Research Working Document – Trends and Projections Lobster Fishing Areas 31A-31B

Guysborough County Inshore Fishermen's Association

sdelorey@bellaliant.com

www.gcifa.ns.ca

Updated 2013

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Introduction

The GCIFA is an accredited non-profit association under the Fisheries Organization Support Act, registered with the Registry of Joint Stock. The association is made up of core fishermen and crewmembers that fish in the County of Guysborough, NS. There are 134 members 109 lobster license holders) who are primarily inshore, small boat, fixed gear fishermen. The fishermen hold a variety of species licenses as well as temporary permits to fish new exploratory fisheries.

The association has a full executive and volunteer board of directors who are elected from the membership. The association operates as a one vote to one member democracy. The association has representatives on 34 industry, advisory and management committees. Members voluntarily sit on these County, Regional, Provincial and National boards with two representatives required for each. Our mission statement is: "to provide community based fisheries management of the local resources, to provide participatory research that is both initiated and relevant to the membership, to provide industry training to the membership and crews and to provide industry representation for the membership".

The inshore lobster fishery has been managed in partnership with DFO, within this area of Guysborough County for many years. GCIFA has been collecting data on the lobster fishery since the 1990's. The fishermen in LFA 31A have been keeping their own personal logs for several decades. The association has partnered with academics from St. Francis Xavier University producing published results in the early 1990's. Since then numerous research projects and partnerships have produced valuable results and has increased our capacity in the understanding of lobster biology and management. In recent years, we have added more partnerships with NSDFAC, DFO, University of New Brunswick, Memorial University, St John and Université LAVAL.

GCIFA Research

GCIFA lobster license holders originally began collecting data sets on their lobster fishery to evaluate DFO imposed and adopted conservation measures in the late 1990'S. At that time GCIFA partnered with DFO to begin tagging studies for berried females, windows and v-notching. Later on 2008-09 budget and human resource cuts, DFO science discontinued the valuable data sets from at-sea sampling during the season. GCIFA wanted to contribute and continue the valuable at-sea sampling data sets that were previously collected by DFO technicians. Interns and a lobster tech were hired by GCIFA to collect this data and other. This research has been very valuable to the fishermen in the lobster industry, local buyers, academics, NS Fisheries Department and DFO scientists, whom we share our data results. We have increased our capacity in lobster knowledge and marine science research methodology as well as research equipment and a fully operational research lab facility. We could not have done this without the continued support of our buyers, our fishermen, the Province of NS and DFO.

At -Sea Samples

At - sea sample consists of a technician recording quantitative and qualitative data on the lobster fishery during the regular season. The technician records information related to the size, sex and overall health of the lobsters in each trap as well as any live discards and incidental by-catch observed in the trap. Our goal is to record at least three sampling days in each of the four ports (31A) and three sampling days in three ports (31B), during the season, one at the beginning of the season, one mid way through and one near the end of the season. Some years we have had success with this schedule and other years due to poor weather or human resource issues, we were unable to fulfill the three days in each port.

All data from sea samples is entered into DFO Marfis system. Sea sampling has replaced port samples because at-sea sampling provides data on everything in the traps and every trap haul. A port sample only provides data on the market size lobster kept in the trap hauls. From a complete sea samples we can extract information on abundance of size class, berried females, health of stock, female development stages and timing for egg release, shell hardness, sex ratios, Species at Risk interactions, live discards and incidental By-catch.

An indicator of catch rate or effort can be assessed by calculating catch per unit effort (CPUE) or lobsters per trap haul as used in the table below. This will allow us to compare data sets over years regardless of the number of trap hauls or sea sampling days. This method does not however take into consideration storms and or weather which could account for lower catch numbers on certain days where sampling was completed. Traps may come up empty because of environmental conditions changing from trap haul to trap haul.

At Sea Sampling Year / Location/ # of Trap Hauls for reference in At- Sea sampling Graphs and Reporting

Port – Year	# of Samples	# of Traps Hauled
Canso – 2008	3	740
Canso – 2009	3	723
Canso - 2010	5	1242
Canso - 2011	4	1016
Canso – 2012	4	992
Canso - 2013	3	578
Dover – 2008	3	713
Dover – 2009	2	371
Dover – 2010	4	748
Dover – 2011	4	994
Dover – 2012	4	992
Dover – 2013	3	750
Queensport - 2008	2	514
Queensport - 2009	2	494
Queensport - 2010	3	606
Queensport - 2011	3	763
Queensport - 2012	3	750
Queensport - 2013	3	752
WhiteHead – 2008	3	763
WhiteHead - 2009	1	251
WhiteHead – 2010	3	750
WhiteHead – 2011	3	760

WhiteHead – 2012	3	750
WhiteHead - 2013	3	754
Port Felix - 2010	3	742
Port Felix - 2011	3	748
Port Felix - 2012	3	750
Port Felix - 2013	3	750
New Harbour - 2010	4	994
New Harbour - 2011	3	747
New Harbour - 2012	3	742
New Harbour - 2013	2	500
Drumhead – 2008	2	500
Drumhead – 2010	1	245
Drumhead – 2012	2	500
Drumhead - 2013	1	250

Canso – LFA 31A

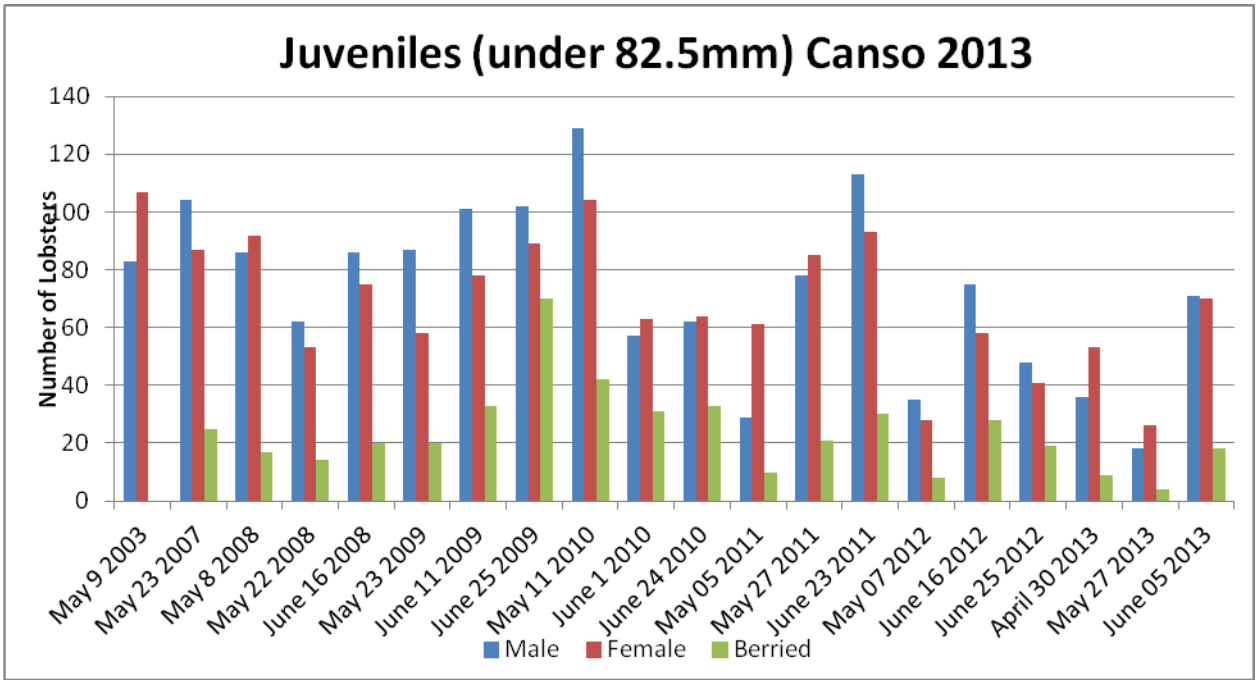

Figure 1: All lobsters under our current measure 82.5mm.
*2003 CL measure was less than 86mm

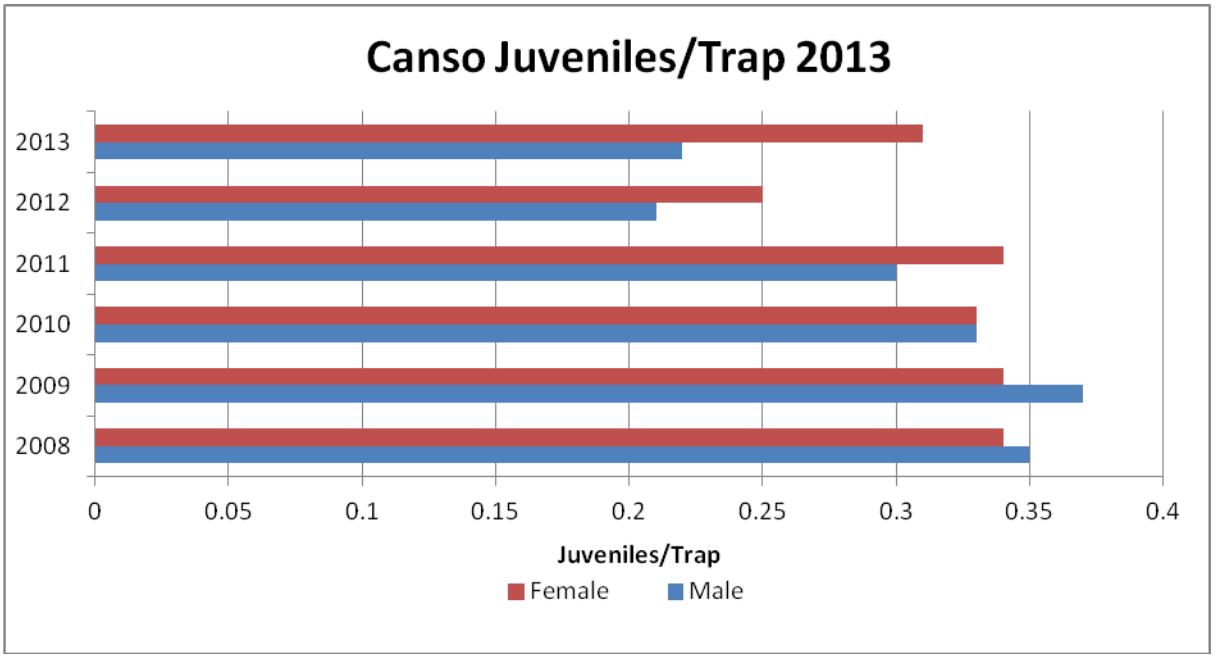

Figure 2: The number of juveniles per trap during at-sea samples from 2008-2013. We recorded a decline in males from 2009 to 2012 with a slight increase in 2013.

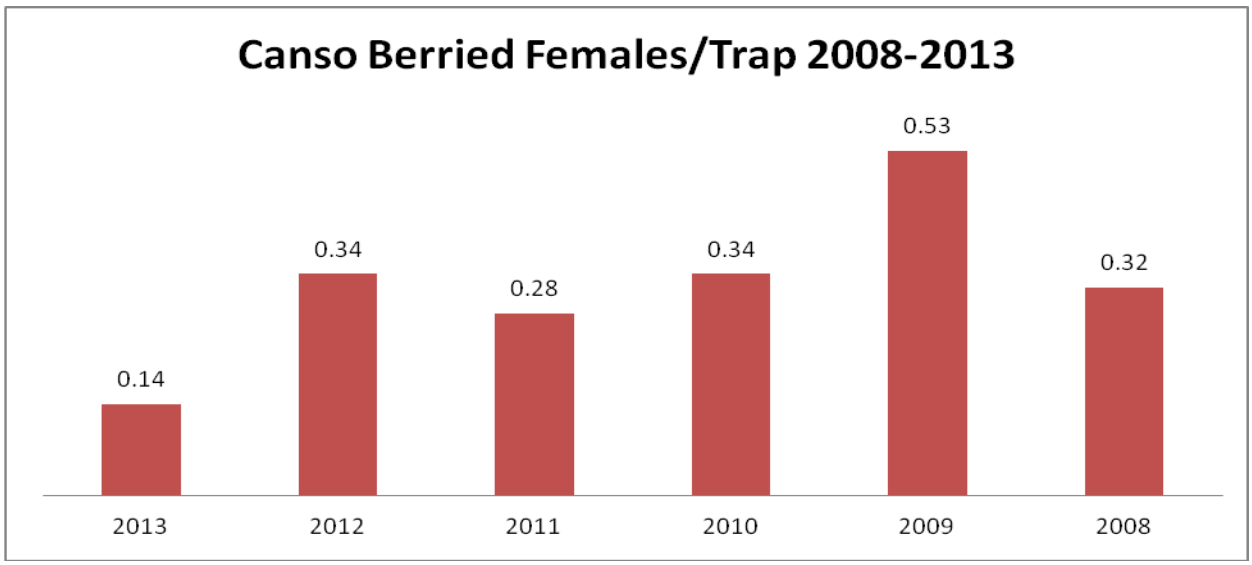

Figure 3: Berried females per trap from 2008-2013

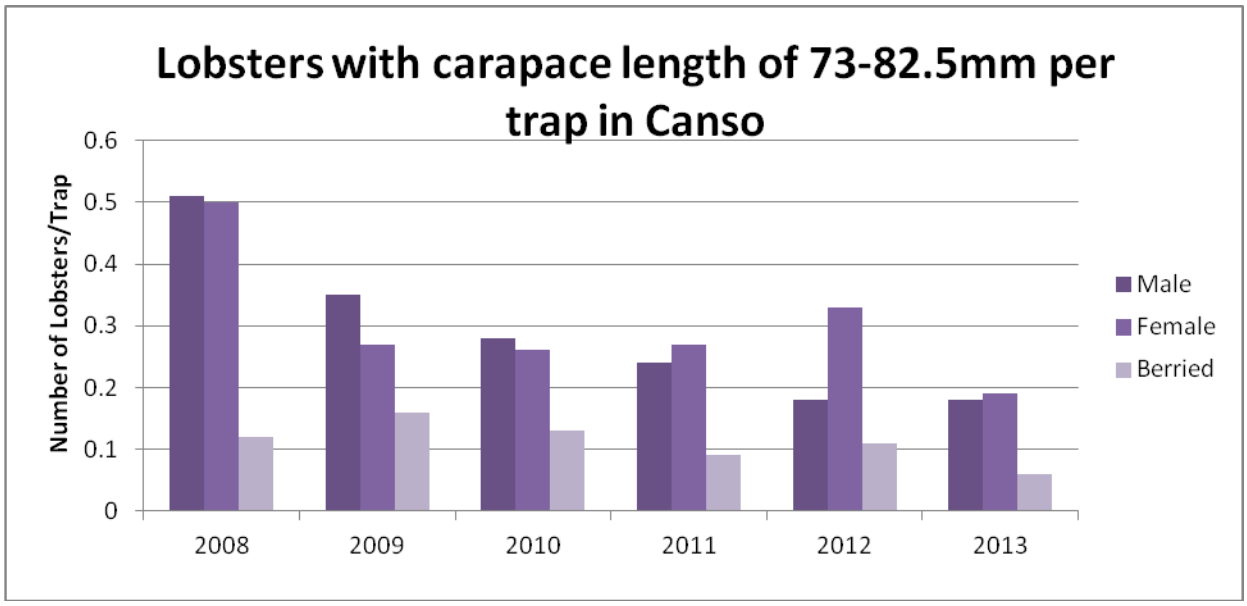

Figure 4: The number of juvenile lobsters (male, female and berried) per trap measuring 73-82.5mm. At a growth rate of 10-15% per molt most juveniles above 73mm (using average of 12.5%) would be ready for market if they molted the following year

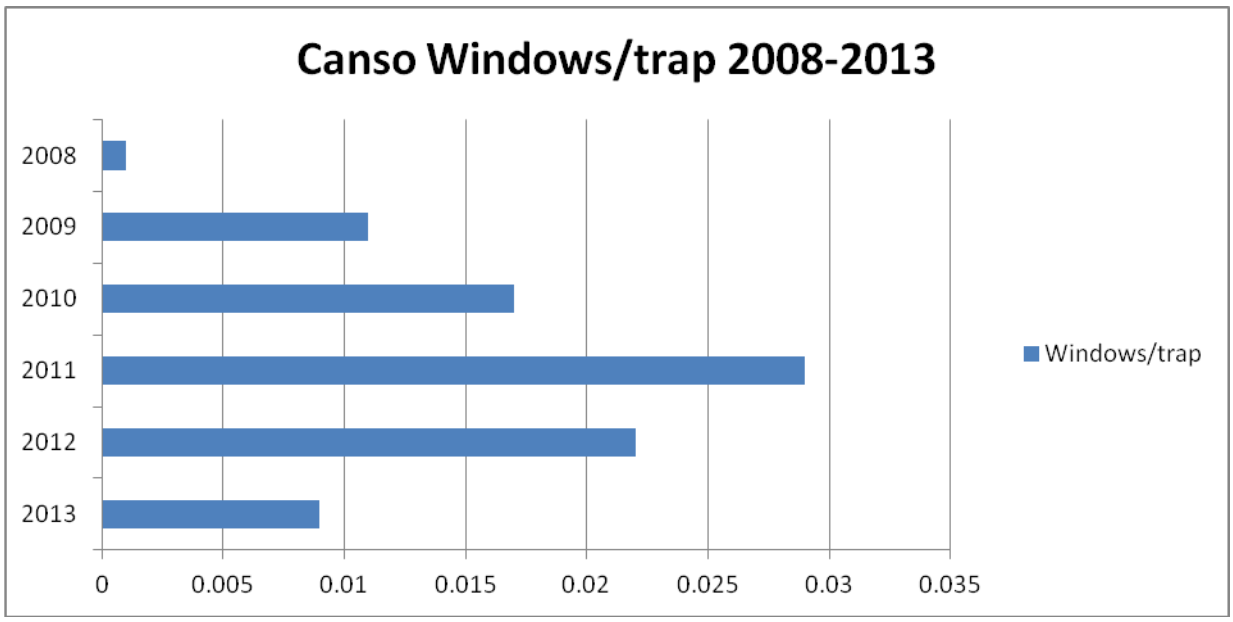

Figure 5: Number of windows caught per trap during sea samples

Picture 1: Juvenile lobster measuring 68mm during sea sample 2013

Little Dover – LFA 31A

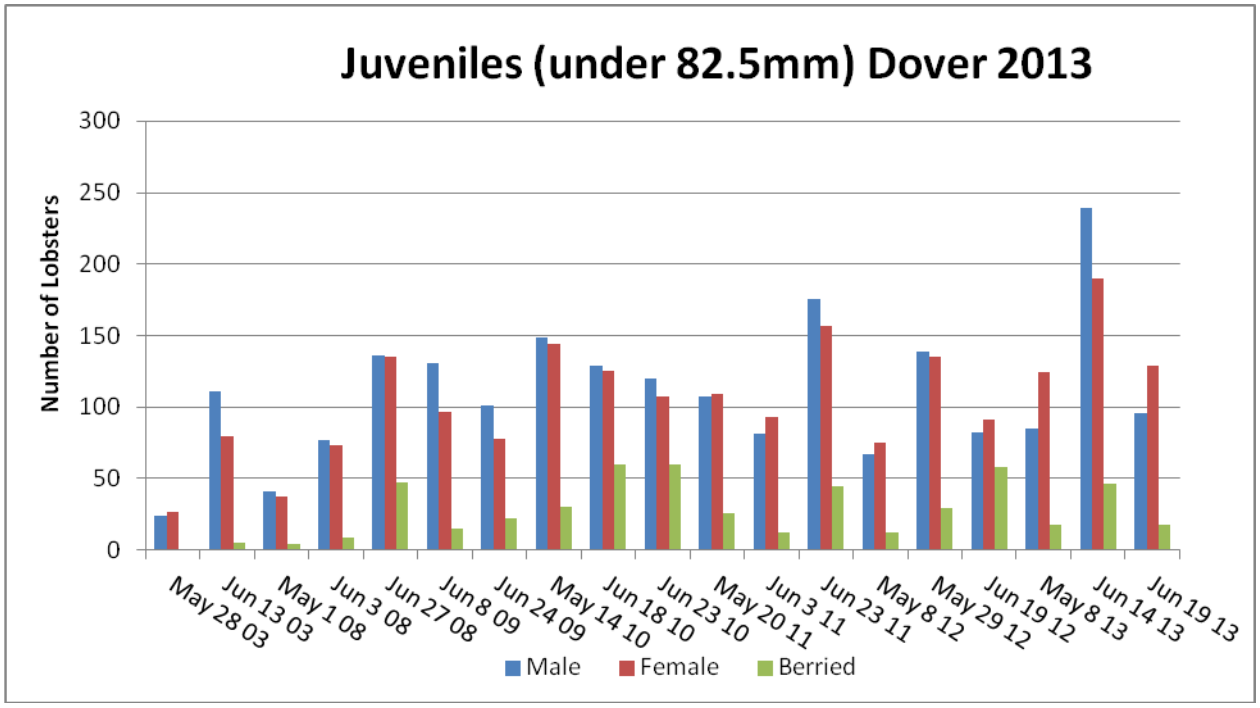

Figure 6: Lobsters under our current measure 82.5mm
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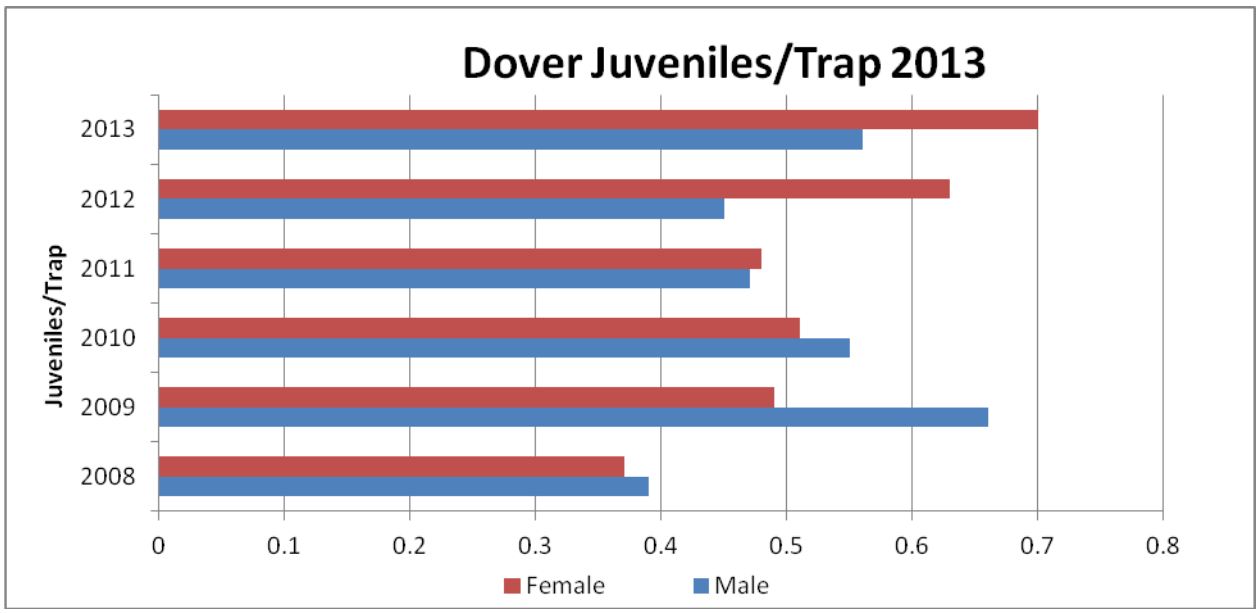


Figure 7: The number of juveniles per trap during at-sea samples from 2008-2013.
A decline in males from 2009 to 2012 was recorded with an increase in both males and females in 2013.

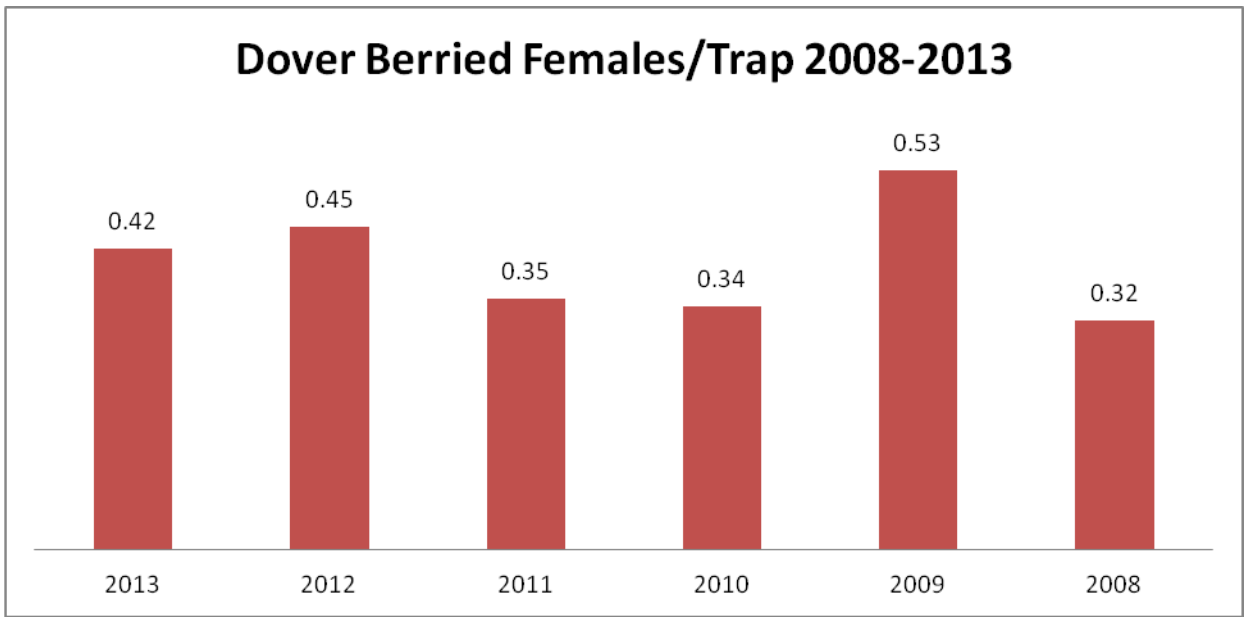


Figure 8: Berried females per trap from 2008-2013

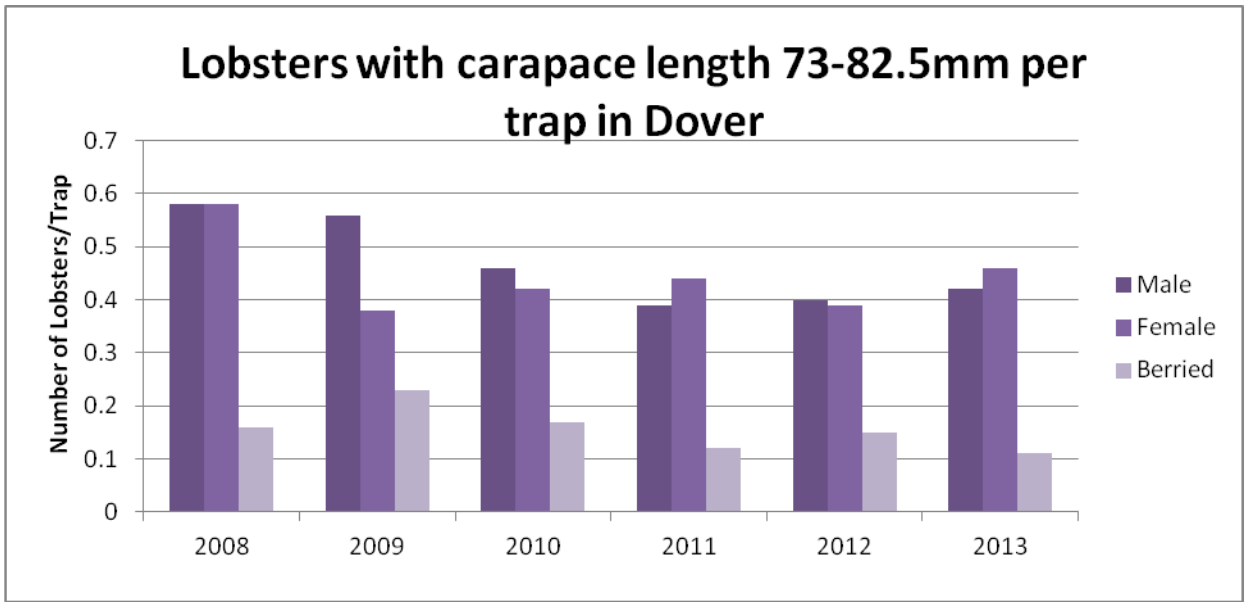


Figure 9: The number of juvenile lobsters (male, female and berried) per trap measuring 73-82.5mm. At a rate of 10-15% per molt most juveniles above 73mm (using average of 12.5%) would be ready for market if they molted the following year

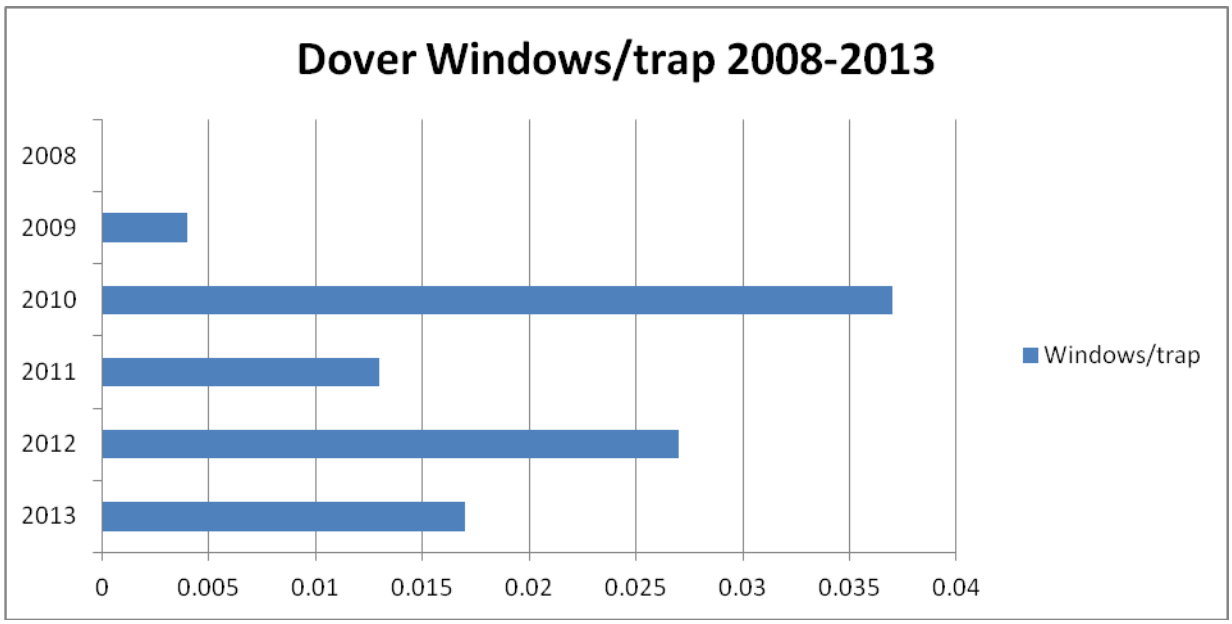
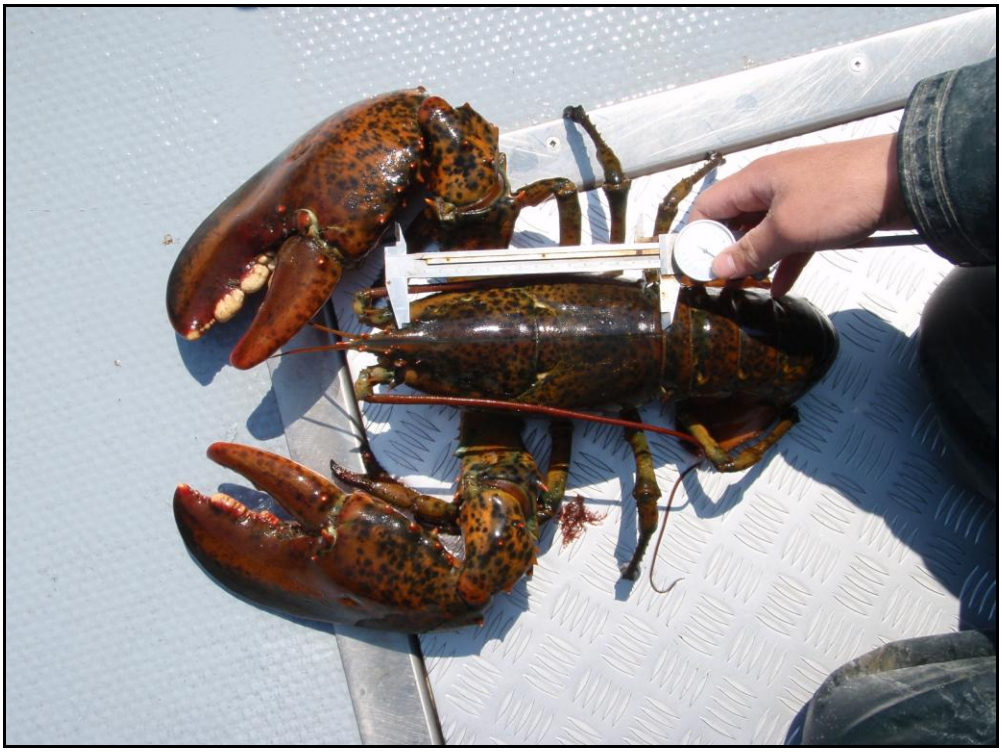


Figure 10: Number of windows caught per trap during at-sea samples. *No windows data was recorded for sampling in 2008



Picture 2: Male lobster caught in Dover measuring approximately 165mm

WhiteHead – LFA 31A

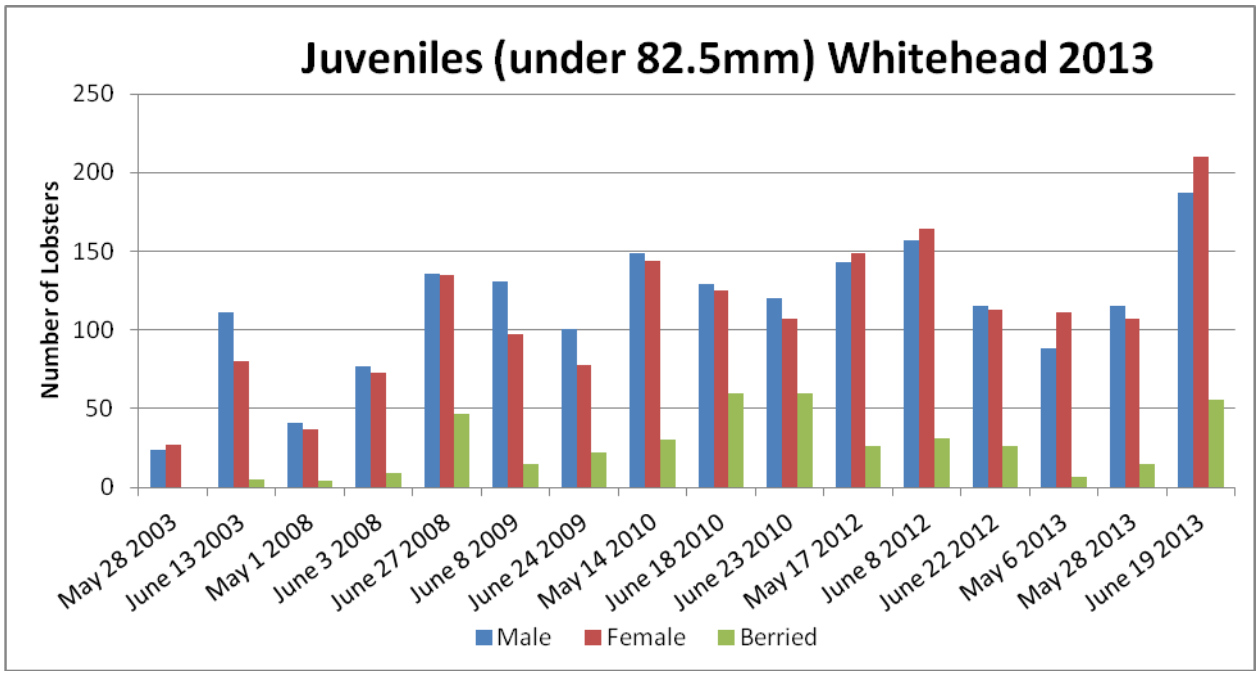


Figure 11: All lobsters under our current measure 82.5mm
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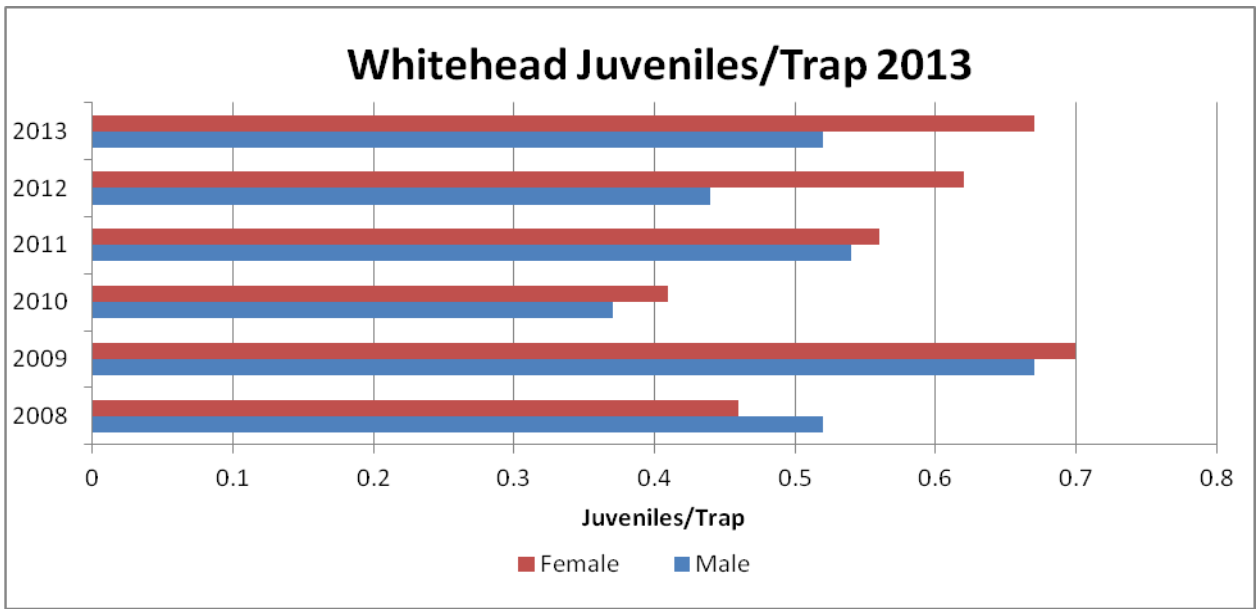
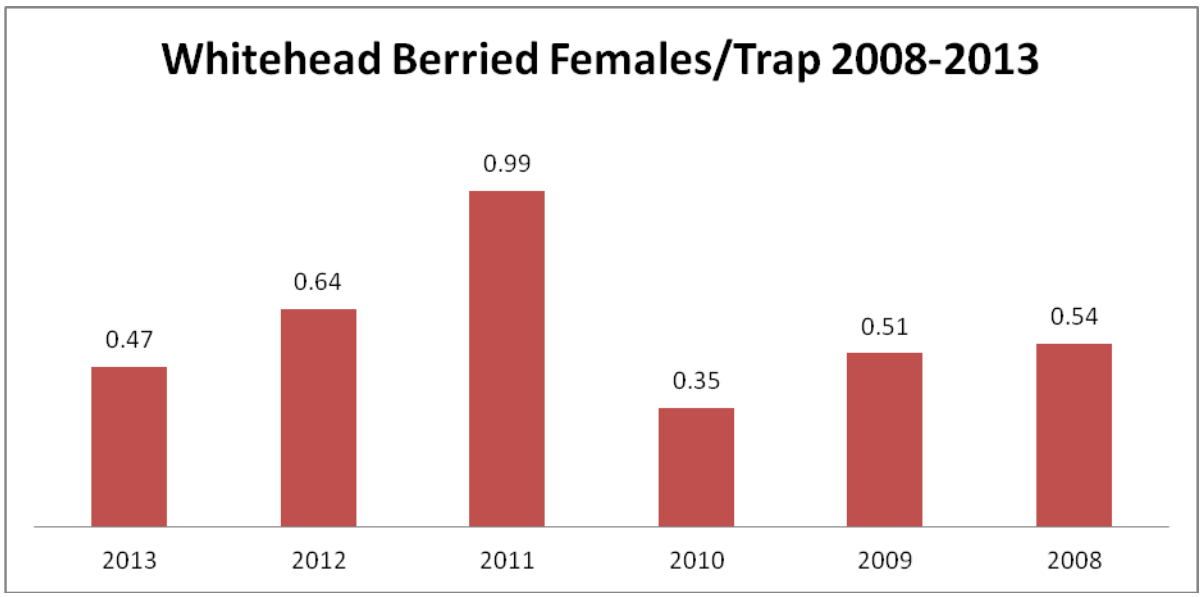


Figure 12: The number of juveniles per trap during at- sea samples from 2008-2013. An increase in both males and females were recorded in 2013.



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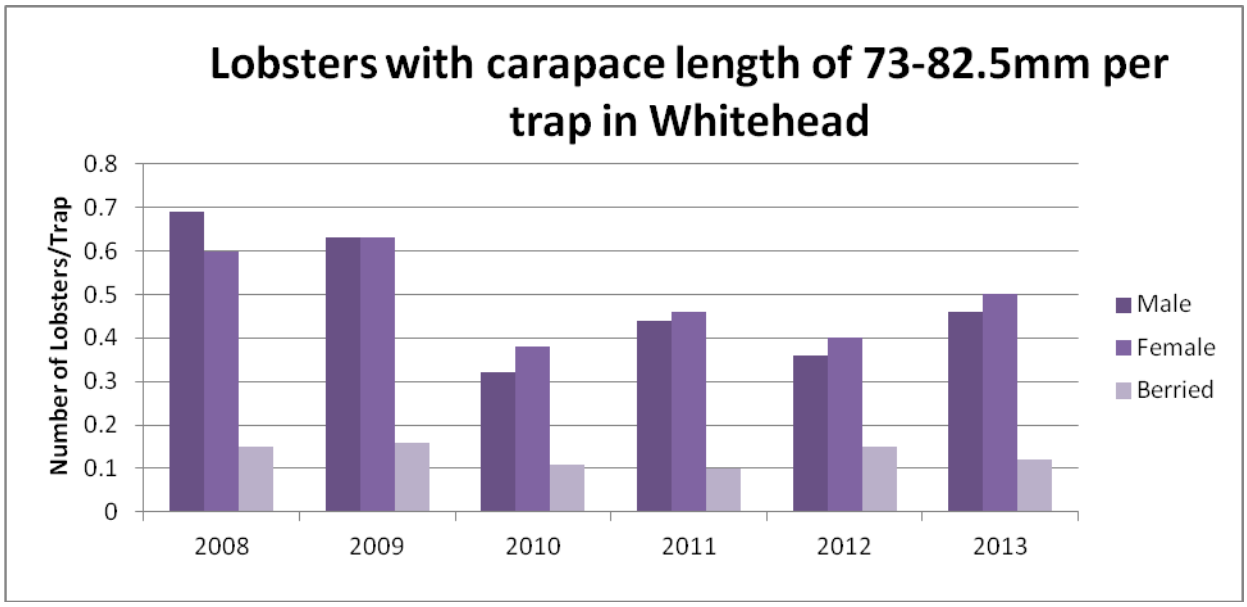

Figure 14: The number of juvenile lobsters (male, female and berried) per trap measuring 73-82.5mm. At a growth rate of 10-15% per molt. juveniles above 73mm (using average of 12.5%) would be ready for market if they molted the following year

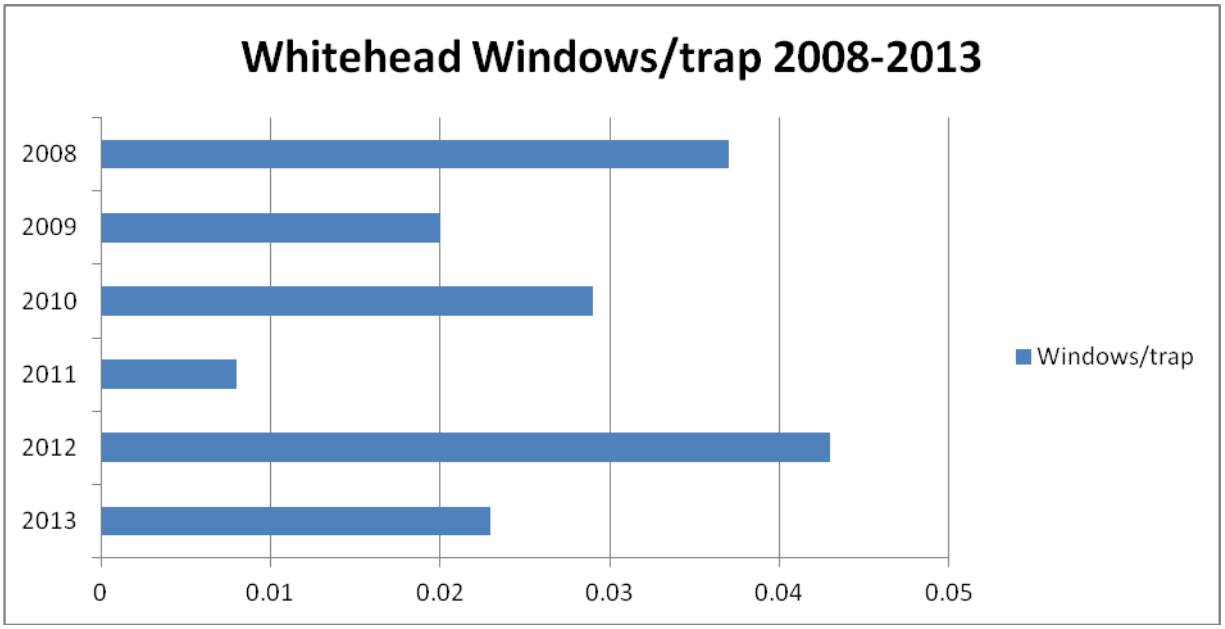

Figure 15: Number of windows caught per trap during at- sea samples.

Picture 3: 'Light Winds' Lobster boat fishing in Whitehead

Queensport – LFA 31A

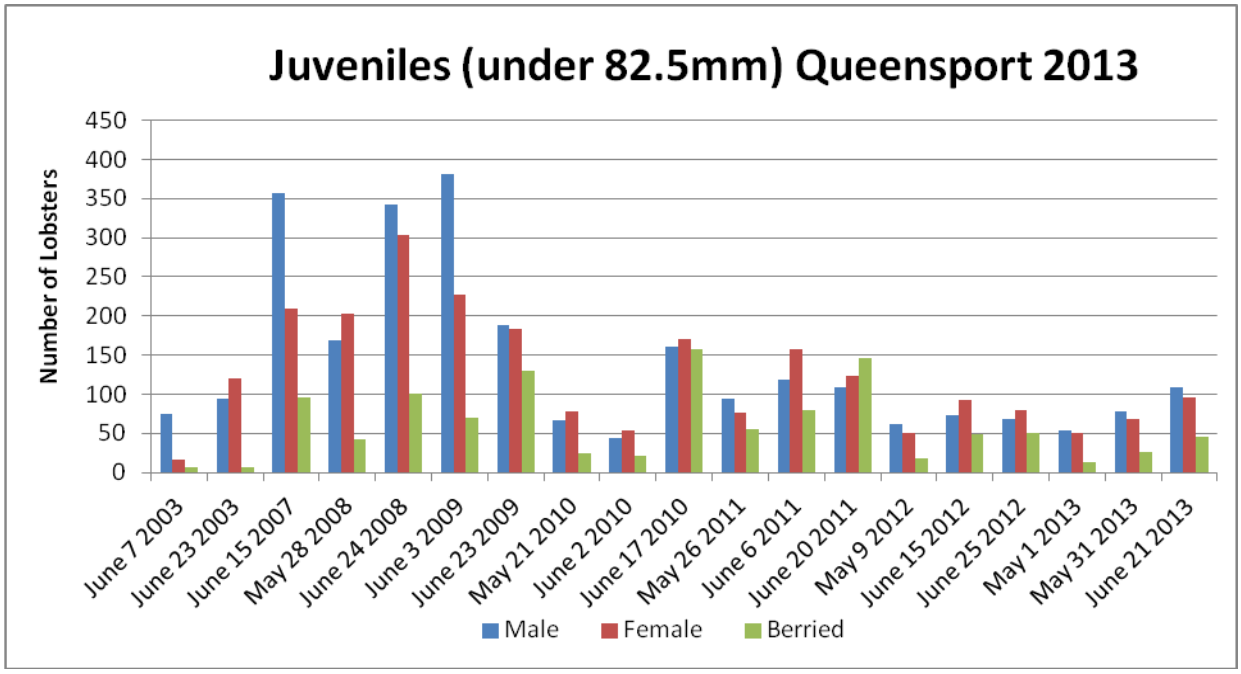

Figure 13: Lobsters under our current measure 82.5mm
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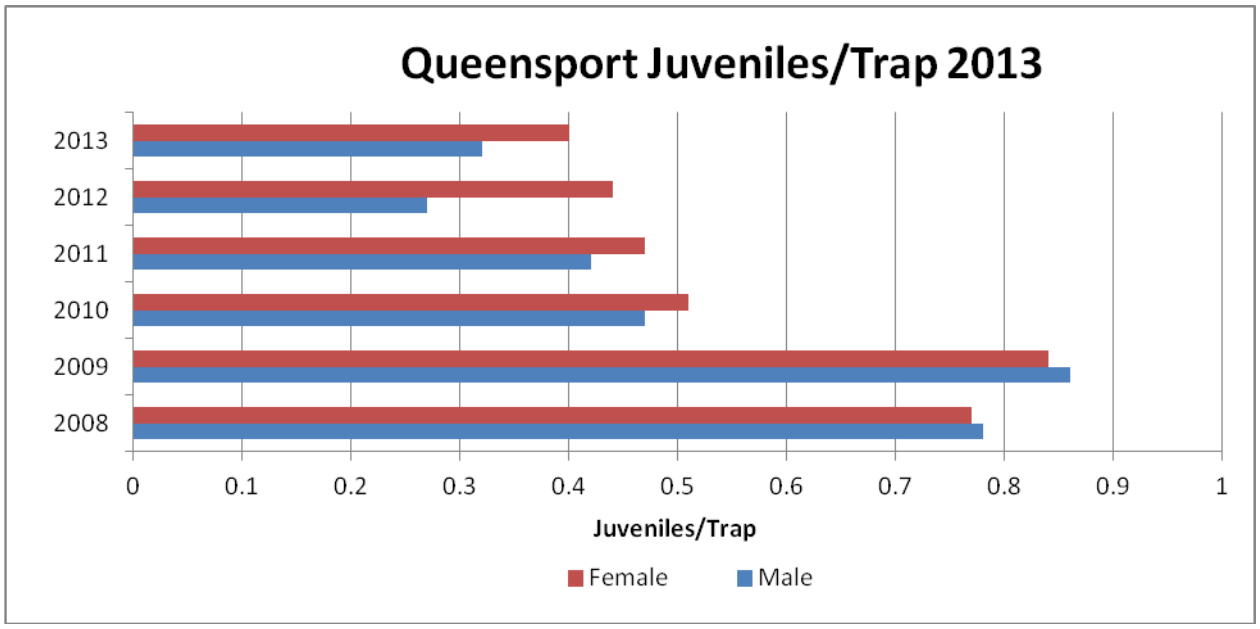
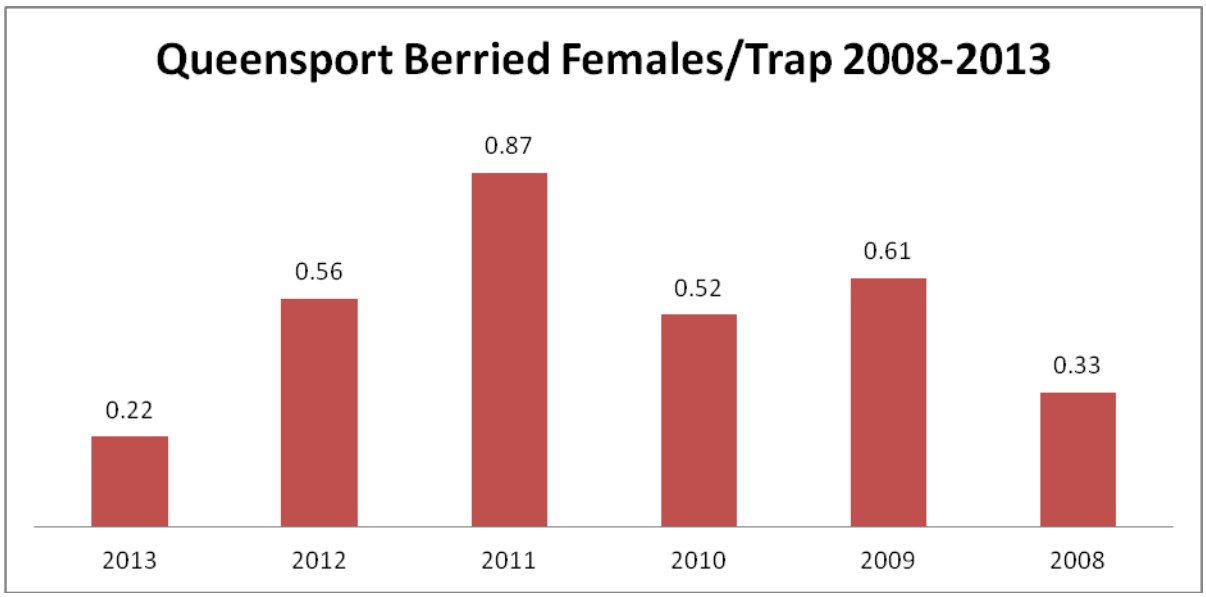


Figure 14: The number of juveniles per trap during at-sea samples from 2008-2013. A slight increase in males and a slight decrease in females were recorded in 2013.



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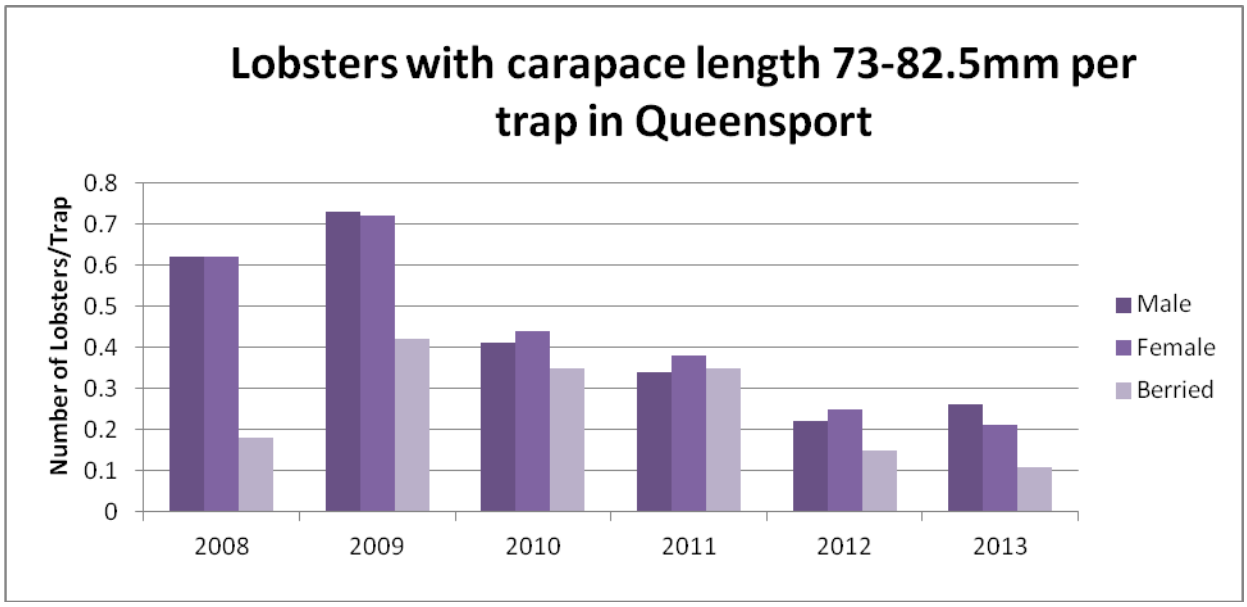


Figure 16: The number of juvenile lobsters (male, female and berried) per trap measuring 73-82.5mm. At a rate of 10-15% per molt juveniles above 73mm (using average of 12.5%) would be ready for market if they molted the following year.

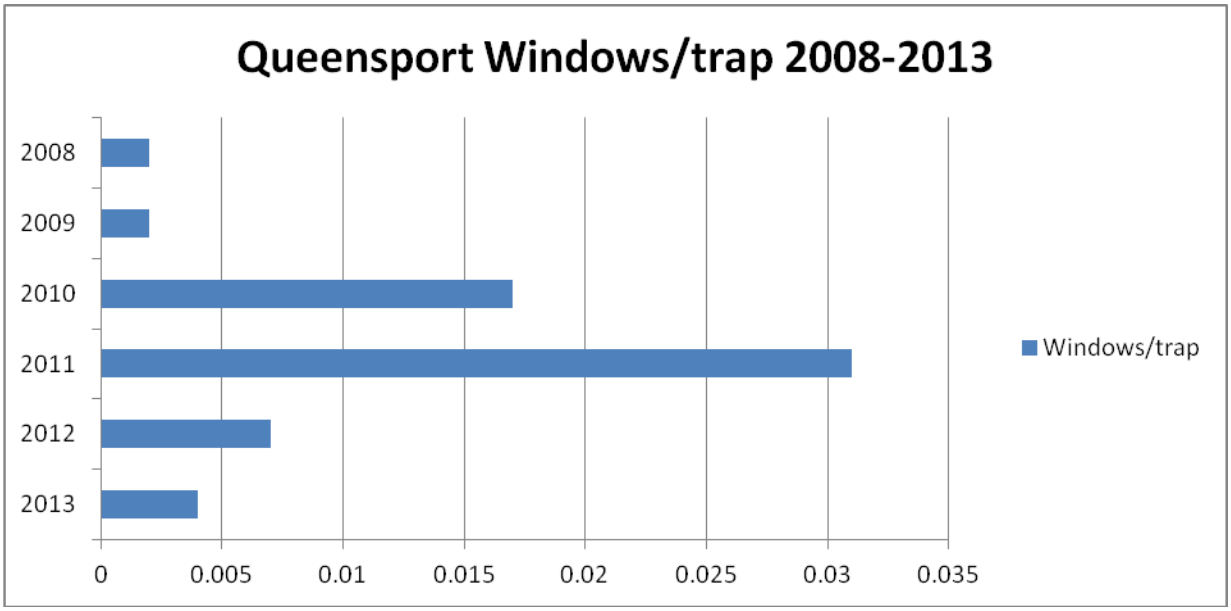


Figure 17: Number of windows caught per trap during at-sea samples.

Picture 4: Coop student Justin Delorey helping Lobster Technician Sarah Delorey with Genetic sampling in Canso 2012

Port Felix – LFA 31B

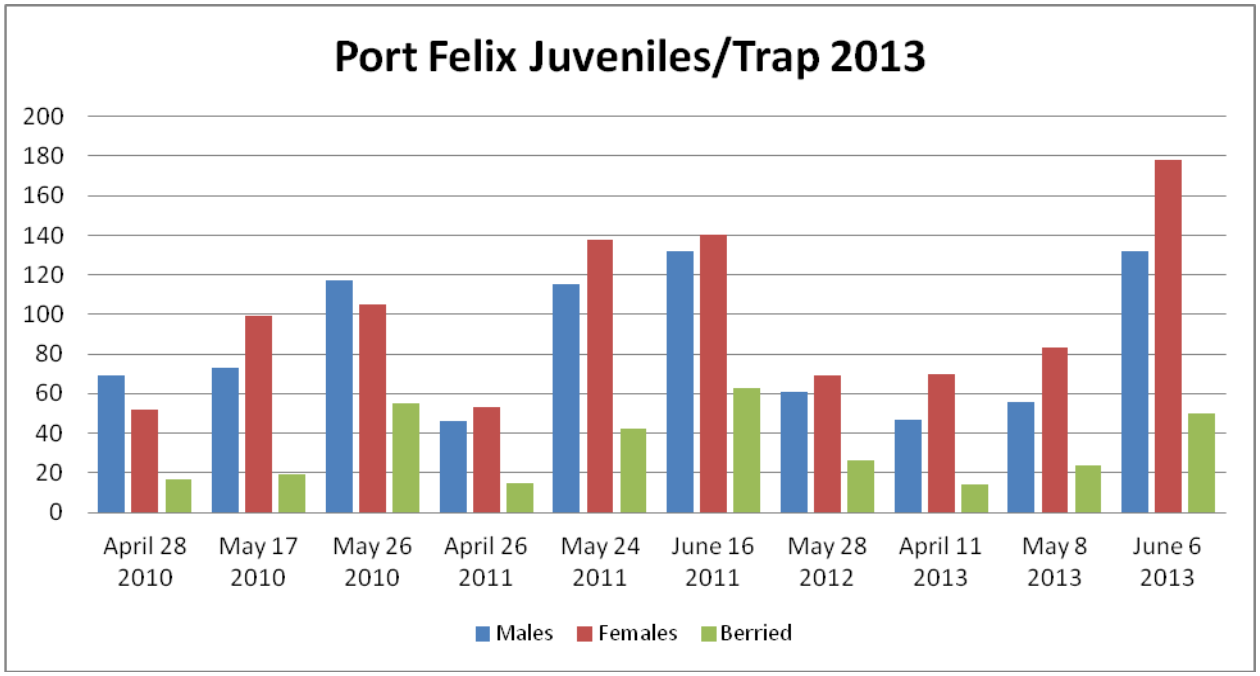


Figure 18: Lobsters under our current measure 82.5mm

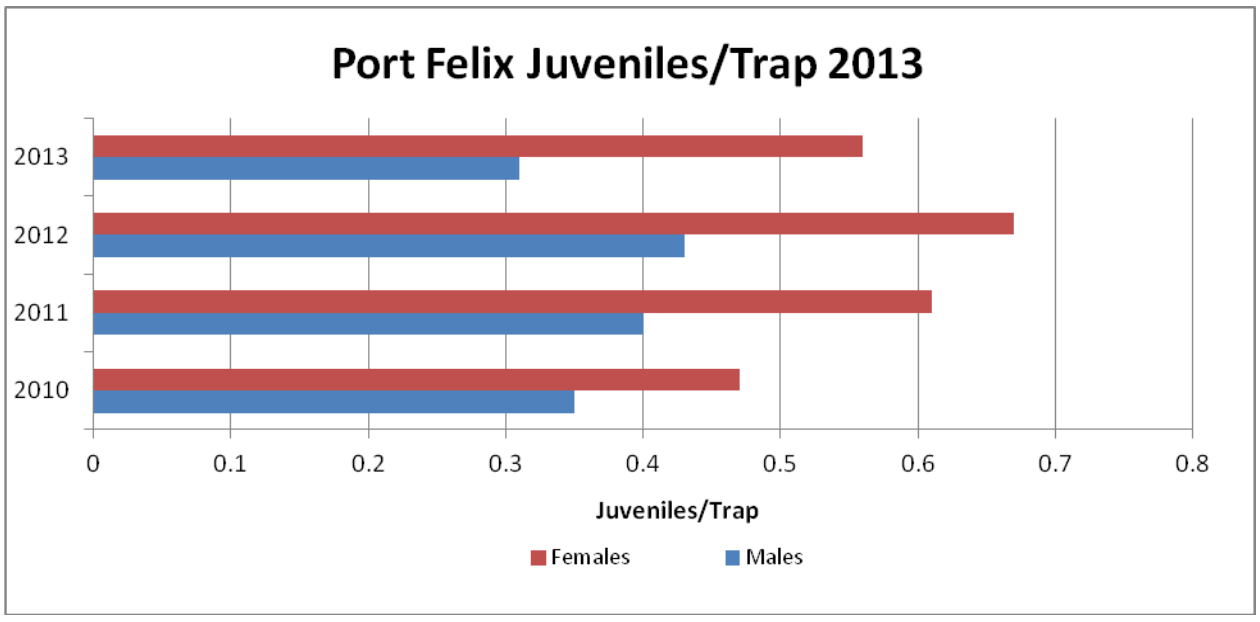


Figure 19: The number of juveniles per trap during at -sea samples from 2010-2013. A slight increase in males and a slight decrease in females were recorded in 2013.

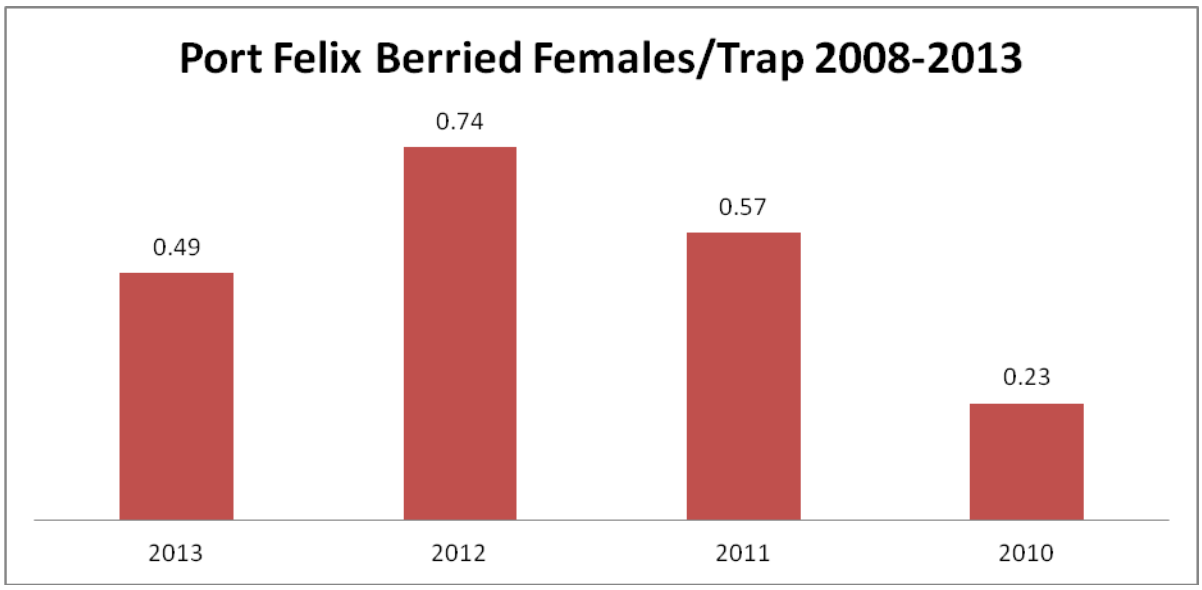


Figure 20: Berried females per trap from 2010-2013

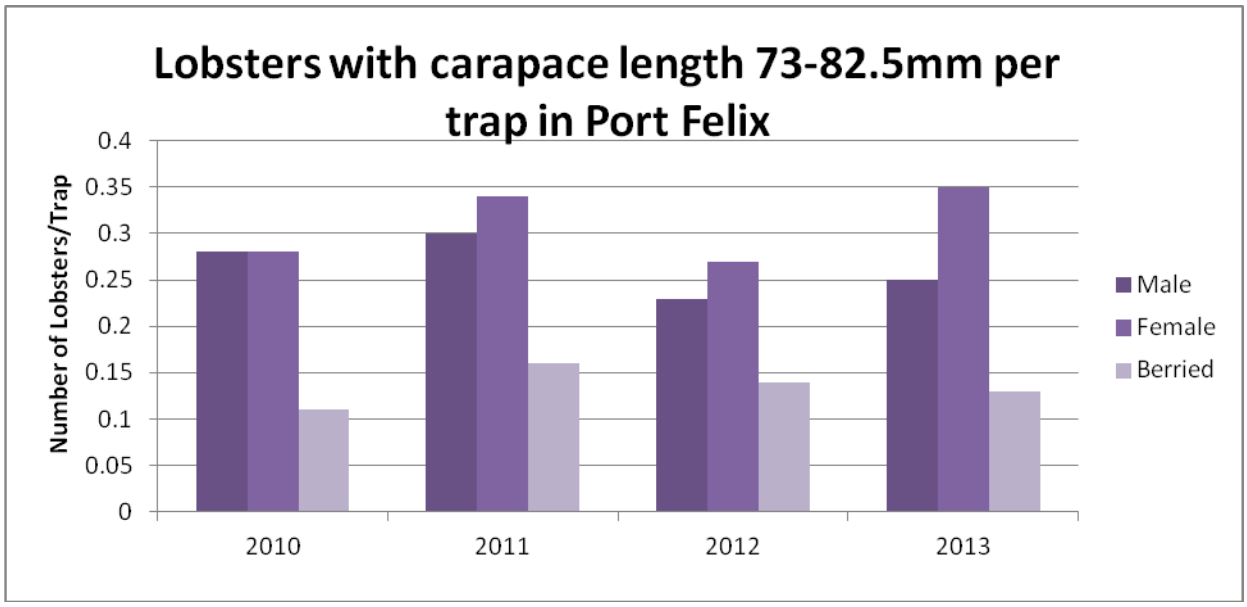


Figure 21: The number of juvenile lobsters (male, female and berried) per trap measuring 73-82.5mm. At a growth rate of 10-15% per molt juveniles above 73mm (using average of 12.5%) would be ready for market if they molted the following year

New Harbour – LFA 31B

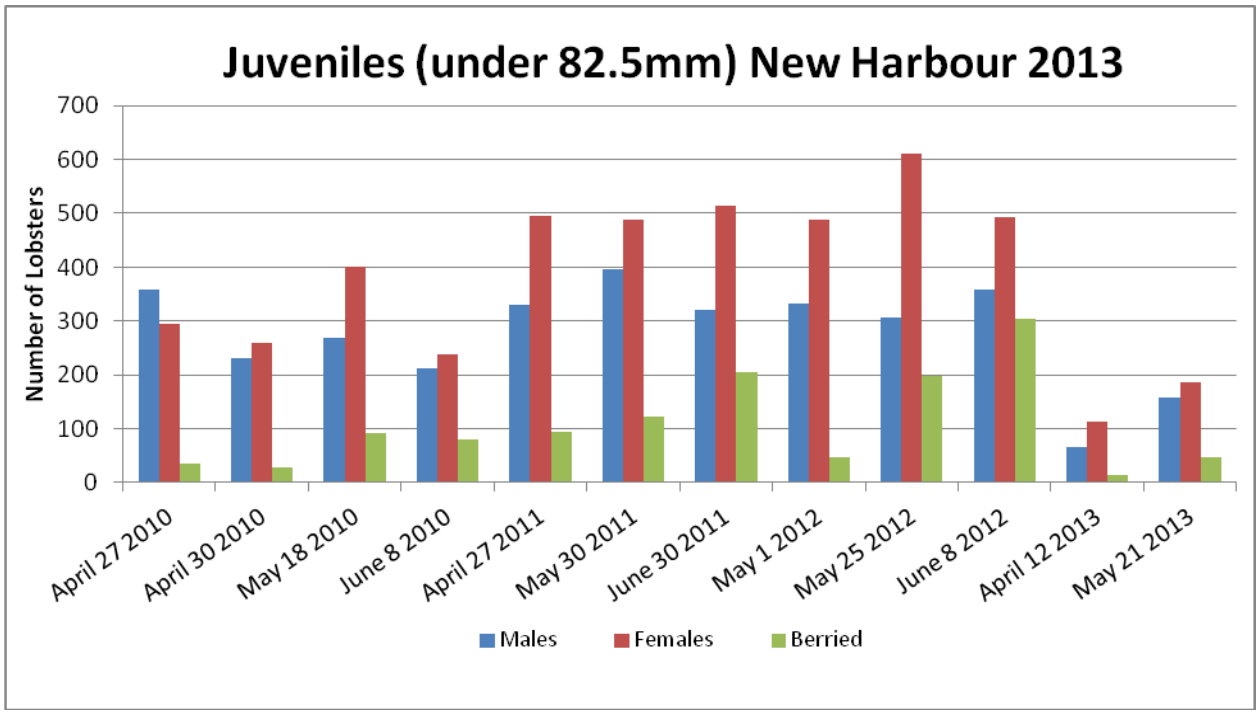


Figure 22: Lobsters under our current measure 82.5mm

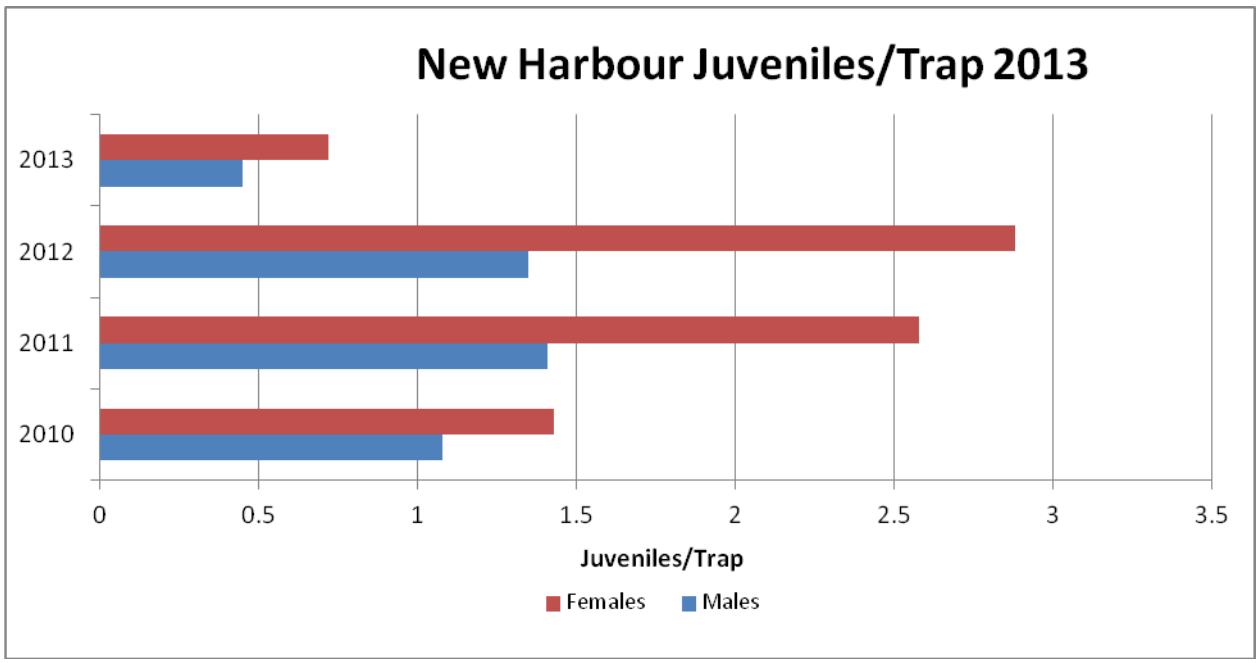


Figure 23: The number of juveniles per trap during at-sea samples from 2010-2013. A slight increase in males and a slight decrease in females were recorded in 2013.

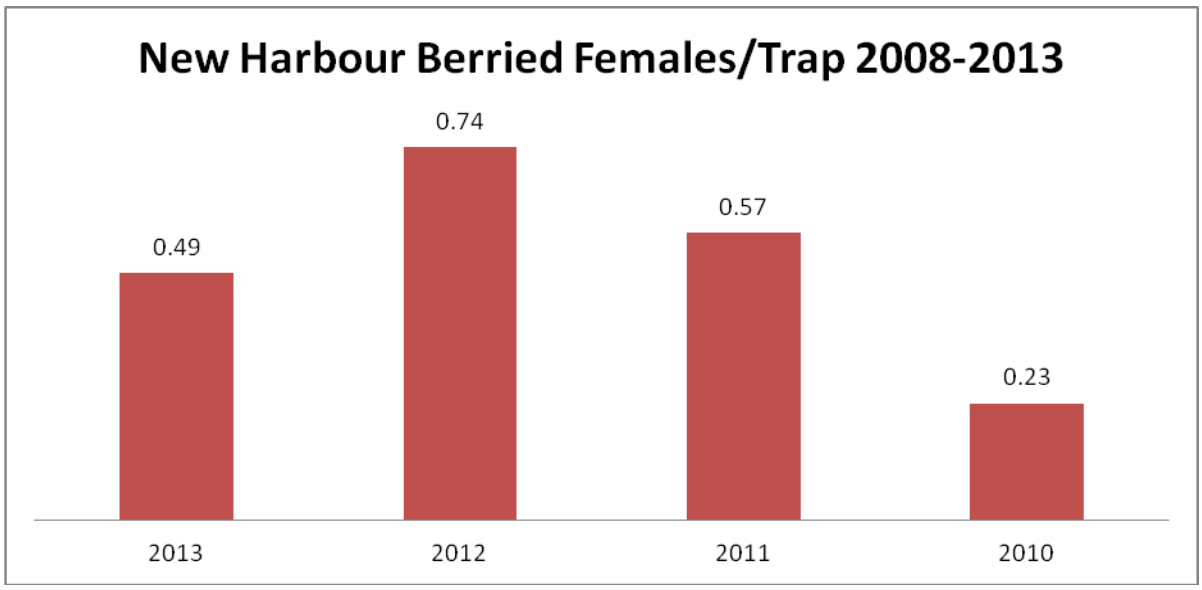


Figure 24: Berried females per trap from 2010-2013

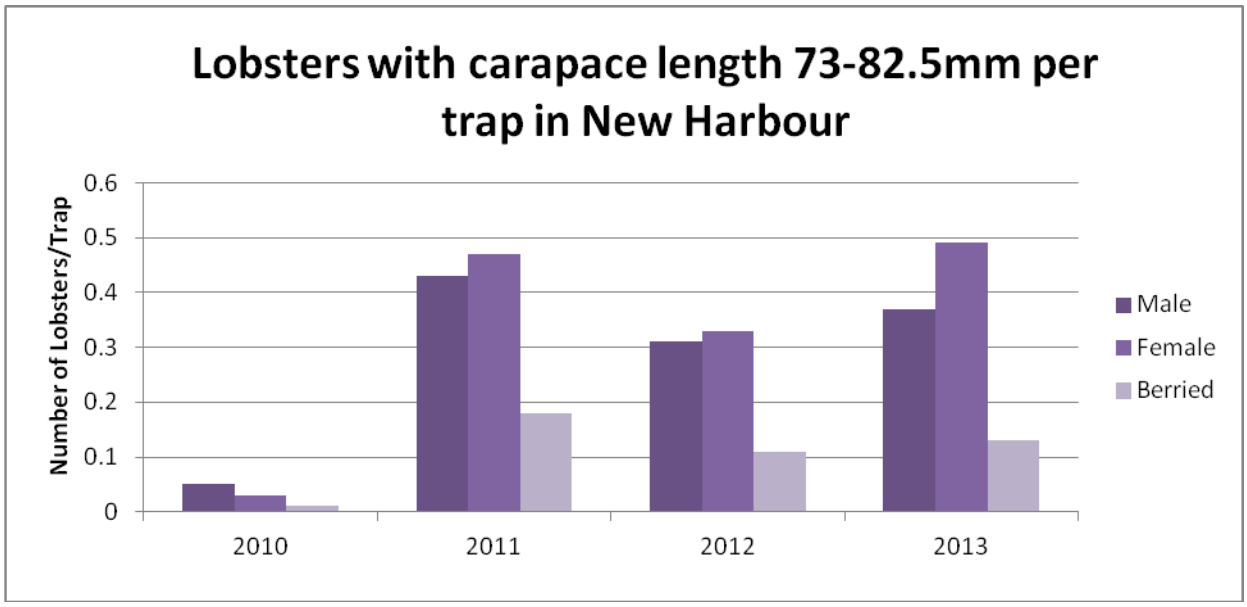


Figure 25: The number of juvenile lobsters (male, female and berried) per trap measuring 73-82.5mm. At a rate of 10-15% per molt juveniles above 73mm (using average of 12.5%) would be ready for market if they molted the following year

Drumhead LFA-31B

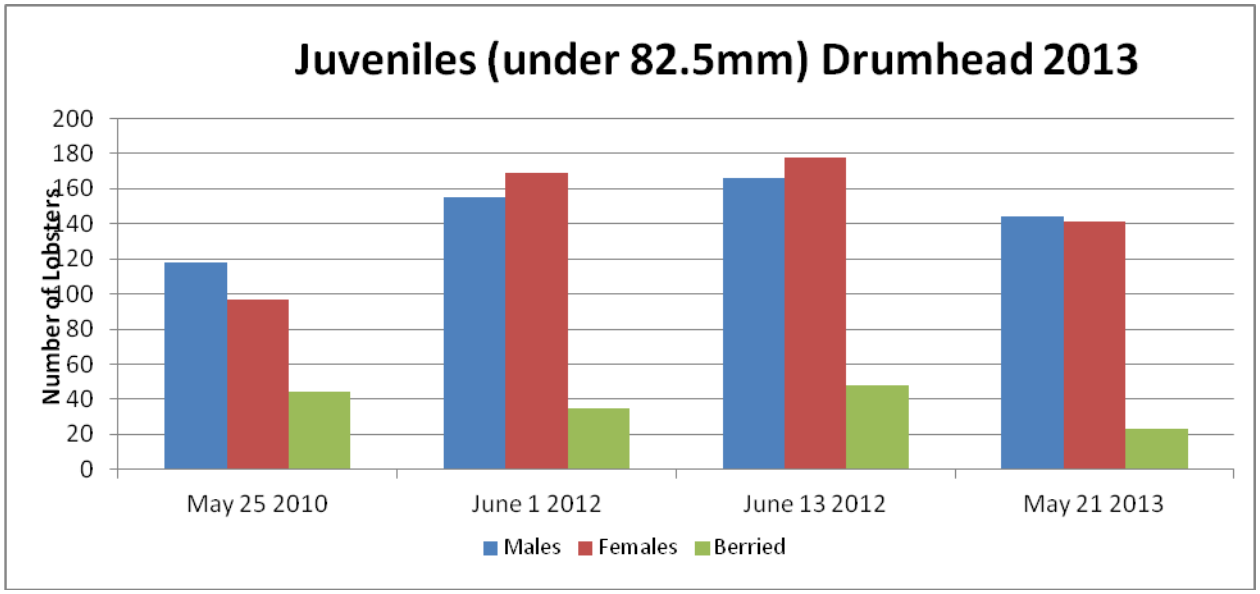


Figure 26: Lobsters under our current measure 82.5mm

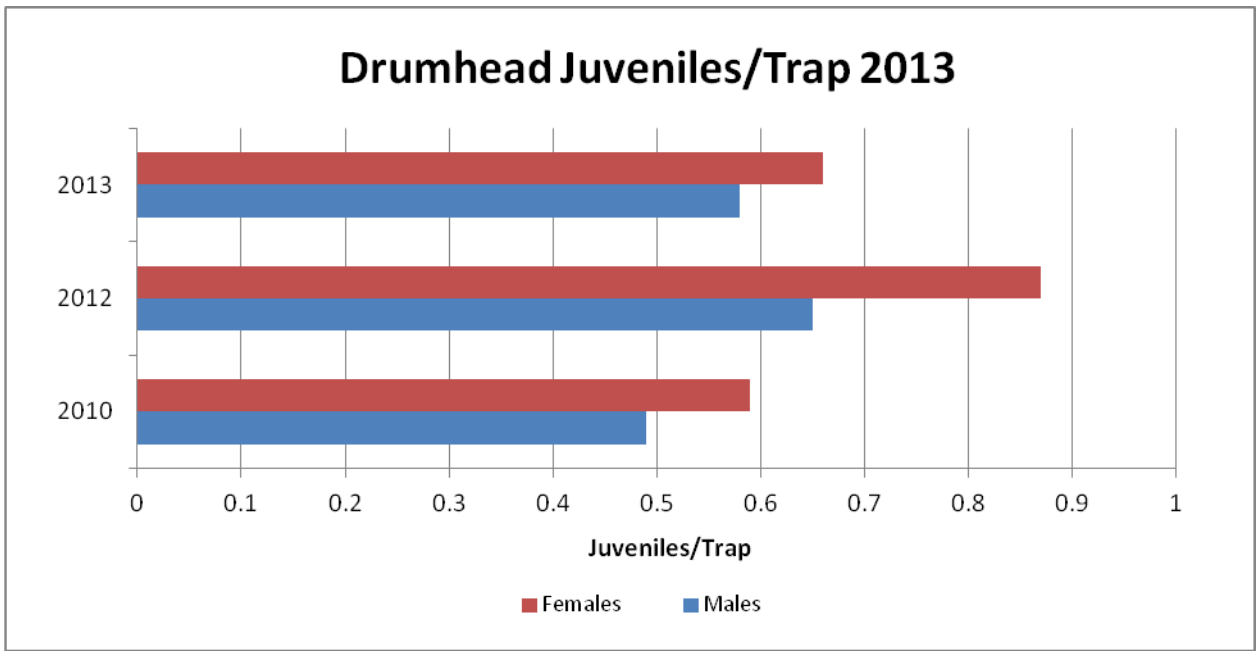


Figure 27: Juveniles per trap during our sea samples from 2010-2013.
A slight increase in males and a slight decrease in females were recorded in 2013.

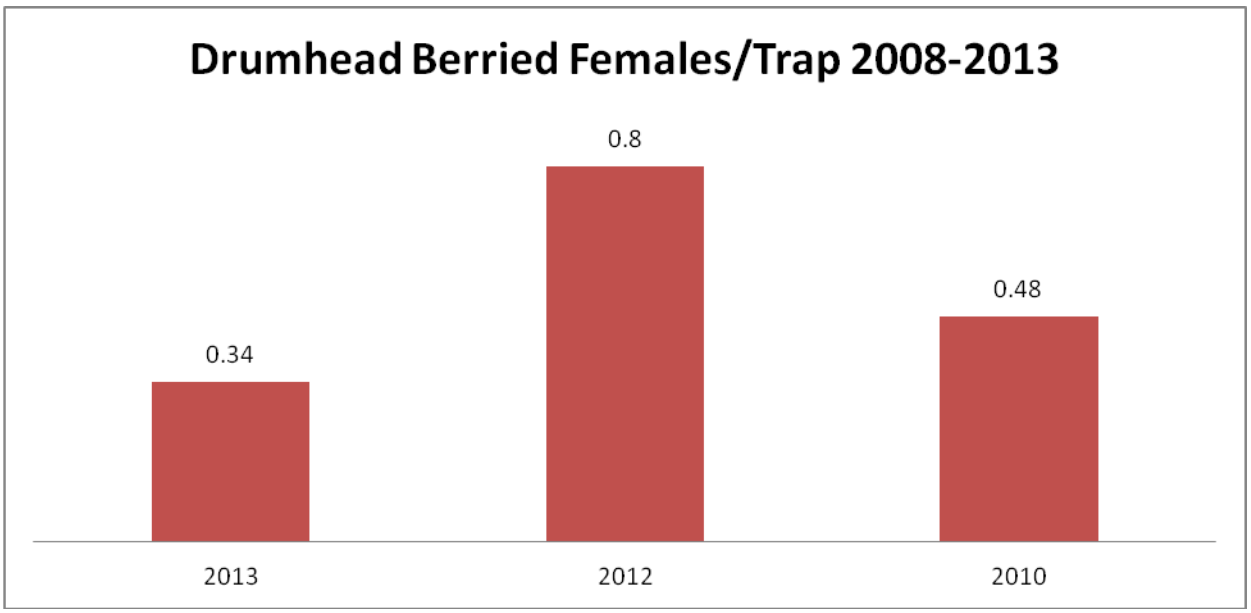


Figure 28: Berried females per trap from 2010-2013

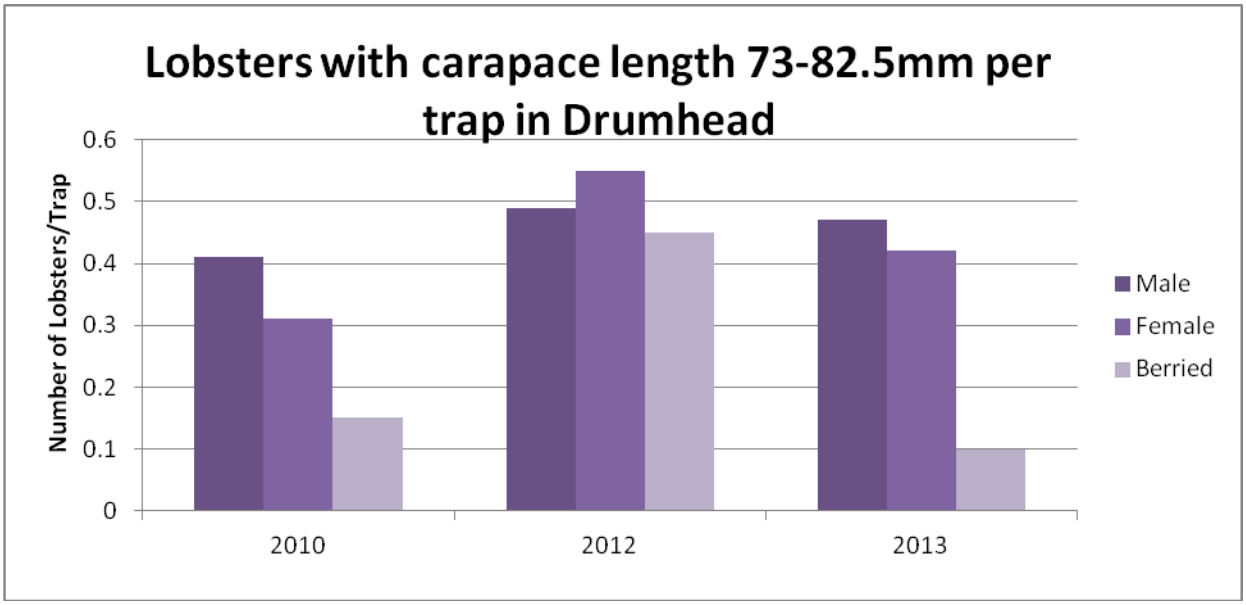


Figure 29: This graph shows the number of juvenile lobsters (male, female and berried) per trap measuring 73-82.5mm. At a growth rate of 10-15% per molt juveniles above 73mm (using average of 12.5%) would be ready for market if they molted the following year

Temperatures Mini Loggers Vemco / HOBO

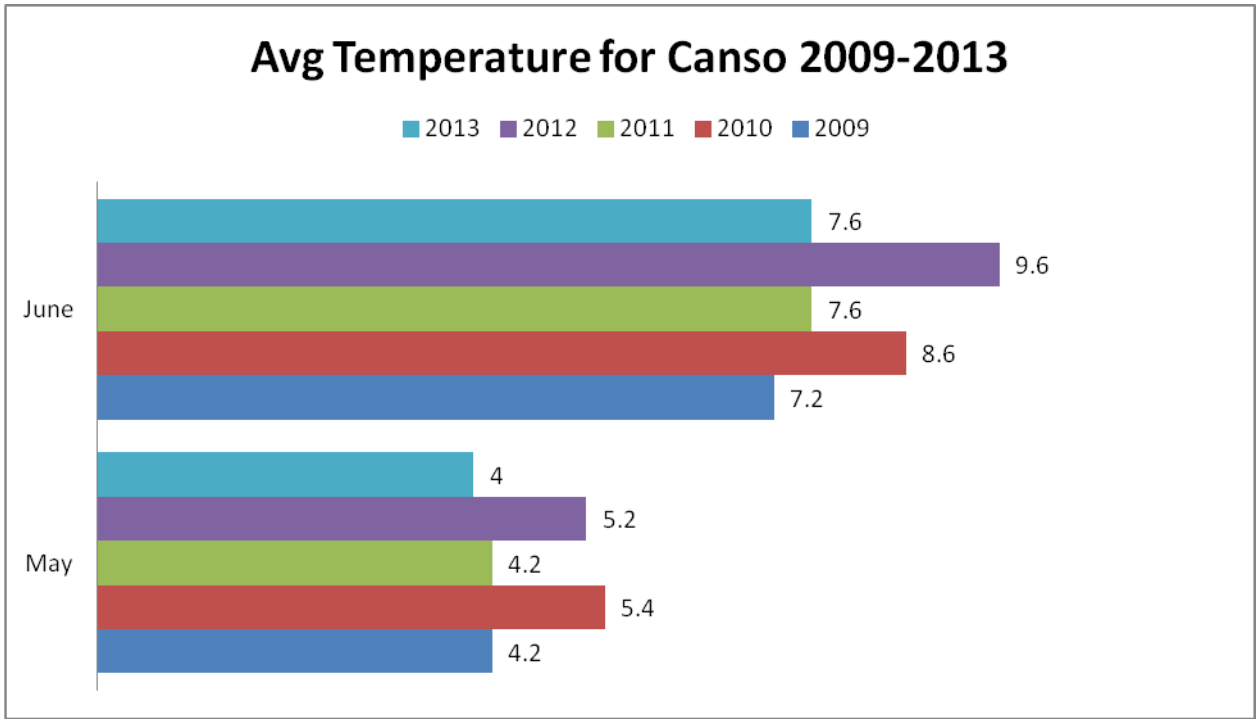


Figure 30: 2012 showed record high temperatures during the season.
*2013 start date was 9 days earlier than 2012.

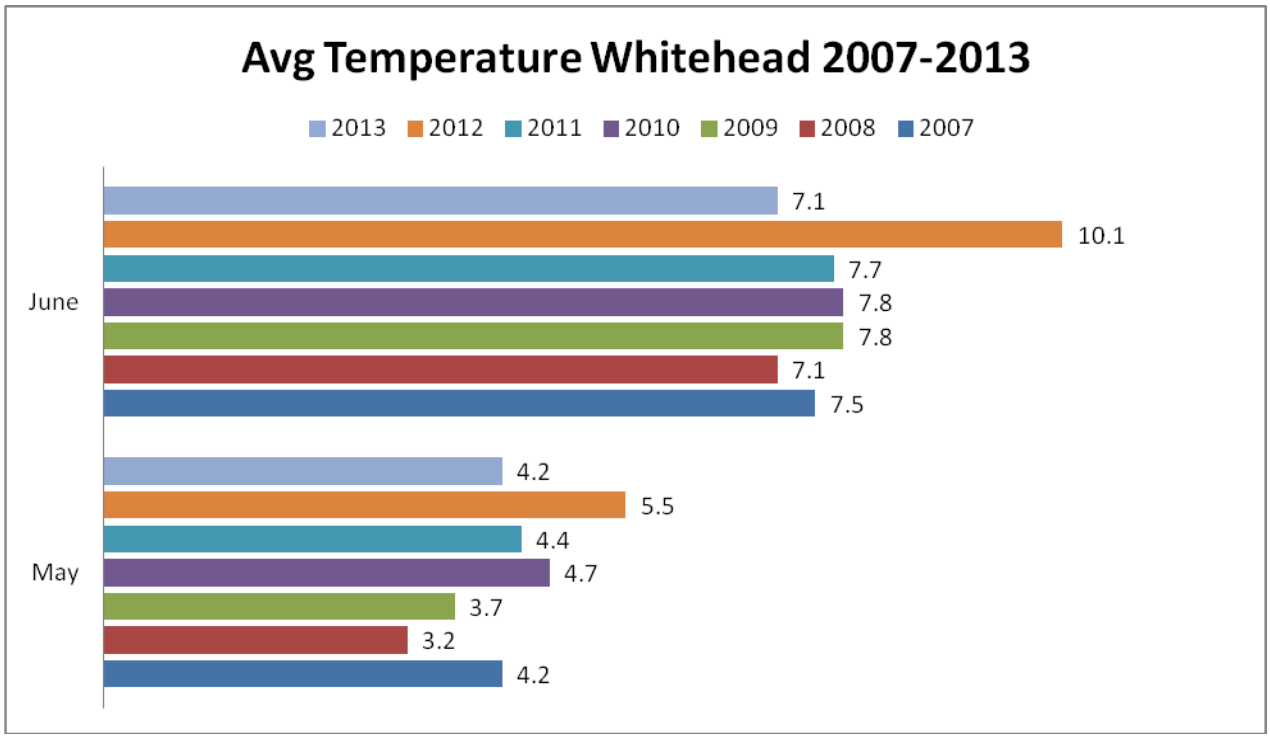


Figure 31: 2012 showed record high temperatures for during the season.
*2013 start date was 9 days earlier than 2012

Comparisons for LFA 31A 2008-2013

LFA 31A is a nine week, spring, biologically driven lobster fishery and most of the observations made can be explained through lobster biology and behaviour. In 2010, we increased the number of at sea samples and increase the amount of data; however comparing lobsters per trap observations can be made. In terms of berried females Dover, WhiteHead saw an increase whereas Canso and Queensport saw a decrease. With each year there is an increase in the average carapace length (CL) of the lobsters.

We did see a large number of small CL berried females in 2010 compared to other years which could be credited to warm water temperature recorded in 2010. As for the juveniles throughout the years; Canso, Dover and WhiteHead have seen an increase whereas Queensport has seen a decrease. Slight changes have been recorded with the exception of Dover with a substantial increase in juveniles over the years.

In 2012, the data showed a large increase in berried female egg stage IV (Larvae has been released, tail is mossy). This is the first year in all the data collected since 2008 that we see a large percentage of mossy females (Stage IV egg classification) during the fishing season. Of all the berried females recorded on June 25, 2012 in Queensport, 47% were classified as stage IV. On June 20, 2011 in Queensport there was 0% recorded stage IV.

The data from the at sea samples show an increase in the number of windows during the season. This is considered to be a good sign as window sized lobsters (114-124mm) are thought to have a higher egg production and higher quality of egg. In 2013, we saw a decline in the number of berried females and windows trapped, however the season started earlier than in previous years and the water temperature was colder than in 2012. We did see an increase in the number of juveniles trapped in 2013.

The at-sea sample data from 2008-2013 recorded lobsters at increased number in various sizes with increased berried and window lobster. This can be used as an indicator of a healthy biomass/ stock. This healthy lobster stock could be used as an indicator for a sustainable lobster fishery.

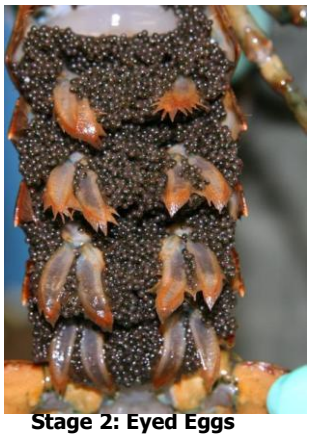
Lobster Node

Over the last three years the Guysborough County Inshore Fishermen's Association, working closely with other fishermen's organizations across the country, established the Canadian Capture Fisheries Research Network. These research questions range from the effectiveness of closed areas to the impacts of grey seal predation on fish stocks. A major area of the Network's research is on lobster. Over the next 5 years as part of the Network's Lobster Node GCIFA members along with fishermen from Newfoundland to the Gulf of Maine will be collecting data that will shed some light on two key questions: 1) how lobster larvae gets distributed across LFAs and 2) whether our lobster is made up of one or many different stocks. Along with fishermen elsewhere in the Atlantic Provinces we started collecting information this year on berried females- their size, location and stage and quality of their clutch development – to get the most complete information possible on larval production. The Network's objective is to collect this data at 50 km or better intervals all along the Atlantic coast.

This data will be used to feed oceanographic models that predict what will happen to lobster larvae once they are released into the marine environment. The models follow individual lobster larvae over time from when and where they are released to when and where they are ready to settle on the seabed. Next year we will also start collecting lobster specimens for genetic testing to see if there are differences in lobster in different parts of the range. We will also study whether differences in the temperature of the water column act as barriers to the movement, survival and settlement of lobster larvae, what happens to larvae after they settle on the seabed and track adult lobster movements. The Network has received 5 year funding from the Natural Sciences and Engineering Council of Canada (NSERC) and is an initiative of the Canadian Council of Professional Fish Harvesters

Picture 5: Stages of egg development


Stage 1: New Eggs


Stage 2: Eyed Eggs


Stage 3: Mature Eggs


Stage 4: Larvae released

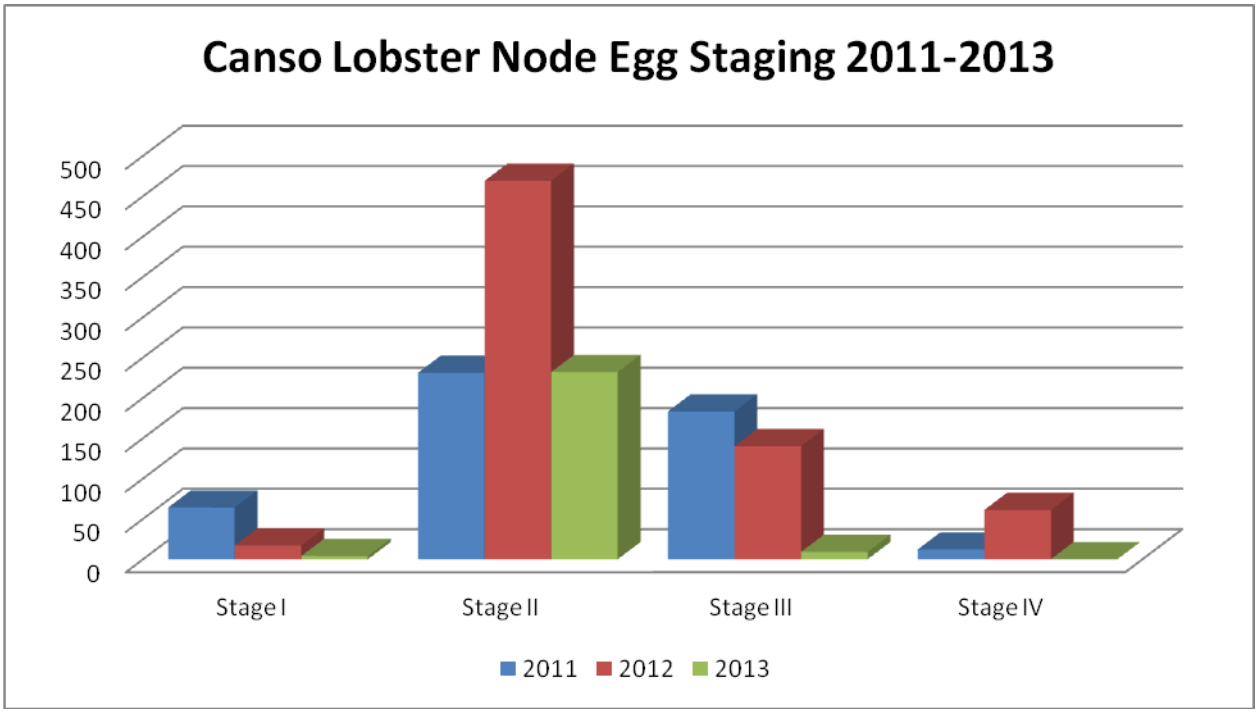


Figure 31: Egg Stages on berried females sampled in Canso

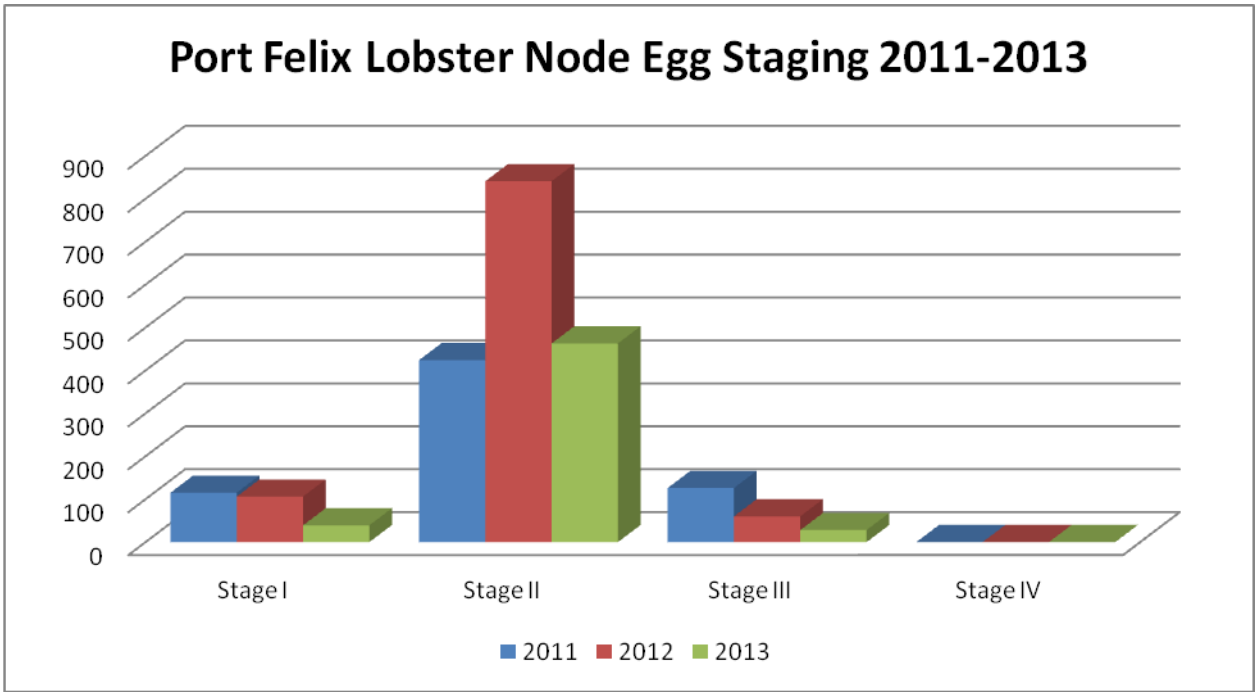


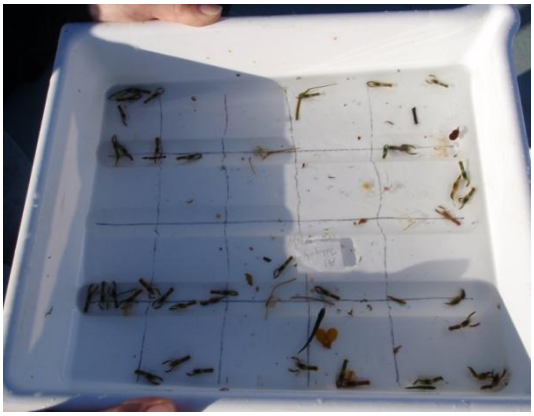
Figure 32: Egg Stages on berried females sampled in Port Felix

Larval Tows

GCIFA have been conducting larval tows for since 2002 but have confidence in consistent fixed stations and data sets since 2005. Larvae sampled at 56 stations are spread out over lobster grounds in four locations, Canso, Dover, WhiteHead and Port Felix. The 56 stations are divided equally between the four locations and make up 4 quadrants. Station A is the Canso Islands, Station B has stations from Little Dover to WhiteHead, Station C is from WhiteHead to Port Felix and Station D is form Port Felix to Cole Harbour area.

A mesh net of dimensions 0.6 x 2.35 m with 1.3 x 1.3 mm mesh was towed behind a lobster boat fitted with a flow meter. Tows were 10 minutes each and sampled 2100m^2 of the top 0.5 m of the water column. Surface temperature data and weather was recorded. Larvae were separated into 4 stages and counted. The results vary from year to year depending on rainfall amounts, surface temperature, currents, wind, storm occurrence and several other factors affecting larvae survival. Often the number of tows completed depends on weather conditions.

Picture 6: Larval Tow Frame and Net



Picture 7: Stage IV's caught and released during tows in Canso 2010

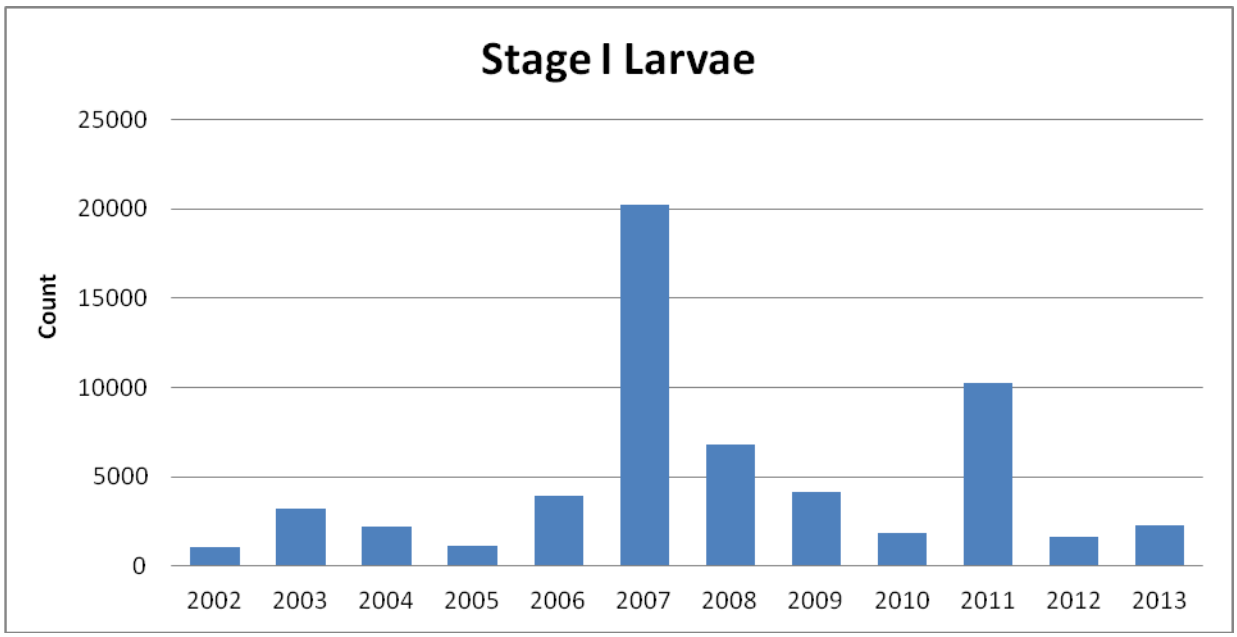


Figure 33: Number of Stage I's recorded during tows for each year with a large increase of Stage I's in 2007 and 2011.

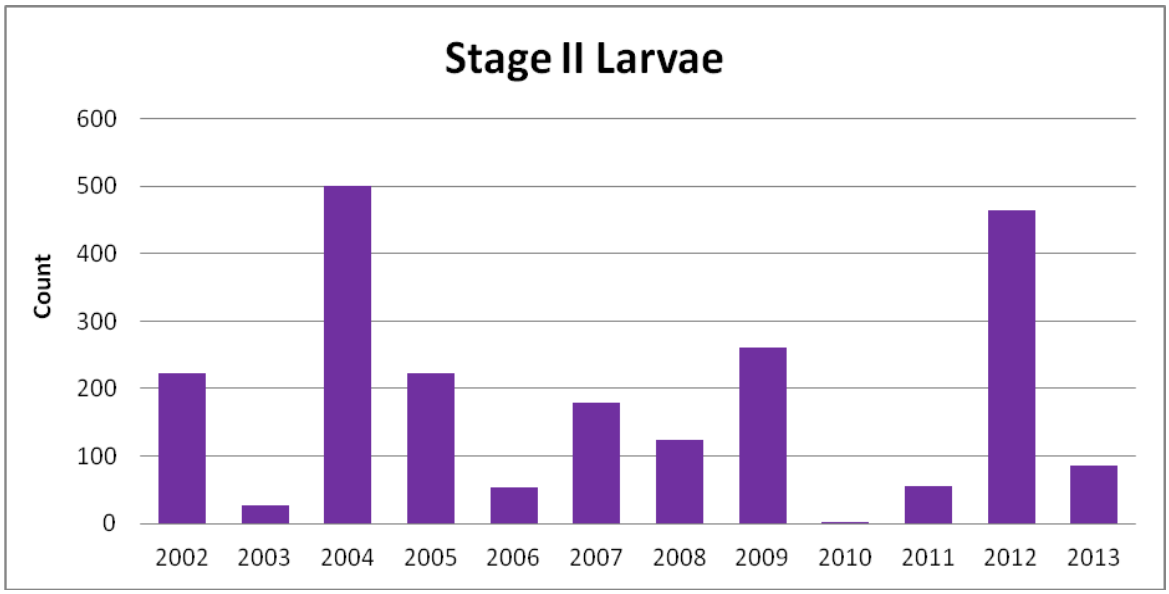


Figure 34: The number of Stage II's recorded during larval tows. We recorded a high number in 2004 and in 2010 we did not record any Stage II's. In 2012 we recorded large increase in stage II larvae

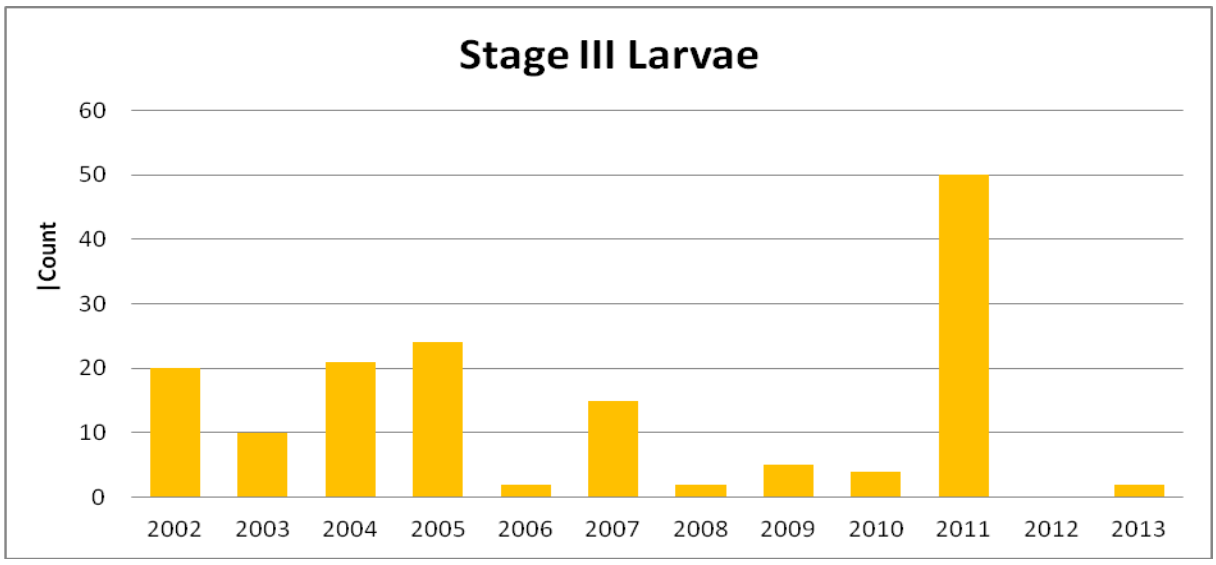


Figure 35: The number of stage III's recorded during larval tows for each year. No stage III larvae were recorded in 2012.

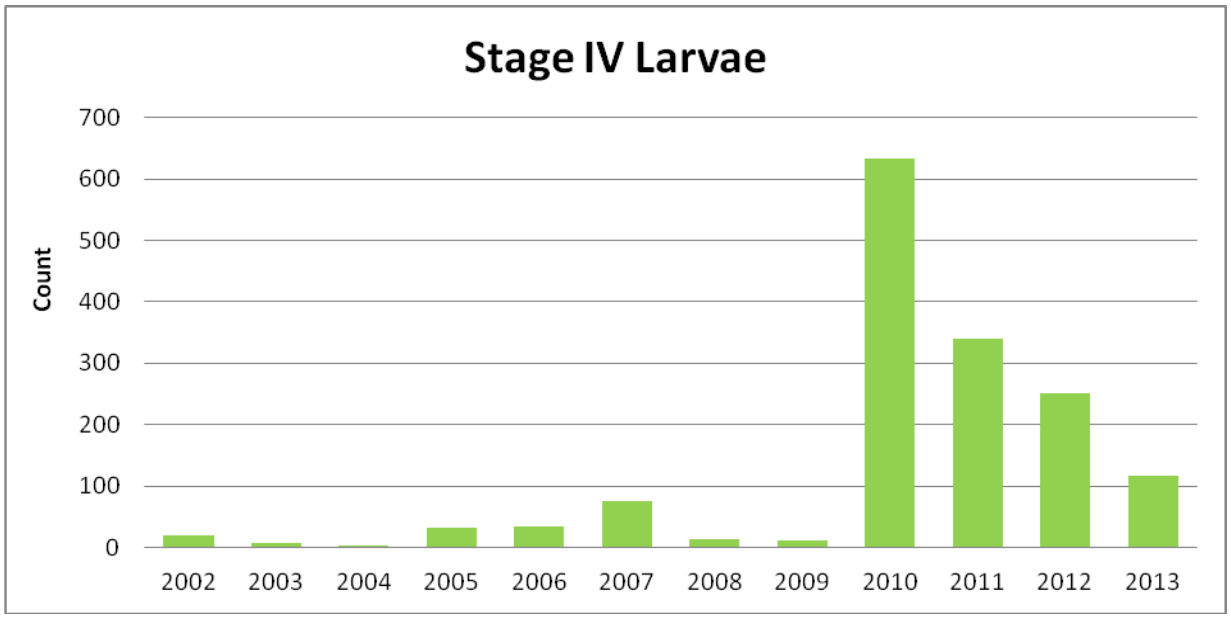


Figure 36: The number of Stage IV's recorded throughout the year during larval tows which shows a large increase beginning in 2010. Ideal and higher than average water temperature would increase the overall survival and or cause the larvae to move quickly through the cycles to a stage IV and may explain the higher number of recovered Stage 1V.

Table 1: Year comparison of larvae stages in actual counts

	I	II	III	IV
2002	1034	222	20	20
2003	3199	26	10	8
2004	2247	500	21	1
2005	1136	222	24	31
2006	3967	53	2	35
2007	20246	179	15	76
2008	6804	123	2	14
2009	4172	260	5	11
2010	1861	1	4	633
2011	10285	56	50	339
2012	1665	464	0	250
2013	2288	85	2	116

Picture 8: Lobster Larvae found in moon jelly during larval tows 2013

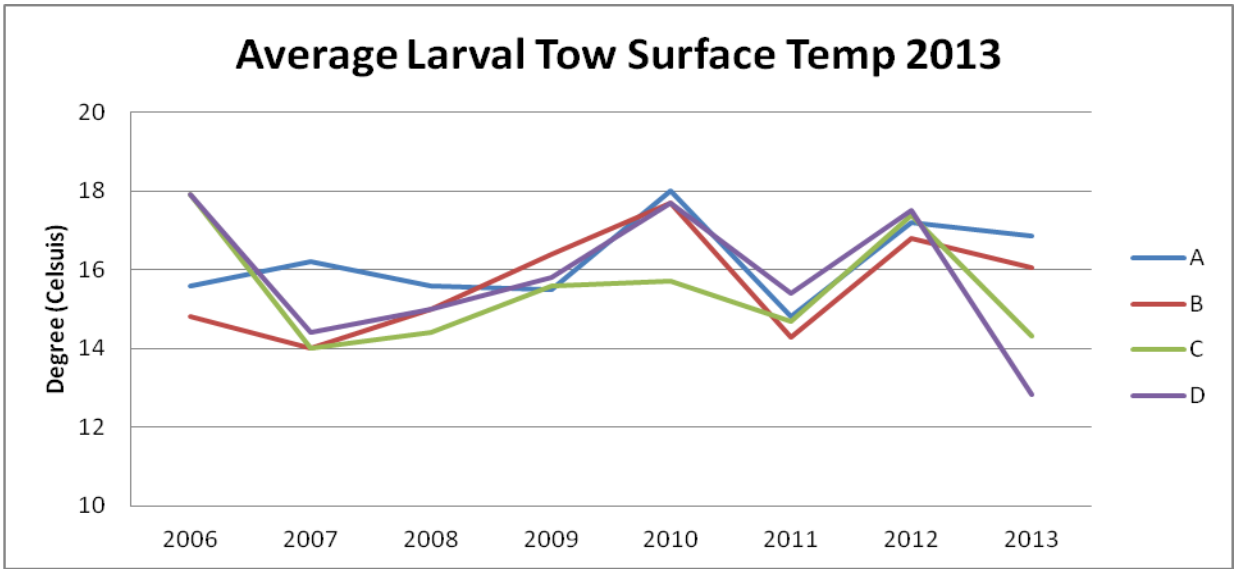


Figure 37: Quadrant "A" – Canso Islands
"B" - Dover
"C" – Between WhiteHead and Dover, part of Port Felix
"D" - towards Port Felix

Surface temperatures have spiked in 2006, 2010 and 2012.

Table 2: Rainfall amounts recorded for Tracadie according to environment Canada 2003-2013

	2003	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**
April	193.2	77.1	77.3	125.1	68.1	54.5	101	35.4	58.9	86.4	70.4
May	77.9	32.8	111.7	73.8	68.2	129.7	64.6	48.6	64.1	57.6	49.6
June	74.9	75.8	45.4	112.5	153.1	63.1	89.9	124.8	76.3	74.6	140.4
July	31.8	66.4	63.9	97.2	65.9	110.7	61.2	118.2	120.6	53	45.6
August	97.2	80.2	34.5	27.5	143.2	265.5	148.8	96.2	77.6	80.6	73.3
Total	**281.8**	**255.2**	**332.8**	**436.1**	**498.5**	**623.5**	**465.5**	**423.2**	**397.5**	**352.2**	**379.3**

Note: This table shows total rainfall amounts from http://climate.weatheroffice.gc.ca/. In 2003 rainfall amounts were 281.8mm and gradually climbed to 623.5mm in 2008. They are gradually dropping off to 352.2mm in 2012.There is a theory that high rainfall amounts may cause a higher mortality rate for lobster larvae since it changes the salinity in the water column and stage I and II larvae may not be able to move to better salinity for survival. If this theory is true then we should start to see our lobster landings gradually increase in approximately 2014.

Yearly Comparisons Larval Tows 2008-2013

There are so many factors that can affect the life cycle of larvae. Temperature and rain (salinity) can speed up or slow down the cycles of larvae. In 2010 we recorded a large increase in Stage IV's which coincided with water temperature increases. Also in 2010 we were late starting larval tows in Canso, and the area that we recorded the higher number of Stage IV's. This may have contributed to the increase since we were on the off week compared to previous years. 2011 we towed on similar weeks to 2010 and still recorded large amount of stage IV's compared to years prior to 2010. We had one less sample in Canso in 2011 than in 2010 due to weather conditions.

In 2012 we saw a large amount of Stage II larvae and Stage IV larvae. During the fishing season fishermen recorded an early release of eggs from berried females and we also recorded an increase in water temperature and a decrease in rainfall for the 2012 lobster fishing season. These are believed to be favourable conditions for lobster larvae production and survival. We did not change our larval tow dates to coincide with this early release as no vessels were available during lobster reason so no data was recorded during the season to capture the release and stage development until after the fishing season. Since we did not start larval towing earlier to coincide with the early release we did not capture the data on the stage 1 and II

Rainfall could be factor in larvae survival as low salinity affects the survival and development of larvae. Large amounts of fresh water in the upper water column, where the Stage 1and II larvae float, could greatly reduce salinity and then effect negatively on survival rate. If Stage III and 1V are moving up and down the water column, searching for suitable bottom type or temperatures, passing through the salinity change could also affect them. From 2003-2008 there is a steady climb in rainfall amounts during our larvae season. In 2013, the numbers of Stage four larvae were down slightly however the water temperature was colder this year than in 2012 and 2010. We will continue to follow for future years the relationship between rainfall or salinity, larvae survival and development and the overall lobster landings.

Juvenile Trapping

To assess the juvenile lobster stock and foresee recruitment into the fishery we've had one fisherman from each of four ports fish 30 traps for three days of each month of August, September, and October. These traps are regular standard sized lobster traps with the escape vents were closed. Sex numbers and ratios as well as carapace length was recorded. The traps used were 102 x 53 x 36 cm high made of 2.5 x 2.5 cm wire mesh with 12.7 or 15.4 cm diameter entrance hoops. The entrances were partly blocked (1/2) with wire mesh to exclude larger lobsters, although this measure has not always been effective in shutting out larger lobsters. Some years (ex. 2009) we have had almost half of all lobsters in the juvenile trap were market size (>82.5mm). Traps are set in the same locations each set with frozen mackerel consistently used for the bait. Soak time was one day. This research not only demonstrates the presence of a healthy juvenile lobster stock, it also allows us to observe movements during the summer months when molting occurs as well as a glimpse of the interactions with other species in the ecosystem during the out of season trapping. .

Juvenile trapping Data per 30 traps x 3 days x 3 months sets

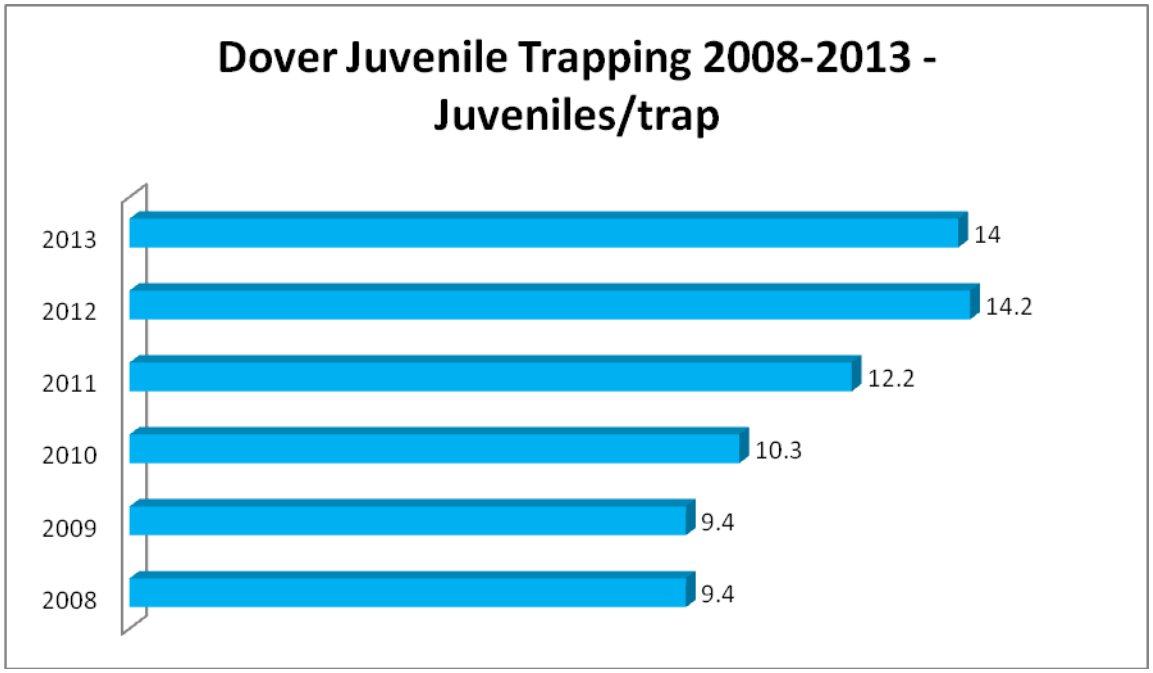


Figure 38: Year comparison of Juveniles trapped in Dover.

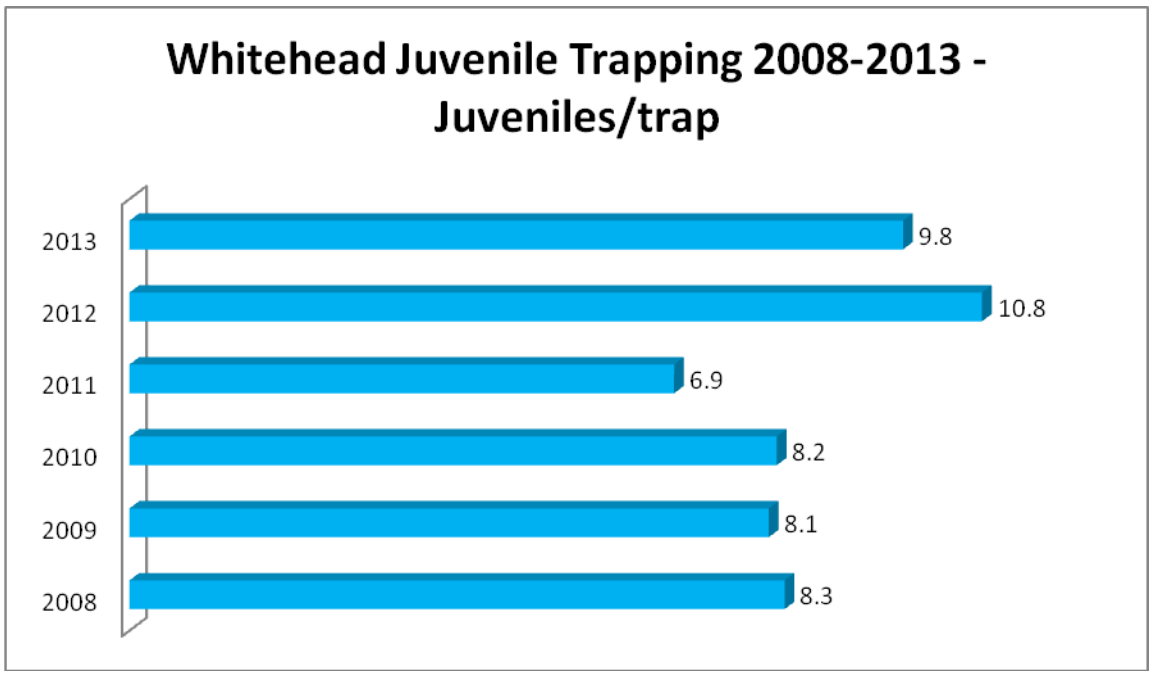


Figure 39: Increase in Juveniles trapping in 2012

Figure 40: Year Comparison of Juveniles trapped in Queensport.

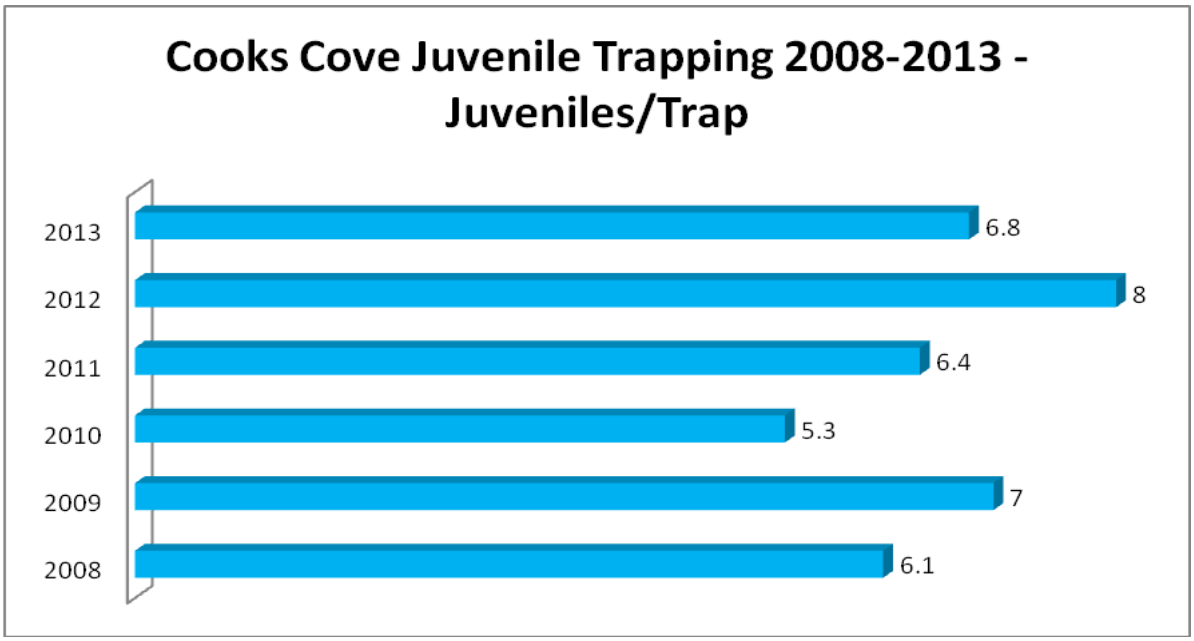


Figure 41: Year Comparison of number of Juveniles trapped in Cooks Cove.

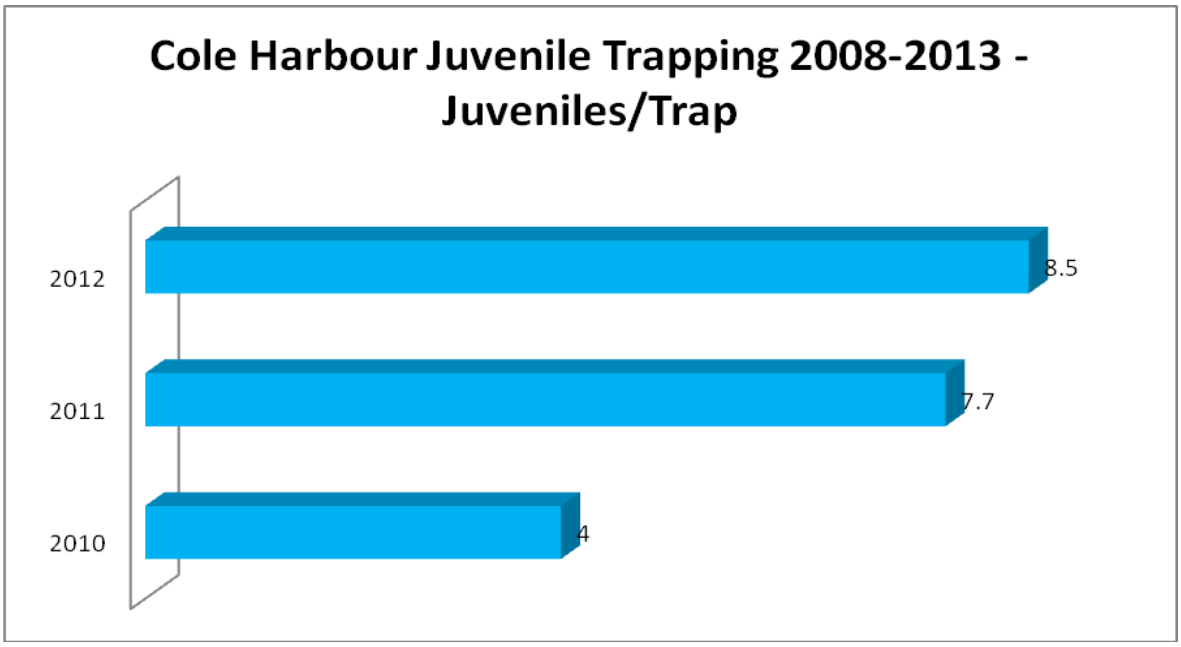


Figure 42: Year Comparison of juveniles trapped in Cole Harbour

Juvenile trapping indicates excellent recruitment for all sizes into the fishery in all location for 2012-13. All locations have consistent numbers of juvenile with Little Dover seeing a steady increase each year. The data recorded in the out of season juvenile traps supports the juvenile data collected during the season in the at – sea sampling data. Both show similar or increases in numbers and a wide variance in size ranges in comparison of the same ports sampled. (Ex. Little Dover saw an increase in juveniles during the fishing season and during the out of season juvenile trapping survey)

Juvenile Trapping Temperatures

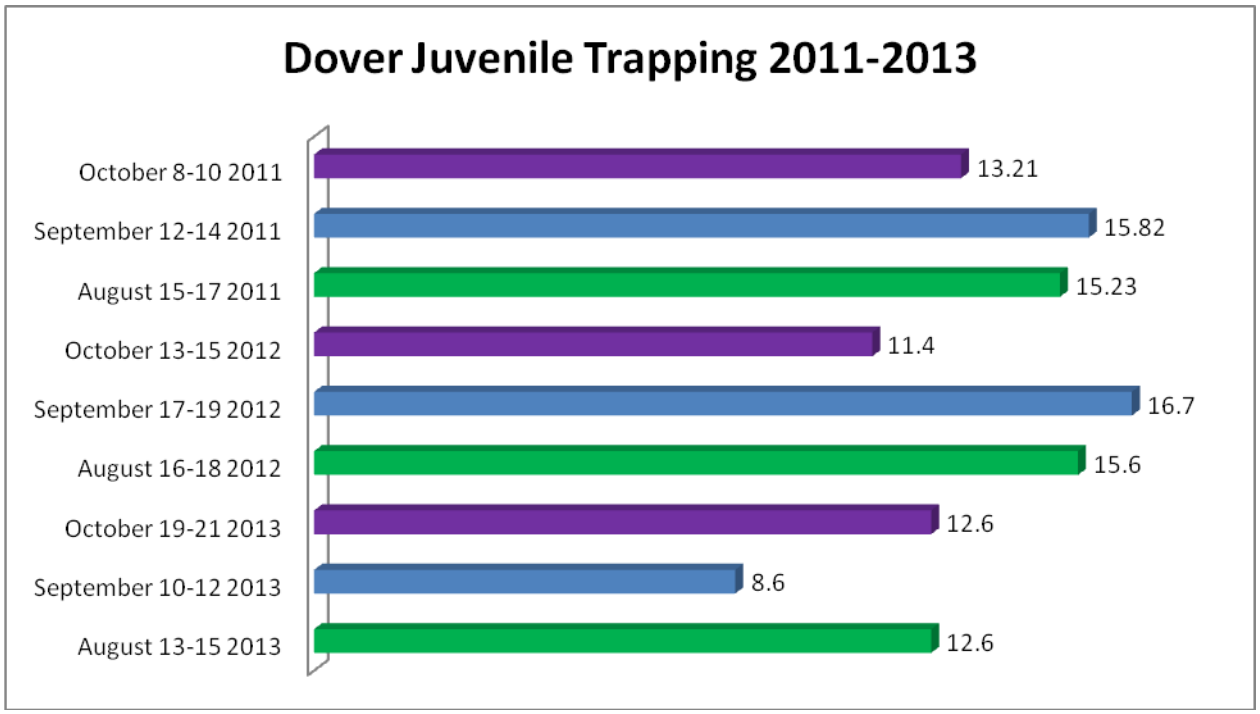


Figure 42: Average Temperatures during juvenile trapping 2011-2013

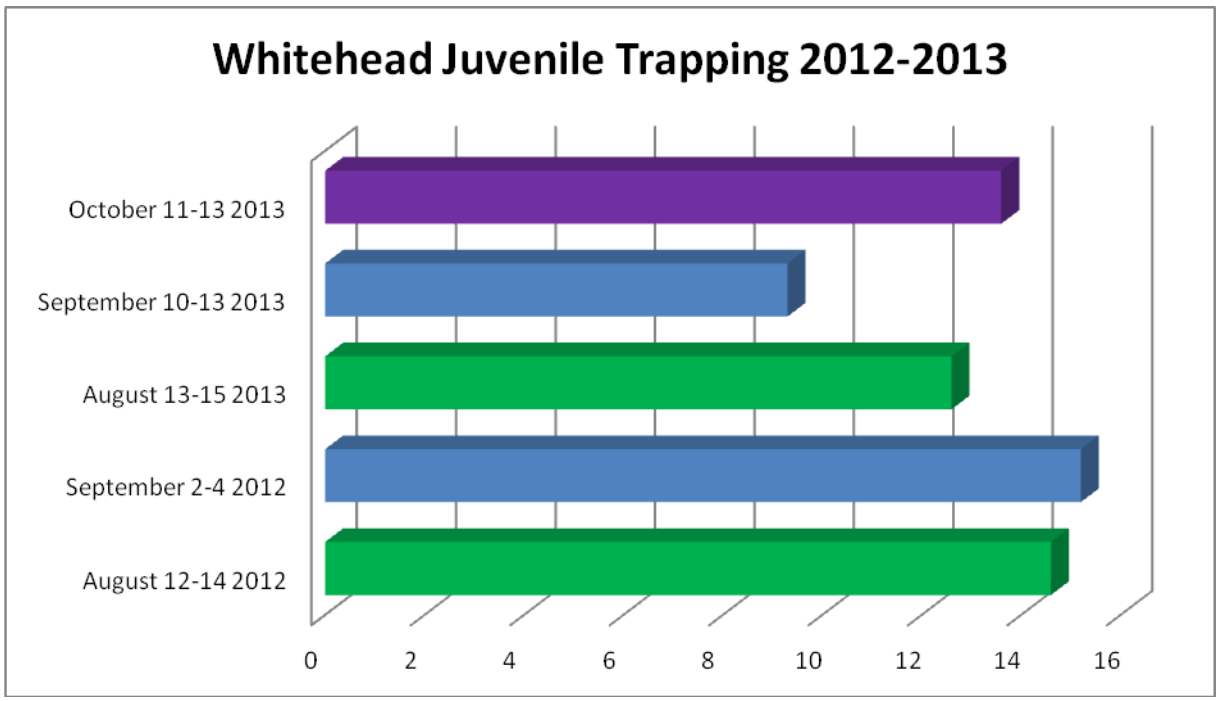


Figure 43: Average Temperatures during juvenile trapping 2011-2013

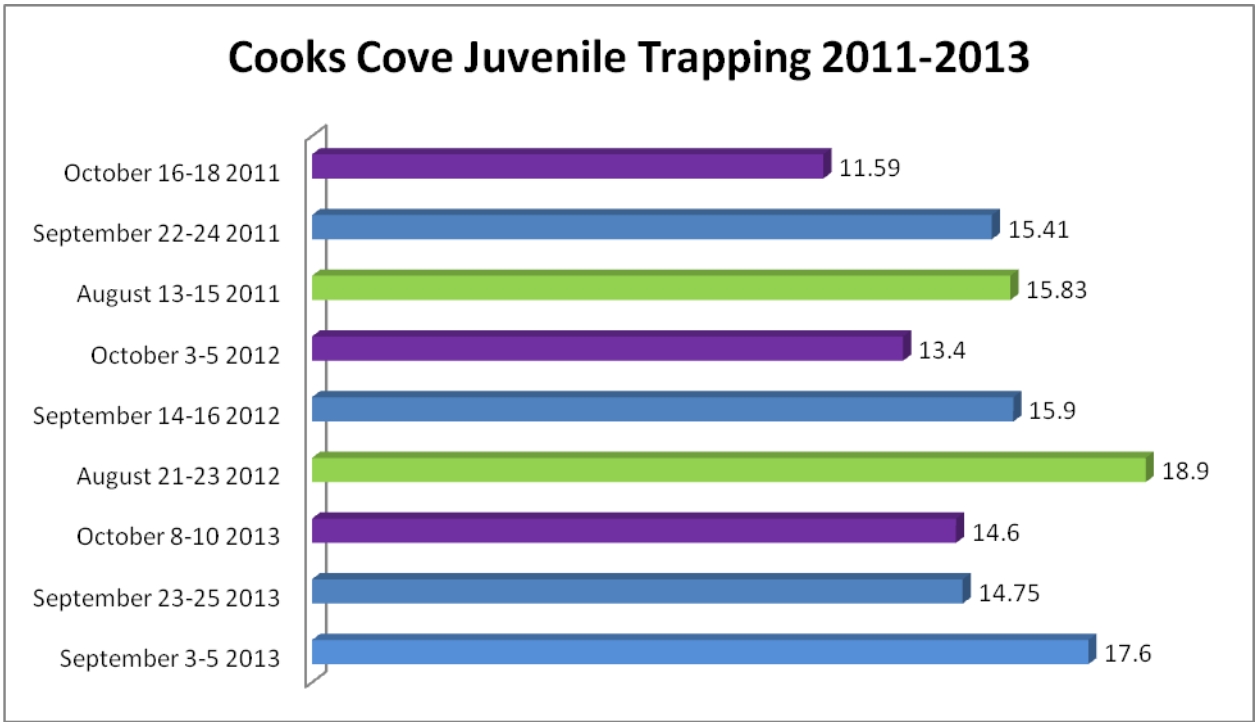


Figure 44: Average Temperatures during juvenile trapping 2011-2013

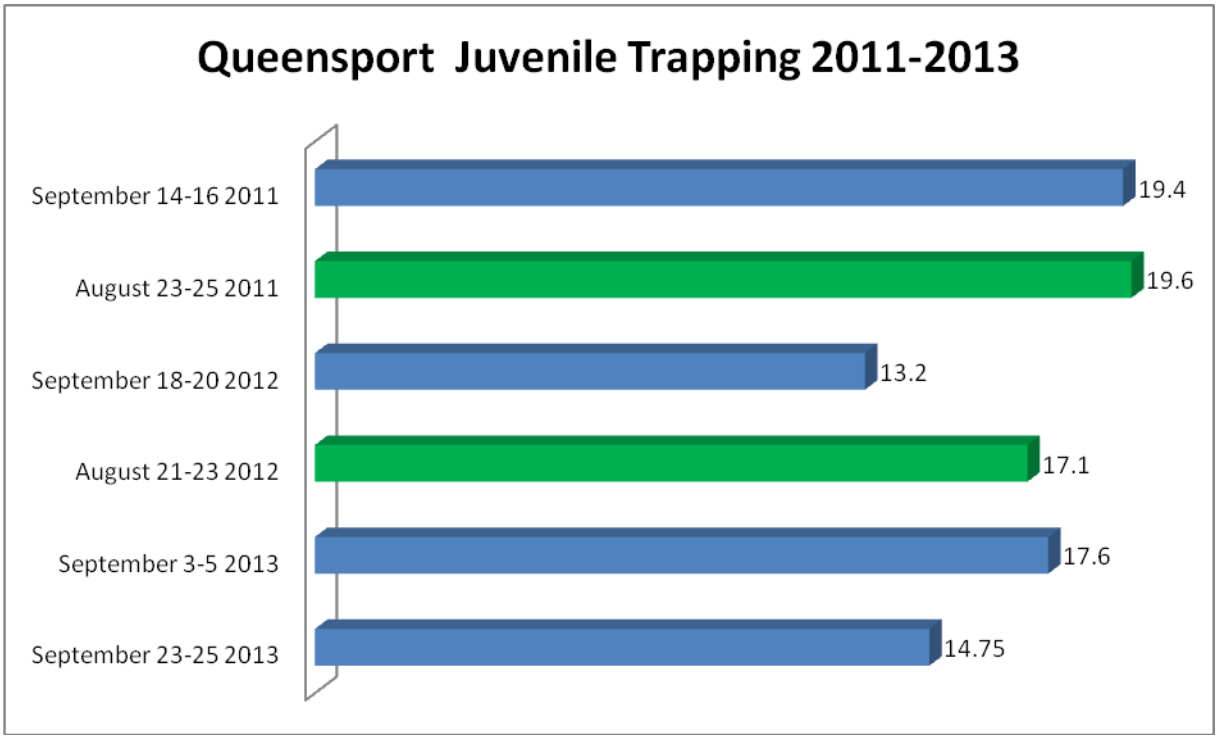


Figure 45: Average Temperatures during juvenile trapping 2011-2013

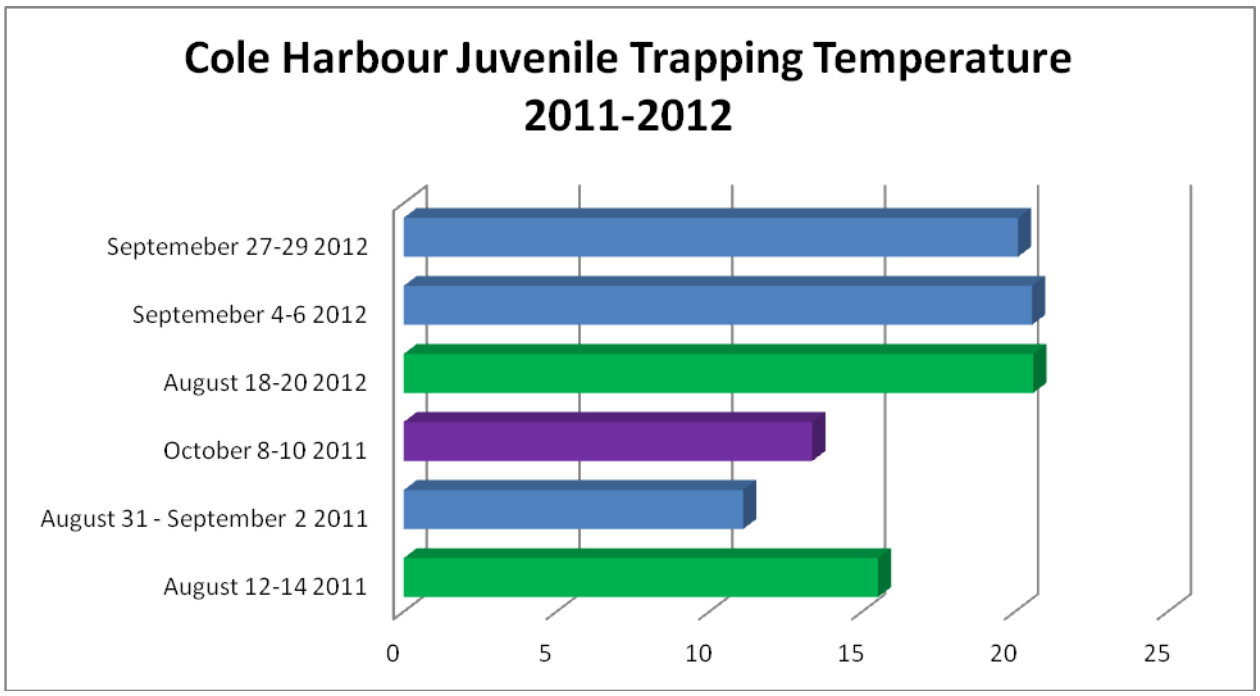


Figure 46: Average Temperatures during juvenile trapping 2011-2012

Artificial Collectors

This project was brought to our attention by R Wahle from the Bigelow laboratory and in 2007 we purchased a set of artificial collectors. These collectors are set in early July by fishermen and hauled in October. The contents of the collectors are recorded.

In 2008 the FSRS added this project as part of their research agenda as a tool to measure settlement of young-of-year lobster. The FSRS covered the cost of more artificial collectors to bring our number of collectors up to 75. One difficulty we have had is where to set these collectors. Finding the right location to set the collector is proving more difficult than originally thought in order to find early stage 4 settlement juveniles which have very cryptic lifestyles.

Picture 9: Artificial collectors ready to set in the water July 2007

Since 2007 we have found one stage four lobster in the artificial collectors. Through discussions with other industry & DFO scientists we have learned this method is very much hit and miss. The small lobsters seem to stay closer to shore and are found within a certain depth. Tracking studies have shown many smaller sized lobsters to stay within a 1 km radius. This particular tracking study is a very expensive and time consuming project which can only be done on a small scale. The collector tray project is very much a laborious task which requires many persons and vessels to lay the trays on the ocean floor. Historically it was thought that small juvenile lobsters are found on cobble bottom more recently there have been observations of smaller lobsters residing directly below a larger lobsters den on a rocky bottom. It is also interesting to find out what other species cohabitate with the juvenile lobsters.

Table 3: Lobster caught in artificial collectors Canso and Whitehead 2010

Date	**Area**	**Size (mm)**
October 29/10	Canso	**16.2**
	Canso	**11.7**
	Canso	**16**
	Canso	38.3
November 1/10	Whitehead	**13.1**
	Whitehead	37.6
	Whitehead	**13.7**
	Whitehead	**13.2**
	Whitehead	**15.4**
	Whitehead	**15.8**

Young of the year lobster are lobsters that have a carapace length up to 17mm, so therefore we had three young of the year in Canso and five in Whitehead. This is the most we have ever seen in either location. As of now there is no explanation as to why we have caught them now as opposed to previous years since the controls were the same as last year; however with the large increase in stage IV lobsters we would expect to see some young of year lobsters in the collectors.

Picture 10: young of the year and one to two year old lobsters found in artificial collectors Canso 2010 (*photo courtesy of Melissa Bond)*

Table 4: Lobster caught in artificial collectors Canso and Whitehead 2011

Date	Area	Size (mm)
September/11	Canso	**8**
	Canso	**9.84**
	Canso	21.03 - female
	Canso	23.49 - female
	Canso	32.28 - Male
October/11	Whitehead	**9.65**
	Whitehead	**9.85**
	Whitehead	**11.75**
	Whitehead	30.27 - Female

Table 5: Lobster caught in artificial collectors Canso and Whitehead 2012

Size (mm)	Canso	Whitehead
<10 mm	**1**	**0**
10-15 mm	**1**	**3**
15- 20 mm	1	0
20-25 mm	1	0
25-30 mm	0	1
30-35 mm	0	5
35-40 mm	3	4
40-45 mm	1	2
45-50 mm	1	2

Table 6: Lobster caught in artificial collectors Whitehead 2013

Size (mm)	Whitehead
<10 mm	**1**
10-15 mm	**0**
15- 20 mm	0
20-25 mm	0
25-30 mm	0
30-35 mm	0
35-40 mm	0
40-45 mm	1
45-50 mm	1

Maturity Sampling in Canso – Collaboration with Dr Angelica Silva DFO

A total of 3,007 individual female lobsters were sampled from 2008 to 2011 aboard volunteer fishing vessels and, on average, 63% were of legal size and 37% sub-legal lobsters (Table 1). The generalized area of sampling varied slightly from year to year, but it remained within the allocated fishing grounds (Figure 2). Of all sampled areas, ovigerous females were most common in Canso, where on average they made up between 20% (2008) to 35% (2009) of all lobsters sampled. The overall range of lobster CL varied from the smallest of 49.2 mm (2011) to 56.8 mm (2009) to the largest size sampled that fluctuated between 127.8 (2009) to 148.5 mm (2008) (Table 2).

The average lobster CL fluctuated between 83.8 mm (June 26, 2008) and 91.4 mm (May 18, 2011) (Table 3). The size frequency of all female lobsters sampled in Canso from 2008 to 2011, along with assessed cement gland staging, are shown in Figures 6a, b, c, and d. As the season progressed each year, Canso sampled lobsters decreased in size and the proportion of ovigerous females increased.

A comparison of the proportion of lobsters that were sexually mature for each sampling date was made by combining all ovigerous females and all those deemed mature (CGS 2 and greater) within the categories of sub-legal and legal lobsters (Table 3). Canso sub-legal lobsters had the highest estimated level of maturity of any other location sampled in this study, fluctuating between 32% (May 20, 2009) and 92% (June 1, 2011) (Table 3). Overall, sexual

maturity of sub-legal lobsters in Canso had an increasing trend from 2008 to 2011, as fewer sub-legal were estimated mature in 2008 (37% to 69%) than in 2011 (75% to 82%). Most legal size lobsters sampled in Canso were at least 80% mature at any given time, though there was one instance in which only 41% were mature at the beginning of 2010 (Table 3). In the most recent year sampled, 97% to 100% were mature.

Among the four areas, Canso had the largest number of: (i) mature females of all sizes as per cement gland development in May and June of each year; (ii) ovigerous females at all times, (iii) sub-legal ovigerous females, and iv) mature sub-legal females as per cement gland development. The smallest mature females were found in 2011 (CGS 2 = 67.3 mm; Min ovigerous = 66.1 mm) in Canso. From 2008 to 2011, there was a clear trend of higher percentages of maturity, though the reasons for this apparent increase are unknown.

Ugarte (1994) sampled lobsters in Canso in 1992 and determined that size at onset of maturity of lobsters was different for shallower inner areas (76 mm) than those from deeper areas (99 mm), and that 50% would have reached maturity at these sizes. The same study provided an overall size at onset of maturity of 83 mm and also found that ovigerous lobsters were moving from deeper to shallow areas in 1992. By assessing maturity on the basis of cement gland development and presence of ovigerous females more legal and sub-legal lobsters that were mature were detected as the season progressed (Figure 11). It would be useful to monitor lobster maturity in the long term off Canso to compare with findings from southwest areas, and to better understand how lobster reproductive processes may be affected by environmental changes.

Intensive sampling over the last four years indicates that the cement gland development method is feasible for inferring status of sexual mature lobsters. Verification of maturity of ovaries from Canso was conducted during June in 2009 and 2011 and confirmed that cement glands are a good indicator of ovarian maturation for this area. Additional verification that lobsters deemed mature were not moulting was also carried out. Maturity is occurring at smaller sizes in Canso than areas further to the west. The reasons are not clear but may be related to differences in the seasonal temperature regime.

Table 7: Summary of field sampling information 2008-2011

LFA	AREA	YEAR	May	June	N total	N <MLS	N ovig
31A	**Canso**	2008	28	5, 18, 26	721	315	147
	Canso	2009	20	2,16, 23	665	329	235
	Canso	2010	19,30	22, 28	677	267	170
	Canso	2011	3, 18	1, 21,27	944	214	253

Table 8: Canso 2008-2011. Summary of lobster maturity data for Canso for each sampled date, and includes number of female lobsters (N all), average carapace length (CL ± sd) and percentage (%) of mature legal and sub-legal lobsters mature lobsters are those with cement gland stages 2-4 and those that have eggs (ovigerous).

Canso	Sample Data	N all	Average All CL (mm)± sd	% Mature legal	% Mature sub-legal
2008	May 28	172	86.1± 8.3	85	69
	June 5	186	84.6± 8.6	88	60
	June 18	216	83.2±11.4	96	57
	June 26	147	83.8±10.1	89	37
2009	May 20	265	84.5± 9.5	79	32
	June 2	191	84.5± 8.5	82	48
	June 16	62	85.9± 8.0	100	75
	June 23	147	86.5± 9.6	100	85
2010	May 19	212	85.6± 9.6	41	33
	May 30	165	86.4 ±10.3	96	65
	June 22	144	84.8 ±11.7	99	63
	June 28	156	88.5± 10.0	98	79
2011	May 3	170	88.9± 7.7	98	80
	May 18	173	91.4 ±10.8	99	81
	June 01	264	91.5 ±11.1	97	92
	June 21	169	89.4± 10.3	98	86
	June 27	168	89.3± 13.3	100	75

Future Research

GCIFA will continue our sea samples, juvenile trapping, temperature gauges, and larval tows. We will continue to improve on our incidental bycatch and live discards as well as getting more at sea sampling done in both LFA 31a and LFA 31b. We will continue our partnerships with Dr Angelica Silva and with the Canadian Capture Fisheries on the lobster node as well as our local buyers.