Lobster Quality
Preseason Sampling Program
Southwest Nova Scotia LFA33 & LFA34

Preseason Summary Report

November 2021

Submitted by:

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HIGHLIGHTS FOR 2021

Preseason sampling took place from late August to mid-November during periods of good weather, calm seas.

4 sampling areas with inside-outside sampling locations (8 in total) in LFAs 33 & 34 (see map below). 51 sampling dates and 7,039 lobster samples taken.

Protocol calls for 150 lobster samples per date collected for lobster sex, size, blood protein (BRIX), hardness, moult stage, and egg-bearing status.

Summary focus on BRIX trend over time and by location.

In 2021, there is little evidence of trends in BRIX values across all sampled areas. BRIX levels are considered moderate to low over the 2021 sampling period.
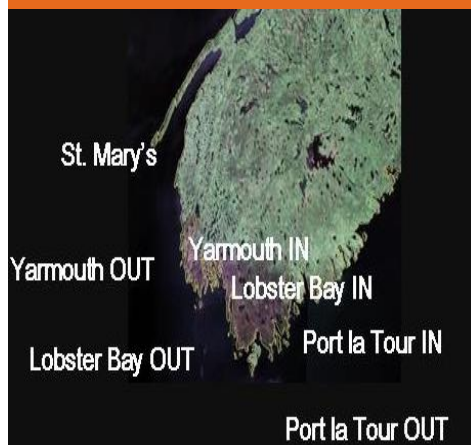
2021 LMQ Sampling Area- 4 areas ; 8 sampling locations 4- INSIDE and 4- OUTSIDE August-November 2021.

2021 LFA 33 & 34 LOBSTER QUALITY

This report summarizes results of preseason at-sea sampling in 8 locations within LFA 33 and LFA 34 from August 25 to November 18, 2021. This sampling represents a continuation of the longstanding Atlantic Lobster Moult and Quality Project (ALMQ) 16-year longitudinal database that has continued uninterrupted since 2006.

Preseason sampling was conducted by Coldwater Lobster Association in 8 different locations – the designated 'inside' and 'outside' areas of Lobster Bay, St. Mary's Bay, Yarmouth in LFA34, and Port La Tour in LFA33. Data analyses were carried out with the cooperation of the Centre de recherche marine/Marine Research Centre of the Université Sainte-Anne, Petit de Grat Campus. The 2021 preseason survey analysis was developed by the Centre de recherche marine/Marine Research Centre, Université Sainte-Anne, Petit de Grat campus in collaboration with Coldwater Lobster Association and members of the southwest Nova Scotia lobster industry. We acknowledge this opportunity to maintain the ALMQ longitudinal database and to develop it for the future. In 2021, a new methodology is presented to develop the prediction of lobster quality for the upcoming 2021-2022 commercial season.

As in previous years, individual lobster data on blood protein level (measured via a refractometer as the BRIX Index), manual shell hardness (soft, medium or hard), moult stage (from selected lobster pleopod examination under a microscope), carapace length, and sex data

Figure 1. Preseason Lobster Sampling tools.

were collected manually for the 7,039 individual lobster samples over each location-date. These data represent determinants of lobster quality, i.e., meat content for a superior dining experience, suitability for storage and shipping, and are provided as an indicator to the industry about the early season status of the post-moult lobster harvest in the designated sampling subareas of LFAs 33 & 34.

The results presented here focus on the distribution of the recorded BRIX levels for 2021 compared to past years' samples from the same preseason time and sampling locations over the full AMLQ database period 2006-2021. This information enables the industry to compare the 2021 sample results to known past years of observed preseason and subsequent in-season lobster quality and status. In 2021, as has been the protocol in the past, BRIX index values below 6.0 units/ml in the samples provide a probable indication of "Poor" quality and less than fully-meated lobster, that are less suitable for storage and shipping and for presentation at the dining table. BRIX index values between 6.0–7.99 are deemed "Moderate" quality and indicate that lobsters may still be recovering from their prior moult and may still be of concern with respect to quality. BRIX levels at 8 or above are indicative of "Good" quality and are relatively more fully-meated lobsters that are more suitable for storage and shipping and presentation for consumption.

Rank	BRIX Indicator	BRIX Value (units/ml)	Description
1	Good	8.0 or greater	indicative of good quality; more fully-meated; more suitable for storage, shipping and presentation for consumption
2	Moderate	Between 6.0 and 7.99	may still be recovering from a prior moult; of some concern with respect to holding, shipping
3	Poor	Less than 6.0	poor quality; appear weak, potentially soft shell, not suitable for holding, shipping, or dining

The manual assessment of shell hardness is a subjective indicator of lobster quality. Guidelines are in place for manual estimates of shell hardness on a non-numeric scale of 2 ("soft"), 4 ("medium"), and 5 ("hard"). While "soft" lobsters (less than 1% of all samples) are 100% of known poor quality, over 90% of sampled lobsters are subjectively judged to be "hard". In 2021, as in previous years, shell hardness measures remain poorly correlated with BRIX levels and correlations are mostly not significantly different from zero for all sample location-dates. Shell hardness measures cannot be the lone determining factor in lobster quality prediction.
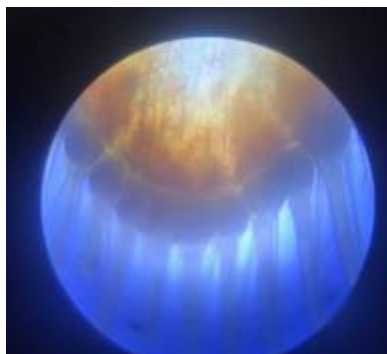

Figure 2. View of lobster pleopod under microscope.

Moult stage analyses are carried out by analyzing selected lobsters. As per the ALMQ sampling protocol, 30 (male and female) lobsters from the sample of 150 lobsters per sampling location-date have a pleopod removed. Each lobster's moult status is determined by microscopic analysis of the lobster pleopod (swimmeret). Moult stage levels of zero (0) indicate no moult activity is pending; advanced moult stages (3+) indicate the moult is approaching and imminent. Pleopod analysis in female lobsters may also indicate the onset of the egg bearing cycle.

Overview of the 2021 Preseason Survey Results

In 2021, a total of 7,039 preseason lobster samples were taken over the 4-month period from August 25 to November 18, a period of almost 13 weeks. A summary of the sample results by BRIX category are shown in the following pages by each sampling location. Graphic results present: (i) the time trend of the 2021 samples, and (ii) comparable preseason sampling for the years 2012 to 2021. The graphic trends are described and predictions and recommendations for the 2021 start-of-season are presented.

Weather conditions over the 51 trips completed were favourable with light winds and calm seas. Approximately 6 times during the survey, weather conditions affected the counts, most commonly resulting in shorter soak times to enable the sample day to be carried out before severe weather closed the fishing grounds. Early on in the survey, residual swell from offshore hurricanes showed a decrease in lobster counts (captains' opinions) as to the lack of numbers versus expectations. However, in only 7 of the 51 trips (in Port La Tour and St. Mary's Bay) were fewer than 150 samples achieved from 4 strings of 10 lobster pots (traps) each (see also Table 1 below). Survey vessel captains spoke of how the weather was much more conducive for data collection this year as opposed to the 2020 sampling period including, warmer sea temperature and air temperature.

Over the survey, minimal by-catch appeared in the traps (Jonah crab and cod), especially as the lobster counts increased (in most locations) toward the latter part of the survey. It is noted that BRIX levels observed at the beginning of the survey deemed to be average, soon dropped off as more berried females, soft shell and "weak" lobsters started appearing more often in the traps. However, as the weeks went by in the survey, a noticeable shift from higher to lower lobster counts for inside areas were occurring, while lower to higher counts of lobster began appearing in corresponding outside locations. BRIX levels throughout the survey were in the "mid-range" with many lobster still soft and weak (apparently recovering from earlier moults) but steadily moving offshore from having moulted in and around the inside locations. These data are summarized in Table 1 below. The percentage number of "soft" and "weak" lobsters observed in 2021 preseason sampling were 2.1% soft and 12.5% weak over all samples. These observations nearly doubled compared to the 2020 percentages of 1% soft and 7% weak in the 2020 preseason samples.

Figure 3. Blood sample taken using clean syringe; sample used in refractometer to determine lobster blood protein BRIX level.

Berried (egg-bearing) females were examined in considerable detail again this year. Of the 51 sampling location-date combinations, 35 captured at least 1 berried female ("seed") lobster. The average observed was 4.7 berried females per sample date or 1.6% (165) of all female lobsters captured (10,435) during the survey. In 2020, that figure was 2.5% on 10,851 female lobsters captured. Berried female analyses recorded carapace size, clutch fullness, egg stage and condition. Analyses of these and other berried female data will be provided in further detail in the full report of the 2021-2022 Preseason and In-season Lobster Quality Sampling Program to be released early in 2022.

Table 1. Summary of 2021 Preseason Sampling Survey

Sampling Location	Area	2021 Sampling Date	Total Harvested Lobster Count (#)	Lobsters Sampled (#)	Sample %Soft/ %Weak	Sample Ave BRIX level (units/mL)
Yarmouth	Inside	September 1	451	150	0.00%/4.00%	8.3
		September 15	412	150	0.67%/10.00%	8.3
		September 29	340	150	2.00%/3.33%	8.7
		October 14	347	150	3.33%/8.00%	9.3
		October 26	497	150	2.00%/18.00%	8.3
		November 9	478	150	0.67%/14.67%	8.6
		November 10	525	150	1.33%/12.0%	8.2
	Outside	August 31	286	150	0.67%/2.67%	8.0
		September 14	343	150	1.33%/10.00%	7.9
		September 28	490	150	0.00%/28.00%	7.9
		October 13	791	150	8.67%/15.33%	7.4
		October 25	1073	150	2.67%/26.67%	8.1
		November 8	875	150	1.33%/27.33%	8.0
Lobster Bay	Inside	August 29	421	150	2.00%/3.33%	8.6
		September 8	704	150	1.33%/6.67%	8.6
		September 23	849	150	5.33%/19.33%	8.9
		October 6	754	150	10.67%/16.67%	8.0
		November 4	633	150	4.00%/31.33%	9.6
		November 18	461	150	4.00%/33.33%	9.5
	Outside	September 7	433	150	0.67%/6.00%	8.1
		September 22	425	150	1.33%/7.33%	7.9
		October 5	558	150	2.67%/34.00%	7.5
		November 3	818	150	2.67%/25.33%	8.3
Port La Tour	Inside	August 26	226	130	3.08%/3.85%	7.9
		September 9	140	96	2.08%/2.08%	6.7
		September 22	520	150	2.00%/6.00%	7.2
		October 7	566	150	2.67%/6.00%	6.9
		October 20	595	150	2.67%/13.33%	7.8
		November 3	527	150	2.67%/9.33%	9.6
		November 16	387	150	0.00%/6.67%	10.8
		November 18	489	150	2.67%/13.33%	9.9
	Outside	August 25	7	7	0.00%/0.00%	9.5
		September 8	3	2	0.00%/0.00%	6.5
		September 21	59	49	0.00%/0.00%	6.5
		October 5	70	47	0.00%/10.64%	7.0
		October 19	270	150	6.67%/14.67%	6.8
		November 2	672	150	4.67%/20.00%	7.7
		November 17	544	150	2.00%/25.33%	7.8
St. Mary's Bay	Inside	August 31	269	150	0.67%/2.00%	8.6
		September 14	397	150	1.33%/9.33%	8.5
		September 28	373	150	0.67%/3.33%	8.7
		October 13	359	150	0.67%/4.67%	9.3
		October 26	348	150	0.00%/10.00%	9.5
		November 9	368	150	0.67%/7.33%	9.9
		November 10	315	150	0.00%/6.67%	10.0
	Outside	August 30	120	108	0.00%/0.93%	8.6
		September 13	226	150	0.00%/2.67%	8.4
		September 27	554	150	0.00%/10.67%	8.5
		October 12	707	150	2.00%/4.67%	8.3
		October 25	865	150	1.33%/22.00%	8.4
		November 8	775	150	1.33%/16.00%	8.4
TOTALS	8 location-areas	51 sample dates	23,715 lobsters landed	7,039 lobsters sampled	Overall % Soft/Weak 2.1%/12.5%	8.3 units/ml

Review of the 2020 Preseason Survey Results

In the 2020 survey, a total of 6,940 lobster samples were taken over 52 preseason sample dates during a period of 13 weeks in the 8 sampling locations. Locations were each sampled 6 or 7 times each over the 2020 preseason period from mid-August to mid-November. The 2020 preseason sampling results indicated that lobsters prior to November 2020 were of moderate quality with BRIX values generally between 6 and 8. In mid-November 2020, at the end of the preseason sampling period, all 8 sampled areas experienced a spike in BRIX values exceeding 9.5 to a maximum of 12.7. Such a spike had not been seen in the recorded ALMQ time series since 2006. Predictions for the start of the commercial season in LFAs 33 and 34, scheduled for November 30, 2020, were referred to as cautiously optimistic, especially in light of the experience of other LFAs in 2020 that showed initially high BRIX values at the start of the season followed by declines as the season continued. At the start of the 2020-2021 commercial season in LFAs33 and 34 – which began 9 days after the expected start of the season (second week of December 2020) – the high BRIX values observed in the spike of mid-November were not observed.

2021 Preseason Survey Results

Blood Protein (BRIX) Distribution. The following pages present the survey breakdown of the 2021 BRIX results for each of the 8 lobster sampling locations within LFAs33 and 34. Graphic results are provided for the BRIX indicator values ("Good", "Moderate", "Poor") as well as BRIX sample means for each of the location's 2021 sampling dates. Annual comparative graphics allow comparison of recent years (2012 to 2020) of sample mean BRIX indicator levels, and BRIX distribution by category leading up to the start of the current 2021-2022 season at 3 to 4 weeks prior to the start of the commercial season on the last Monday of November.

Lobster Quality Category Classification. For the first time in 2021, consolidated data from each sample date by location are classified into lobster quality categories derived from the full ALMQ database (2006-2021). Lobster quality categories for each consolidated location sample are based on collective lobster sample characteristics (of 150 sampled lobsters by the protocol) including: BRIX values and carapace length means, medians, ranges, and moments, as well as sample month and days prior to the season opening. Using linear discriminant analysis, the historical consolidated sample data were categorized into 5 'lobster quality' categories as defined in Table 2 below for each location. The results of the analysis enabled the numercial description of each category, and subsequently, the assignment of each of the 2021 sample dates into its most probable Lobster Quality category.

Preseason Lobster Quality categories are particular to the history of each of the 8 locations. These categories are described in Table 2 below:

Table 2. Lobster Quality Category Descriptions

Level	Lobster Quality Category	Description of Sample Location-Date Distribution
1	High (H)	This category is indicative of a consolidated sample date of 150 lobsters with elevated average BRIX value specific to the location over the database period, e.g., exceeding 10 for most locations, and other positive distribution characteristics, e.g., high relative BRIX median and range
2	Moderate–High (MH)	This category is indicative of a consolidated sample date of 150 lobsters with slightly above-average BRIX values specific to the location over the database period, e.g., approximately between 9.5 and 10 in most locations
3	Moderate (M)	This category is indicative of a consolidated sample date of 150 lobsters with near average BRIX values specific to the location over the database period, e.g., approximately between 8.5 and 9.5 for most locations
4	Moderate–Low (ML)	This category is indicative of a consolidated sample date of 150 lobsters with slightly below-average BRIX values specific to the location over the database period, e.g., approximately between 7.5 and 8.5 for most locations
5	Low (L)	This category is indicative of a consolidated sample date of 150 lobsters with below average BRIX values specific to the location over the database period, e.g., less than 7.5 for most locations

The comparison of the 2021 preseason sample results by location to past preseason sampling years suggests that the corresponding commercial season years are likewise comparable. For example, if 2021 preseason sample results for Lobster Bay Inside compare favorably to past preseason survey years of Low (L) Lobster Quality for Lobster Bay Inside (historically estimated from the data to be: 2016 and 2018–see also table below), then the 2021 preseason mcan be considered to predict that the 2021-2022 commercial season is comparable to the commercial seasons of 2016-2017 or 2018-2019. Lobster Quality Category assignment for the 2021 sample dates are accompanied by likelihood values that the sample data indeed belong to the selected Lobster Quality Category.

The 2021 Lobster Quality Category assignments are determined by the categories with the highest likelihood (expected probability) of occurrence. Assigned categories by location and year are based on preseason sampling data and are provided in the following table of assigned Lobster Quality categories for each location over the full database (2006-2020) that contains nearly 800 location-date samples of (typically, 150) lobster.

Table 3. 2006-2020 Lobster Quality Category Assignments

Locations:	Yarmouth Inside	Yarmouth Outside	Lobster Bay Inside	Lobster Bay Outside	Port La Tour Inside	Port La Tour Outside	St.Mary's Bay Inside	St.Mary's Bay Outside	Total Annual Sample Dates
2006	MH	H	H	MH	MH	H	H	MH	68
2007	H	H	H	MH	M	-	H	H	61
2008	H	MH	MH	MH	MH	-	MH	MH	60
2009	MH	H	H	MH	MH	MH	M	M	67
2010	H	MH	H	H	H	MH	MH	H	73
2011	MH	M	H	MH	MH	H	MH	-	65
2012	MH	MH	MH	H	M	M	MH	-	63
2013	M	M	MH	H	M	M	M	-	52
2014	ML	ML	M	M	L	ML	-	-	34
2015	ML	ML	ML	M	L	L	-	-	32
2016	L	L	L	L	L	M	ML	ML	52
2017	ML	ML	ML	L	L	L	ML	ML	52
2018	L	ML	L	ML	MH	L	L	L	46
2019	ML	L	M	ML	ML	ML	-	L	12
2020	ML	L	M	ML	ML	ML	ML	M	56
Total Sample Dates	131	130	158	117	138	40	46	33	793

Table 3 values indicate the annual time series of assigned Lobster Quality Category for each location and each lobster sample date from 2006 to 2020. The relative decline over time of lobster quality across all locations in LFAs 33&34 over the full period 2006 to 2020 is evident. In particular, the designated lobster quality categories exhibit a noticable shift after 2013 to a regime of lower relative lobster quality from the higher categories (moderate (M) or higher (MH, H)) throughout the period from 2006 to 2013.

Since 2014, however, assigned Lobster Quality Categories across the locations are nearly all designated as moderate (M) levels or below (ML, and L). Although it is difficult to identifiy trends in these consolidated data, it generally appears that since 2018, there may be the beginning of a recovery of lobster quality indicators from L to ML going forward to 2020. These data provide the backdrop for the predictions of lobster quality categories for the 51 preseason sample dates by location in the 2021 preseason period.

Finally, it is noted that this analysis assigns each of the 51 sample dates in 2021 by location to one of the designated Lobster Quality Categories (H, MH, M, ML, or L). Summarized results are presented for all sample dates for each location in the pages which follow.

YARMOUTH INSIDE

2021 SUMMARY OF RESULTS

Blood Protein (BRIX) Distribution

The 2021 preseason survey results for Yarmouth Inside show a relatively steady set of results for the 7 sample dates in this location. The percent of "Good" category lobsters (BRIX>=8) increased slightly until mid-October along with average BRIX values, before declining somewhat thereafter. Correspondingly, the proportion of "Poor" lobsters sampled increases toward the end of the sampling period (October 26 and November 9 and 10 samples) from 6% to 17%.
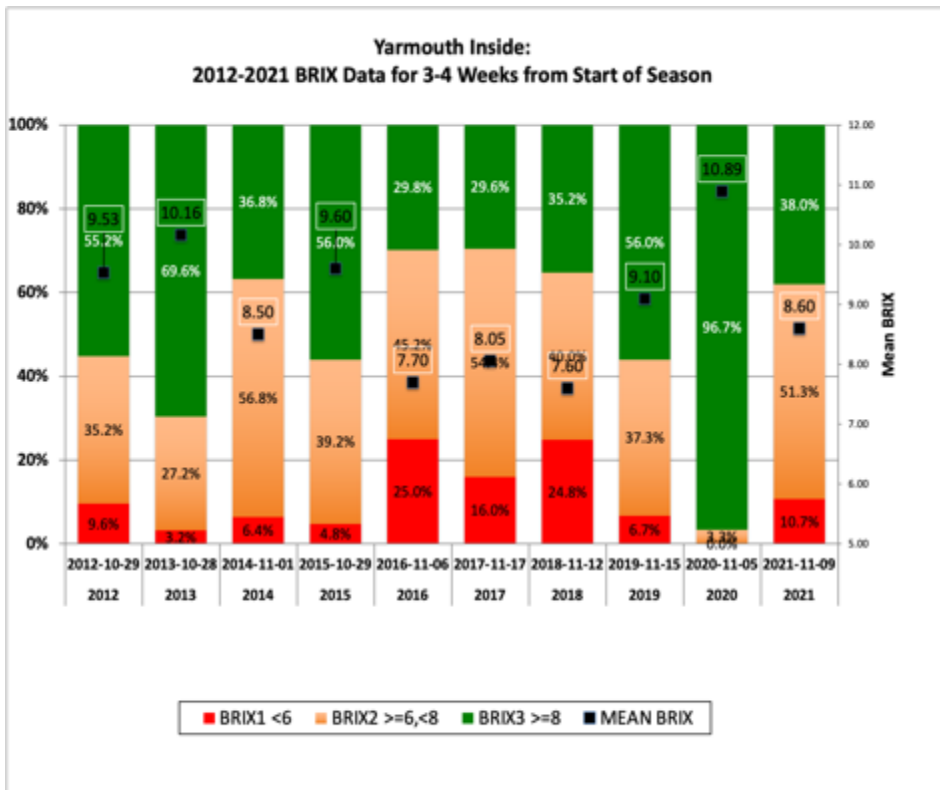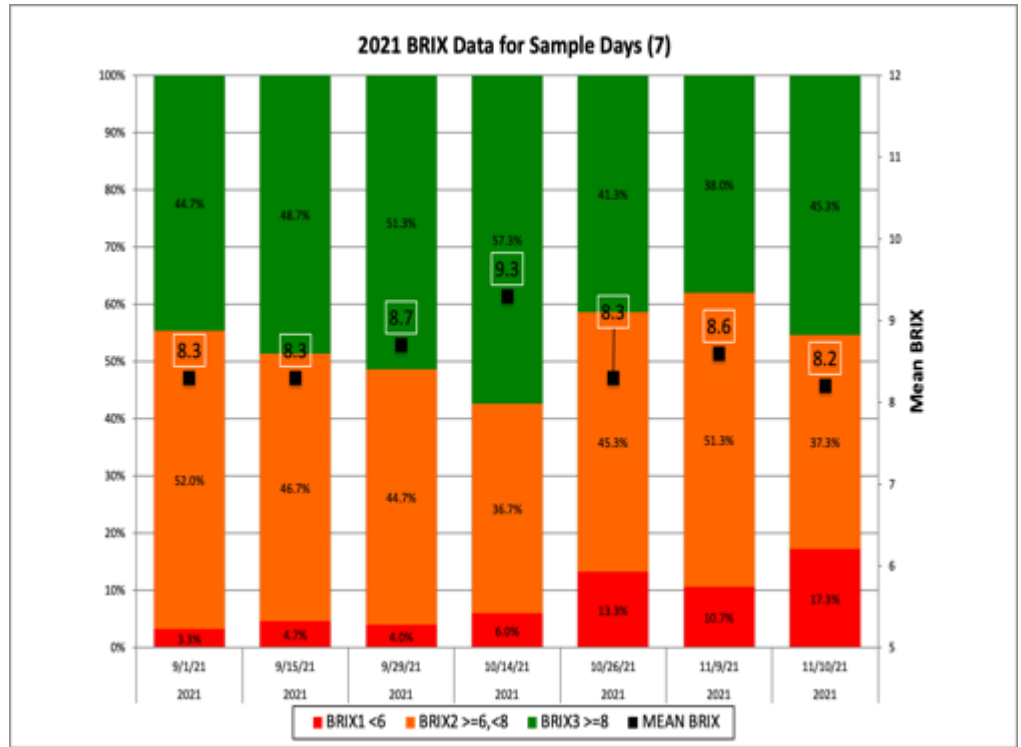
Annual samples 3-4 weeks from the start of each commercial harvest season opening are somewhat variable between 2012 and 2019. The 2021 sample (November 9) falls within the historical results (the spike in BRIX experienced in the November 5, 2020 sample excepted).

The 2021 observations show moderate quality results with a BRIX mean value of 8.6. The BRIX mean and distribution of "Good" (38% in 2021), "Moderate" (51%) and "Poor" (11%) BRIX are most closely comparable to that of the 2014 sample (November 1, 2014).

Lobster Quality Category Classification

The assignment of the Lobster Quality categories for each sample date in Yarmouth Inside are provided in the graphic below. Based on the historical sampling in this location, the 7 sample dates in 2021 are all classified as ML – Moderate Low. The likelihood of the Yarmouth Inside samples being in the ML category is largest at 70% whereas the likelihood of the Yarmouth Inside samples being from all of the higher quality categories H, MH or M is only 20%. Similarly, the likelihood that the Yarmouth Inside samples in 2021 are representative of the L category is estimated at only 10%.

Yarmouth Inside Lobster Quality Category for 2021 Sampling Dates
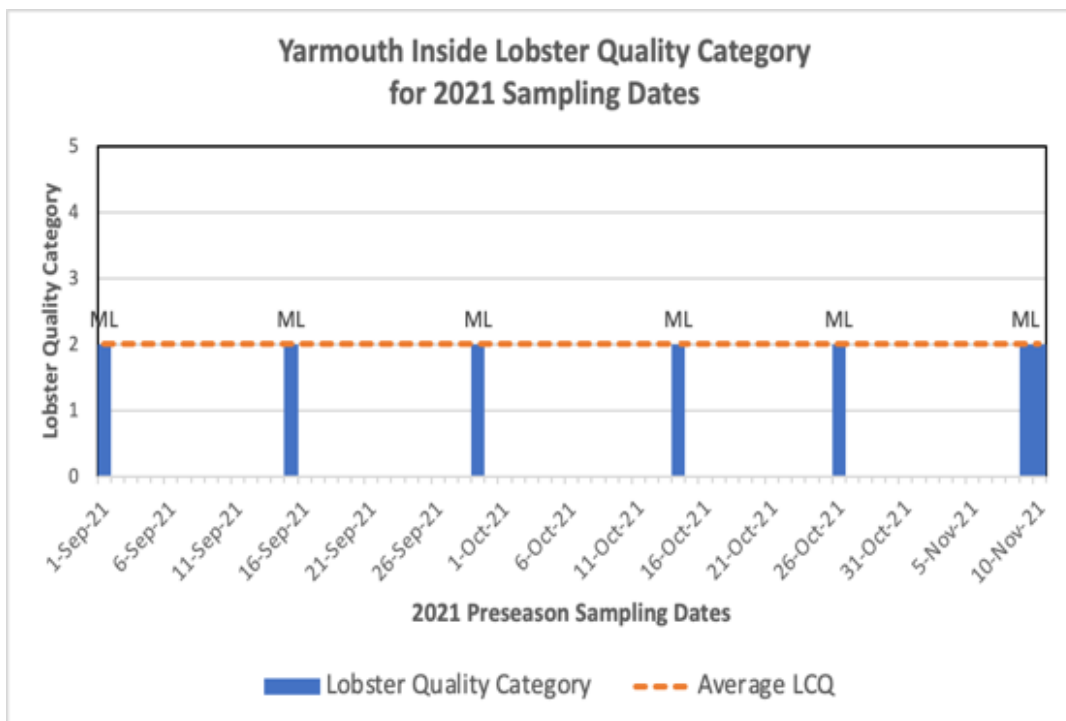
Historically, Lobster Quality classifications for Yarmouth Inside of Moderate-Low (ML) have occurred in 2014, 2015, 2017, 2019 and 2020 (as per the table above). Accordingly, the 2021 preseason classification for Yarmouth Inside implies that the 2021-2022 commercial season is most comparable to the 2014-15, 2015-16, 2017-18, 2019-20, or the 2020-21 commercial seasons. These years are all part of the post-2013 lobster quality decline period, and indicate that Yarmouth Inside remains in the reduced quality range relative to the full 2006-2021 database.

Summary : YARMOUTH INSIDE –

1) 2021 samples exhibit relatively constant BRIX behaviour over the preseason sampling period at moderate to low quality levels; the 2021 sample is most comparable to 2014 preseason sample 3-4 weeks before the start of the commercial season

2) Lobster quality category for 2021 samples are classified as "Moderate-Low" (ML) with estimated 70% likelihood of occurrence

3) Past years with ML classification include 2014, 2015, 2017, 2019 and 2020 – all years at the post-2013 lower quality regime

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YARMOUTH OUTSIDE

2021 SUMMARY OF RESULTS

Blood Protein (BRIX) Distribution

The 2021 preseason samples for Yarmouth Outside, like Yarmouth Inside, show a relatively steady set of BRIX distribution results. The historically moderate-to-low mean BRIX values vary in the range of 8.1 (October 25) to 7.4 (October 13) with overall BRIX mean of 7.9 for the 6 sample dates in this location. The percent of "Good" category lobsters (BRIX>=8) vary in the range between 29% (October 13) to 46% (October 25); the range for "Poor" category (BRIX<6) varied between a low of 3% (September 14) to a high of 13% (October 13).
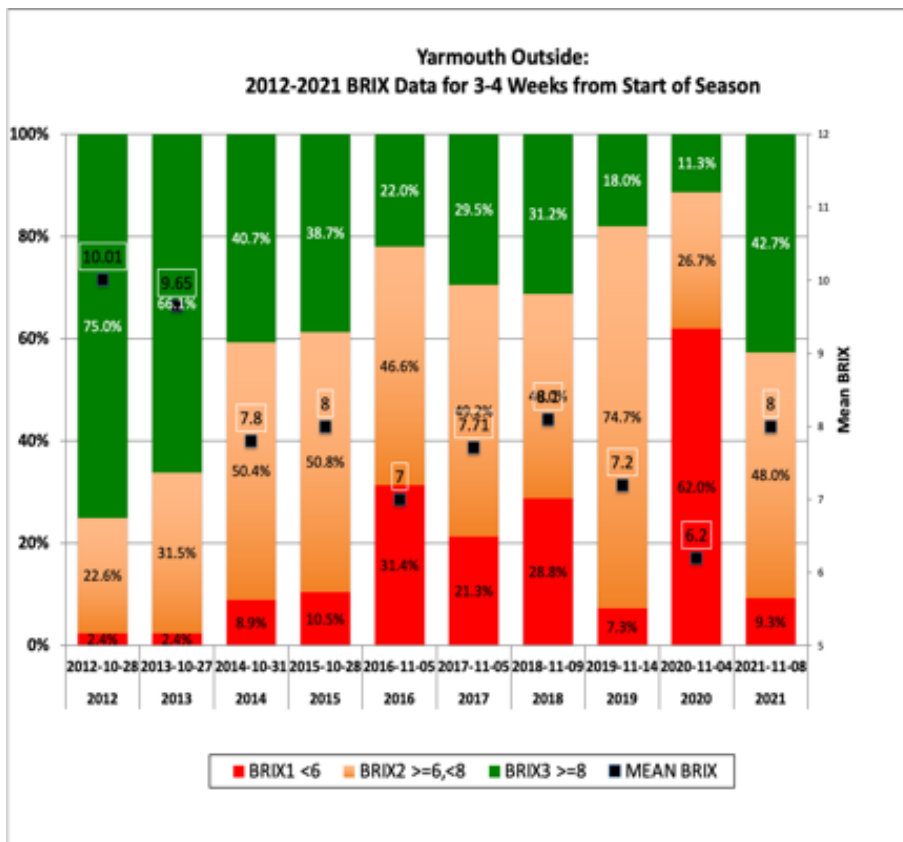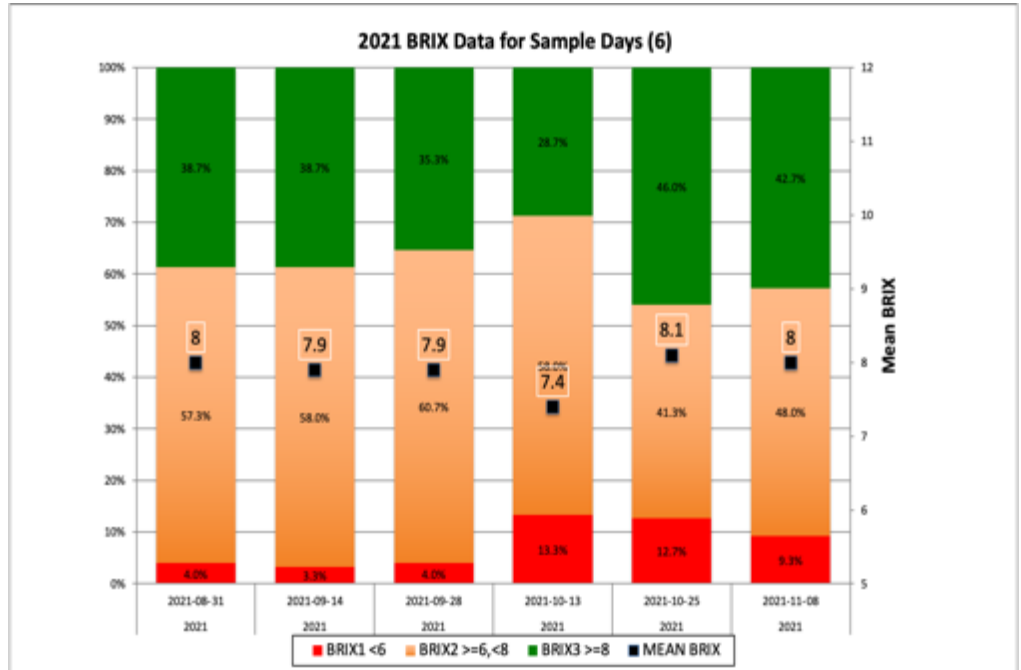
Yarmouth Outside sample BRIX distribution annual results, for 3-4 weeks from the start of the commercial harvest season opening, show a trend over time of declining high BRIX and increasing low category BRIX values from 2012 to 2020. However, the 2021 sample (November 8) suggests that this declining trend in Yarmouth Outside may have reversed in this current year. The 2021 sample 3-4 weeks before the start of the season is comparable to the earlier 2014 and 2015 samples with respect to the mean BRIX value (8) and the similar distribution of the 3 BRIX categories.

Lobster Quality Category Classification

The assignment of the Lobster Quality categories for each sample date in Yarmouth Outside are provided in the graphic below. Based on the historical sampling in this location since 2006, the 6 sample dates in 2021 are classified as L (3 sample dates), ML (2 sample dates) or M (1 sample date).
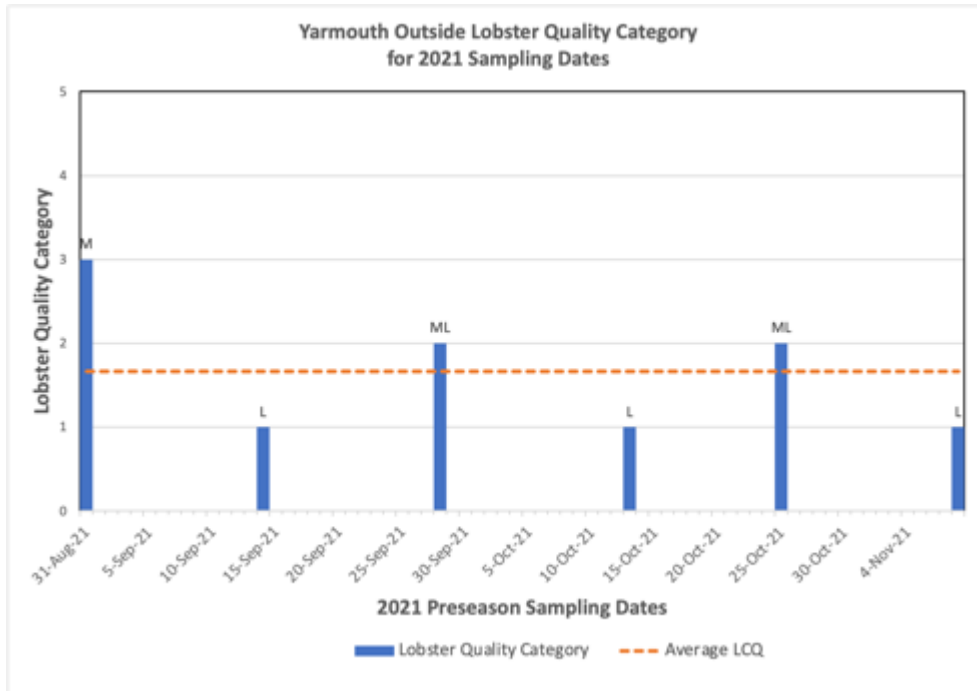
The likelihood of the Yarmouth Outside samples being in the ML category is largest at approximately 50% whereas the likelihood of the Yarmouth Outside samples being from the lower quality category L is 30%. Finally, the likelihood that the Yarmouth Outside samples in 2021 are representative of the higher lobster quality categories H, MH, or M is collectively estimated at 20%.

Summary : YARMOUTH OUTSIDE –

1) 2021 samples exhibit constant BRIX behaviour over the preseason sampling period at moderate to low quality levels, most comparable to the 2014 or 2015 preseason samples 3-4 weeks before the start of the commercial season

2) Lobster quality category for samples classified as ML has highest estimated likelihood of 50%

3) Past representative years with ML classification include 2014, 2015, 2017, 2018– years of the post-2013 lower quality regime

LOBSTER BAY INSIDE

2021 SUMMARY OF RESULTS

Blood Protein (BRIX) Distribution

2021 preseason survey results for Lobster Bay Inside were relatively stable from August through November for BRIX means ranging from a high of 9.6 (November 4) to a low of 8 (October 6) with overall moderate-high BRIX mean of 8.9 and comparable BRIX distribution categories over the sample dates. BRIX values appear to have rebounded between the low mean of 8 (October 6) and the highs of 9.6


2021 BRIX Data for Sample Days (6)
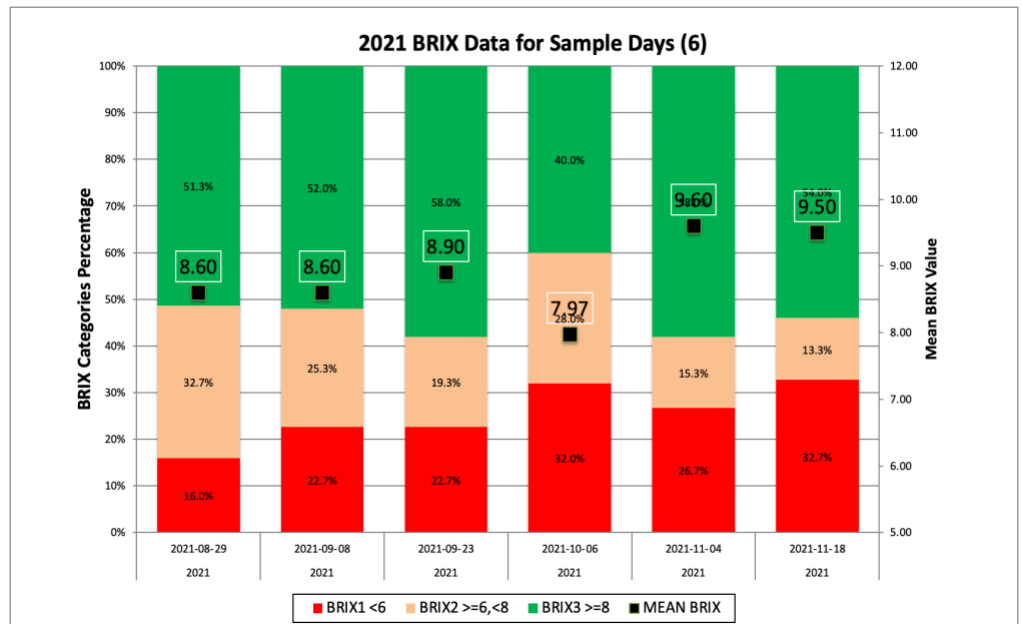
and 9.5 in the last two November sample dates. "Good" category BRIX exceeded 50% in all but one sample date (October 6). "Poor" category BRIX averaged approximately 25% across the 6 samples in 2021.

Lobster Bay Inside: 2012-2021 BRIX Data for 3-4 Weeks from Start of Season
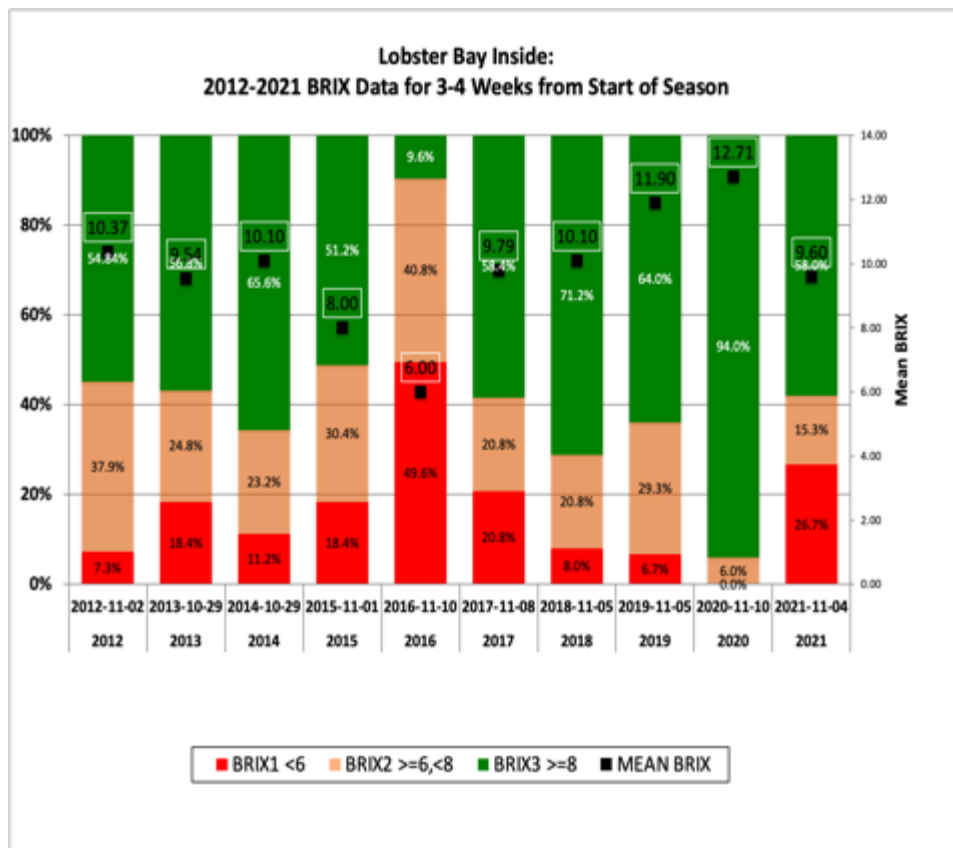
The 2021 Lobster Bay Inside sample results for 3-4 weeks from the start of the commercial harvest season opening vary considerably from an extreme low (mean BRIX of 6) in 2016 to an extreme high (mean BRIX of 12.7) in the 2020 spike. The 2021 sample year returns to a mean BRIX value of 9.6, close to the overall (2012-2020) mean of 9.8. The 2021 sample has a relatively high proportion of "Good" BRIX values (58%) and "Poor" BRIX values (27%) in comparison to the other samples in the series. 2021 is most comparable to the 2013 and 2017 samples 3-4 weeks before the scheduled openings of those commercial seasons.

Lobster Quality Category Classification

The assignment of the Lobster Quality categories for each sample date in Lobster Bay Inside are provided in the graphic below. Based on the historical sampling in this location, the 6 sample dates in 2021 are classified as L (4 sample dates), M (November 4), improving to MH (November 18). For the initial 4 sample dates in Lobster Bay Inside, the maximum likelihood of the samples over all categories is the L lobster quality category estimated at 50%. However, the final sample likelihood of that sample being from the MH quality category is estimated to be 60%. This result indicates a marked improvement in Lobster Bay Inside quality by the end of the preseason sample period.
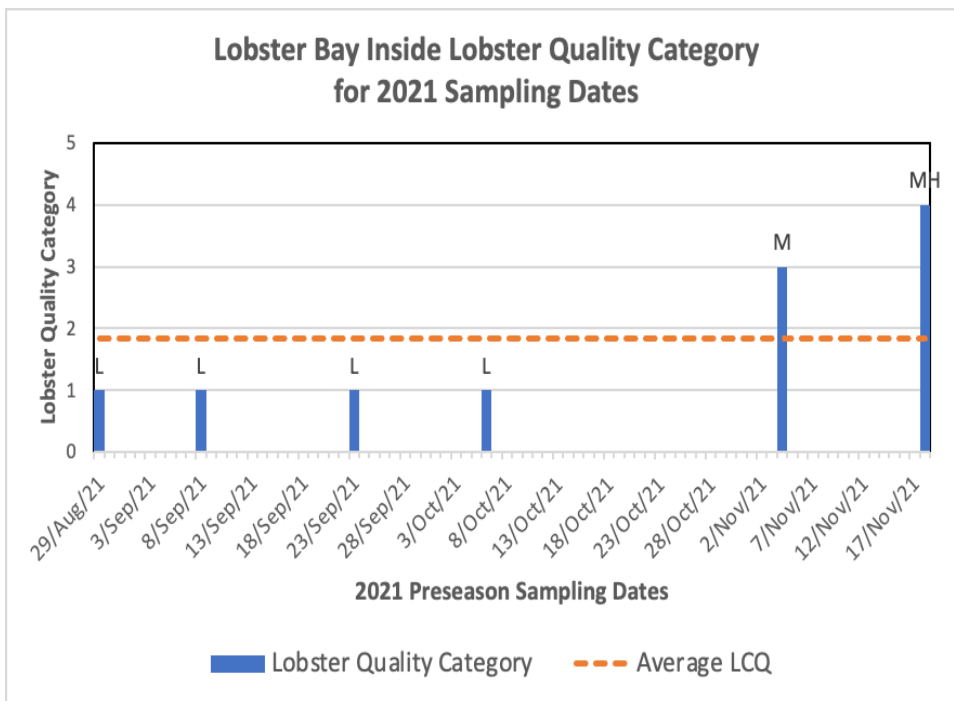
With respect to the last 2 November sample dates (November 4 and 18), the likelihood that Lobster Bay Inside is representative of moderate or higher lobster quality category (M, MH, or H) is estimated as 85%. Similarly, the likelihood of lower quality category (ML or L) for these final samples is averaged at only 15%.

Summary : LOBSTER BAY INSIDE–

1) 2021 samples exhibit stable BRIX behaviour with some improvement in BRIX from the early sample periods to the end of the preseason sample period

2) 2021 samples are most comparable to the 2013 or 2017 preseason samples 3-4 weeks before the start of the commercial season

2) Lobster quality category for samples classified as L as the beginning of the 2021 preseason sampling period have estimated likelihood of 50%

3) 2021 November samples suggest improvement in Lobster Quality category to MH, estimated at 60% for the last sample date (November 18).

LOBSTER BAY OUTSIDE

2021 SUMMARY OF RESULTS

Blood Protein (BRIX) Distribution

2021 preseason survey results for Lobster Bay Outside were relatively constant over 4 sample dates from September through November with lower to moderate BRIX means ranging from a minimum of 7.5 (October 5) to 8.3 (November 3), and overall low BRIX mean of 7.9. The "Good" category BRIX exceeded 35% in all dates and averaged 38% over the 4 dates; "Poor" category BRIX averaged 12% across the 4 sample dates.
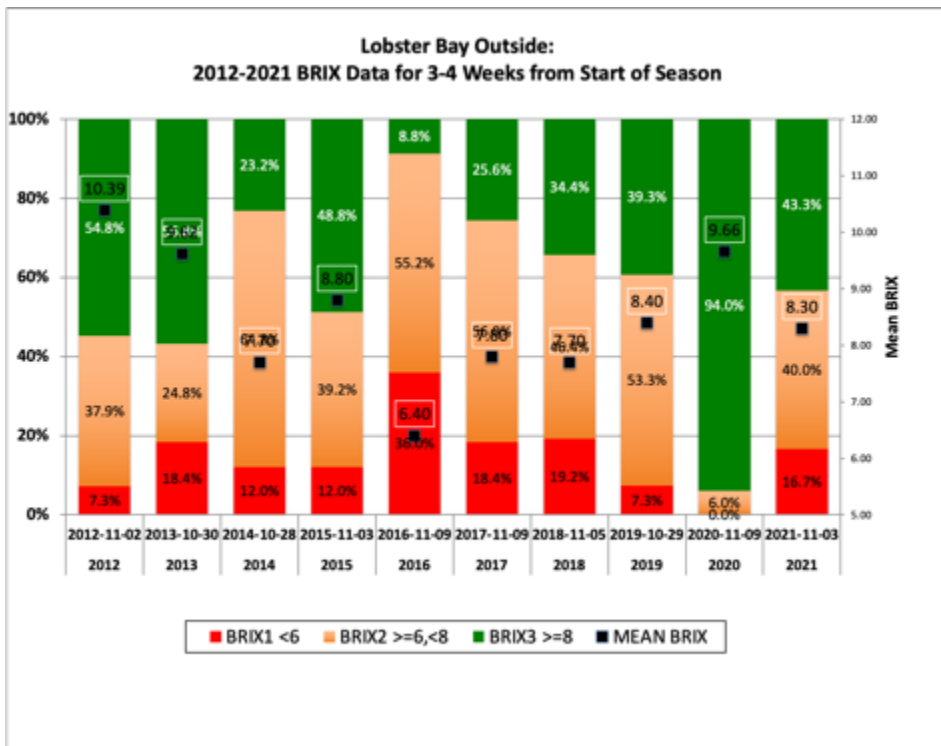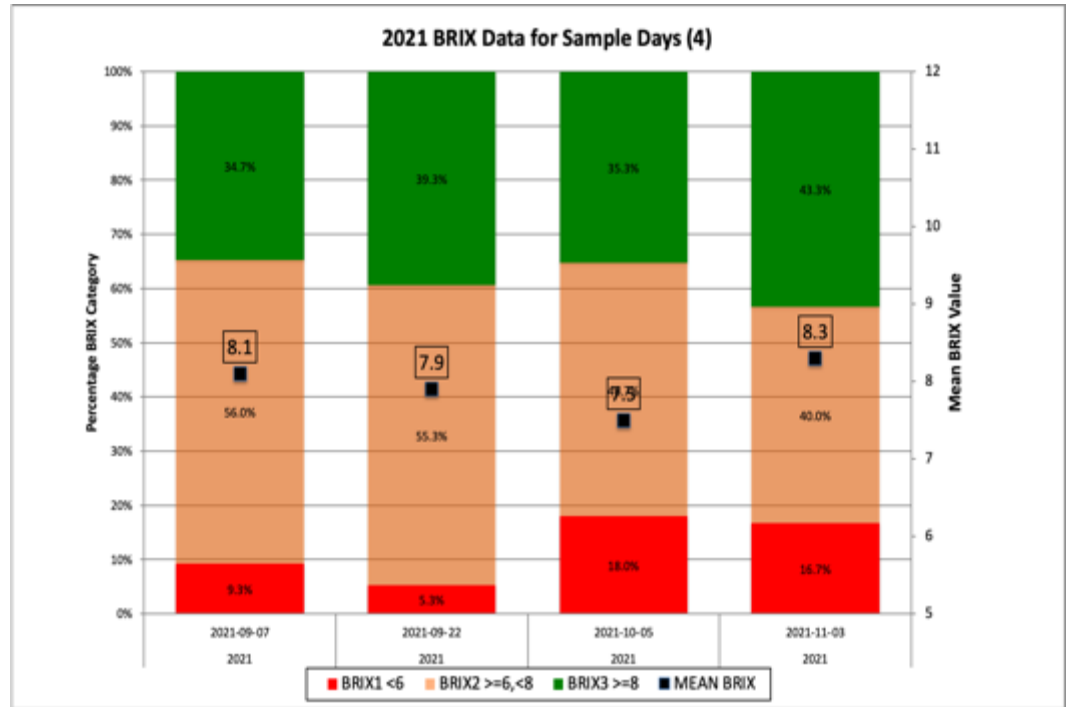
The 2021 Lobster Bay Outside annual results in the graphic for 3-4 weeks from the start of the commercial harvest season opening show an improving trend since 2016 both in terms of increasing "Good" and decreasing "Poor" category BRIX values in each sample date. Similarly, the mean BRIX value increases marginally to a moderate-low level of 8.3 in the 2021 sample (November 3) (the anomalous high of 2020, excepted).

Lobster Quality Category Classification

The assignment of the Lobster Quality categories for each sample date in Lobster Bay Outside are provided in the graphic below. Based on the historical sampling in this location, the 4 sample dates in 2021 are classified as M (the first and last sample dates), and L (2 intermediate sample dates).
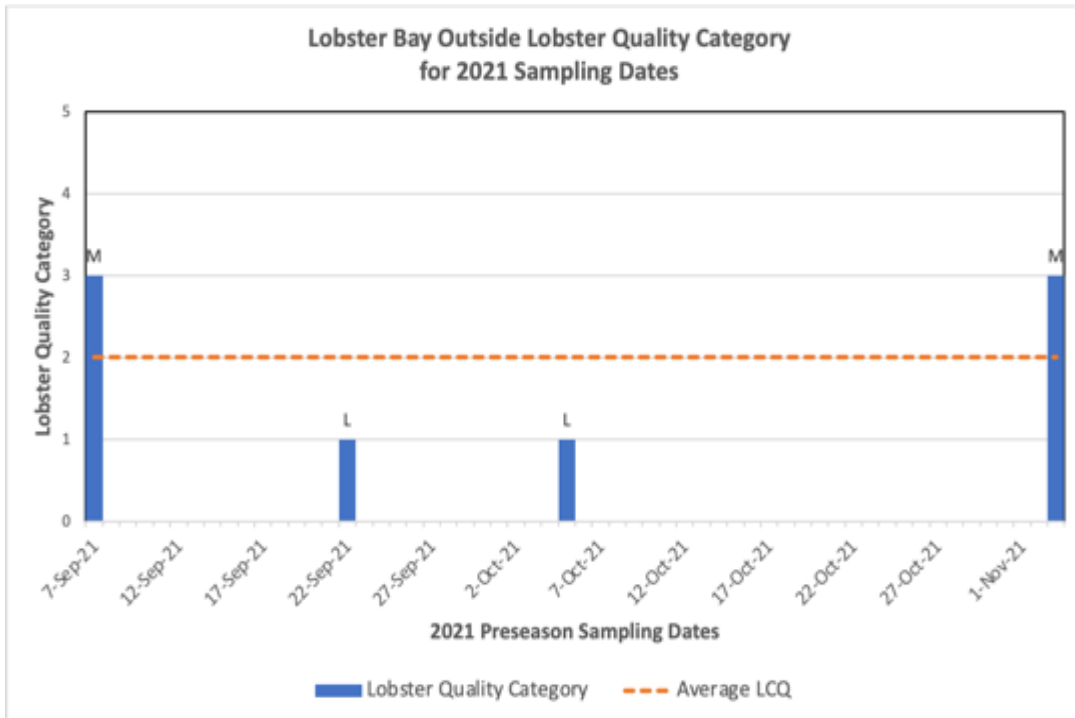
The average over all 2021 sample dates is a lobster quality category of ML (between M and L). The likelihood that the results are representative of either M or L categories for this location are estimated each at 30%. The last sample (November 3) maximum likelihood is 38% for the M (moderate) lobster quality category for Lobster Bay Outside with highest sample mean BRIX of 8.3.

Summary : LOBSTER BAY OUTSIDE–

1) 2021 samples have relatively constant BRIX over the 4 preseason sampling dates at low to moderate quality levels for this location

2) 2021 preseason sample 3-4 weeks before the start of the commercial season continues the improving trend from low BRIX results to higher BRIX since the lower results of the 2016 preseason sample

3) Overall Lobster Quality category for the 2021 samples average to ML; however, maximum likelihood is estimated at 30% for each of the L and M categories; likelihood of M or less is 80%

4) Last sample date (November 4) suggests some improvement in Lobster Quality category to M, estimated maximum likelihood category at 38%, and highest sample date mean BRIX of 8.3.
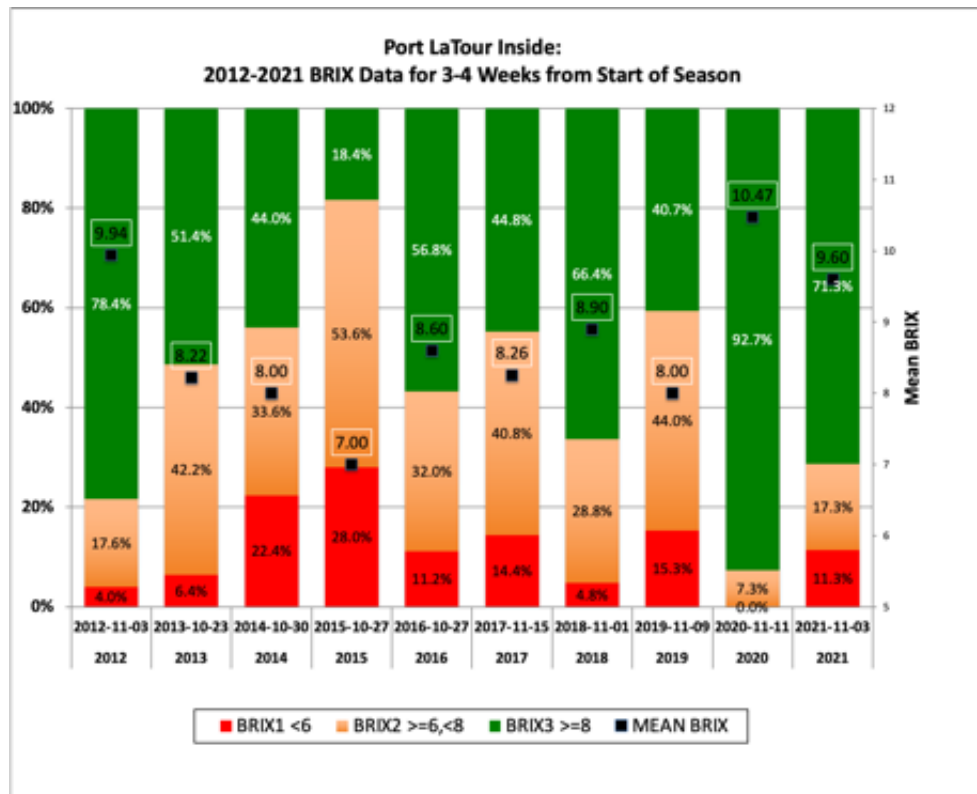
PORT LA TOUR INSIDE

2021 SUMMARY OF RESULTS

Blood Protein (BRIX) Distribution

2021 preseason survey results for Port La Tour Inside were variable but improving over 8 sample dates from end August through mid-November. BRIX means moved from a minimum of 6.7 (September 9) to a maximum of 10.8 (November 3) near the end of the sampling period. The "Good" category BRIX exceeded 66% for all 3 November
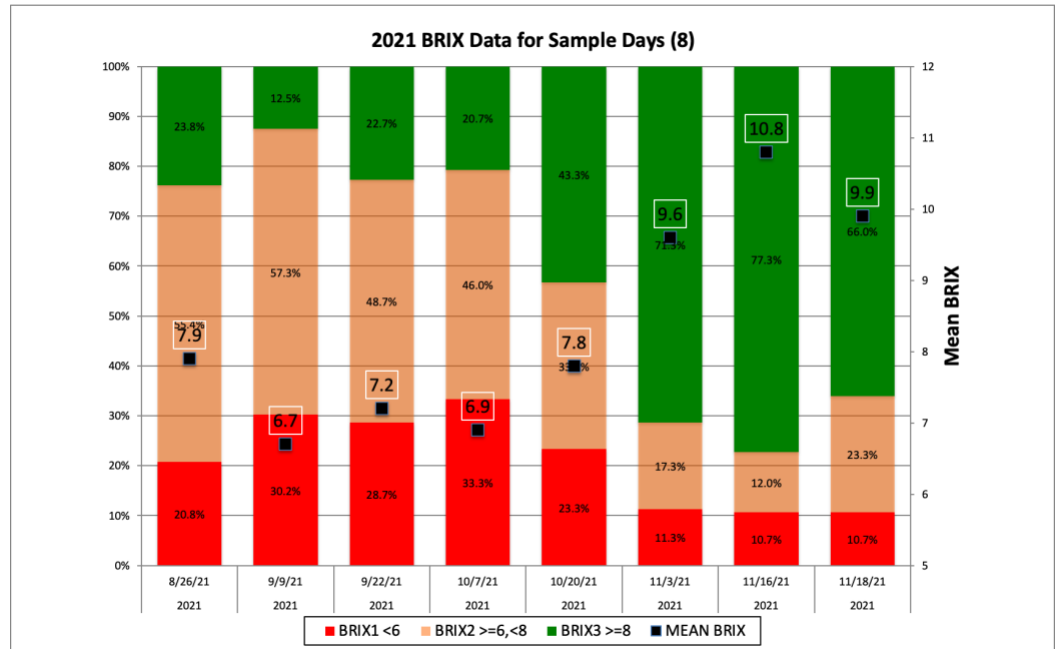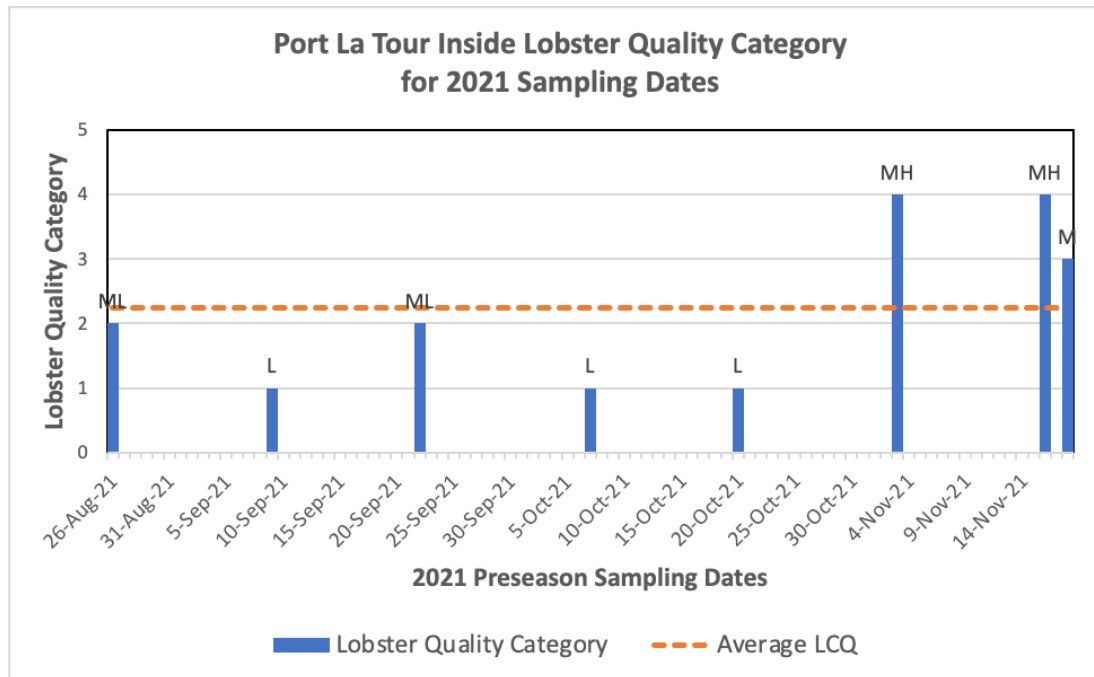

sample dates; "Poor" category BRIX for November were steady at 11%. The 3 November mean BRIX values averaged over 10 – exceeding mean BRIX in the earlier sample dates by almost 40%.

2021 Port La Tour Inside results in the graphic for 3-4 weeks from the start of the commercial harvest season opening are variable over the period from 2012 to 2021. These results have shown improvement since 2016 with "Good" BRIX reaching over 70% in 2021 (November 3 sample) and relatively low "Poor" category BRIX (11%). At the same time, the mean BRIX value in 2021 is among the highest (9.6) in this time series (the 2020 spike excepted).

Lobster Quality Category Classification

The assignment of the Lobster Quality categories for each sample date in Port La Tour Inside are provided in the graphic below. Based on the historical sampling in this location, the 8 sample dates in 2021 are classified as a mix of L (3 dates), ML (2 dates), M (1 date) and MH (2 dates). While the overall lobster quality category is slightly above ML, evidence from the last 3 sample dates indicate that the lobster quality category of Port La Tour Outside has improved to M or above. The likelihood of M or greater in the last 3 samples has estimate of 55%.

Port La Tour Inside Lobster Quality Category for 2021 Sampling Dates — bar chart of Lobster Quality Category vs 2021 Preseason Sampling Dates with Average LCQ.
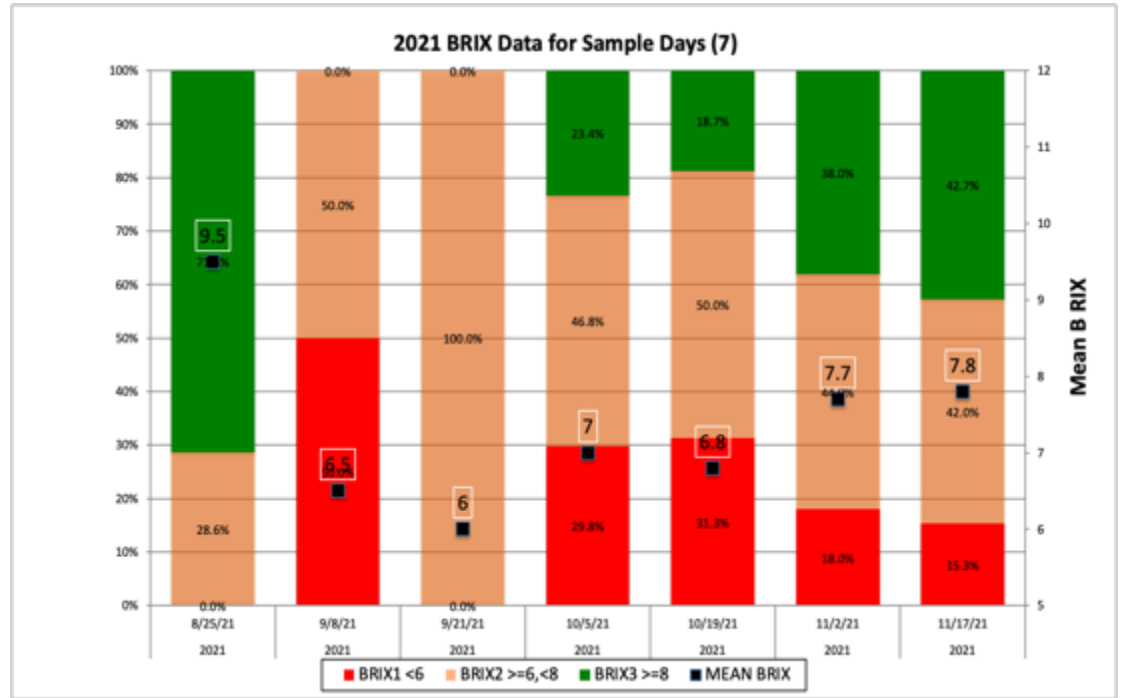

Summary : PORT LA TOUR INSIDE–

1) 2021 samples exhibit variable but improving BRIX behaviour over the 8 preseason sampling dates from low and moderate-low quality to moderate-high BRIX levels for this location

2) 2021 preseason sample 3-4 weeks before the start of the commercial season has mean BRIX value (9.6) among the highest in the time series

3) Overall Lobster Quality category for the 2021 samples average to above ML; however, maximum likelihood is estimated at 55% for M or greater in the last 3 sample dates before the start of the commercial season with high average BRIX values at 10
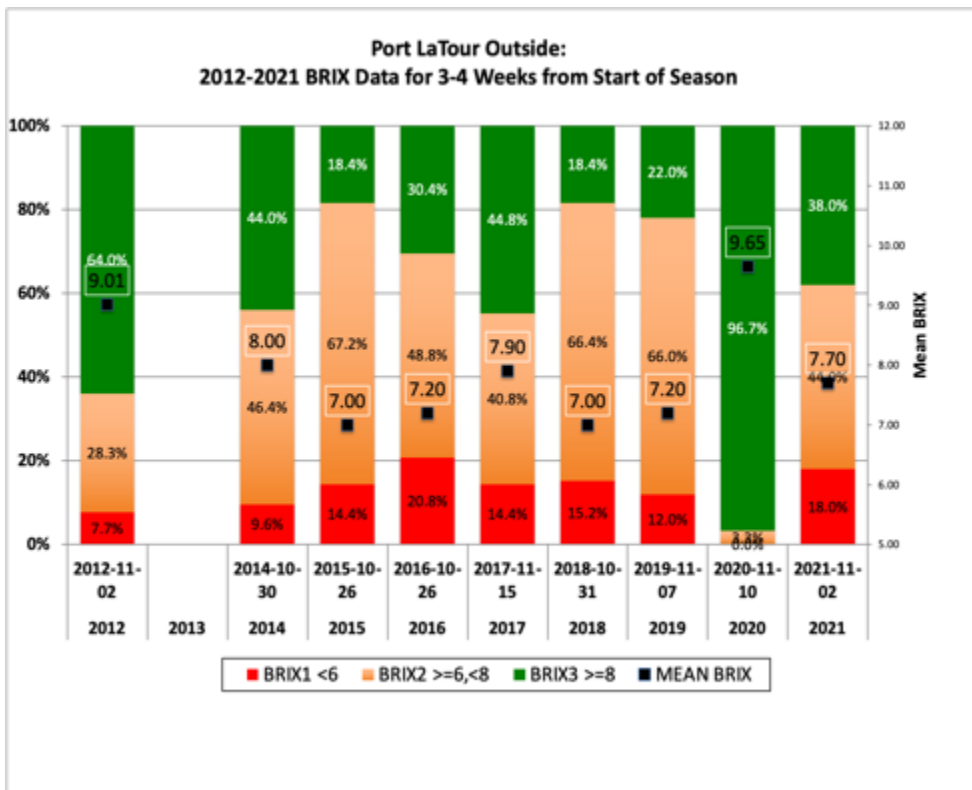

PORT LA TOUR OUTSIDE

2021 SUMMARY OF RESULTS

Blood Protein (BRIX) Distribution

2021 preseason survey results for Port La Tour Outside were variable over 7 sample dates from end August through mid-November. Beginning in October, mean BRIX values tended to increase from low mean values below 7 to close to 8 by the end of the sample period. The proportion of "Good" category lobsters increased while "Poor" category proportions diminished


somewhat over this same period (from 30%, October 5 to 15%, November 17).

The annual results for Port La Tour Outside sampling exhibit a similar behaviour to the Port La Tour Inside results for the case of 3-4 weeks before the start of the season. These results show an improvement since 2018 and a small rise in the relatively low mean BRIX values from 7 (2018) to 7.7 (2021) (not taking into account the 2020 spike). "Good" category BRIX in 2021 attained almost 40% whereas the "poor" category was below 20% of the 2021 sample (November 2).

Lobster Quality Category Classification

The assignment of the Lobster Quality categories for each sample date in Port La Tour Outside are provided in the graphic below. Based on the historical sampling in this location, the 7 sample dates in 2021 are classified initially as H moving to ML, M, and L before terminating at Lobster Quality category M.
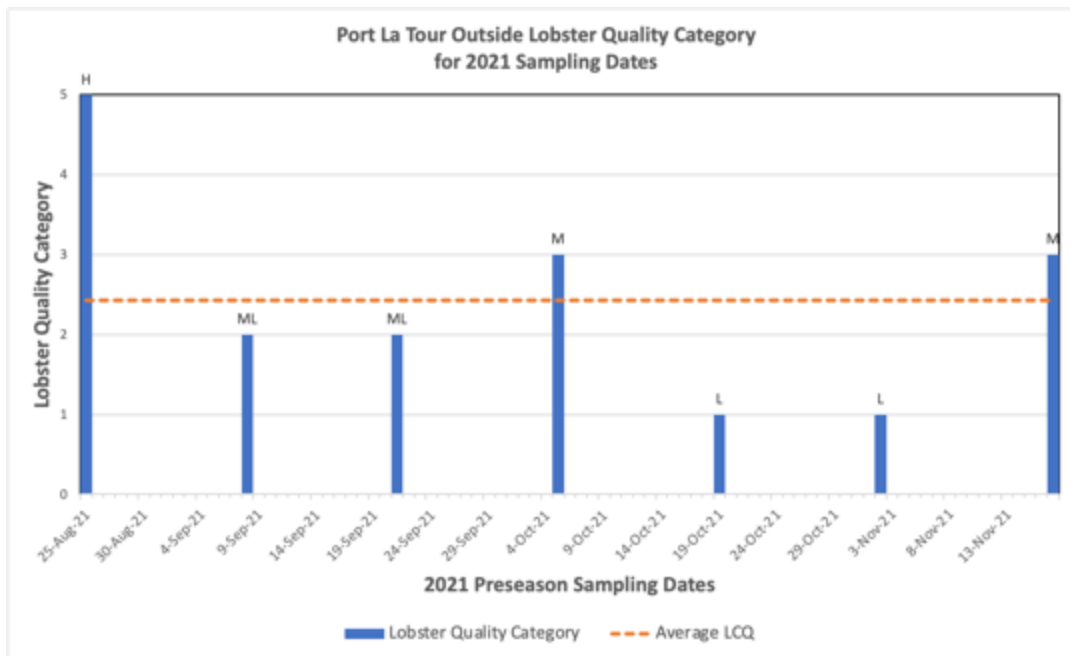
The overall mean category is between M and ML for all sample dates. The likelihood that the overall Lobster Quality category is M or lower (ML to L) is estimated at 70% for Port La Tour Outside.

Summary : PORT LA TOUR OUTSIDE–

1) 2021 samples exhibit gradual improvement in BRIX behaviour over the last 4 preseason sampling dates from mean BRIX levels below 7 to 7.8

2) 2021 preseason sample 3-4 weeks before the start of the commercial season is comparable to BRIX distributions in 2014 and 2017

3) Overall Lobster Quality category for the 2021 samples average between M and ML; estimated likelihood that Port La Tour Outside Lobster Quality category is M or lower (ML or L) is 70%


ST. MARY'S BAY INSIDE

2021 SUMMARY OF RESULTS

Blood Protein (BRIX) Distribution

2021 preseason samples for St. Mary's Bay Inside over 7 sample dates exhibit a gradual improvement from moderately lower mean BRIX (8.5) at the mid-September sample to maximum high mean BRIX (10) at the final 2021 November 10 sample. "Poor" BRIX values remain below
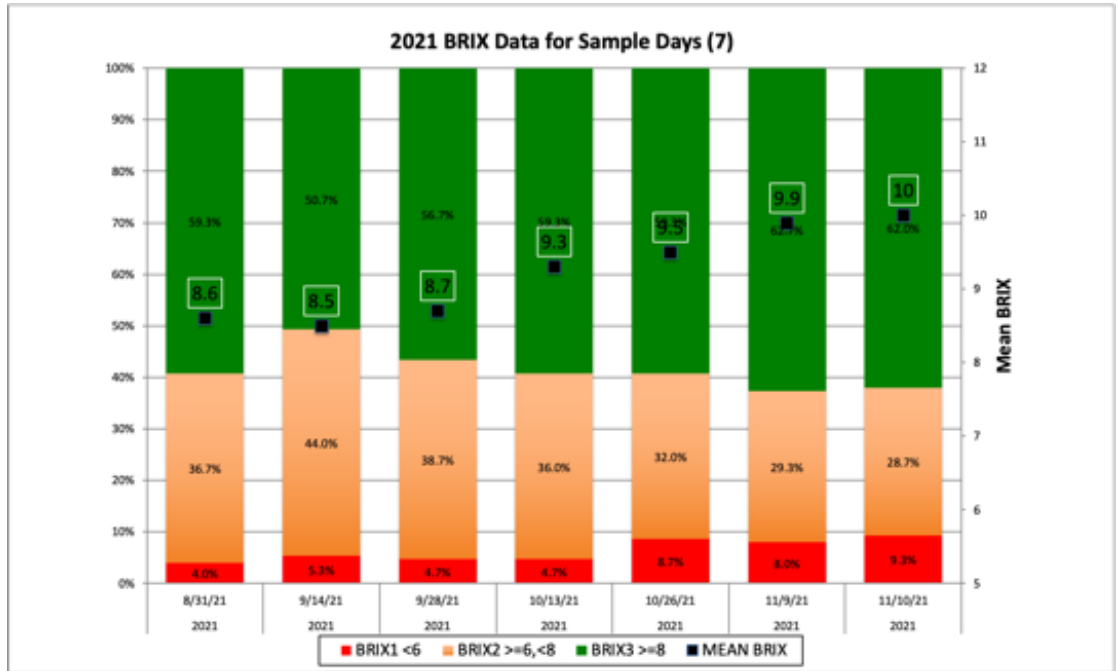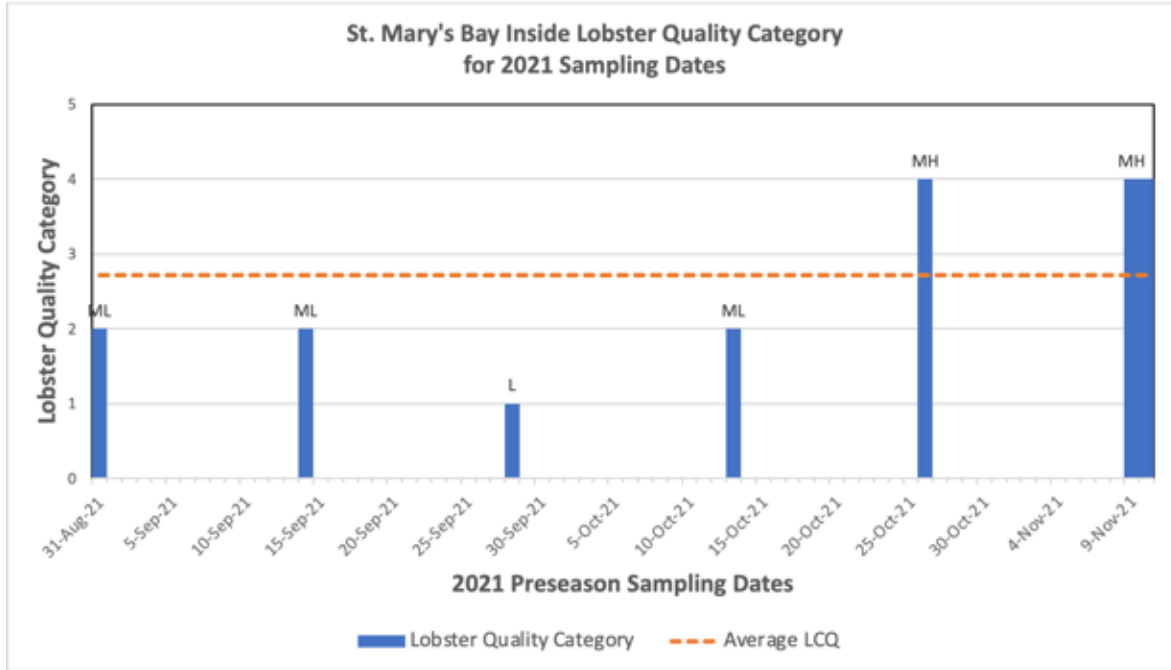

10% across all the 2021 samples; "Good" category BRIX proportions move from 50% (September 14) to over 60% at the end of the sample period (November 10).
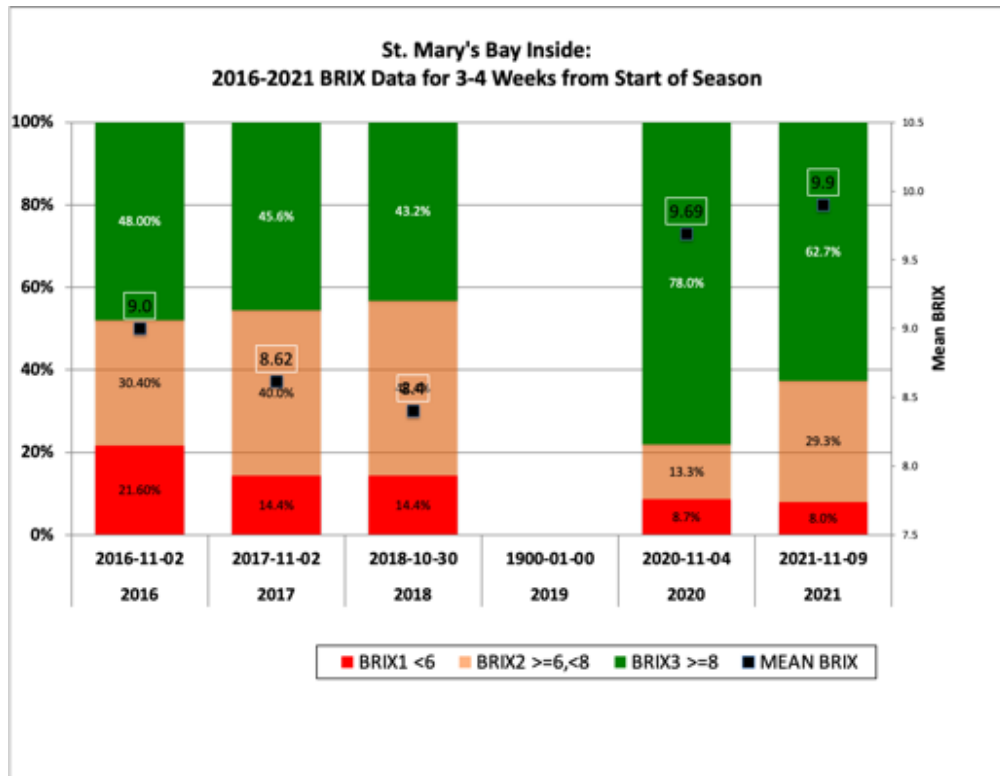
The annual trend in the graphic for 3-4 weeks prior to the start of the season shifts toward higher BRIX values as evidenced by the 2020 and 2021 samples with mean BRIX values near 10. These mean BRIX values exceed all values in this series and lends to a positive prediction for good quality in St. Mary's Bay Inside for the 2021-2022 season.

Lobster Quality Category Classification

The assignment of the Lobster Quality categories for each sample date in St. Mary's Bay Inside are provided in the graphic below. Based on the historical sampling in this location, the 7 sample dates in 2021 are classified overall as M with the last 3 sample dates all at category MH. The likelihood that these 3 sample dates are taken from the MH category is estimated at just over 50%. For these last 3 sample dates, the likelihood that the Lobster Quality category is M or less (M, ML, or L) is collectively estimated as approximately 40%.

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Summary : ST. MARY'S BAY INSIDE–

1) 2021 samples exhibit gradual improvement in BRIX distribution with moderate mean BRIX levels of 8.5 moving to a high mean BRIX of 10 by the end of the sample period

2) 2021 and 2020 preseason samples 3-4 weeks before the start of the commercial season demonstrate a shift in BRIX to higher levels

3) Overall Lobster Quality category for the 2021 samples approaches M levels; estimated likelihood that St. Mary's Bay Inside Lobster Quality category is MH is over 50% based on the last 3 samples in 2021

ST. MARY'S BAY OUTSIDE

2021 SUMMARY OF RESULTS

Blood Protein (BRIX) Distribution

2021 preseason samples in St. Mary's Bay Outside exhibit a near constant set of mean BRIX values and proportional distributions across the 6 sample dates. The overall mean BRIX values fall in a tight range of moderate mean BRIX values from a minimum of 8.3 (October 12) to a maximum of 8.6 (August 30) with overall moderate mean BRIX of 8.4.
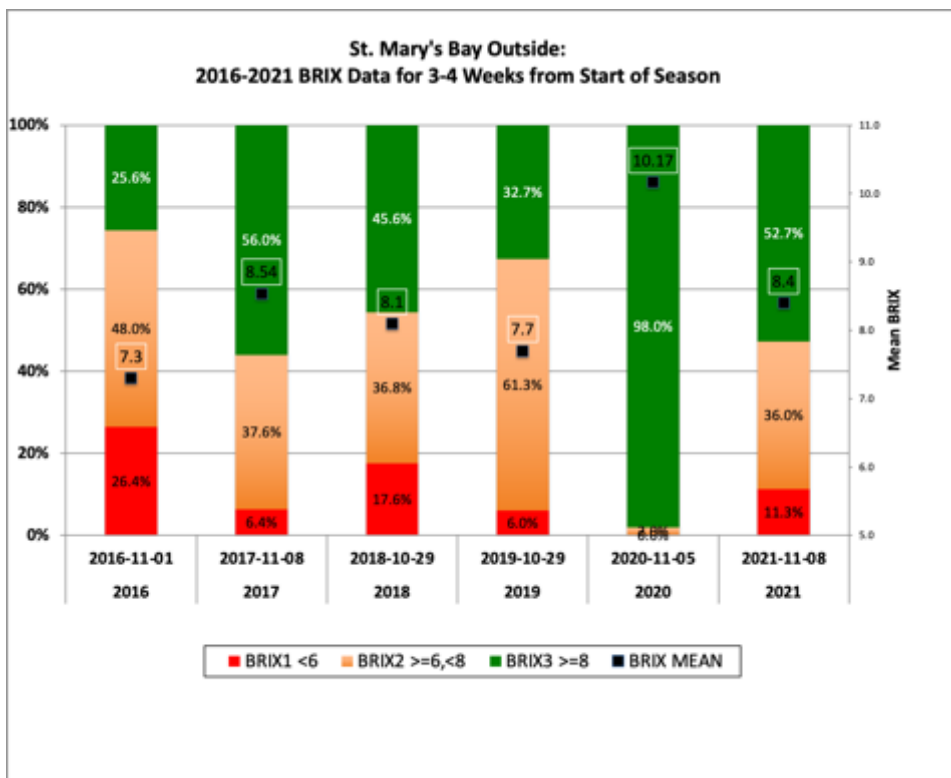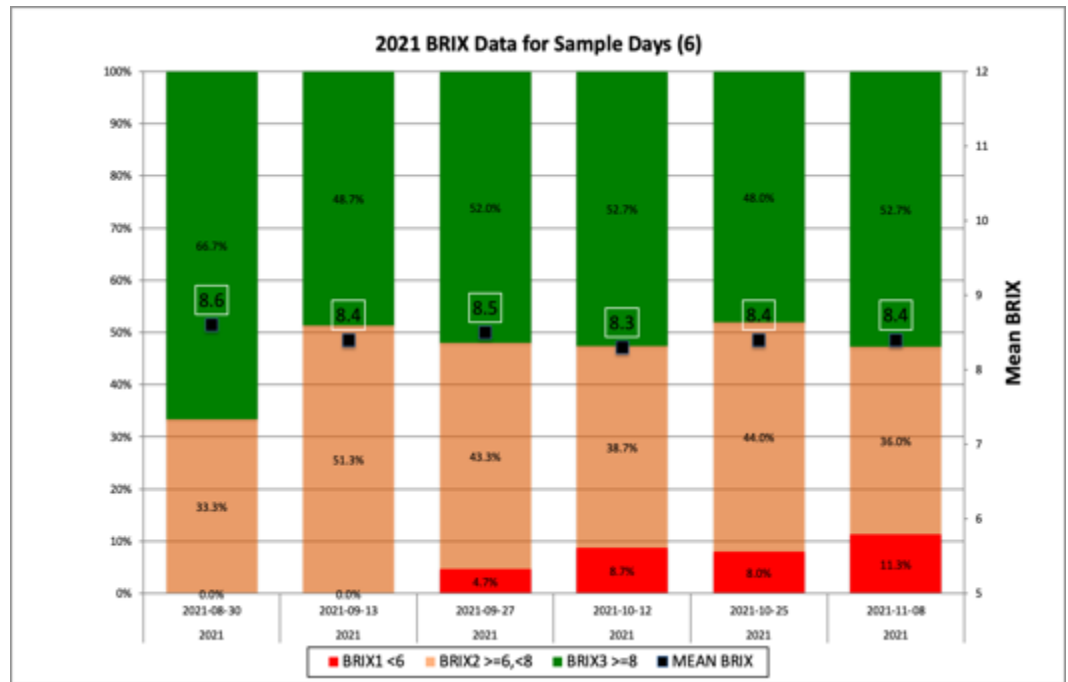

The annual trend in the graphic for 3-4 weeks prior to the start of the season also shows a moderate mean BRIX of 8.4 for the 2021 sample (November 8). This value is among the highest for this location and time series (the 2020 spike excluded).

This result is directly comparable to the 2017 BRIX distribution with its mean BRIX value (8.54). "Good" BRIX category proportion for 2021 is over 50%; "Poor" BRIX category proportion is just over 10%.

Lobster Quality Category Classification

The assignment of the Lobster Quality class for each sample date in St. Mary's Bay Outside are provided in the graphic below. Based on the historical sampling in this location, the 6 sample dates in 2021 are classified as ML (3 dates) or M (2 dates) with the exception of L (first 2021 sample date, August 30).
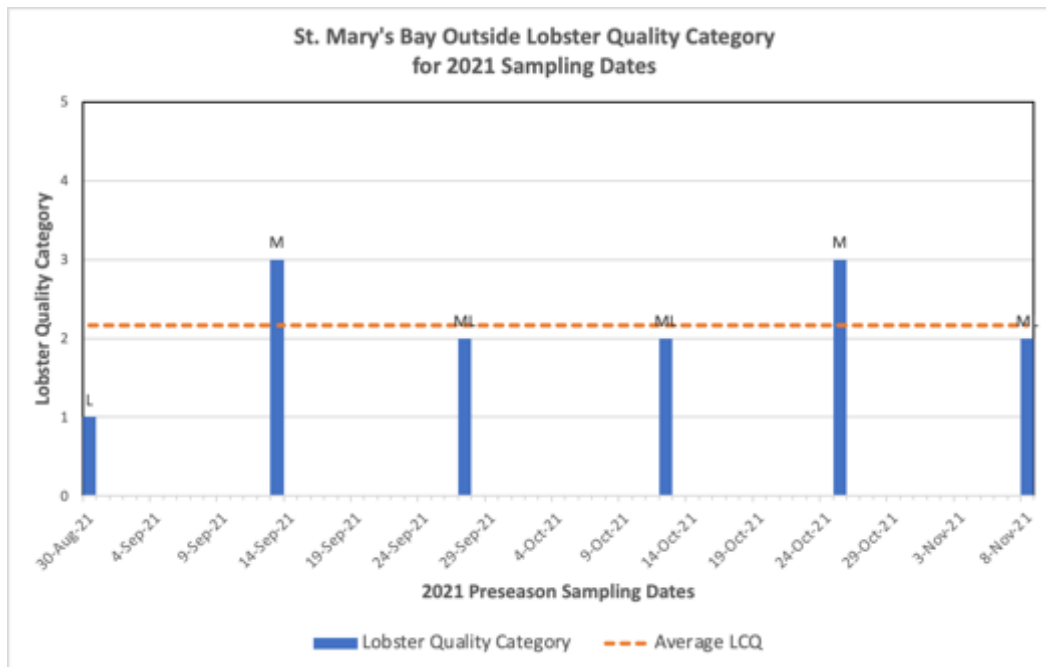
The overall maximum likelihood category for St.Mary's Bay Outside is ML estimated at 56%. The likelihood that these data are taken from either the M (30%) or ML (60%) Lobster Quality category is estimated at over 90% considering the last 5 sample dates.

Summary : ST. MARY'S BAY OUTSIDE–

1) 2021 samples exhibit a near constant series of BRIX distribution and mean values; moderate mean BRIX values range from 8.3 to 8.6 with overall mean of 8.4

2) 2021 preseason sample 3-4 weeks before the start of the commercial season is comparable in BRIX mean and distribution to 2017

3) Overall Lobster Quality category for the 2021 samples is between M and ML levels; estimated likelihood that St. Mary's Bay Inside Lobster Quality category is either M or ML is over 90% based on the last 5 samples in 2021

2021 Preseason Summary

2021 preseason sampling results in LFAs 33 and 34 indicate that lobsters landed at the start of the 2021-2022 season in southwest Nova Scotia, are of overall _moderate-low (ML) quality._ 2021 preseason samples mean overall BRIX is also at the moderate-low level of 8.3 units/ml.

Preseason results vary by location. Table 4 below summarizes the mean BRIX results for all sample dates for each location as well as each location's overall Lobster Quality Category and comparable year(s) from the historical database.

Table 4. 2021 Preseason Sampling Summary Results

Locations:	Yarmouth Inside	Yarmouth Outside	Lobster Bay Inside	Lobster Bay Outside	Port La Tour Inside	Port La Tour Outside	St.Mary's Bay Inside	St.Mary's Bay Outside	Overall Locations
2021 Samples Mean BRIX	8.5	7.9	8.9	8.0	8.4	7.4	9.2	8.4	8.3
Lobster Quality Category Ave	ML	ML	ML	ML	ML+	ML+	M	ML	ML
Comparable Years	Post 2013: 2014-2020	Post 2013: 2014-2021	2015, 2017	2018-2020	2019, 2020	2019, 2020	2009, 2013	2016, 2017	

- St. Mary's Bay (Inside and Outside) is the only location that collectively outperforms the overall mean in 2021 with highest mean BRIX value for St. Mary's Bay Inside (9.2), and high (BRIX>9) for the 4 post-September sample dates.

- Lobster Bay (Inside and Outside) underperforms in 2021 relative to its BRIX history over the 2006-2020 period – despite the higher mean BRIX (8.9) for Lobster Bay Inside.

- Yarmouth (Inside and Outside) also underperforms in 2021 compared to its better BRIX history in the earlier years of the database (see also Table 3 above).

- Port La Tour (Inside and Outside), while collectively below the overall mean BRIX value of 8.3, performs relatively better in 2021 compared to past years, especially Port La Tour Inside where BRIX means exceed 9.5 for all 3 of the November sample dates.

- The incidence of weak lobsters nearly doubled in 2021 compared to 2020 values. Weaks in the Inside locations averaged over 10% per sample. Weaks in the Outside locations averaged over 15% per sample (see also graphics below).

- Lobster Bay Inside dominated the incidence of weaks in the Inside areas, averaging over 18% and increasing from 3% to 33% as sampling progressed.

2021-2022 Preseason Sampling
Inside Areas Per Cent Weaks by Sample Date
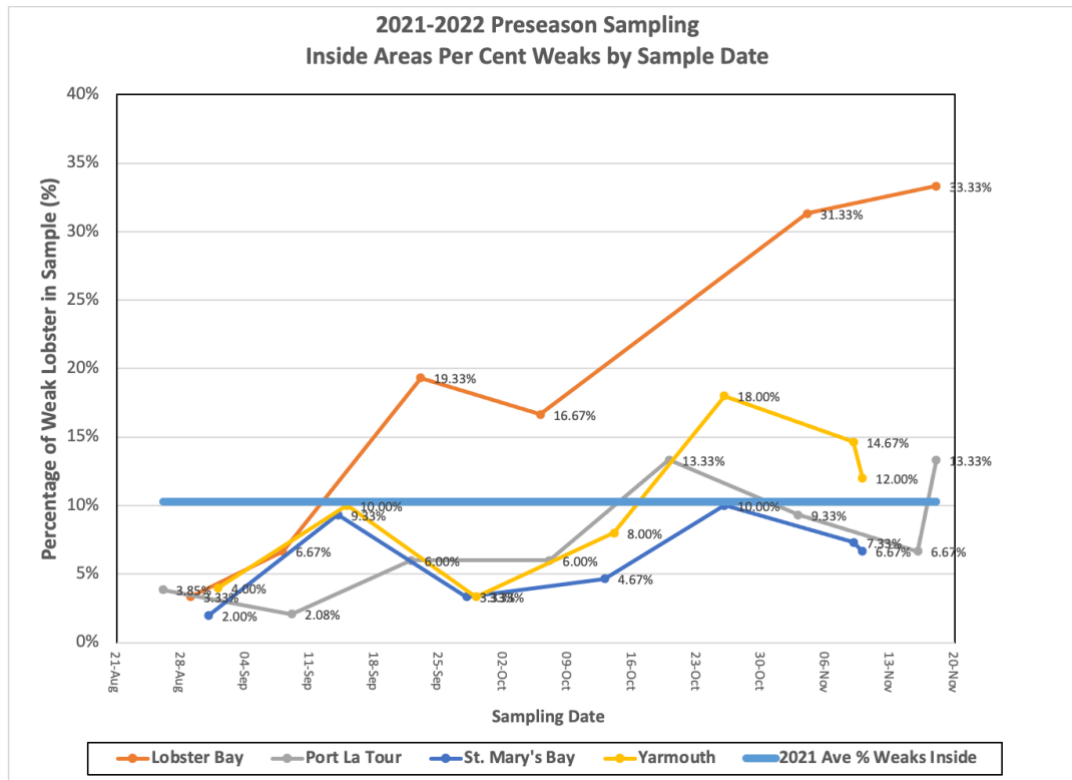
- In Outside areas, all locations experienced increased weaks over the sampling period, rising from lows of 0% (Port La Tour) to highs of over 25% (Yarmouth, Lobster Bay, and Port La Tour).

2021-2022 Preseason Sampling
Outside Areas Per Cent Weaks by Sample Date
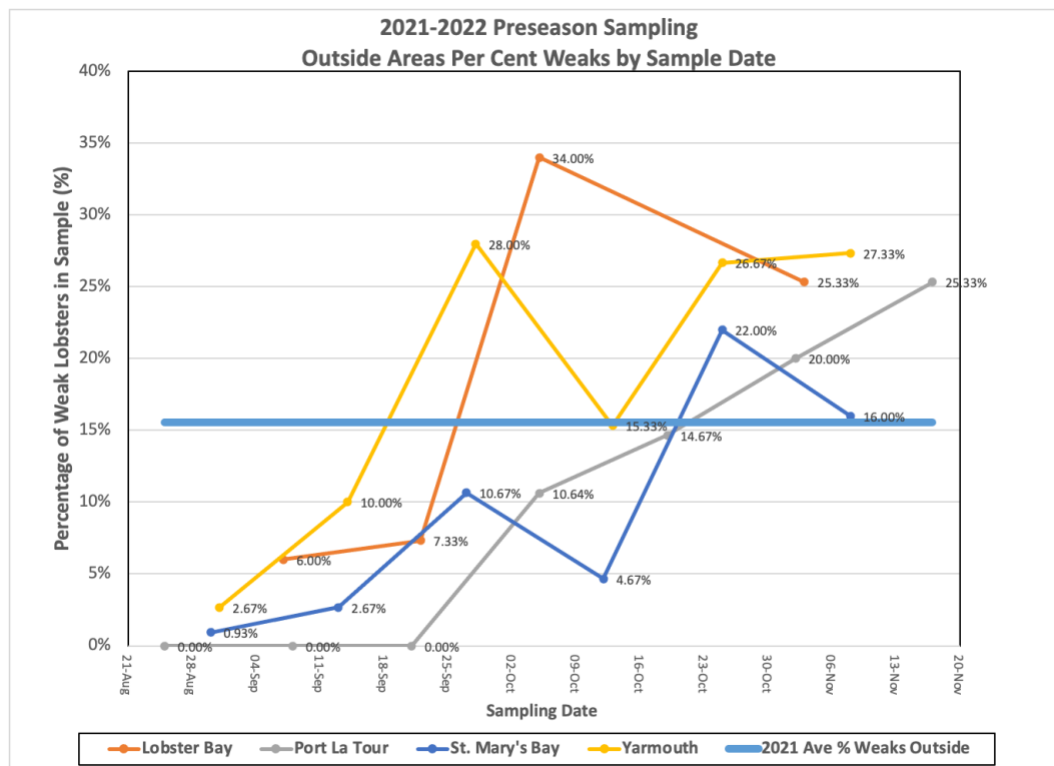
Acknowledgements

Coldwater Lobster Association and Université Sainte-Anne wish to thank all participants in, and contributors to the 2021 Preseason Lobster Moult & Quality Survey. Your commitment to this scientific task is commendable and it is only worthwhile to the sector thanks to your valuable contribution. We appreciate and thank all of you for your continued support for this important scientific study for the benefit of the lobster sector in southwest Nova Scotia. To those about to embark on another lobster season in LFAs 33 and 34, here's to calm waters, a prosperous season, and stable international and domestic markets. Stay safe and watch out for one another.

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