects were considered (Fig. 17 insets). However, there were potential preservation-related differences in OSF in summer and fall samples, when oil sac fullness was generally at its highest (Fig. 19). The comparison of preservation method effects on lipid content metrics in *C. finmarchicus* suggests that preservation method should be included as a variable when conducting more detailed analyses on these data. Oil sac data from Nantucket Shoals that were included in the merged dataset but excluded from the analyses herein (GoM, dataset **7**) were also derived from samples that have been preserved in formalin, and similar caution must be taken if new comparable oil sac data are added to the merged dataset at a later date.

The merged data are as complete as possible at present. However, because the merged dataset was assembled from a diverse set of individual historical observations, there are missing metadata associated with some of the observations, particularly those from older datasets (e.g., SS datasets **8-19**; GSL dataset **28**). For datasets **8-19** additional metadata (updated station names and approximate station coordinates) were obtained from existing DFO AZMP data packages where available. In other cases of missing metadata, it may also be possible to obtain additional metadata from other storage sources. In the case of SS datasets **8-19**, there are additional data files in *.qpw format stored on individual computers at the Bedford Institute of Oceanography. For these datasets, there are also metadata for field missions for one or more years between 2002 and 2006 that have not yet been digitized, currently stored at the Bedford Institute of Oceanography and potentially available through the data provider.

For the older SS datasets included in **8-19**, detailed metadata are largely missing and probably cannot be recovered. These size data originate from net tows that were used to measure abundance and biomass, but only station positions were recorded, occasionally with dates and/or times, but generally not with event numbers. Missions can be identified from dates and years. To obtain the appropriate metadata may prove to be difficult, but the options could be to (a) retrieve all the net tow abundance or biomass data from the DFO BIOCHEM database, and match up the station positions for the net tows with the size or weight data that came from them, or (b) return to the digital or hard copy log books and conduct the same matching-up procedure, thereafter assigning the appropriate coding for the metadata IDs. It should be noted that there should be careful consideration of the type of gear used for sampling, especially with oil sac data, where gear type can influence the extent of oil sac damage; however, these metadata were also not always available for older data.

An additional limitation of some of the data is the level of taxonomic classification. Several of the observations have not been identified to species level and are labeled only *Calanus* spp. (e.g., in GSL dataset **26**). Use of data not identified to species requires careful consideration. Species can be attributed to these data by generating stage-specific size distributions for all the data (as well as literature and experience, e.g., a *PL* of 3.4 mm has been found to be a maximum prosome length for *C. finmarchicus* in the Labrador Sea, and copepods with *PL* >3.4 mm are generally *C. glacialis* [pers. comm., Marc Ringuette]; while 2.9 mm is a general cut-off maximum *PL* used to distinguish *C. finmarchicus* C5 from *C. glacialis* in the GSL area [pers. comm. Stéphane Plourde]). These can be used to determine ranges of prosome lengths for stages of *C. finmarchicus*, *glacialis* and *hyperboreus*. However, using these data may artificially inflate the *PL* metrics from northern areas with higher occurrence of *C. glacialis* (GSL and NFL). A more conservative approach is to disregard inconclusive species data, or alternatively make a comparison with/without these data. There is an abundance of *C. finmarchicus PL* data from GSL, so it should be carefully considered whether it is worthwhile to include *Calanus* spp. data in all species-specific analyses. Because of the possibility of hybridization of *C. finmarchicus* and *C. glacialis* (Parent et al., 2012), all observations that have been definitively identified to species level were used in the analyses here as such, ignoring a maximum PL cutoff between *C. finmarchicus* and *C. glacialis*.

Differences in data collection and methodology in determining size metrics limited straightforward comparisons between datasets. In most datasets, OSA was estimated directly in imaging analysis software through digitization of the outer edges of the oil sac. However, for dataset **7**, OSA was estimated from oil sac length and width, which overlooked inconsistencies in oil sac shape. These OSA estimates were not included in further analyses. Similarly, lack of OSL measurements in some datasets limited largescale calculation and comparison of OSV. Although OSV has long been considered a useful metric for inferring energy content (Miller et al., 1998), OSA was the most available lipid metric throughout the datasets. OSV-inferred wax ester content has been shown to be well correlated with the direct chromatographic measurements of wax ester in *Calanus* (Miller et al., 1998). Yet there is some evidence that inferring wax ester in this way can lead to overestimation, so alternatives such as OSA have been proposed as a proxy for energy content. Vogedes et al. (2010) developed an oil sac cross-sectional area calibration, and concluded that OSA, rather than OSV, approximation provided a better estimate of wax ester content. However, Davies et al. (2012) appropriately pointed out that using OSA as a proxy for a volumetric quantity assumes constant oil sac shape, when in reality variation in oil sac shape directly results in variation in volume, and therefore variation in estimates of wax ester. Because oil sac shape varies among copepod species and environmental conditions (Lee et al., 2006), the use of the OSA calibration is considered limited by e.g., Davies et al. (2012). Although OSA has been used here for the analyses, the OSV data should be used for comparison.

Lastly, while a seasonal comparison of the available data based on common definitions is a simple approach and can, for example, inform us about the energetic quality of available prey along predicted whale feeding habitats, it neglects substantial regional differences in the timing of seasonal ecological transitions, such as the initiation of the spring phytoplankton bloom. These differences influence seasonal dynamics in copepod lipid accumulation and utilization. Moreover, the simple seasonal comparison ignores the varying species- and area-specific life cycles of *Calanus* spp., which result in co-occurring active and diapausing populations at different depths. A more appropriate method for a direct spatial comparison may be to determine the approximate lipid accumulation periods of each copepod species on a month-by-month basis, based on average proportional life history data (Johnson et al., 2008), thereby comparing regional data on copepods in similar phases of the lipid accumulation process.

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6. Tables

Table 1. Numbers of observations of *Calanus finmarchicus* samples per stage for each metric (prosome length [PL], dry weight [DW], oil sac area [OSA] or oil sac volume [OSV]) and total number of individuals with at least one observation in the Gulf of Maine (GoM) (datasets **1-3**).

Year	*Stations*	*Stage*	*PL*	*DW*	*OSA*	*OSV*	*State*	*Totals (Formalin/Live/NA)*
2003	S	C5	400		3	3	Formalin	**400**
		C6	314				Formalin	**314**
2004	S	C5	331				Formalin	**331**
		C6	393				Formalin	**393**
2005	S	C5	335				Formalin	**335**
		C6	319				Formalin	**319**
2006	WB-7(WBTS)	C5	22				Formalin	**22**
		C6	27				Formalin	**27**
2007	S	C4	569				Formalin	**569**
		C5	602				Formalin	**602**
		C6	489				Formalin	**489**
2008	DMC(CMTS)	C4	352		110	110	Formalin/Live	**241/111**
		C5	333		144	144	Formalin/Live	**189/144**
		C6	179		7	7	Formalin/Live	**172/7**
2009	DMC(CMTS)	C4	103		102	102	Live	**103**
		C5	496		341	341	Formalin/Live	**155/341**
		C6	310				Formalin	**310**
2010	DMC(CMTS)	C4	274		274	274	Live	**274**
		C5	596		596	596	Live	**596**
2011	DMC(CMTS)	C4	282		282	282	Live	**282**
		C5	335		335	335	Live	**335**
2012	WB-7(WBTS), DMC(CMTS), CH stations: 103, 105, 108, 112, 115, 116, 206	C4	7	5	7	7	Live/NA	**7/3**
		C5	1261	249	1154	1154	Formalin/Live/NA	**837/178/395**
		C6	1		1	1	Live	**1**
2013	WB-7(WBTS)	C5	88		84	84	Formalin/Live	**56/32**
		C6	22		20	20	Live	**22**
2016	WB-3, WB-7(WBTS)	C5	684		421	420	Formalin	**684**
Totals			**9124**	**254**	**3881**	**3880**		**6445/2433/398**

Table 2. Number of observations of prosome length (PL) and dry weight (DW) data on *Calanus finmarchicus* C6 females from the GLOBEC 1995 dataset from Gulf of Maine (GoM) regions (Crest: Crest of Georges Bank; NEPeak: Northeast Peak of Georges Bank; SFLK: Southern Flank of Georges Bank) (dataset **4**).

Cruise	*Start date*	*End date*	*Region*	*PL*	*DW*
End262	26/02/1995	03/03/1995	Crest	12	12
			NEPeak	36	34
			Totals:	**48**	**46**
End264	28/03/1995	03/04/1995	Crest	24	24
			NEPeak	48	48
			SFLK	24	24
			Totals:	**96**	**96**
End266	27/04/1995	05/05/1995	Crest	24	24
			SFLK	48	47
			Totals:	**72**	**71**
End267	23/05/1995	18/06/1995	GMaine	47	48
			GSC	12	12
			NEPeak	24	24
			Totals:	**131**	**132**
GLOBEC 1995 totals:				**347**	**345**

Table 3. Number of observations of prosome length (PL) data on *Calanus finmarchicus* stages C4-C6 from the Nantucket Shoals (GoM) (datasets **5-7**).

Cruise	*Year*	*Month*	*PL*			*Annual totals*
			C4	C5	C6	
AL7702	1977	Apr	108	329	119	1155
YU7702		Aug		539		
AR7701		Oct		60		
AL7802	1978	Feb	3	112	197	627
DE7802		Mar	2	37	76	
BE7801		Aug	2	154	44	
AL7903	1979	Apr	43	176	45	264
DL9905	1999	Apr	33	70	6	109
DE0902	2009	Feb	54	274	406	734
DE1001	2010	Feb	27	144	287	631
HB1002		Apr	22	54	97	
PC1607	2016	Aug		30		30
HB1701	2017	Feb	55	131	230	506
PC1706		Nov		90		
GM2002_L1	2020	Feb		300		480
GM2002_L2		Mar		180		
	Totals:		**349**	**2680**	**1507**	**4536**

Table 4. Number of observations available from the Scotian Shelf (SS) for each metric of *Calanus finmarchicus* (*C. fin*) and *C. hyperboreus* (*C. hyp*) (prosome length [PL], oil sac area [OSA] or oil sac volume [OSV], and dry weight [DW]) (datasets **8-25**). All data from 2008 onwards are from live samples.

Year/season	*Mission*	*Date start*	*Date end*	*Stations*	*Species*	*Stage*	*PL*	*OSA or OSV*	*DW*	*Total ind*
1995/spring		April		HL1, HL2, HL3, HL4, HL5, H6, H7, LL1, LL2, LL3, LL4, LL5, LL6, LL7, LL8	*C. fin*	C4	225			225
						C5	239			239
						C6f/m	213/ 39			252
1995/summer		July		HL1, HL2, HL3, HL4, HL5	*C. fin*	C4	67			67
						C5	151			151
						C6f/m	49/3			52
1996/spring		May		HL1, HL2, HL3, HL4, HL5, H6, H7	*C. fin*	C4	247			247
						C5	309			309
						C6f/m	210/ 26			236
1996/summer		June		HL1, HL2, HL3, HL4, HL5, H6, H7	*C. fin*	C4	240			240
						C5	359			359
						C6f/m	177/ 26			203
1997/spring		April/ May		BBL1-6, CSL1-6, GUL1-3, HL1-7, LL1-7, RL1-5, LBASIN, LEB	*C. fin*	C4	820			820
						C5	1010			1010
						C6f/m	1178/ 129			1307
					C. hyp	C4	308			308
						C5	411			411
						C6f/m	141/2			141/2
1998/spring		April		BB1-7, CSL1-6, GUL1-3, GWA1-2, HL1-7, LL1-7, RL1-6, NL1-3	*C. fin*	C4	672			672
						C5	727			727
						C6f/m	912/ 162			1074
					C. hyp	C6f	127			
1998/summer	HUD 98-028	June		HL1-6	*C. fin*	C4	165			165
						C5	222			222
						C6f/m	60/29			89
					C. hyp	C4	46			
						C5	7			
						C6f	7			
1998/fall	HUD 98-050	October		BBL1-6, CSL1-6, GUL1-3, HL1-7, LL1-7, RL1-5	*C. fin*	C4	699			699
						C5	751			751
						C6f/m	350/ 48			398
1999/spring	HUD 99-003	April		BBL1-6, CSL1-6, CANSO, CTRY HARB, HL1-7, LL1-7, RL1-5, Gully, LEB	*C. fin*	C4	561			561
						C5	652			652
						C6f/m	775/ 227			1002
1999/summer	HUD 99-022	June		CSL1-5, HL1-5, LL3	*C. fin*	C4	290			290
						C5	382			382
						C6f/m	231/ 54			285
					C. hyp	C4	174			
						C5	60			
						C6f	38			
2008/spring	HUD 2008-004	15/04	18/04	BB1, BB7, HL1, HL3, M2, PS10, RL1	*C. fin*	C4	70	70/70		70
						C5	146	146/ 146		146

2008/fall	HUD 2008-037	07/10	13/10	HL2, HL3, HL5, RL5-6, BBL3, BBL4, BBL5, PS4, BC, RL1	*C. fin*	C5	526	526/ 526		526
2009/fall	HUD 2009-048	05/10	18/10	BBL3, BBL4, BBL7, BC2, CS3, CS4, GUL3, HL2, HL3, HL4, LL2, LL7, RL1, RL5, SIB1, SIB7	*C. fin*	C4	33	33/32	43	63
						C5	104	104/ 103	338	398
2010/spring	HUD 2010-009	10/04	30/05/	BBL3, CS3, HL2, HL3, HL5, LL7, RL5,	*C. fin*	C4	208	208/ 206	132	211
						C5	206	206/ 206	123	206
2011/spring	HUD 2011-004	08/04	23/04	BBL3, BBL6, CSL4, HL2, HL3, HL5, RL1, RL5,	*C. fin*	C4	253	252/ 251	167	261
						C5	267	266/ 265	179	270
	HUD 2011-009	08/05	08/05	BBL3, CS3, HL2, HL3, HL5, LL7, RL5, HL2	*C. fin*	C4	33	33		33
						C5	37	37		37
			Totals:		***C. fin***	**C4**	**4583**	**596/ 592**	**342**	**4624**
						C5	**6088**	**1285/ 1283**	**640**	**6385**
						C6	**4898**			**4898**
					C. hyp	**C4**	**528**			**528**
						C5	**478**			**477**
						C6	**315**			**315**

Table 5. Stage-specific counts of observations for prosome length (PL) data that can be used for analyses of *Calanus* spp. prosome lengths in the Gulf of Saint Lawrence (GSL) (dataset **26**).

Year	*Mission*	*Start date*	*End date*	*Region*	*C4*	*C5*	*C6F*	*C6M*	*Totals*	*Species*
1979-1980	IML-1979-1980	March	May	Estuary-Down, Estuary -Mid, Estuary -Up				954	**954**	*C. fin*
1991	IML-91-xx	24/04	06/07	Estuary			164		**164**	*C. fin*
1993	P445	15/06	22/06	SW Gulf	472	190	270	21	**953**	*Calanus spp.*
1994	IML-94-23	07/06	13/09	Estuary	58	299	284	137	**778**	*Calanus spp.*
1996	IML-96-23	September		Estuary	1206	3406	984	718	**6314**	*C. fin/C. glac*
	IML-96-xx	June		SW Gulf	1560	476	566	21	**2623**	*Calanus spp.*
1997	IML-97-09	30/07	26/08	Estuary	78	129	65	3	**275**	*Calanus spp.*
1998	IML-98-16	11/09	11/09	Estuary	13	400	347	169	**929**	*C. fin/C. glac*
1999	IML-99-14	19/06	25/06	SW Gulf			379		**379**	*C. fin/C. glac, C. fin, C. glac, C.hyp*
	IML-99-20	21/05	17/06	Estuary	168	543	210	49	**970**	*Calanus spp.*
2000	IML-00-13	07/07	17/10	Estuary	144	1028	709	428	**2309**	*Calanus spp.*
	IML-00-24	26/06	03/07	SW Gulf	266	193	236	10	**705**	*C. fin/C. glac, C. fin, C. glac, C. hyp*
2001	IML-01-06	02/05	20/09	Estuary	165	863	672	313	**2013**	*Calanus spp.*
	IML-01-15	30/05	06/06	Estuary - Gulf	339	324	282	35	**980**	*Calanus spp.*
2002	IML-02-12	01/05	18/10	Estuary	204	690	523	160	**1577**	*Calanus spp.*
2003	IML-03-33	16/06	23/06	SW Gulf	1334	593	592	16	**2535**	*Calanus spp.*
2004	IML-04-01	29/02	14/03	Gaspé Current, Anticosti Gyre	69	92	11	9	**181**	*C. fin/C. glac*
	IML-04-12	21/07	23/11	Estuary	78	479	187	30	**774**	*C. fin/C. glac*
	IML-04-21	10/06	16/06	Estuary - Gulf	107	61	80	5	**253**	*Calanus spp.*
	IML-04-61	02/11	12/11	Estuary - Gulf	272	451	34	5	**762**	*Calanus spp.*
2005	IML-05-01-001	04/02	04/02	Anticosti Gyre	17	50	4		**71**	*C. fin/C. glac*
	IML-05-01-002	04/02	04/02	Gaspé Current	7	17	1		**25**	*C. fin/C. glac*
	IML-05-01-003	12/03	12/03	Anticosti Gyre	19	34			**53**	*C. fin/C. glac*
	IML-05-01-004	12/03	12/03	Gaspé Current	4	8	3	1	**16**	*C. fin/C. glac*
	IML-05-01-005	24/03	24/03	Anticosti Gyre	19	50	8	7	**84**	*C. fin/C. glac*
	IML-05-01-006	24/03	24/03	Gaspé Current	14	17	2	2	**35**	*C. fin/C. glac*
	IML-05-01-007	18/08	18/08	Gaspé Current	3	17			**20**	*C. fin/C. glac*
	IML-05-01-008	21/08	21/08	Anticosti Gyre	4	48	13		**65**	*C. fin/C. glac*
	IML-05-31	19/05	15/11	Estuary	405	1071	819	151	**2446**	*C. fin/C. glac*

	IML-05-71	08/11	20/11	Gaspé Current, Estuary - Gulf, Anticosti Gyre	500	1116	42	13	**1671**	*C. fin/C. glac*
2006	IML-06-01	03/02	21/09	Gaspé Current, Anticosti Gyre	142	411	80	23	**656**	*C. fin/C. glac*
	IML-06-05	06/04	16/10	Estuary	321	895	385	364	**1965**	*C. fin/C. glac*
	IML-06-08	21/06	08/07	Estuary - Gulf	1899	1679	306	46	**3930**	*C. fin/C. glac, C.hyp*
	IML-06-43	04/08	27/08	Estuary - Gulf	885	2453	553	140	**4031**	*C. fin/C. glac*
	IML-06-60	01/11	09/11	Estuary - Gulf	330	705	47	11	**1093**	*C. fin/C. glac*
2007	IML-07-31	13/06	22/06	Estuary - Gulf	478	185	182	9	**854**	*C. fin/C. glac*
	IML-07-49	30/10	10/11	Estuary - Gulf	348	543	27	8	**926**	*C. fin/C. glac*
2009	IML-09-37	06/06	13/06	Estuary - Gulf	116	73	66	8	**263**	*Calanus* spp.
2010	IML-10-37	05/06	07/06	Estuary - Gulf	100	93	44		**237**	*Calanus* spp.
2011	IML-11-01	07/02	07/02	NW Gulf	34	30	15	3	**82**	*Calanus* spp.
	IML-11-32	03/06	20/06	Estuary - Gulf, NW Gulf	440	290	579	26	**1335**	*Calanus spp.,C. fin/C. glac, C. fin, C. glac, C. hyp,*
	IML-11-33	13/04	12/10	Estuary	382	490	306	48	**1226**	*Calanus* spp.
	IML-11-50	27/08	27/08	NW Gulf	27	33	17		**77**	*Calanus* spp.
	IML-11-61	02/11	10/11	Estuary - Gulf	356	627	71	7	**1061**	*Calanus* spp.
2012	IML-12-09	18/04	27/11	Estuary	602	679	366	69	**1716**	*Calanus* spp.
	IML-12-12	04/06	11/06	Estuary - Gulf	794	523	175	11	**1503**	*Calanus* spp.
	IML-12-27	02/08	30/08	SW Gulf	607	679	204	30	**1520**	*Calanus* spp.
	IML-12-44	30/10	05/11	Estuary - Gulf	394	500	109	24	**1027**	*Calanus* spp.
2013	IML-13-05	09/04	17/10	Estuary	361	651	393	68	**1473**	*Calanus* spp.
	IML-13-19	02/06	12/06	Estuary - Gulf	586	587	365	31	**1569**	*Calanus* spp.
	IML-13-38	22/10	08/11	Estuary - Gulf	457	621	90	15	**1183**	*Calanus* spp.
2014	IML-14-01	07/05	16/12	Estuary	522	713	343	22	**1600**	*Calanus* spp.
	IML-14-14	01/06	09/06	SW Gulf	531	291	250	15	**1087**	*Calanus* spp.
	IML-14-37	28/10	05/11	SW Gulf	375	434	52	7	**868**	*Calanus* spp.
2015	IML-15-01	18/01	18/01	Estuary	29	24	12	4	**69**	*Calanus* spp.
2016	IML-16-01	23/01	07/12	Estuary	672	469	208	59	**1408**	*Calanus* spp.
	IML-16-04	09/03	09/03	Estuary / Gulf	1	2	1		**4**	*Calanus* spp.
	IML-16-15	02/06	11/06	Estuary / Gulf	453	101	41	4	**599**	*Calanus* spp.
	IML-16-50	21/10	02/11	Estuary / Gulf	526	491	36	5	**1058**	*Calanus* spp.

	TEL-16-61	21/09	21/09	Estuary / Gulf	21	12	1		**34**	*Calanus* spp.
	IML-16-99	21/07	21/07	Estuary / Gulf	14	10	3	2	**29**	*Calanus* spp.
2017	IML-17-05	24/03	04/12	Estuary	239	810	219	22	**1290**	*Calanus* spp.
	IML-17-08	31/05	06/06	Gulf	316	459	233	11	**1019**	*Calanus* spp.
	IML-17-48	09/11	22/11	Gulf	235	552	64	17	**868**	*Calanus* spp.
2018	IML18-14	05/06	11/06	Gulf	588	332	248	25	**1193**	*Calanus* spp.
	IML18-28	23/10	01/11	Gulf	489	498	71	14	**1072**	*Calanus* spp.
	IML-18-04	12/03	06/12	Estuary	465	569	267	59	**1360**	*Calanus* spp.
2019	IML19-09	26/05	02/06	SW Gulf	378	429	161	15	**983**	*Calanus* spp.
	IML-19-04	12/04	17/11	RIKI	420	749	238	27	**1434**	*Calanus* spp.
	IML-19-49	22/10	06/11	SW Gulf	476	537	44	12	**1069**	*Calanus* spp.
			Totals:		**23934**	**32835**	**14359**	**4518**		

Table 6. Number of observations of stage-specific measurements for prosome length (PL) and dry weight (DW) data for *Calanus finmarchicus* (*C. fin*) and *C. hyperboreus* (*C. hyp*) in the Gulf of Saint Lawrence (GSL) (dataset **27**).

Year	*Mission*	*Region*	*Date start*	*Date end*	*PL (C. fin/ hyp)*			*Total PL (C. fin/ hyp)*	*DW (C. fin/ hyp)*			*Total DW (C. fin/ hyp)*
					C4	C5	C6f		C4	C5	C6f	
1991	IML-91-xx	Estuary	24/04	31/05			87	87			72	72
1992	IML-92-xx	Estuary	29/06	18/08			79	79			77	77
1993	IML-93-12	Estuary	26/05	18/07			177	177			175	175
1994	GLO-94-xx		29/05	04/06							52	52
	IML-94-23	Estuary	07/06	13/09		56/ **60**	59/ **60**	115/ **120**	9/**30**	56/ **60**	83/ **60**	148/ **150**
1995	IML-95-17	Estuary	06/06	19/10	34/ **48**	47/ **48**	72/**72**	153/ **168**	34/ **47**	47/ **48**	70/ **72**	151/ **167**
1996	IML-96-17	Estuary	14/05	06/11	45/ **45**	58/ **60**	60/ **60**	163/ **165**	57 /**63**	93/ **96**	88/ **96**	238/ **255**
1997	IML-97-09	Estuary	17/09	15/10	12/ **18**	12/ **24**	11/ **60**	35/**102**			/**35**	/**35**
2006	IML-06-05	Estuary	06/04	16/10						329		329
	IML-06-08	various	23/06	05/07		184		184		182		182
2007	IML-07-26	Estuary	14/06	21/11					6/1	683		689/**1**
2009	IML-09-29	Estuary	20/04	01/10					259	415/**1**	7	681/**1**
2010	IML-10-33	Estuary	26/05	15/09					138/**3**	418	10	566/**3**
2013	IML-13-05	Estuary	12/10	12/10							/**47**	/**47**
		Totals:						993/ **555**				3360/ **659**

Table 7. Number of observations from the Gulf of Saint Lawrence (GSL) for each metric (prosome length [PL], oil sac area/volume [OSA/V], and dry weight [DW]) per copepod species per stage. *Calanus finmarchicus* totals are in **bold** (datasets **28 & 29**).

Year	*Mission*	*Date start*	*Date end*	*Region*	*Species*	*Stage*	*PL*	*OSA/V*	*DW*	*Total ind*	*Mission totals (C. fin)*	*State*
1999	IML-99-xx	13/01	09/11	NW Gulf	*C. fin*	C5	308	308/0	0	308	**544**	Live
						C6	236	236/0	0	236		Live
					C. glac	C6	104	104/0	0	104		Formalin
	IML-99-20	21/05	22/11	Estuary	*C. fin*	C5	589	589/0	0	589	**1086**	Formalin
						C6	497	497/0	0	497		Formalin
2000	IML-00-xx	26/02	03/12	NW Gulf	*C. fin*	C5	71	71/71	0	71	**112**	Formalin
						C6	41	41/41	0	41		Formalin
					C. glac	C6	41	41/41	0	41		Formalin
					Calanus sp.	C5	223	223/223	0	223		Formalin
						C6	290	290/290	0	290		Formalin
	IML-00-13	03/05	17/10	Estuary	*C. fin*	C5	460	460/460	0	460	**835**	Formalin
						C6	375	375/375	0	375		Formalin
					C. glac	C6	140	140/140	0	140		Formalin
2006	IML-06-05	06/04	16/10	Estuary	*C. fin*	C5	326	325/325	313	326	**326**	Live
2007	IML-07-26	14/06	21/11	Estuary	*C. fin*	C4	6	6/6	0	6	**700**	Live
						C5	693	693/693	0	693		Live
						C6	1	1/1	0	1		Live
					C. hyp	C4	1	1/1	0	1		Live
2008	IML-08-57	November	November	various	*C. fin*	C5	3158	3158/3158	0	3158	**3158**	Live
2009	IML-09-29	20/04	01/10	Estuary	*C. fin*	C4	287	287/287	287	288	**665**	Live
						C5	364	364/364	364	364		Live
						C6	13	13/13	13	13		Live
					C. glac	C5	1	1/1	1	1		Live
					C. hyp	C5	1	1/1	1	1		Live
	IML-09-63	November	November	various	*C. fin*	C5	2039	2039/2039	0	2039	**2039**	Live
2019	COR2019-002	12/08	02/09	Gulf	*C.fin*	C5	235	234/234	233	237	**237**	Live
					C. hyp	C4	177	177/177	179	179		Live
						C5	91	91/91	92	92		Live
					C. fin totals:						**9702**	

Table 8. Number of observations available from the Newfoundland Shelf for *C. finmarchicus* (prosome length [PL], oil sac area [OSA]) (dataset **44)**.

Year	*Month*	*Mission*	*Stage*		*PL*	*OSA*
2006	June	TEL673	C5		164	164
	August	TEM697			115	115
	September	TEM697			245	245
	November	HUD731			169	169
	December	HUD731			84	84
				Annual totals	**777**	**777**
2007	November	HUD754	C5		300	300
	December	HUD754			99	99
				Annual totals	**399**	**399**
2008	November	HUD865	C5		490	490
	December	HUD865			330	330
				Annual totals	**820**	**820**
2009	November	HUD929	C5		357	357
	December	HUD929			318	318
				Annual totals	**675**	**675**
2014	November	HUD114	C5		**194**	**194**
			C6f		**7**	**7**
	December	HUD114	C5		**198**	**198**
			C6f/m		**27/6**	**27/6**
			C5	Annual totals	**392**	**392**
			C6f/m	Annual totals	**34/6**	**34/6**
2015	November	HUD115	C5		**203**	**203**
			C6f/m		**12/1**	**12/1**
2016	November	HUD116	C5		**96**	**96**
			C6f/m		**6/6**	**6/6**
					3427	**3427**

Table 9: A summary of the number of observations from the merged dataset of all areas for the main metrics (prosome length [PL], dry weight [DW] and oil sac area [OSA]) for the main stages (C4-6) of *Calanus finmarchicus*, *C. glacialis* and *C. hyperboreus* (*C. fin/glac/hyp*) per area. Bold type indicates values used in analyses in this report.

Region	*Species*	*Stage*	*Total samples*	*PL*	*DW*	*OSA*
GoM	*C. fin*	C4	1939	1936	5	775
		C5	8312	8163	249	3558
		C6	3909	3908	345	28
		C.fin totals	**14160**	**14007**	**599**	**4361**
SS	*C. fin*	C4	4624	4583	342	596
		C5	6385	6088	640	1285
		C6	4898	4898		
		C. fin totals	**15907**	**15569**	**982**	**1881**
	C. hyp	C4	528	528		
		C5	478	478		
		C6	**315**	**315**		
		C. hyp totals	**1321**	**1321**		
GSL	*Calanus* sp.	C4	16907	16907		
		C5	19228	19228		223
		C6	11262	11262		265
		Calanus sp. totals	47397	47397		488
	C. fin	C4	810	384	790	288
		C5	10483	8600	3132	8213
		C6	3566	3444	648	1028
		C. fin totals	**14859**	**12428**	**4570**	**9529**
	C. fin/glac	C4	6830	6830		
		C5	13830	13830		
		C6	5849	5849		
		C. fin/glac totals	26509	26509		
	C. glac	C4	2		2	
		C5	11	9	11	1
		C6	325	325		282
		C. glac totals	338	334	13	283
	C. hyp	C4	547	486	323	178
		C5	373	323	298	92
		C6	627	532	310	
		C. hyp totals	**1547**	**1341**	**931**	**270**
NFL	*C. fin*	C5	3362	3362		3350
		C6	65	65		65
		C. fin totals	**3427**	**3427**		**3415**
LS	*C. fin*	C4	4149	4149	4149	
		C5	5045	5045	5045	
		C6	7122	7122	7122	
		C. fin totals	**16316**	**16316**	**16316**	
	C. glac	C4	580	580	580	
		C5	684	658	658	
		C6	401	401	401	
		C. glac totals	1639	1639	1639	
	C. hyp	C4	1422	1422	1422	
		C5	2126	2126	2126	
		C6	**652**	**652**	**652**	
		C. hyp totals	**4200**	**4200**	**4200**	
	All species	All stages, totals	147620	144488	29250	20227
	C. fin	All stages, totals	64669	61747	22467	19186
	C. hyp	All stages, totals	7068	6862	5131	270

Table 10. Mean prosome length (PL [mm]) and oil sac metrics (OSA [mm^2] and OSV [mm^3]) from C4, C5 and C6 *Calanus finmarchicus* from the main regions of comparison (Gulf of Maine, including Nantucket Shoals [GoM], Scotian Shelf [SS]), Gulf of Saint Lawrence [GSL] and Newfoundland Shelf [NFL] from 1977-2019. Red highlights years which include oil sac data for some or all areas.

Stage		*GoM*			*SS*			*GSL*			*NFL/LS*		
	Year	*PL*	*OSA*	*OSV*	*PL*	*OSA*	*OSV*	*PL*	*OSA*	*OSV*	*PL*	*OSA*	*OSV*
C4	*1977*	2.01											
	1978	1.95											
	1979	1.88											
	1994										2.05		
	1995				1.91			1.98			1.96		
	1996				1.83			2.02			2.04		
	1997				1.95			1.89			2.01		
	1998				1.88						2.03		
	1999	2.0			1.86						2.00		
	2000										2.04		
	2001										2.05		
	2002										2.02		
	2003										1.89		
	2004										1.97		
	2005										2.02		
	2006										2.09		
	2007	1.82						2.32	0.59	0.13			
	2008	1.74	0.24	0.03	2.25	0.43	0.08						
	2009	1.8	0.25	0.04	1.72	0.11	0.01	2.09	0.32	0.06			
	2010	1.82	0.2	0.03	1.98	0.32	0.05						
	2011	1.75	0.19	0.03	1.98	0.30	0.05						
	2012	1.63	0.25	0.04									
	2017	1.79											
	Overall	**1.81**	**0.21**	**0.03**	**1.90**	**0.31**	**0.05**	**2.07**	**0.46**	**0.10**	**2.02**		
C5	*1977*	2.48											
	1978	2.32											
	1979	2.4											
	1994							2.72			2.68		
	1995				2.48			2.66			2.68		
	1996				2.46			2.52			2.63		
	1997				2.55			2.51			2.60		
	1998				2.43						2.81		
	1999	2.44			2.45			2.62	0.84		2.74		
	2000							2.65	0.89	0.27	2.63		
	2001										2.72		
	2002										2.76		
	2003	2.37	0.47	0.08							2.57		

	2004	2.36									2.50		
	2005	2.36									2.70		
	2006	2.69						2.36	0.77	0.22	2.58	0.84	0.29
	2007	2.34						2.68	1.06	0.37	2.44	0.91	0.28
	2008	2.33	0.73	0.2	2.37	0.66	0.17	2.33	0.78	0.24	2.40	0.91	0.29
	2009	2.31	0.69	0.19	2.34	0.78	0.23	2.44	0.76	0.21	2.46	0.80	0.23
	2010	2.33	0.6	0.15	2.42	0.63	0.16						
	2011	2.26	0.53	0.12	2.47	0.59	0.17						
	2012	2.35	0.68	0.17									
	2013	2.32	0.59	0.13									
	2014										2.21	0.58	0.16
	2015										2.35	0.70	0.20
	2016	2.18	0.4	0.07							2.30	0.62	0.18
	2017	2.24											
	2019							2.49	0.89	0.28			
	2020	2.33											
	Overall	**2.36**	**0.59**	**0.15**	**2.45**	**0.67**	**0.18**	**2.45**	**0.81**	**0.24**	**2.58**	**0.81**	**0.25**
C6	*1977*	2.85											
	1978	2.58											
	1979	2.65											
	1991							3.05					
	1992							3.05					
	1993							3.06					
	1994							3.02			2.99		
	1995	2.66			2.81			2.95			3.07		
	1996				2.87			3.01			3.06		
	1997				2.84			2.89			2.92		
	1998				2.77						3.03		
	1999	2.74			2.78			2.93	0.48		2.98		
	2000							2.97	0.64	0.16	3.04		
	2001										2.98		
	2002										2.94		
	2003	2.63									2.94		
	2004	2.59									2.88		
	2005	2.66									2.94		
	2006	2.87									3.02		
	2007	2.68						3.17	0.74	0.15			
	2008	2.73	0.66	0.14									
	2009	2.57						2.70	0.51	0.09			
	2010	2.61											
	2011							2.79					
	2012	2.55	0.81	0.21									
	2013	2.46	0.44	0.08									
	2014										2.64	0.68	0.18
	2015										2.84	0.96	0.33

	2016										2.64	0.74	0.22
	2017	2.54											
	Overall	**2.63**	**0.51**	**0.10**	**2.80**			**2.96**	**0.55**	**0.16**	**2.98**	**0.75**	**0.22**

Table 11. Seasonal mean, standard deviation, minimum and maximum values of prosome length (PL, mm) of C4-C6 *Calanus finmarchicus* by area.

C4

Area	*Season*	*N*	*mean*	*sd*	*min*	*max*
GoM	winter	260	1.77	0.16	1.46	2.71
	spring	630	1.89	0.18	1.19	2.57
	summer	753	1.79	0.14	0.90	2.30
	fall	293	1.72	0.13	1.26	2.32
SS	spring	3089	1.96	0.16	1.44	3.36
	summer	762	1.78	0.12	1.36	2.08
	fall	732	1.76	0.17	1.33	2.52
GSL	spring	12	1.89	0.09	1.72	2.03
	summer	302	2.05	0.18	1.74	2.74
	fall	58	2.26	0.28	1.79	2.76
total N:		**6891**				

C5

Area	*Season*	*N*	*mean*	*sd*	*min*	*max*
GoM	winter	1770	2.29	0.20	1.52	3.10
	spring	1689	2.44	0.24	1.49	3.62
	summer	3122	2.34	0.23	1.59	3.34
	fall	1582	2.29	0.20	1.28	2.92
SS	spring	3593	2.52	0.20	1.63	3.73
	summer	1114	2.39	0.19	1.92	3.00
	fall	1381	2.31	0.20	1.65	3.11
GSL	winter	78	2.51	0.14	2.13	2.88
	spring	503	2.52	0.16	2.11	3.24
	summer	1874	2.56	0.29	1.57	3.51
	fall	6133	2.41	0.25	1.31	3.45
NFL	winter	1029	2.38	0.26	1.64	3.17
	summer	279	2.55	0.25	1.88	3.28
	fall	2054	2.39	0.25	1.53	3.27
total N:		**26201**				

C6

Area	*Season*	*N*	*mean*	*sd*	*min*	*max*
GoM	winter	1729	2.56	0.17	1.75	3.64
	spring	1132	2.69	0.19	2.11	3.42
	summer	724	2.70	0.18	2.06	3.51
	fall	323	2.61	0.17	2.17	3.09
SS	spring	3871	2.82	0.20	1.96	3.44
	summer	629	2.80	0.21	2.28	3.36
	fall	398	2.64	0.20	2.08	3.40
GSL	winter	239	2.64	0.20	2.26	3.81
	spring	1301	2.88	0.21	2.25	3.81
	summer	1624	2.96	0.24	2.26	3.80
	fall	267	2.96	0.20	2.31	3.89
NFL	winter	33	2.62	0.30	1.83	2.99
	fall	32	2.72	0.25	2.26	3.19
total N:		**12302**				

Table 12. Seasonal mean, standard deviation, minimum and maximum values of DW (DW, mg) of C4-C6 *Calanus finmarchicus* by area.

C4

Area	Season	N	mean	sd	min	max
GoM	fall	5	0.13	0.06	0.08	0.22
SS	spring	299	0.14	0.07	0.05	0.50
	fall	43	0.07	0.09	0.02	0.52
GSL	spring	12	0.07	0.02	0.04	0.11
	summer	674	0.13	0.07	0.04	0.62
	fall	104	0.20	0.14	0.05	0.65
total N:		**1137**				

C5

Area	Season	N	mean	sd	min	max
GoM	fall	249	0.29	0.10	0.08	0.81
SS	spring	302	0.29	0.12	0.08	0.78
	fall	338	0.22	0.09	0.03	0.52
GSL	spring	432	0.29	0.12	0.09	0.82
	summer	1973	0.36	0.19	0.02	1.43
	fall	727	0.39	0.14	0.06	1.39
total N:		**4021**				

C6

Area	Season	N	mean	sd	min	max
GoM	winter	34	0.26	0.03	0.22	0.33
	spring	252	0.33	0.09	0.17	0.62
	summer	59	0.29	0.06	0.18	0.45
GSL	spring	144	0.33	0.11	0.13	1.22
	summer	453	0.38	0.1	0.03	1.04
	fall	51	0.39	0.1	0.17	0.56
total N:		**993**				

Table 13. Seasonal mean, standard deviation, minimum and maximum values of oil sac area (OSA, mm^2) of C4-C6 *Calanus finmarchicus* by area.

C4

Area	Season	N	mean	sd	min	max
GoM	winter	63	0.16	0.11	0.01	0.50
	spring	247	0.18	0.13	0.01	0.60
	summer	345	0.24	0.12	0.01	0.54
	fall	120	0.22	0.13	0.01	0.52
SS	spring	563	0.32	0.17	0.01	1.23
	fall	33	0.11	0.08	0.01	0.36
GSL	summer	240	0.25	0.13	0.02	0.79
	fall	48	0.72	0.30	0.22	1.24
total N:		**1659**				

C5

Area	Season	N	mean	sd	min	max
GoM	winter	340	0.56	0.24	0.02	1.34
	spring	369	0.54	0.30	0.03	1.52
	summer	1432	0.61	0.27	0.04	1.56
	fall	937	0.67	0.21	0.13	1.29
SS	spring	655	0.62	0.27	0.09	1.91
	fall	630	0.68	0.26	0.10	1.62
GSL	winter	78	0.83	0.18	0.50	1.30
	spring	484	0.60	0.24	0.04	1.23
	summer	1538	0.85	0.36	0.02	2.10
	fall	6113	0.82	0.31	0.01	2.02
NFL	winter	1017	0.79	0.33	0.01	1.95
	summer	279	0.94	0.46	0.09	2.05
	fall	2054	0.80	0.33	0.04	2.02
total N:		**15926**				

C6

Area	Season	N	mean	sd	min	max
GoM	winter	20	0.44	0.17	0.14	0.76
	summer	7	0.66	0.07	0.56	0.76
	fall	1	0.81	NA	0.81	0.81
GSL	winter	30	0.70	0.22	0.30	1.17
	spring	301	0.52	0.22	0.06	1.13
	summer	470	0.48	0.26	0.02	1.33
	fall	227	0.70	0.40	0.03	2.41
NFL	winter	33	0.68	0.33	0.16	1.30
	fall	32	0.81	0.40	0.14	2.14
total N:		**1121**				

Table 14. Seasonal mean, standard deviation, minimum and maximum values of prosome length (PL, mm) of C4-C6 *Calanus hyperboreus* by area.

C4

Area	*Season*	*N*	*mean*	*sd*	*min*	*max*
SS	spring	308	3.29	0.17	2.64	3.76
	summer	220	3.39	0.18	2.84	3.84
GSL	spring	6	3.35	0.22	3.08	3.55
	summer	402	3.33	0.14	2.59	3.80
	fall	60	3.38	0.11	3.20	3.71
total N:		**996**				

C5

Area	*Season*	*N*	*mean*	*sd*	*min*	*max*
SS	spring	410	4.52	0.28	3.75	5.42
	summer	67	4.44	0.26	3.75	5.25
GSL	spring	12	4.45	0.20	4.21	4.78
	summer	262	4.53	0.34	2.26	5.82
	fall	24	4.45	0.32	3.29	4.89
total N:		**775**				

C6

Area	*Season*	*N*	*mean*	*sd*	*min*	*max*
SS	spring	270	5.94	0.34	5.08	7.5
	summer	45	6.05	0.28	5.58	6.83
GSL	spring	12	5.63	0.27	5.27	5.99
	summer	424	5.73	0.29	5.13	6.84
	fall	72	5.56	0.51	4.11	6.24
total N:		**823**				

Table 15. Seasonal mean, standard deviation, minimum and maximum values of dry weight (DW, mg) of C4-C6 *Calanus hyperboreus* in the Gulf of Saint Lawrence (GSL).

C4

Area	*Season*	*N*	*mean*	*sd*	*min*	*max*
GSL	spring	6	0.35	0.24	0.10	0.68
	summer	239	0.51	0.19	0.15	1.22
	fall	78	0.50	0.20	0.17	1.07
total N:		**323**				

C5

Area	*Season*	*N*	*mean*	*sd*	*min*	*max*
GSL	spring	12	0.65	0.23	0.41	1.01
	summer	225	2.05	0.64	0.35	4.05
	fall	60	1.97	0.50	0.94	3.61
total N:		**297**				

C6

Area	*Season*	*N*	*mean*	*sd*	*min*	*max*
GSL	spring	12	1.47	0.66	0.81	3.13
	summer	144	3.20	0.91	0.84	5.26
	fall	154	2.83	1.28	0.58	5.49
total N:		**310**				

Table 16. Seasonal mean, standard deviation, minimum and maximum values of oil sac area (OSA, mm^2) of C4-C5 *Calanus hyperboreus* in the Gulf of Saint Lawrence (GSL).

C4

Area	*Season*	*N*	*mean*	*sd*	*min*	*max*
GSL	summer	130	1.04	0.29	0.29	1.73
	fall	48	1.10	0.33	0.36	1.86
total N:		**178**				

C5

Area	*Season*	*N*	*mean*	*sd*	*min*	*max*
GSL	summer	80	3.20	0.67	0.98	5.11
	fall	12	3.01	0.51	2.04	4.01
total N:		**92**				

Table 17. Coefficients and R^2 values where appropriate of linear and quantile regression (Qreg) models describing relationships between the most commonly available metrics (prosome length [PL], dry weight [DW] and oil sac area [OSA] in *Calanus finmarchicus* and *C. hyperboreus* C4-C5 in the Gulf of Maine (GoM) (not including Nantucket Shoals), Scotian Shelf (SS), Gulf of Saint Lawrence (GSL), and Newfoundland Shelf (NFL) areas. Quantile regression was performed using data from all areas in order to produce an overall model of maximum apparent PL-dependent OSA (OSA_{max}).

		*DW = β0 + β1*PL*			*OSA = β0 + β1*PL*			*OSA = β0 + β1*DW*		
		β0	β1	R^2	β0	β1	R^2	β0	β1	R^2
Calanus finmarchicus										
GoM	C4	N/A	N/A	N/A	-0.33	0.30	0.16	N/A	N/A	N/A
	C5	-0.74	0.45	0.62	-1.24	0.80	0.45	0.27	1.57	0.67
SS	C4	-0.17	0.15	0.27	-0.48	0.40	0.33	0.09	1.75	0.41
	C5	-0.27	0.23	0.20	-0.99	0.69	0.37	0.14	1.74	0.61
GSL	C4	-0.52	0.32	0.56	-1.32	0.78	0.53	-0.03	2.41	0.90
	C5	-0.23	0.22	0.18	-1.31	0.86	0.45	0.04	2.20	0.77
NFL	C5	N/A	N/A	N/A	-1.28	0.87	0.41	N/A	N/A	N/A
All areas (Qreg)	C5				-1.55	1.10				
Calanus hyperboreus										
GSL	C4	-2.09	0.77	0.25	-2.43	1.05	0.17	0.18	2.04	0.89
	C5	-0.07	0.45	0.07	-4.77	1.75	0.70	1.41	0.82	0.59

Table 18. The proportion (%) of sampled *Calanus finmarchicus* C5 copepodites reaching an estimated overall maximum oil sac area (OSA_{max}) in each season in the Gulf of Maine (GoM) (not including Nantucket Shoals), Scotian Shelf (SS), Gulf of Saint Lawrence (GSL) and Newfoundland Shelf (NFL) areas. Proportions shown also by preservation state and depth stratification (where maximum depth was provided) in each area.

	Season					*Preservation state*		*Max depth*	
	winter	spring	summer	fall	overall	live	formalin	shallow (<80 m)	deep
GoM	0.29	2.98	1.26	0.64	1.17	1.91	0.24	0.55	0.96
SS	N/A	0.76	N/A	2.06	1.40	1.4	N/A	1.04	1.87
GSL	0	0	2.54	3.96	3.42	3.82	1.92	0.48	1.34
NFL	12	N/A	22.94	10.56	12.03	12.03	N/A	9.82	13.4

7. Figures

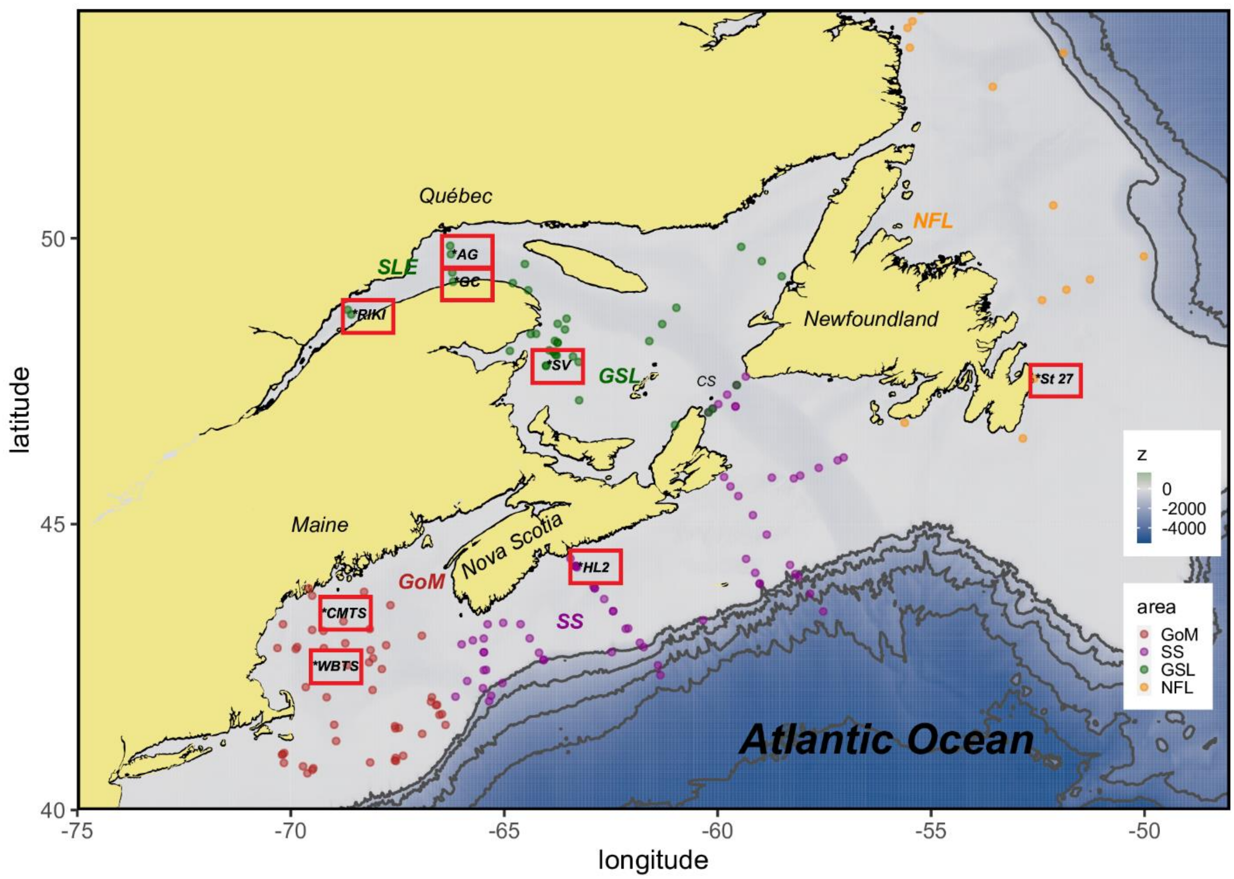

Figure 1. Map of the main areas in the Northwest Atlantic where *Calanus* spp. samples summarized in this report were collected over the years 1977-2020 (Gulf of Maine [GoM], Scotian Shelf [SS], Gulf of Saint Lawrence [GSL], Saint Lawrence Estuary [SLE] and Newfoundland Shelf/Labrador Sea [NFL]. Asterisks indicate the high frequency time series stations ("fixed stations") in each region, also outlined with red rectangles. Northern- (60.56ºN) and easternmost (-43.00ºW) sampling points in NFL area are not shown. Color-shaded bar indicates water depth (z, meters) relative to sea level. Note the overlap in Cabot Strait (CS) between SS and GSL datapoints.

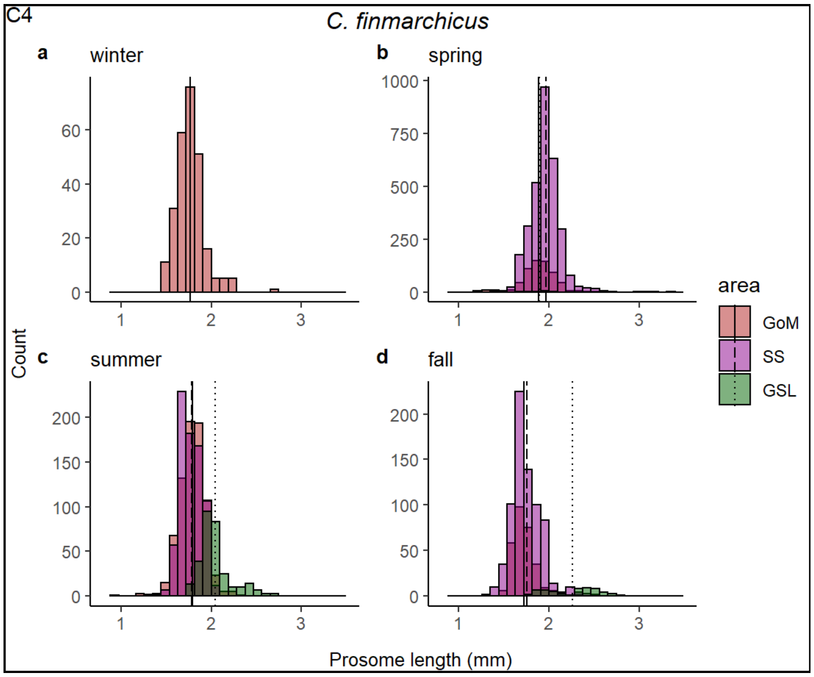

Figure 2. Distribution of prosome length (PL, mm) observations of *Calanus finmarchicus* stage C4 in the Gulf of Maine (GoM), Scotian Shelf (SS) and Gulf of Saint Lawrence (GSL) areas extracted from merged dataset. Vertical lines show regional mean PL.

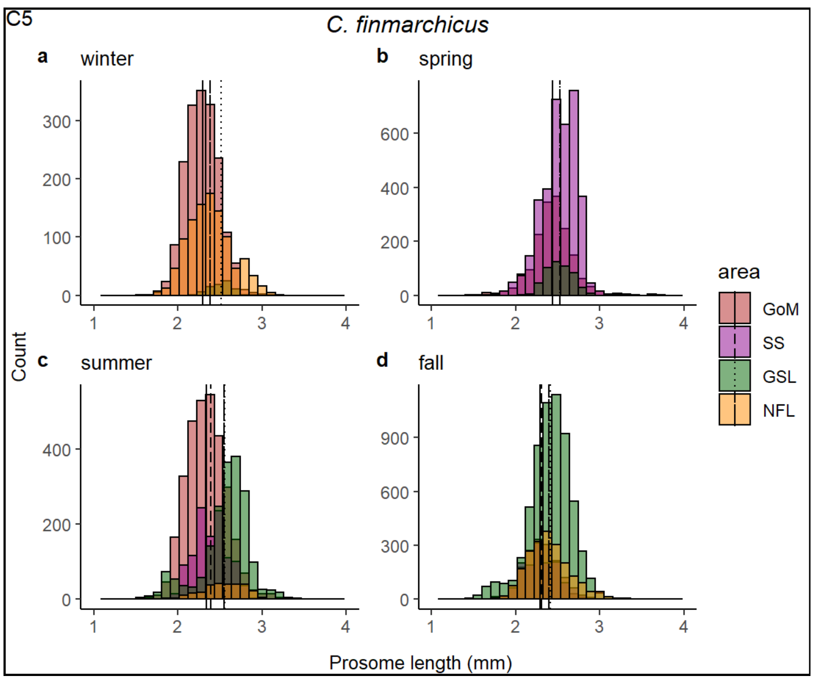

Figure 3. Distribution of prosome length (PL, mm) observations of *Calanus finmarchicus* stage C5 in the Gulf of Maine (GoM), Scotian Shelf (SS), Gulf of Saint Lawrence (GSL) and Newfoundland Shelf (NFL) areas extracted from merged dataset. Vertical lines show regional mean PL.

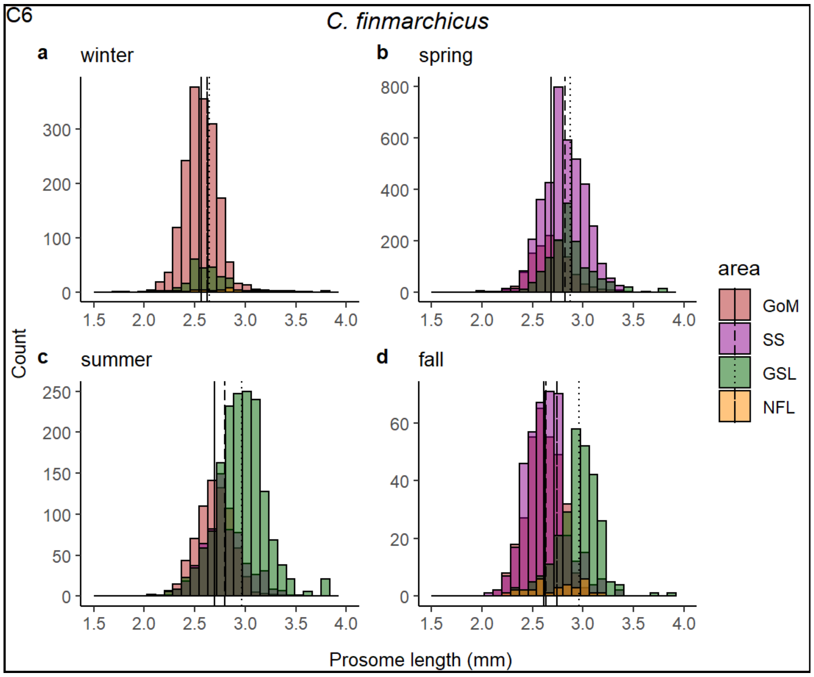

Figure 4. Distribution of prosome length (PL, mm) observations of *Calanus finmarchicus* stage C6 in the Gulf of Maine (GoM), Scotian Shelf (SS), Gulf of Saint Lawrence (GSL) and Newfoundland Shelf (NFL) areas extracted from merged dataset. Vertical lines show regional mean PL.

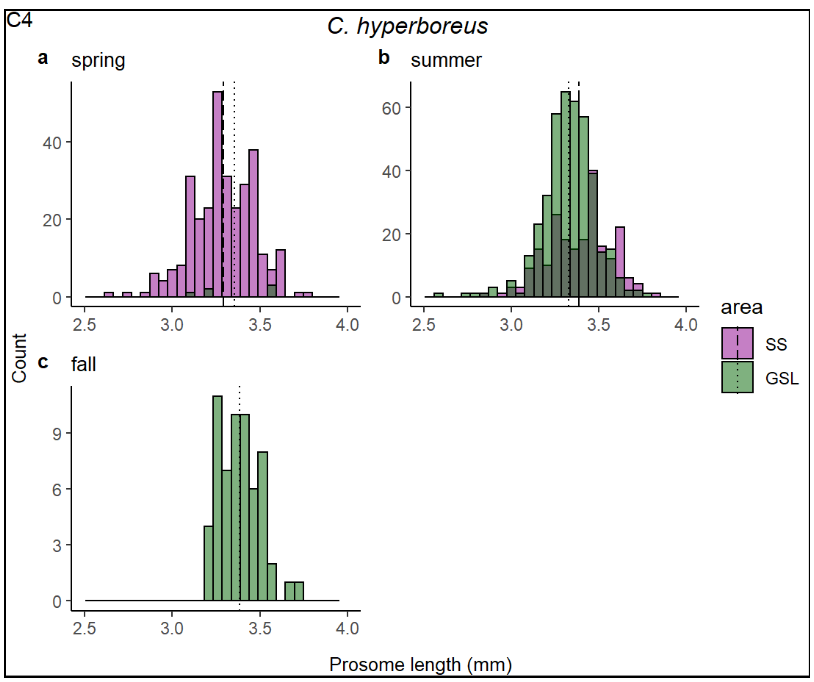

Figure 5. Distribution of prosome length (PL, mm) observations of *Calanus hyperboreus* stage C4 in the Scotian Shelf (SS) and Gulf of Saint Lawrence (GSL) areas extracted from merged dataset. Vertical lines show regional mean PL.

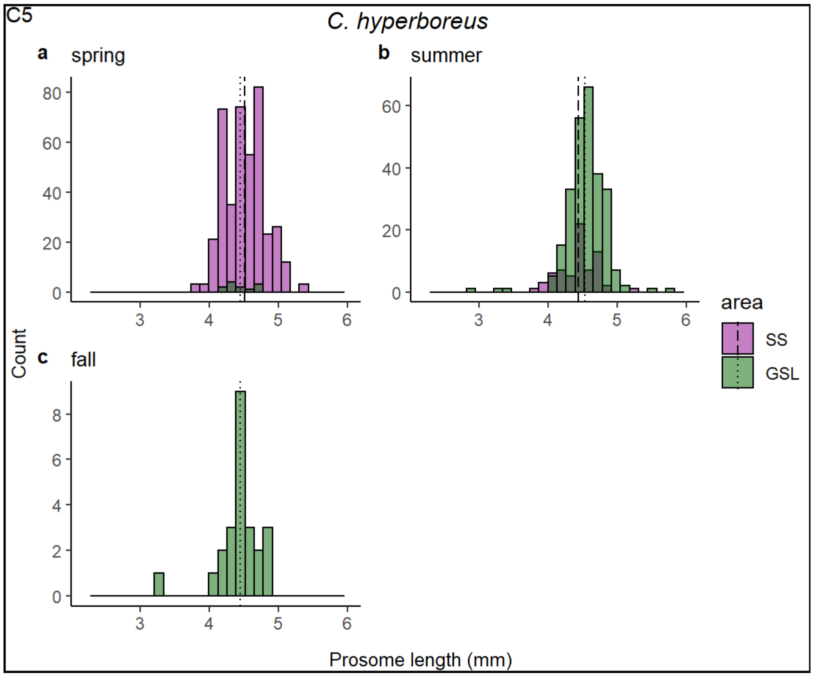

Figure 6. Distribution of prosome length (PL, mm) observations of *Calanus hyperboreus* stage C5 in the Scotian Shelf (SS) and Gulf of Saint Lawrence (GSL) areas extracted from merged dataset. Vertical lines show regional mean PL.

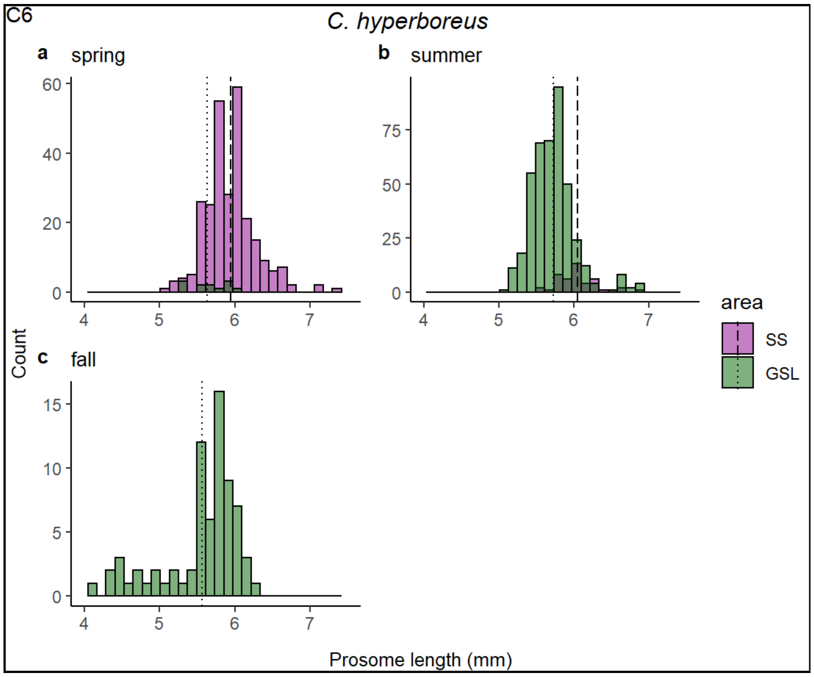

Figure 7. Distribution of prosome length (PL, mm) observations of *Calanus hyperboreus* stage C6 in the Scotian Shelf (SS) and Gulf of Saint Lawrence (GSL) areas extracted from merged dataset. Vertical lines show regional mean PL.

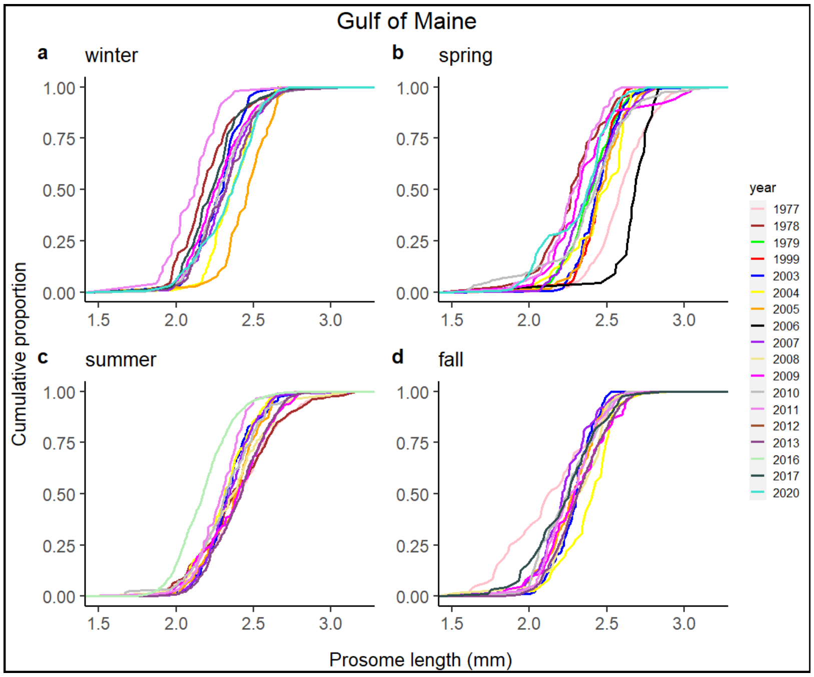

Figure 8. Seasonal cumulative distribution of prosome lengths (PL) per year of *Calanus finmarchicus* stage C5 in the Gulf of Maine.

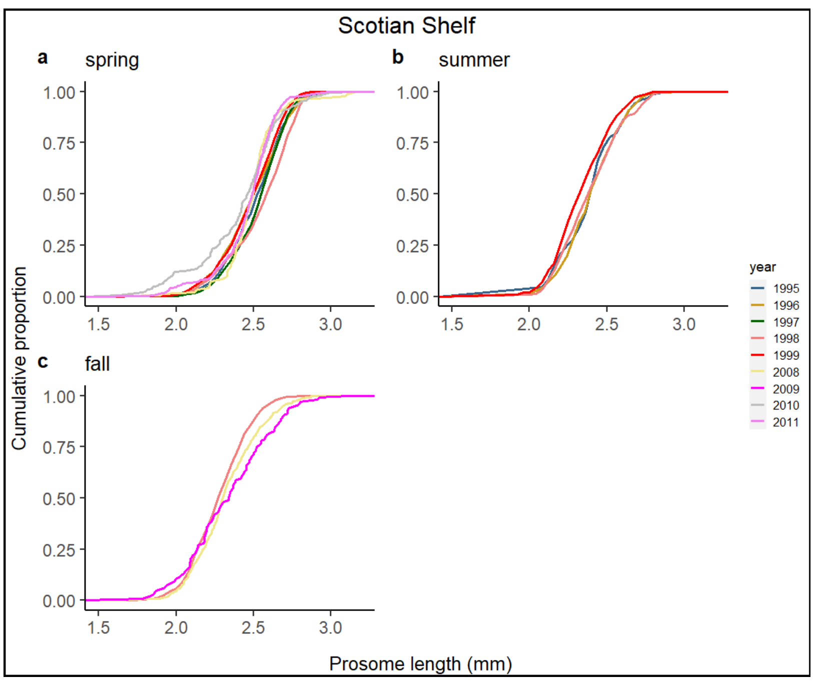

Figure 9. Seasonal cumulative distribution of prosome lengths (PL) per year of *Calanus finmarchicus* stage C5 in the Scotian Shelf.

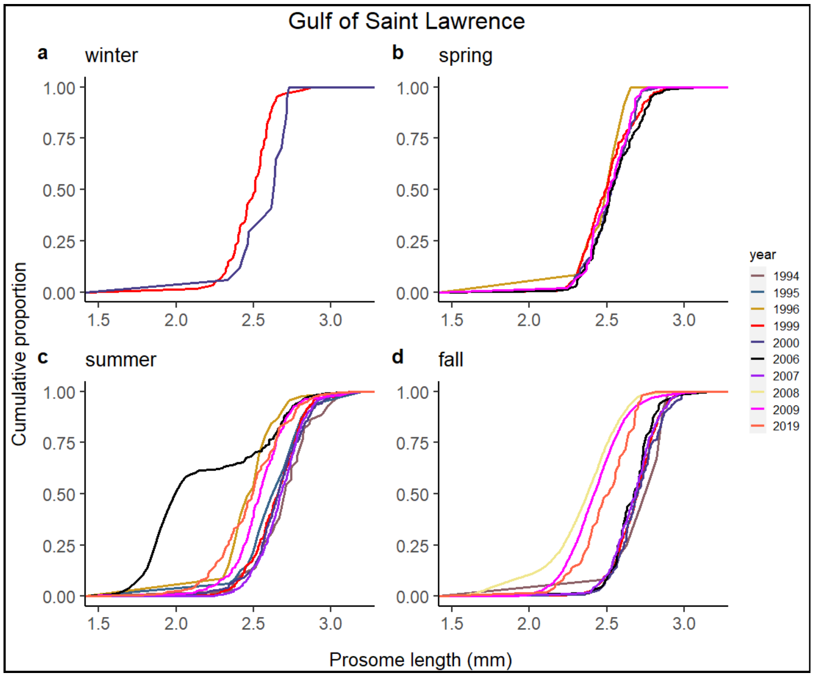

Figure 10. Seasonal cumulative distribution of prosome lengths (PL) per year of *Calanus finmarchicus* stage C5 in the Gulf of St Lawrence.

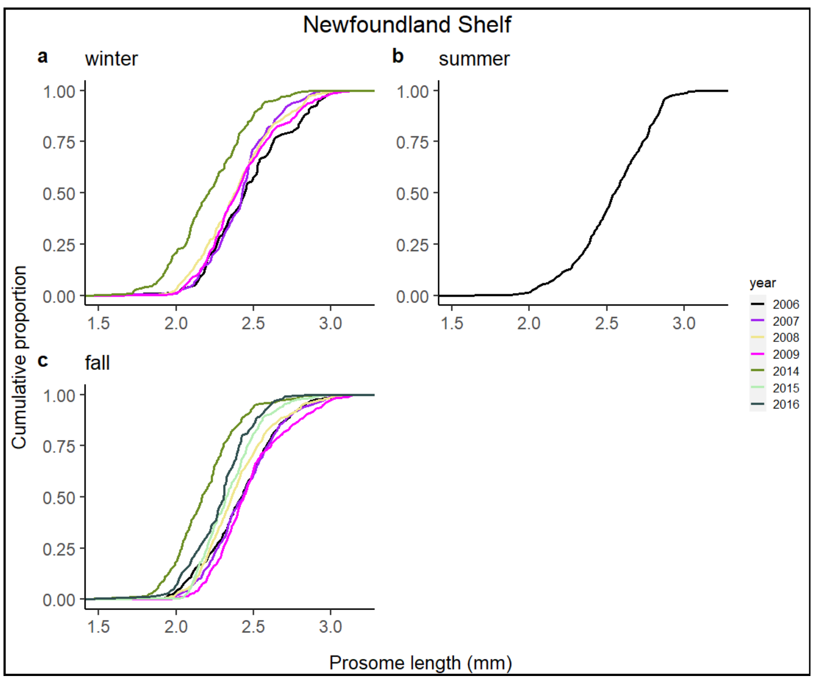

Figure 11. Seasonal cumulative distribution of prosome lengths (PL) per year of *Calanus finmarchicus* stage C5 in the Newfoundland Shelf.

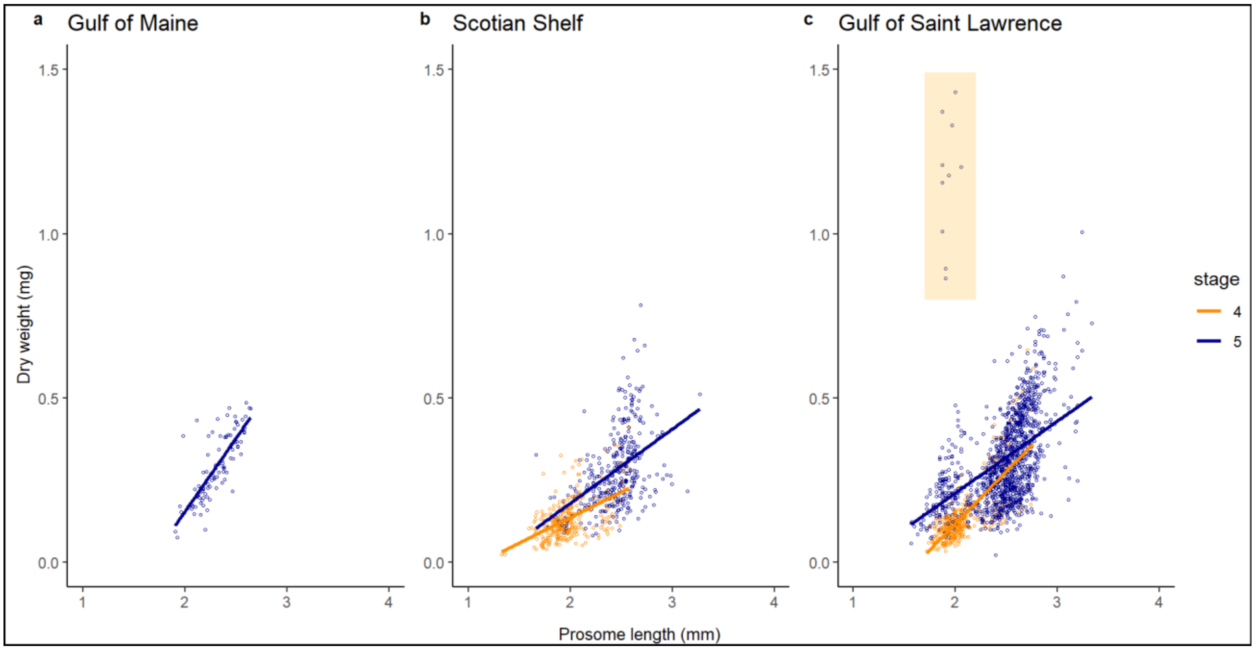

Figure 12. Relationships between prosome length (PL, mm) and dry weight (DW, mg) of *Calanus finmarchicus* stages C4 and C5 in the main areas of comparison: Gulf of Maine (GoM), Scotian Shelf (SS) and Gulf of Saint Lawrence (GSL). Stage C4 was excluded from (a) due to low sample size (n = 5). Datapoints in highlighted rectangle in (c) are all from the data subset category "Germany-Kanada" (dataset **27**).

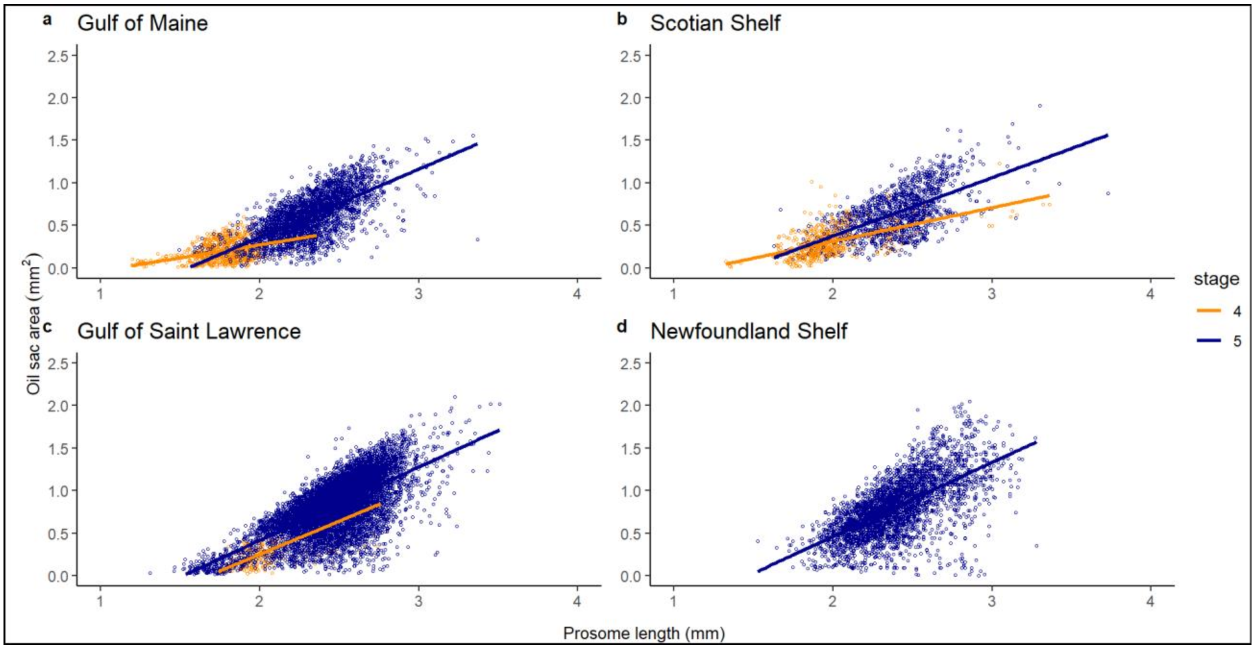

Figure 13. Relationships between prosome length (PL, mm) and oil sac area (OSA, mm^2) of *Calanus finmarchicus* stages C4 and C5 in the main areas of comparison: Gulf of Maine (GoM), Scotian Shelf (SS), Gulf of Saint Lawrence (GSL) and Newfoundland Shelf (NFL).

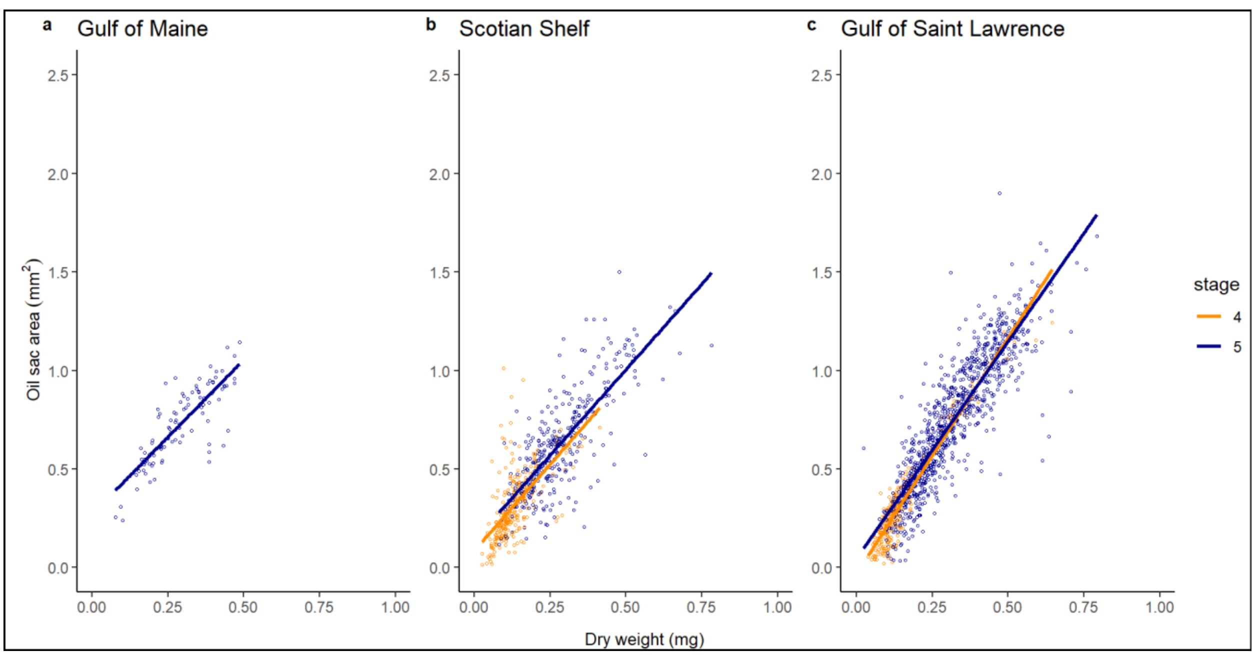

Figure 14. Relationships between dry weight (DW, mg) and oil sac area (OSA, mm^2) of *Calanus finmarchicus* stages C4 and C5 in the main areas of comparison: Gulf of Maine (GoM), Scotian Shelf (SS) and Gulf of Saint Lawrence (GSL).

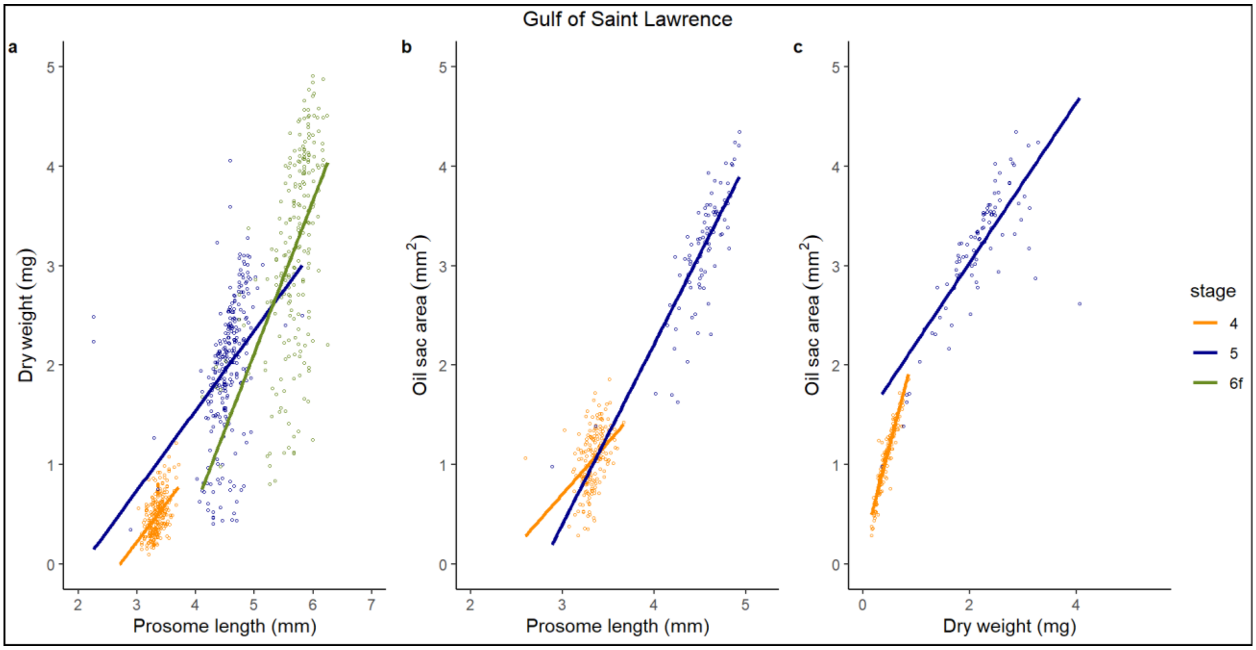

Figure 15. Relationships between prosome length (PL, mm), dry weight (DW, mg) and oil sac area (OSA, mm^2) of *Calanus hyperboreus* stages C4, C5 and C6 females in the Gulf of Saint Lawrence (GSL).

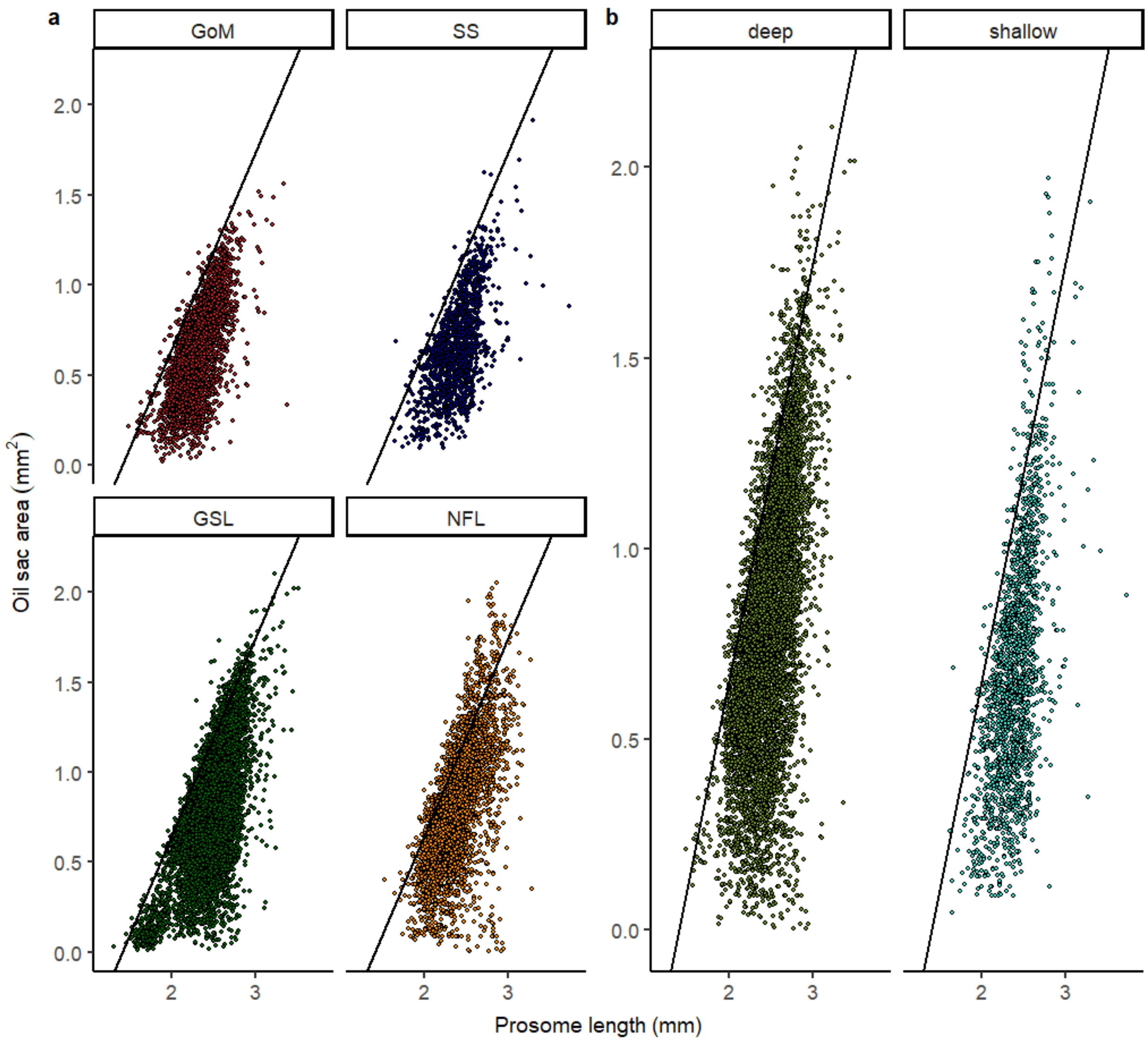

Figure 16. Relationship between oil sac area (OSA, mm^2) and prosome length (PL, mm) in *Calanus finmarchicus* stage C5 copepodites (a) in different sampling areas, and (b) at different maximum sampling depths (deep > 80 m). Regression line represents a maximum oil sac area (OSA_{max}) for any given prosome length (PL) derived from all available data. Data in (b) included from all samples where maximum depth was specified.

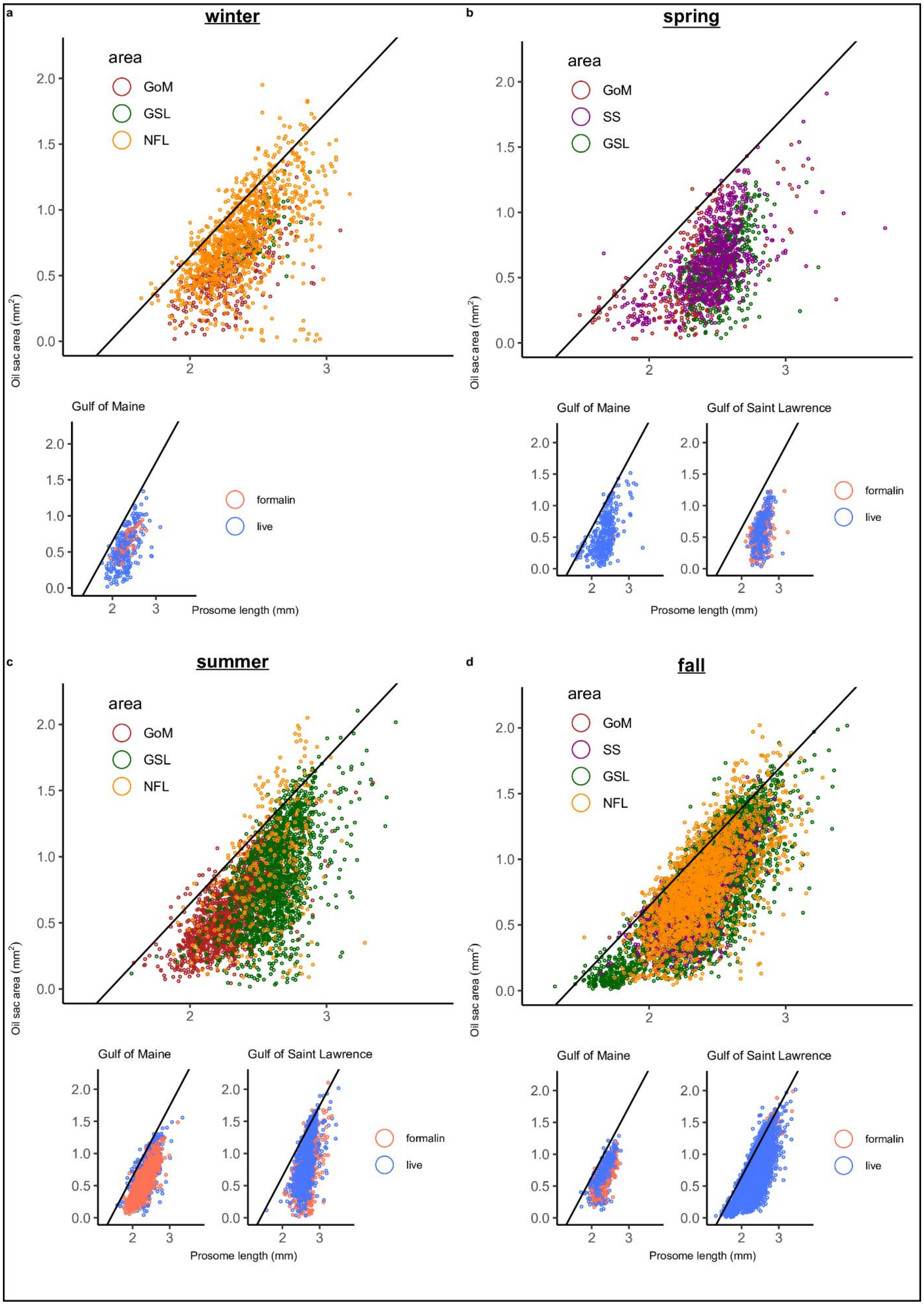

Figure 17. Seasonal variation in the relationship between oil sac area (OSA, mm^2) and prosome length (PL, mm) in *Calanus finmarchicus* stage C5 copepodites. Regression line represents a maximum oil sac area (OSA_{max}) for any given prosome length (PL) derived from all available data. Insets show data by sample preservation method (formalin-preserved vs. live) in areas where both types of samples were available.

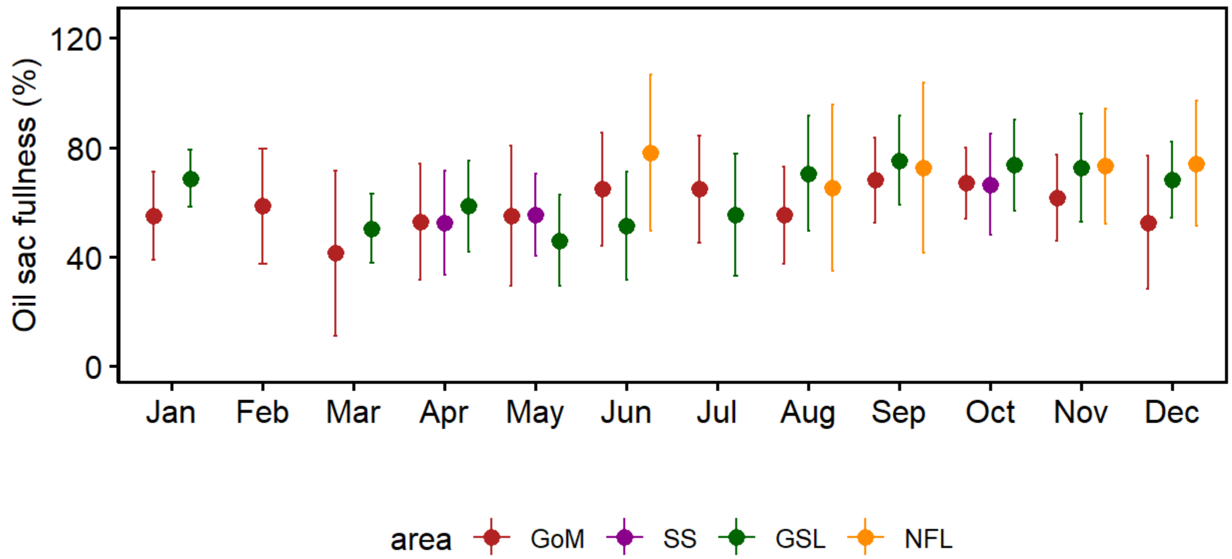

Figure 18. Mean (±SD) monthly regional *Calanus finmarchicus* stage C5 size-adjusted oil sac fullness (OSF, %) in the Gulf of Maine (GoM), Scotian Shelf (SS), Gulf of Saint Lawrence (GSL) and Newfoundland Shelf (NFL) areas, calculated from all available data (1999-2019) as percentage of maximum oil sac area (OSA_{max}).

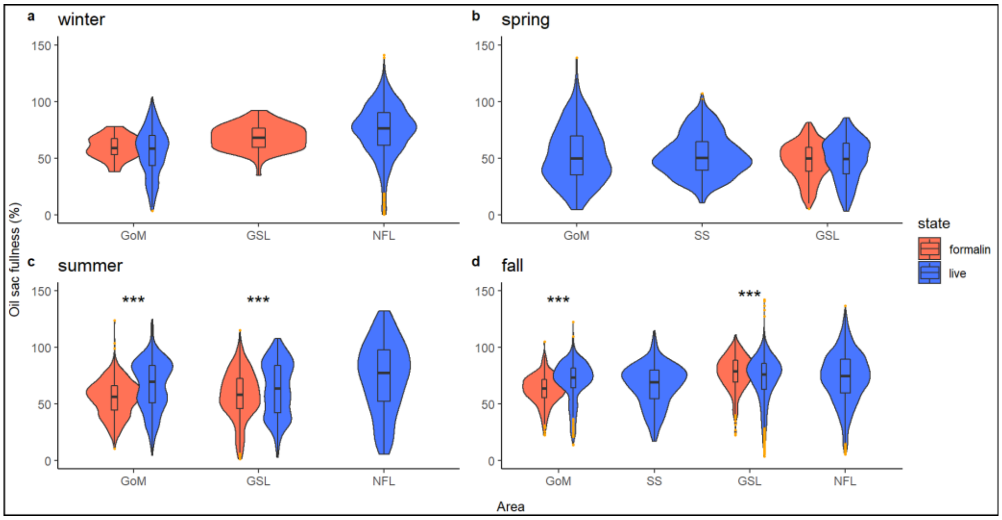

Figure 19. Effects of formalin preservation on oil sac fullness (OSF, %) of *Calanus finmarchicus* stage C5 in the Gulf of Maine (GoM), Scotian Shelf (SS), Gulf of Saint Lawrence (GSL) and Newfoundland Shelf (NFL) areas. Distribution shape of the regional data is shown by the width of each 'violin', derived from a kernel density estimate. Inner boxplots show median as central line, the interquartile range (IQR) defined by outer edges of the box, and the whiskers extending to maximum and minimum values (1.5*IQR). Outliers beyond whiskers are highlighted in orange. Asterisks indicate significant differences between preservation method groups within an area (Welch's *t*-tests, * $p < 0.05$, *** $p < 0.001$). Data were included from all available years (1999-2019).

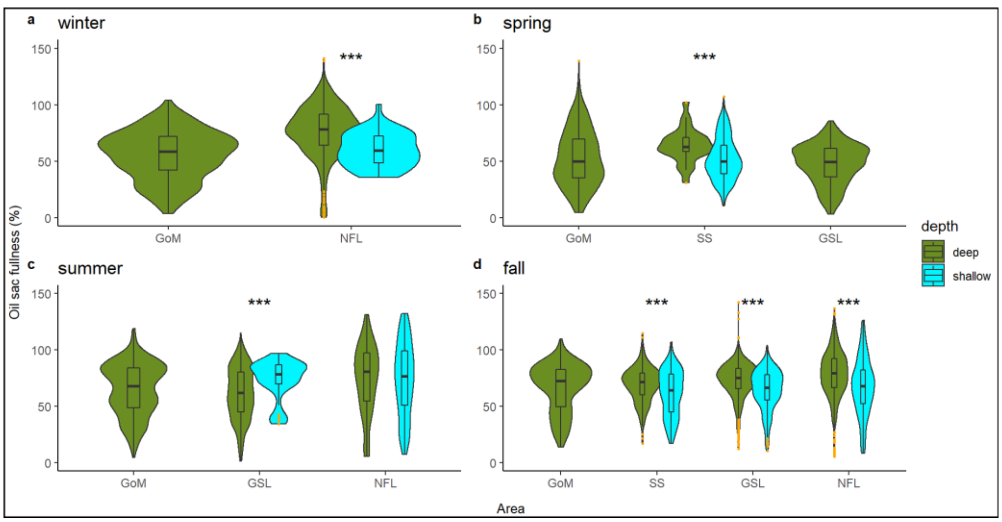

Figure 20. Effects of maximum sampling depth on oil sac fullness (OSF, %) of *Calanus finmarchicus* stage C5 in the Gulf of Maine (GoM), Scotian Shelf (SS), Gulf of Saint Lawrence (GSL) and Newfoundland Shelf (NFL) areas. Distribution shape of the regional data is shown by the width of each 'violin', derived from a kernel density estimate. Inner boxplots show median as central line, the interquartile range (IQR) defined by outer edges of the box, and the whiskers extending to maximum and minimum values (1.5*IQR). Outliers beyond whiskers are highlighted in orange. Asterisks indicate significant differences between depths within an area (Welch's *t*-test/Mann Whitney U test, *** $p < 0.001$). Data were included from all available years where maximum depth was specified (1999-2019).

8. Appendix I

Appendix I: Copy of data management file (README_ Calanus_NAtlantic_SizeMetrics_2022.txt) for published dataset (Calanus_NAtlantic_SizeMetrics_2022.txt)

GENERAL INFORMATION
Title of the data set: Calanus spp. size and lipid content metrics in North Atlantic, 1977-2020
Language of the data set: English
Description: Data set covers metrics and metadata related to wild collected copepods Calanus spp. (C. hyperboreus, C. glacialis, C. finmarchicus) and Metridia longa:
- body size in prosome length [PL]
- dry weight [DW]
- lipid content (oil sac area [OSA] and oil sac volume [OSV])

Spatial coverage: North Atlantic sampling sites
- Scotian Shelf (SS)
- Gulf of Saint Lawrence (GSL)
- Gulf of Maine-Georges Bank-Nantucket Shoals (GoM)
- Newfoundland Shelf and Labrador Sea (NFL)

Temporal coverage: 1977-2020
Data processing and quality assurance: Data were checked for missing values, but suspect data (outlier values) were retained in the data set, bar obvious data input errors.
Author Information:
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B. Associate or co-investigators
Name (s): Erica Head, Laura Helenius, Phoebe Jekielek, Chris Orphanides, Pierre Pepin, Geneviève Perrin, Stéphane Plourde, Marc Ringuette, Jeffrey Runge, Harvey Walsh
C. Corresponding Contact Information
Name: Catherine Johnson
Institution: Fisheries and Oceans Canada
ORCID: 0000-0001-5291-3141
Email: catherine.johson@dfo-mpo.gc.ca
Keywords (Tags): Calanus finmarchicus, Calanus hyperboreus, Calanus glacialis, copepod, body size, lipid content
Status of the dataset: In progress
The start date when data were first collected: 1977
The end date when data were last collected: 2020
Publication (Links to publications that cite or use the data): Spatial variability of Calanus spp. size and lipid content in the northwest Atlantic – Compilation and brief summary of historical observations, 1977-2020 (Can. Tech. Rep. Fish. Aquat. Sci.)
Licenses/restrictions placed on the data: This data set is licensed under CC BY 4.0 (https://creativecommons.org/licenses/by/4.0/).

SPATIAL COVERAGE
Geographic location of data collection North Atlantic Ocean
What is the spatial extent of the dataset? Range of recorded coordinates:
40.643 to 60.560 latitude
-43.000 to -70.312 longitude

What is the vertical extent of the dataset in meters? Min depth: 0 m, Max depth: 1000 m

DATA AND FILE OVERVIEW
File list: Calanus_NAtlantic_SizeMetrics_2022.txt

DATA-SPECIFIC INFORMATION
Number of variables: 37
Number of cases/rows: 151448
Variable List:

1. Area: sampling area (GoM = Gulf of Maine, GSL = Gulf of St Lawrence, LS = Labrador Sea, NFL = Newfoundland Shelf, SS = Scotian Shelf)
2. Dataset: number of original source dataset (listed in technical report)
3. Cruise: cruise name/label
4. Data_cat: additional data category label
5. Year: year of collection
6. Month: month of collection
7. Date: exact date of collection if available
8. Time: time of collection (AST)
9. Lat: latitude of collection point
10. Long: longitude of collection point
11. Gear: net used for collection
12. Max_depth: maximum depth at collection
13. Min_depth: minimum depth at collection
14. Station: name of sampling station if available
15. Sta_depth: average depth at sampling station
16. Species: Genus/species (Calanus spp., Cfin = C. finmarchicus, Cglac = C. glacialis, Chyp = C. hyperboreus, Cfin/glac, Mlonga = Metridia longa, Metridia spp.)
17. Stage: copepodite stage (1-6, 6f = adult female, 6m = adult male)
18. State: method of preservation (formalin, live) if available
19. DW: dry weight (mg)
20. PL: prosome length (mm)
21. OSA: oil sac area (mm^2)
22. OSL: oil sac length (mm)
23. OSV: oil sac volume (mm^3)
24. Npercent: nitrogen content (%)
25. Cpercent: carbon content (%)
26. N_ug: nitrogen content (µg)
27. C_ug: carbon content (µg)
28. CN: carbon to nitrogen ratio
29. Ph: Prosome height (mm)
30. Pa: Prosome area (mm^2)
31. Ceph_l: Cephalosome length (mm)
32. Met_l: Metasome length (mm)
33. Uro_l: Urosome length (mm)
34. OSH: Oil sac height (mm)
35. Pixel_mm: pixel size in original image (mm)
36. Spec no: identity number in original data set
37. Pro_d: prosome diameter (mm)