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Recent Trends and Management Changes in the American Lobster (*Homarus americanus*) Fishery in Newfoundland

Tendances et changements en gestion récents concernant la pêche du homard américain (*Homarus americanus*) à Terre-Neuve-et-Labrador

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ABSTRACT

The Newfoundland lobster fishery is managed by input controls including a minimum legal size (MLS), protection of ovigerous females, seasons, limited entry and trap limits. Currently, there are approximately 2900 fishers prosecuting the fishery in Lobster Fishing Areas (LFAs) 3-14. Trap limits vary by LFA, and range from 100-350 traps per licensed fisher. From 1992 to 2000, Newfoundland lobster landings declined in most LFAs, and landings for all of Newfoundland fell from 3200 t to1800 t. Overall landings have since increased to about 2300 t in 2003, due largely to increased landings in LFAs 11, 13A and 13B. Landings fell in 2004 to about 1900 t, but then rose to 2600 t in 2005. Reported landings in LFA 11 have risen to over 900 t, while catches in LFA 10 continue to decline precipitously. Landings in LFA 4 have also declined sharply in recent years. Catch data for the Newfoundland lobster fishery, and for individual lobster fishing areas (LFAs), are presented along with recent catch per unit effort (CPUE) data collected from one long-term monitoring site in LFA 5, as well as size composition data from at-sea sampling for three localized monitoring sites, in LFA 5, LFA 11, and LFA 14B. Exploitation rate indices for these monitoring sites were high, and size-frequency distributions indicate that, each year, the catch is composed almost exclusively of incoming recruits. Due to insufficient data, it is impossible to assess the overall status of the resource at the present time.

RÉSUMÉ

La pêche du homard à Terre-Neuve-et-Labrador est gérée par le contrôle des données à l'entrée, notamment une taille minimale de capture, la protection des femelles œuvées, les saisons, un accès limité et des limites quant au nombre de casiers. À l'heure actuelle, il y a environ 2 900 pêcheurs œuvrant dans les zones de pêche du homard (ZPH) 3-14. Les limites quant au nombre de casiers varient selon la ZPH. Ce nombre varie entre 100 et 350 casiers par pêcheur titulaire d'un permis. De 1992 à 2000, les quantités débarquées de homard à Terre-Neuve-et-Labrador ont diminué dans la plupart des ZPH et les quantités débarquées pour l'ensemble de Terre-Neuve-et-Labrador ont chuté de 3 200 t à1 800 t. En général, les quantités débarquées ont augmenté depuis à environ 2 300 t en 2003, principalement en raison de l'augmentation des quantités débarquées dans les ZPH 11, 13A et 13B. Les quantités débarquées ont chuté en 2004 à environ 1 900 t, mais ont augmenté à 2 600 t en 2005. Les quantités débarquées déclarées dans la ZPH 11 ont augmenté à plus de 900 t, tandis que les captures dans la ZPH 10 continuent de diminuer abruptement. Les quantités débarquées dans la ZPH 4 ont également diminué de façon marquée au cours des dernières années. Les données sur les captures concernant la pêche du homard à Terre-Neuve-et-Labrador et certaines zones de pêche du homard sont présentées avec les données récentes sur la capture par unité d'effort (CPUE) recueillies d'un site de surveillance à long terme dans la ZPH 5, ainsi que des données sur la composition par taille provenant de l'échantillonnage en mer concernant trois sites de surveillance localisés dans la ZPH 5, la ZPH 11 et la ZPH 14B. Les indices du taux d'exploitation pour ces sites de surveillance étaient élevés, et les distributions des fréquences de taille indiquent que, chaque année, la capture se compose presque exclusivement de recrues. En raison de données insuffisantes, il est impossible d'évaluer l'état général de la ressource à l'heure actuelle.

INTRODUCTION

SPECIES BIOLOGY

The American lobster, *Homarus americanus*, is a decapod crustacean characterized by a life cycle which is predominately benthic. Lobsters may live for more than 30 years. In Newfoundland waters, at the northern range of the species distribution, it takes about 8-10 years for a newly hatched lobster to reach the minimum legal size (MLS). The MLS is currently set at a carapace length (CL) of 82.5 mm. Growth is achieved through molting, and frequency of molting decreases with increasing age. Growth is also affected by temperature, as molting probability tends to decrease with lower temperatures.

Mating occurs in the months of July to September, and the female extrudes eggs roughly 1 year subsequent to mating. The eggs are carried in clutches on the underside of the female's tail, and the ovigerous (egg-bearing) animal protects and maintains the eggs for a period of 9-12 months. Thus, female lobsters are characterized by a biennial molt-reproductive cycle, though mature female lobsters at the lower end of the size range sometimes molt and spawn within the same year. At 1-2 mm below the MLS in Newfoundland, about 50% of females will spawn during the summer. Fecundity of females increases exponentially with size. Eggs from larger lobsters tend to contain more energy per unit weight, and larger females tend to release their offspring earlier in the season, when growth and survival are enhanced (Attard and Hudon 1987).

Hatching occurs during a four month period extending from late May through most of September. Once released, the larvae swim upward and undergo a series of three molts during their 6-10 week planktonic phase, during which most mortality is thought to occur. With the third molt, into Stage IV, a metamorphosis occurs and the newly developed postlarvae begin the process of transitioning from pelagic to benthic existence. Newly settled lobster progress through several juvenile stages and an adolescent phase before reaching adulthood.

The adult lobster is thought to have few natural predators and commercial harvesting accounts for most adult mortality. Diet typically consists of rock crab, polychaetes, molluscs, echinoderms, and various finfish.

THE FISHERY

The history of the lobster fishery in Newfoundland dates back to the early 1870s. Statistics indicate that landings peaked at almost 8000 t in 1889 (Fig. 1). Early documentation indicates that essentially everything that was captured was landed and processed by one of many small canning operations that existed around the coast. A stock collapse occurred in the mid 1920s, after which the fishery was closed for three years, from 1925 to 1927. The fishery reopened in 1928, and landings reached over 2000 t, but dropped sharply the following year. In the early 1930s, shipment of live animals to US markets commenced, and regulations protecting undersize and ovigerous animals were strictly enforced. By the early 1950s, essentially all landings were shipped to the US, and the fishery has remained a live market industry since. Effort was largely uncontrolled up to 1976, at which point a limited entry licensing policy was implemented, and trap numbers were regulated.

Following a 17 year period of general decline, to about 1200 t in 1972, landings increased to about 2600 t in 1979 (Fig. 1). This trend was consistent with those of other Atlantic regions, and was attributed to a period of strong recruitment associated with persistent favourable environmental/ecological factors which are still not fully understood. This general upward trend in Newfoundland landings continued through the 1980s. In January of 1986, a new geographical management system was introduced. Lobster fishing districts, which had been implemented around 1910, were replaced by Lobster Fishing Areas, or LFAs (Fig. 2). A conversion to uniform trap limits was implemented for all LFAs between the late 1980s and early 1990s.

In 1995, the Fisheries Resource Conservation Council (FRCC) published "A conservation framework for Atlantic lobster". In this report, the FRCC expressed concerns about the future viability of Atlantic Canada's lobster stocks, suggesting that high exploitation rates, combined with the considerable harvesting of immature animals could result in decreased egg production and recruitment failure in periods characterized by adverse environmental conditions (FRCC 1995). The report suggested several methods for increasing egg production and reducing exploitation rates, some of which were incorporated into subsequent management plans for the lobster fishery in Newfoundland. Over the course of the 1998-2002 management plan, there was a 25% reduction in licenses in the Newfoundland lobster fishery, and minimum legal size was increased from 81 mm CL to 82.5 mm CL in May of 1998. Additionally, a maximum legal size restriction of 127 mm CL was implemented for west coast LFAs.

Newfoundland lobster landings in recent years declined in most LFAs (Fig. 3), and landings for all of Newfoundland fell from 3200 t in 1992 to 1800 t in 2000 (Fig. 1). Overall landings have since increased to about 2600 t in 2005, due largely to increased landings in LFAs 11, 13A and 13B (Fig. 3). Landings in LFA 11 have reached an all-time high, while catches in LFA 10 continue to decline precipitously. This disparity contrasts sharply with landings trends for the two areas prior to the mid 1990s. Landings in LFA 4 have also declined sharply in recent years.

The American lobster fishery in Newfoundland is prosecuted from small open boats during an 8-10 week spring fishing season. Traps are set close to shore, at depths generally less than 50 m. Fishing effort is controlled through limited entry and trap limits. There are currently about 2900 licenses with trap limits varying from 100 to 350 per licensed fisher, depending on LFA (Table 1). Additionally, it is required that traps possess vents which allow undersize lobster to escape. The MLS is now set at 82.5 mm CL, and regulations prohibiting the retention of ovigerous females and v-notched females are enforced. V-notching is a voluntary practice that involves cutting a shallow mark in a specific portion of the tail fan. The mark is typically retained for 2 to 3 molts, and notched females cannot be retained if captured. This protects the animal from exploitation, even when not carrying eggs externally.

A new management plan was implemented in 2003 following a series of consultations with stakeholders, and was due to expire in 2005. It was extended to include the 2005 and 2006 fishing seasons, in part to allow for input from the recent FRCC review of the Atlantic lobster fishery. Management changes implemented since 2003 involve reductions in individual trap limits, from 200 to 100 for LFA 9 and from 300 to 200 in LFA 10. A reduction in the individual trap limit from 425 to 350 traps for 14B occurred in 2005. In addition, Sunday fishing was prohibited in LFAs 4, 10, 13B, 14A, 14B and 14C in the 2003-05 management plan.

METHODOLOGY

Lobster fishery monitoring includes voluntary completion of logbooks to obtain basic catch and effort data, and a commercial at-sea sampling program, in which an observer records daily catches aboard fishers' boats throughout the season. All animals are recorded by the observer, including undersize, ovigerous and v-notched animals, in addition to the commercial component, to produce an index of population size structure.

Data collection commenced at Eastport, in central Bonavista Bay (LFA 5), in 1997, around the Connaigre Peninsula in Fortune Bay (LFA 11) in 1999, at Eddies Cove West in St. John Bay (LFA 14B) in 2000. These arrangements were discontinued in 2002, with the exception of Eastport, where monitoring has consistent since 1997. In recent years, fishery monitoring in Eastport has been conducted in partnership with the Oceans Division of DFO. Monitoring of the fishery around the Connaigre peninsula in Fortune Bay (LFA 11) and around Eddies Cove West in St. John Bay (LFA 14B), has been carried out since 2004 through cooperative arrangements with industry, under the Fisheries Science Collaborative Program (FSCP). Under this program, lobster fishery monitoring has also been implemented in LFAs 10 and 14A, but these initiatives have been in place for a relatively short time period, and the data are not presented in this document.

FISHERY LOGBOOK DATA

Voluntary commercial logbook data to monitor daily catches and trap hauls have been collected annually in Eastport (LFA 5) since 1997. Logbook data was also obtained for communities in Fortune Bay, around the Connaigre Peninsula, in LFA 11, and inside St. John Bay in LFA 14B, between 1999-2001. Logbooks were collected from the study sites in Fortune Bay (LFA 11) for the entire 3-year period, while logbooks for sites in St. John Bay (LFA 14B) were collected in 2000-01. As of 2005, an expansion of the logbook program, as part of the FSCP, has resulted in renewal of logbook monitoring for study sites in both Fortune Bay (LFA 11) and St. John Bay (LFA 14B).

Data from commercial logbooks was combined and weekly catch per unit of effort (CPUE, number of commercial lobsters per trap haul) averages were calculated. The CPUE is not standardized in that it does not account for variation in water temperatures, variation in fishing practices between fishers and throughout the fishing season, and inconsistent participation in the logbook program from one year to the next.

Estimates of exploitation for the Eastport portion of Bonavista Bay were obtained by applying a temperature-corrected Leslie analysis (Ennis et al. 1982; Ennis et al. 1986) to logbook data collected from 1997 to 2003. The analysis is a regression of catch per unit effort on the cumulative catch of the season, corrected to account for increases in catchability due to increasing water temperatures, and provides an estimate of initial exploitable biomass at the start of the season. An estimate of total population, N, was obtained by multiplying catch data from logbooks by a scaling factor, to account for all licensed fishers in the area. The scaling factor included estimates of individual license utilization in the area, based on local knowledge. Individual logbooks were assigned to one of three different zones within the Eastport co-management area (Fig. 4) and analysis was performed for each region in a given year. The geographical breakdown is as follows: north (Burnside–N. side Eastport Bay), central (S. side Eastport Bay-Salvage) and south (Newman Sound). For reasons relating to the confidentiality of an individual harvester's catch information, it was necessary to combine the data from all three zones to produce an average exploitation rate for a given year.

Discontinuation of thermograph monitoring in 2003 precluded the possibility of applying the aforementioned analysis to logbook data collected in 2004-05.

AT-SEA SAMPLING

Traditional commercial at-sea sampling programs have, in recent years, employed an individual observer who recorded daily catches aboard various fishers' boats in specific localities around the island. Where possible, carapace lengths of all lobster, both commercial and non-commercial, are recorded, to the nearest mm. Lobster which measure the MLS of 82.5 mm CL are recorded as 83 mm CL. Animals are placed into one of seven categories to account for sex, reproductive condition and, if female, presence or absence of a v-notch, to produce an index of population structure. The categories are as follows:

1 – male
2 – female, non-ovigerous, no v-notch
3 – female, non-ovigerous, new v-notch
4 – female, non-ovigerous, old v-notch
5 – female, ovigerous, no v-notch
6 – female, ovigerous, new v-notch
7 – female, ovigerous, old v-notch

A commercial at-sea sampling program commenced in Eastport in 1998 and has continued through 2006. From 1998 to 2003, an individual observer recorded daily catches aboard fishers' boats throughout the season, as described above. Starting in 2004, methods of data collection in Eastport changed, when funding from the Atlantic Canada Opportunities Agency (ACOA) permitted the hiring of six index fishers, who recorded their daily catches throughout the entire commercial season. In 2005-06, this program was continued, albeit on a smaller scale, through the Oceans Division of DFO. Three index fishers were selected, one for each sub-region in the Eastport co-management area.

Males and females differ in growth rates (Wilder 1953; Campbell 1983; Comeau and Savoie 2001) and catchability (Miller 1990; Tremblay and Smith 2001), and are afforded differing levels of protection in the commercial fishery, due to the prohibition against landing ovigerous and v-notched females. Consequently, they are subject to different rates of exploitation. Using at-sea sampling data, an index of exploitation can be derived by determining the proportion of the catch comprised of 1st year recruits (R) to the commercial fishery. To determine size ranges for this first molt group, R, growth information was obtained from Ennis et al. (1989) for Eastport (LFA 5), from Ennis et al. (1986) for Fortune Bay (LFA 11), and Ennis et al. (1994) for St. John Bay (LFA 14B).

RESULTS AND DISCUSSION

Summaries of participation in the voluntary logbook and at-sea sampling programs, by locality, are provided in Table 2, Table 3 and Table 4. Because of the nature of the St. John Bay fishery, and the tendency for harvesters to "buddy up" and fish two licenses from one vessel, logbooks from St. John Bay may represent the catch of two license holders. Table 4 lists both the number of logbooks collected, and the number of actual licenses represented, for the St. John Bay study area.

FISHERY LOGBOOK DATA

CPUE Trends

Due to the lack of a time series for the majority of logbook data, CPUE trends cannot be evaluated for most areas. The duration and relative consistency of logbook monitoring in LFA 5 allows for some monitoring of changes in this area. Plots of average weekly CPUE during the commercial fishery in Eastport (LFA 5), from 2002 to 2005, are presented in Fig. 4. As Fig. 4 indicates, considerable variation exists in recent CPUE trends. This may be attributed to a variety of factors, including decreasing, and inconsistent, participation in annual logbook monitoring programs. Fishing practices also vary considerably based on weather conditions. Many lobster harvesters hold licenses for other species (e.g. snow crab) and will adjust effort to permit harvest of these other species. Soak times and redistribution of traps can vary greatly, and it is not uncommon for many harvesters to reduce effort substantially in the final weeks of the lobster season, by removing pots from the water and hauling/baiting them less frequently. Water temperatures affect lobster catchability (McLeese and Wilder 1958), and may vary annually.

Exploitation

Exploitation rate estimates obtained from a temperature-corrected Leslie analysis (Ennis et al. 1982; Ennis et al. 1986) on logbook data are summarized and presented in Table 5. Data from 1998 were excluded, as an increase in minimum legal size took place partway through the season, thus compromising the analysis and precluding the possibility of a reasonable estimate of exploitation. Estimates of exploitation obtained from the temperature-corrected Leslie analysis ranged from 78 to 94%. Although presented in Ennis et al. (2003), further analysis of 2001 data was required as an additional logbook was received after the assessment in 2003. An example of a temperature-corrected CPUE plot obtained from logbook data is presented in Figure 5.

Because constant catchability of the target species is one of the assumptions of the Leslie analysis, the use of a correction factor for increasing water temperatures was necessary to estimate biomass and exploitation, as catchability of lobster increases with increasing water temperatures (McLeese and Wilder 1958). Although this correction for temperature changes was applied in the estimate of exploitation using the Leslie analysis, violation of additional assumptions could result in inaccurate estimates of exploitation.

The Leslie method assumes that catchability is constant among individuals, as well as across time. Catchability of commercially exploitable lobster (i.e., those of 83 mm CL and greater), has been shown to increase with increasing size (Miller 1995; Pezzack and Duggan 1995). Agonistic encounters with larger conspecifics may preclude entry into traps by smaller lobster (Schrivener 1971; Miller 1990). The Leslie method assumes that fishing methods and effort do not change over the season, and that effort is distributed uniformly over the stock range. Logbook data indicate that effort changes throughout the season. Fishing effort is allocated to other species as the season progresses, trap numbers tend to diminish, and soak times increase. This increase can affect the size of the catch in terms of both weight and numbers (Miller 1990).

The nature of the fishery is such that weather conditions largely influence the frequency and duration of trap hauls. Distribution of effort likely changes as fishers attempt to maximize catch by moving traps throughout the season, and geographical distribution of effort is not recorded on the scale necessary to test this assumption. Although the basic methods of the fishery do not change, in that traps are the only gear employed, changes in bait types throughout the season may alter catchability and thus compromise the biomass estimates. Ennis et al. (1982) provides further examination of the assumptions of the Leslie analysis.

AT-SEA SAMPLING

Population Structure

Daily at-sea sampling data were combined for a given locality to produce size-frequency distributions for both male and female components of the population. Illustrative examples of these distributions are provided for our study sites in LFA 5 (Fig. 6; Fig. 7), LFA 11 (Fig. 8) and LFA 14B (Fig. 9).

Size-frequency distributions from at-sea sampling data for all localities illustrate the fishery's heavy reliance on incoming recruitment each year, as evidenced from the relative abundance of animals in the recruit (R) and recruit +1 (R+1) size ranges. The truncated size structure indicated by the size-frequency distributions suggests very high exploitation rates, as few animals survive to molt to larger size classes. The majority of the commercial catch of both males and females is composed of recruits that would have molted into that range (R) in the preceding summer/fall. Some animals in this range would have avoided capture upon their first year of eligibility in the fishery, and remained in R for an additional year, instead of molting into R+1.

Although they provide an indication of population structure, judicious use of the size-frequency distributions to infer relative abundance of undersize, ovigerous and v-notched animals is required. These components of the distribution are subject to over-representation due to the sampling design. Unlike the commercial component of the catch, which is removed after the first capture, the non-commercial animals can be captured, and thus recorded, multiple times, particularly near the end of the season, when the commercial component has been substantially depleted.

Exploitation

Annual exploitation rate indices, obtained by determining the proportion of 1st year recruits in the commercial catch for a given year, were all quite high, ranging from 73% to 91% in Eastport (Table 6; Table 7), from 83% to 96% in Fortune Bay (Table 8; Table 9), and from 71% to 94% in St. John Bay (Table 10; Table 11). For Eastport (LFA 5), an average index of exploitation for the period from 1999 to 2005 was 88% for males, and 80% for females. For Fortune Bay (LFA 11), an overall average index of exploitation for 1999-2001 and 2004-05 was 95% for males, and 88% for females. For St. John Bay (LFA 14B), an overall average index of exploitation for 2000-01 and 2004-05 was 90% for males and 84% for females. Exceptionally high values for Fortune Bay may be explained by persistent, unusually strong annual recruitment. For all sampling sites, annual exploitation rate indices for females were consistently lower than those obtained for males, presumably due to the greater catchability of males during the commercial season (Miller 1990; Tremblay and Smith 2001), as well as the protection provided for ovigerous females.

The index does not account for impacts of natural mortality, potential differences in intermolt periods between the recruit size group and larger sizes, and annual variations in recruitment. Natural mortality of adult lobster is not precisely known, but is understood to be low for a slow-growing and long lived species like the adult American lobster, and is typically assigned a value of 0.1 (Miller 1995).

CONCLUSIONS

Due to insufficient data, an overall assessment of the resource is not possible. The status of the resource in localized areas within LFAs 5, 11 and 14 has been assessed using fishery-dependent data. Given the nature of the coast and the tendency of lobster in NL to occupy nearshore habitat, the effects of the fishery could be very localized and difficult to assess without a very intensive sampling and monitoring program. An expansion of the sampling and logbook program would be needed to cover all areas.

Exploitation rate indices remain high in all monitoring sites. Each year the catch is comprised almost exclusively of incoming recruits, and future recruitment is strongly influenced by environmental/ecological conditions. Size-frequency distributions from the monitoring sites reflect the relative lack of larger animals in the population, which suggests high exploitation and an unhealthy population structure.

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Table 1. Trap limits per licensed fisher, by LFA, in 2005.

LFA	Individual Trap Limit
3	200
4	200
5	200
6	100
7	150
8	100
9 (Trepassey Bay)	200
9 (St. Mary's Bay)	100
10	200
11	200
12	150
13A	200
13B	250
14A	300
14B	350
14C	300

Table 2. Summary of participation in fishery monitoring programs in Eastport (LFA 5), 1997-2005.

Year	# logbooks completed	At-sea sampling # harvesters participating	# samples
1997	13		
1998	17	15	32
1999	16	16	33
2000	13	20	39
2001	10	14	43
2002	13	17	39
2003	7	17	36
2004	6	6	186
2005	4	3	75

Table 3. Summary of participation in lobster fishery monitoring in Fortune Bay (LFA 11), 1999–2001 and 2004-05.

Year	# logbooks completed	At-sea sampling # harvesters participating	# samples
1999	27	30	59
2000	11	21	46
2001	10	20	70
2004	0	6	30
2005	13	5	14

Table 4. Summary of participation in lobster fishery monitoring in St. John Bay (LFA 14B), 2000-01 and 2004-05.

Year	# logbooks completed/ # licenses represented	At-sea sampling: # harvesters participating	At-sea sampling: # samples
2000	7/9	10	29
2001	7/9	9	32
2004	6/11	9	25
2005	6/9	7	20

Table 5. Annual Exploitation Rate estimates obtained from a temperature-corrected Leslie analysis of Eastport (LFA 5) logbook data, from 1997 to 1999-2003.

Year	Standing Stock Estimate	Catch Estimate	Exploitation Rate Estimate (%)
1997	39178	34612	88
1998	N/A	N/A	N/A
1999	44233	41746	94
2000	39837	42296	94
2001	39670	35295	89
2002	38136	33431	88
2003	45999	35868	78
Mean			**89**

Table 6. Proportion of recruits in total catch of commercial males from at-sea sampling data collected in Eastport (LFA 5), 1999-2005.

Year	**# of recruits (R)**	**Total commercial catch (T)**	**Percentage of R in T (%)**
1999	699	771	91
2000	760	870	87
2001	622	692	90
2002	573	634	90
2003	648	761	85
2004	1433	1732	83
2005	303	343	89
Mean			**88**

Table 7. Proportion of recruits in total catch of commercial females from at-sea sampling data collected in Eastport (LFA 5), 1999-2005.

Year	**# of recruits (R)**	**Total commercial catch (T)**	**Percentage of R in T (%)**
1999	498	571	87
2000	792	930	85
2001	593	718	83
2002	540	661	82
2003	481	639	75
2004	1552	2121	73
2005	245	322	76
Mean			**80**

Table 8. Proportion of recruits in total catch of commercial males from at-sea sampling data collected in Fortune Bay (LFA 11), 1999-2001 and 2004-05.

Year	**# of recruits (R)**	**Total commercial catch (T)**	**Percentage of R in T (%)**
1999	1624	1685	96
2000	1796	1892	95
2001	2139	2310	93
2002			N/A
2003			N/A
2004	1605	1700	94
2005	804	834	96
Mean			**95**

Table 9. Proportion of recruits in total catch of commercial females from at-sea sampling data collected in Fortune Bay (LFA 11), 1999-2001 and 2004-05.

Year	**# of recruits (R)**	**Total commercial catch (T)**	**Percentage of R in T (%)**
1999	1083	1200	90
2000	1084	1182	92
2001	1785	2056	87
2002			N/A
2003			N/A
2004	1263	1524	83
2005	582	661	88
Mean			**88**

Table 10. Proportion of recruits in total catch of commercial males from at-sea sampling data collected in St. John Bay (LFA 14B), 2000-01 and 2004-05.

Year	**# of recruits (R)**	**Total commercial catch (T)**	**Percentage of R in T (%)**
2000	778	830	94
2001	972	1100	88
2002			N/A
2003			N/A
2004	603	682	88
2005	896	1010	89
Mean			**90**

Table 11. Proportion of recruits in total catch of commercial females from at-sea sampling data collected in St. John Bay (LFA 14B), 2000-01 and 2004-05.

Year	**# of recruits (R)**	**Total commercial catch (T)**	**Percentage of R in T (%)**
2000	611	653	94
2001	813	967	84
2002			N/A
2003			N/A
2004	637	892	71
2005	580	685	85
Mean			**84**

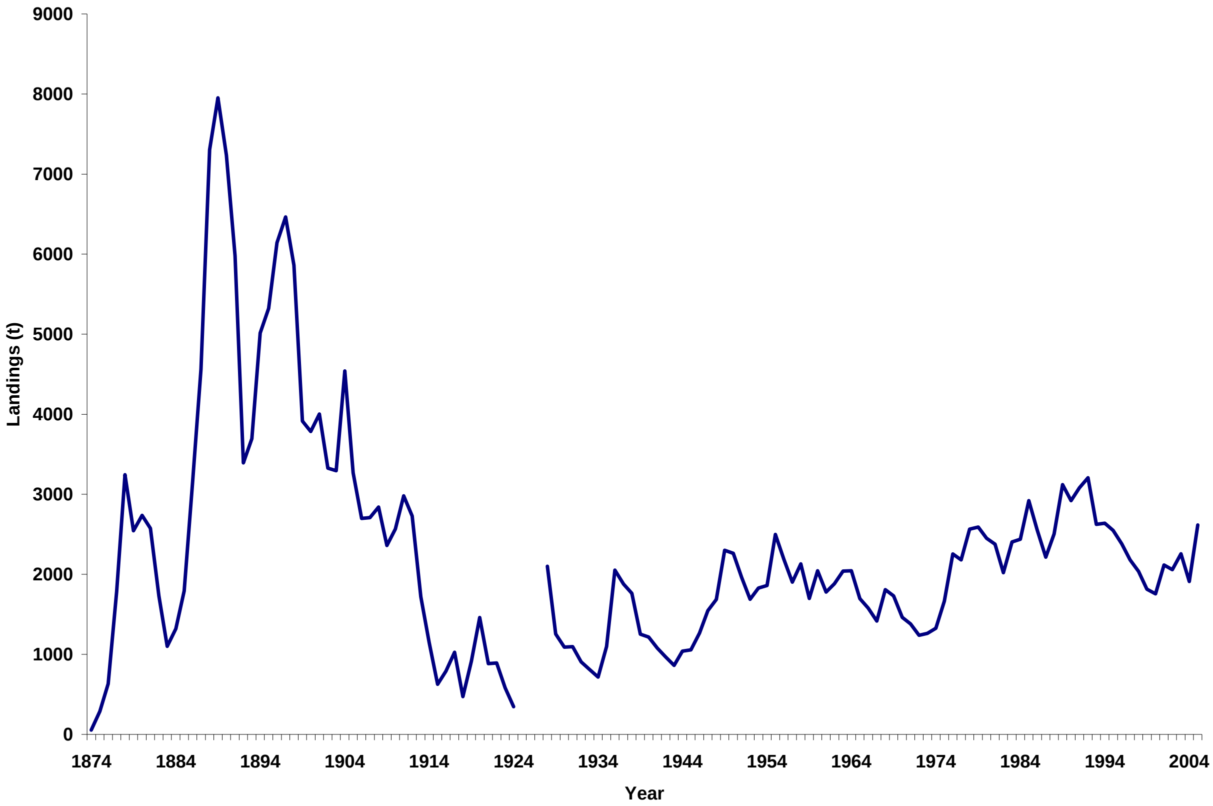


Figure 1: Historical landings for the Newfoundland lobster fishery, 1874-2005. Fishery closed from 1925 to 1927.

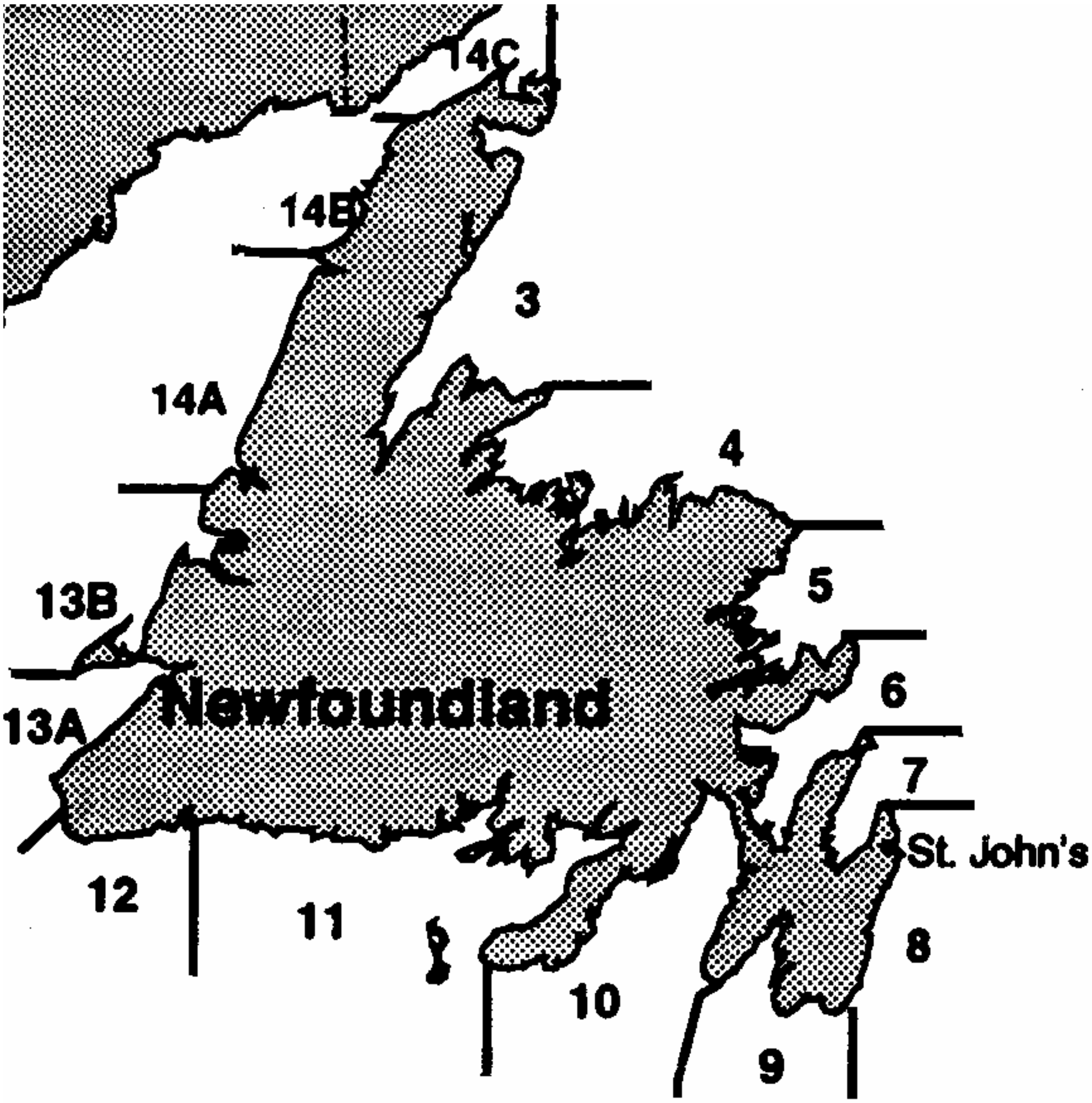
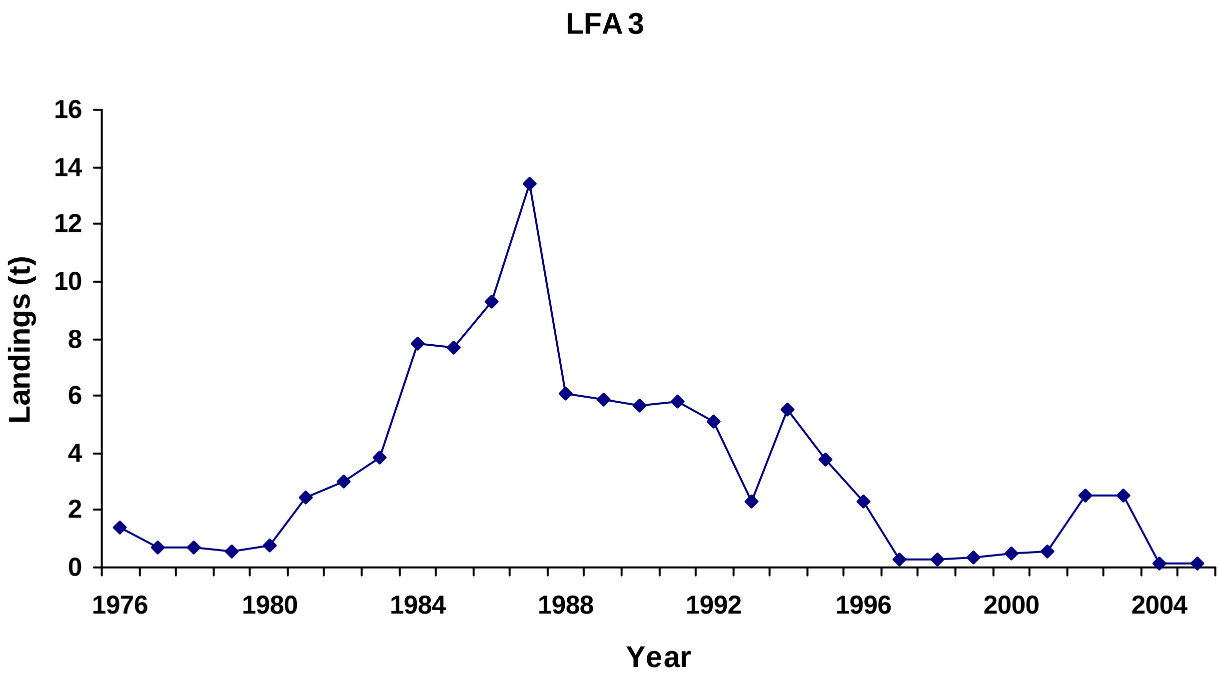


Figure 2: Newfoundland Lobster Fishing Areas (LFAs).



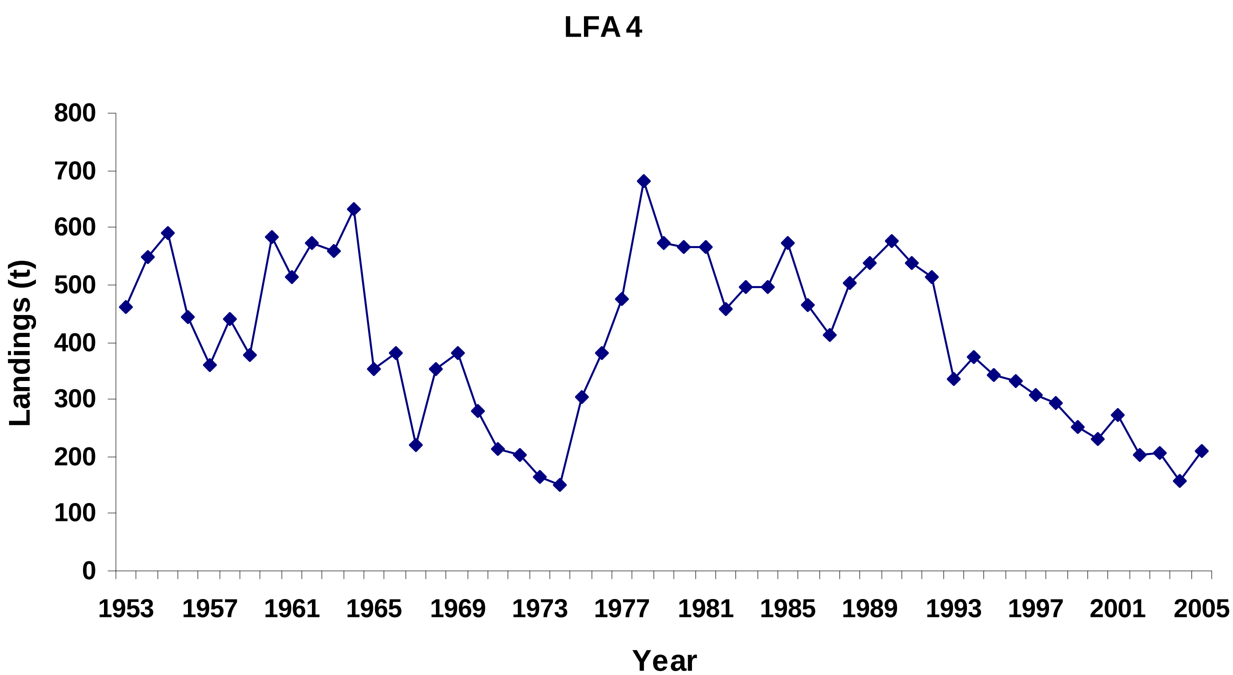
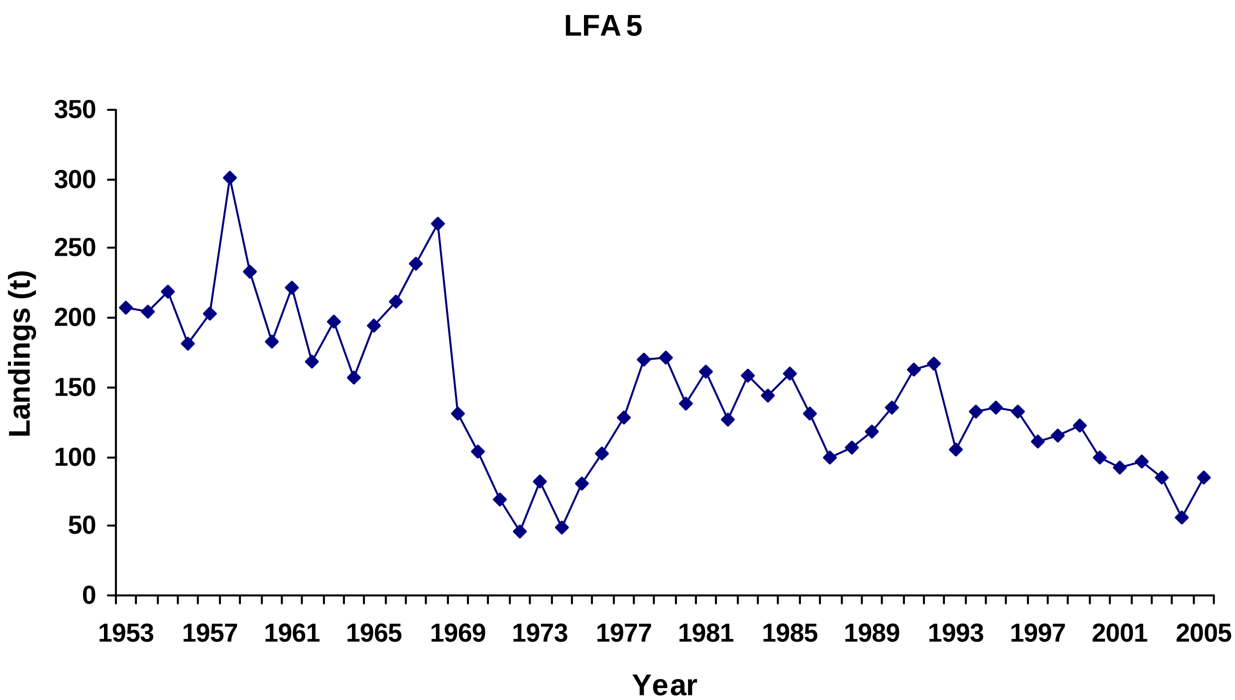


Figure 3: Historical landings for individual Lobster Fishing Areas (LFAs).



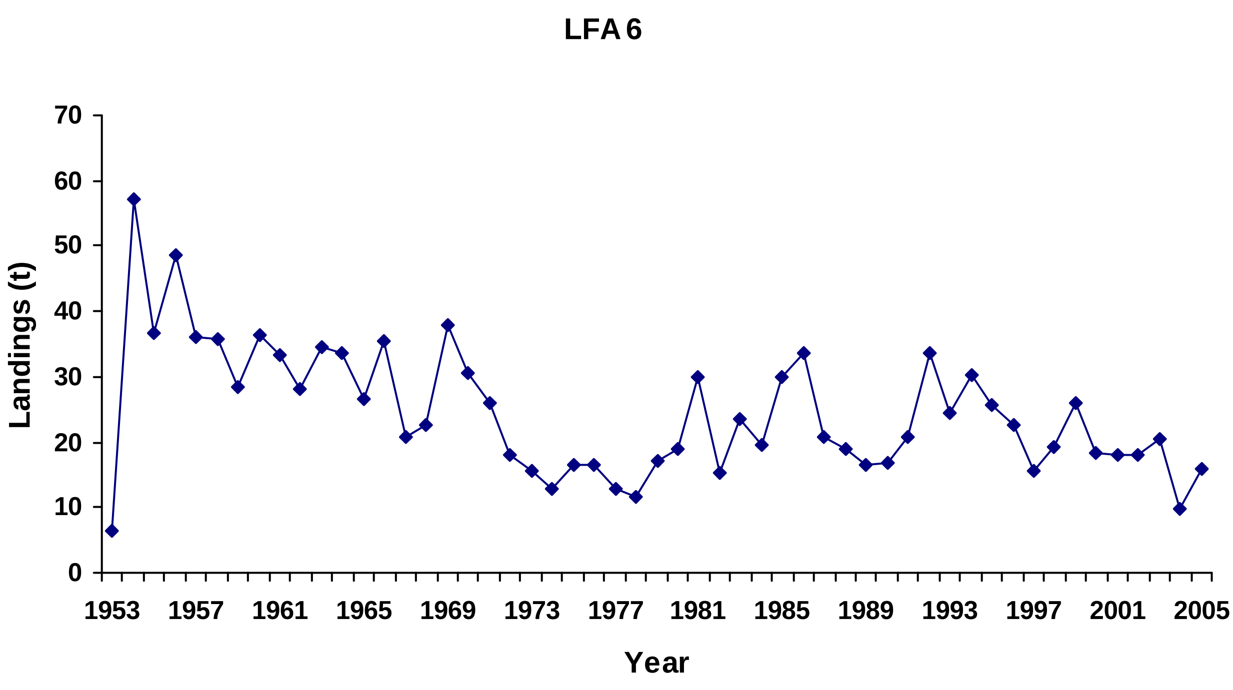
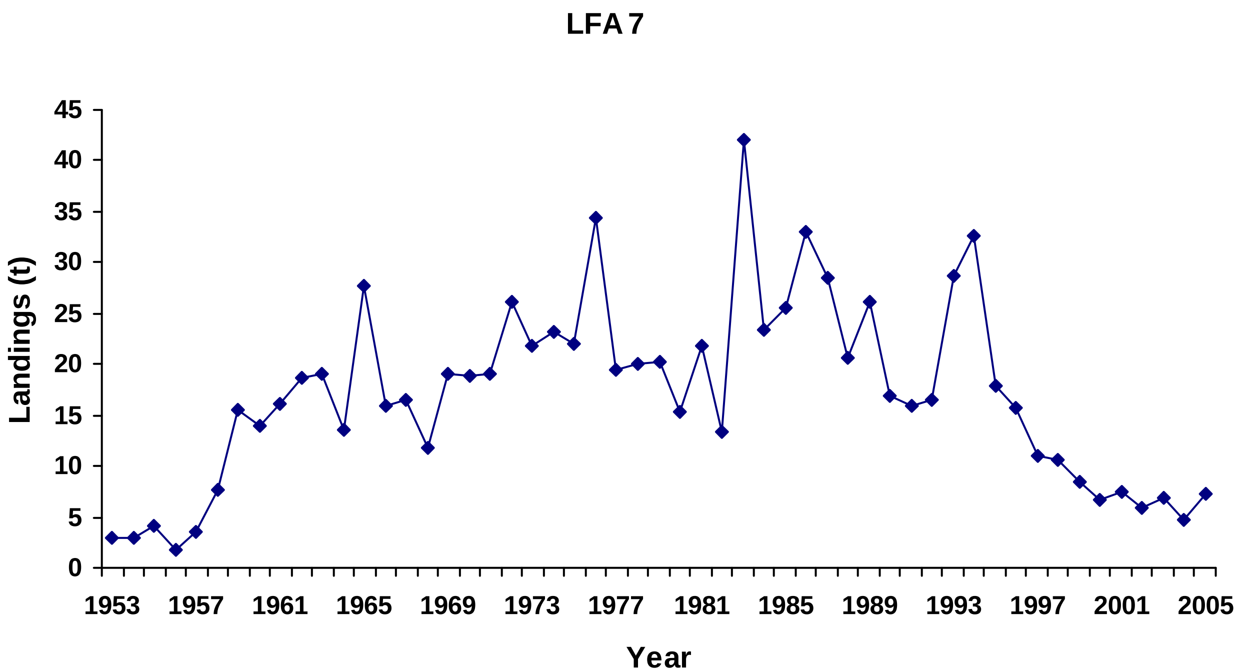
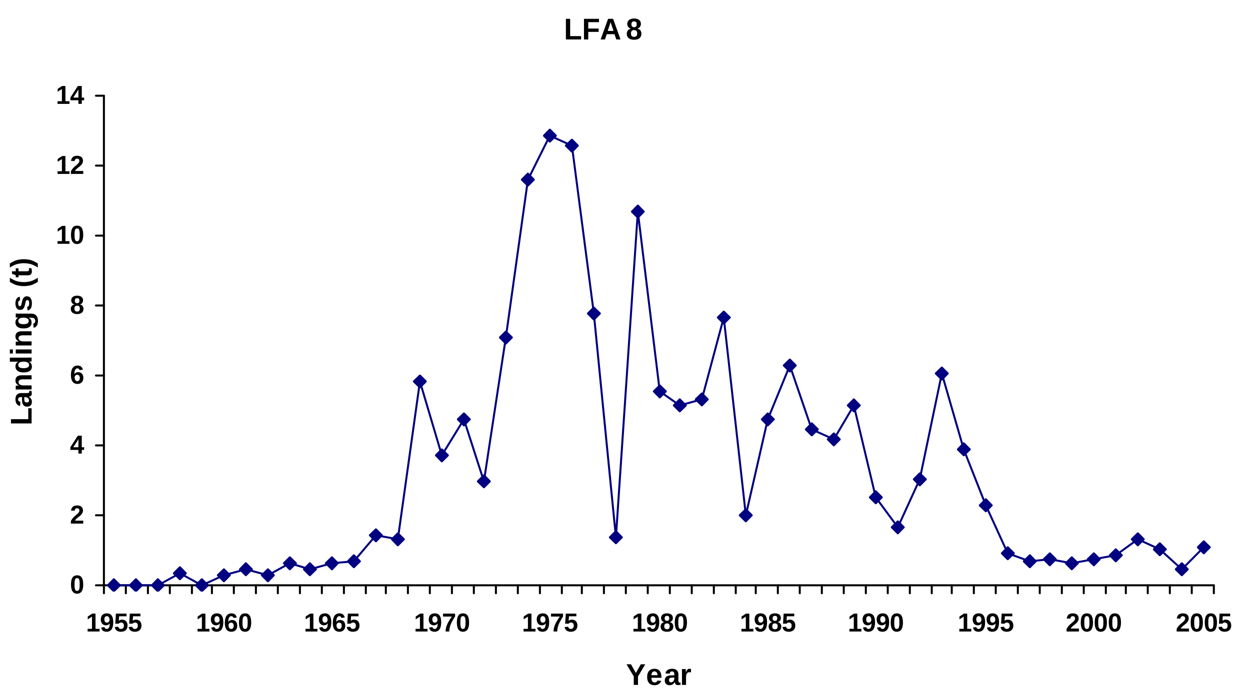


Figure 3: (Cont'd.)

LFA 7



LFA 8



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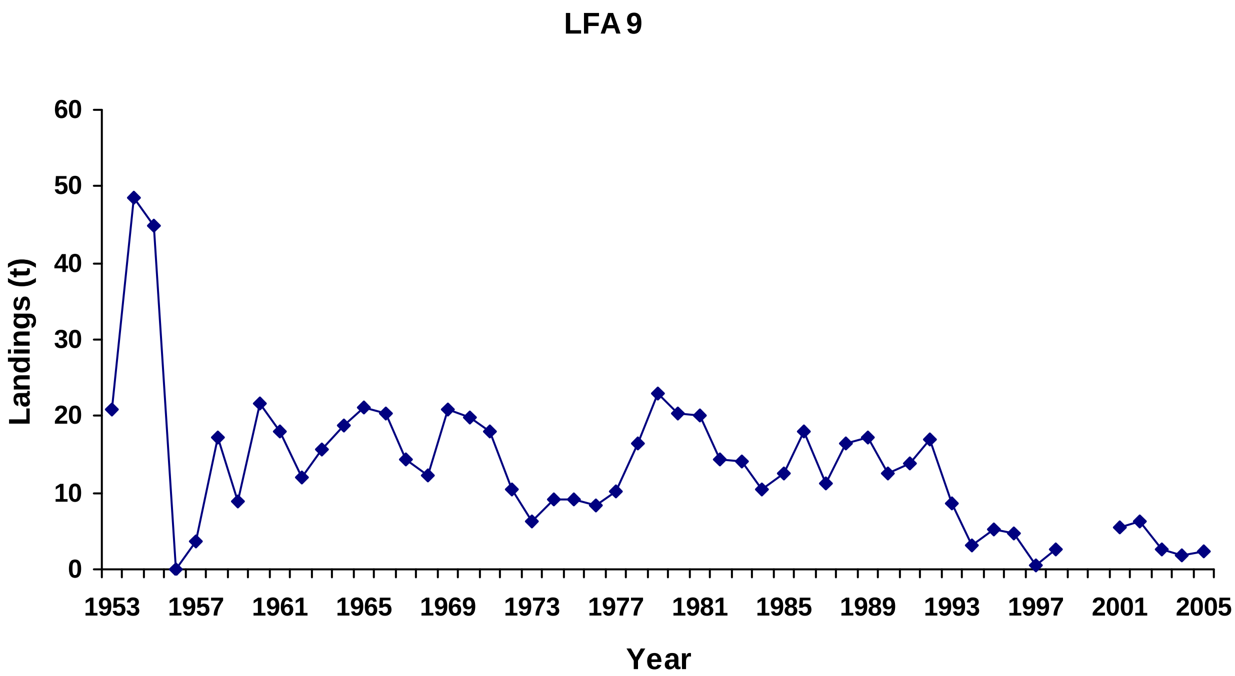


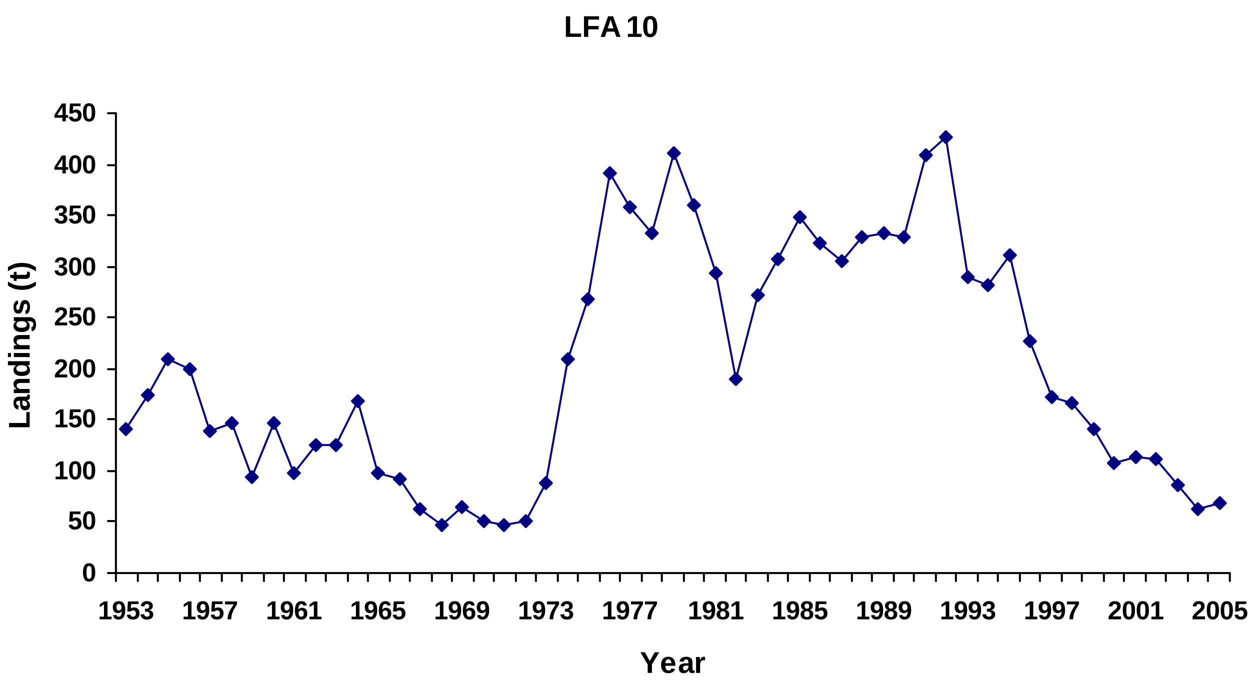
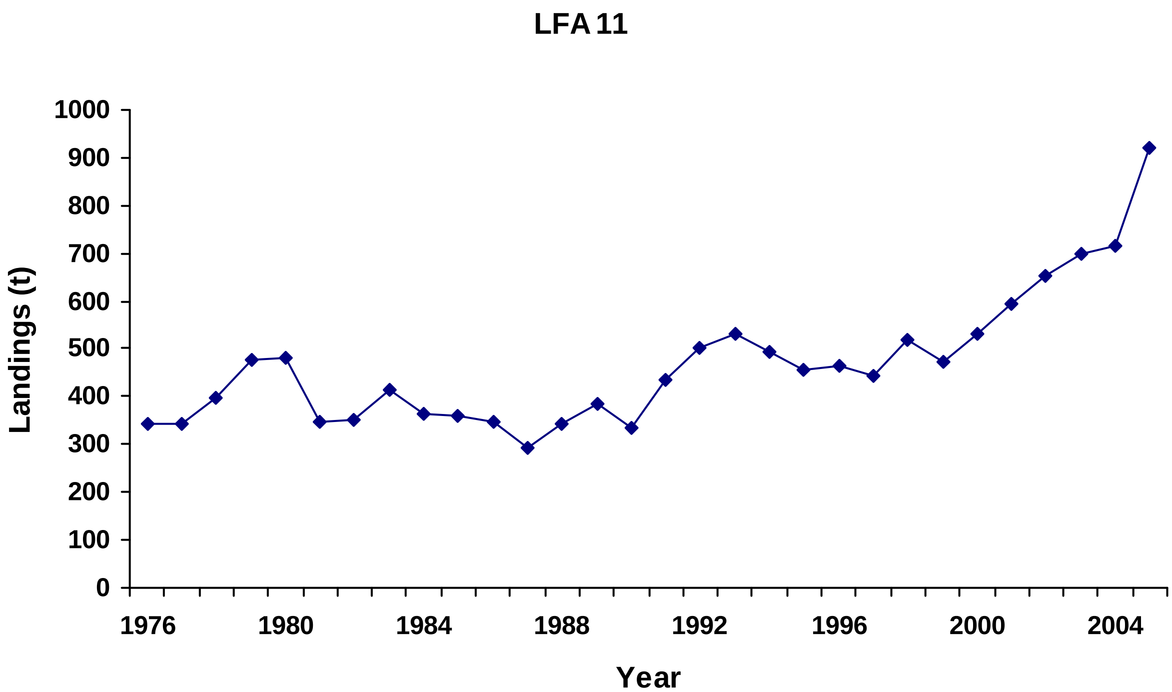
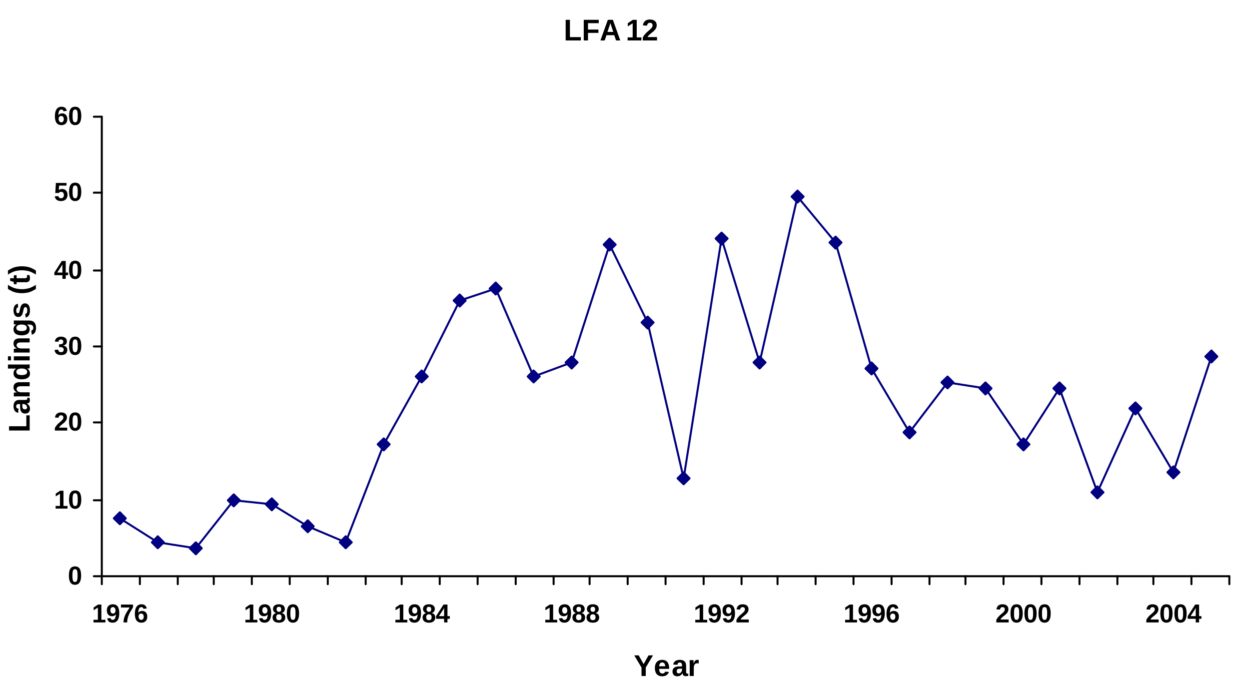


Figure 3: (Cont'd.)





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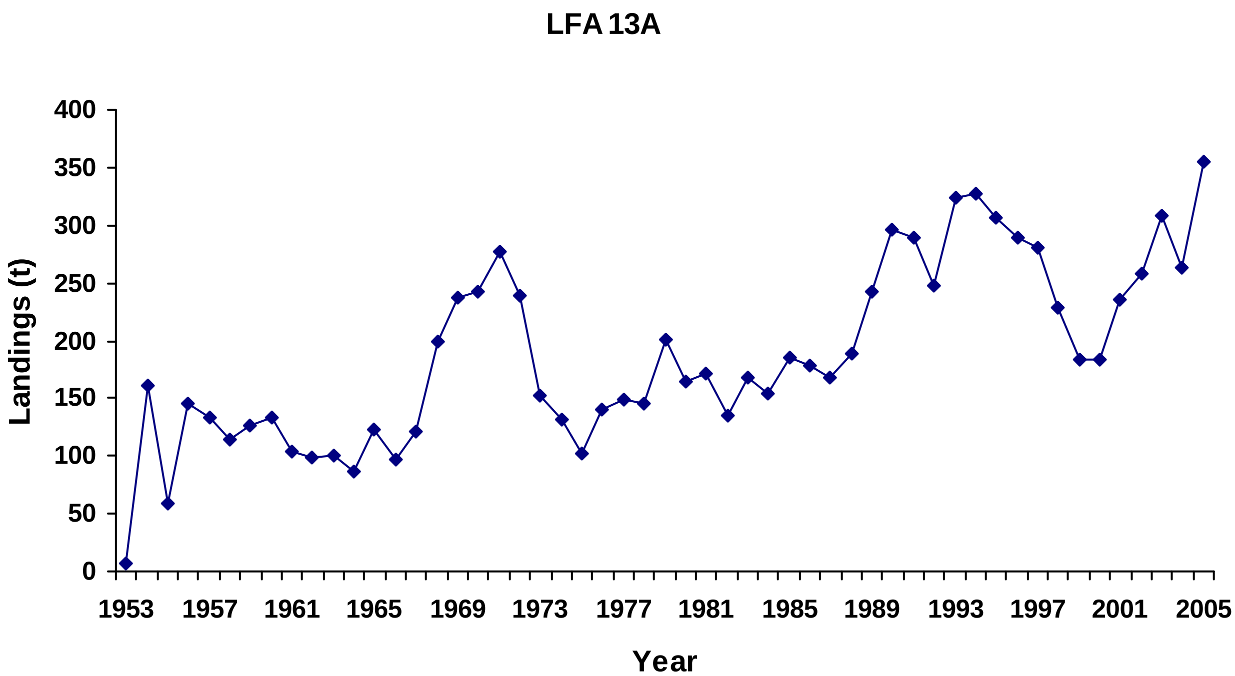

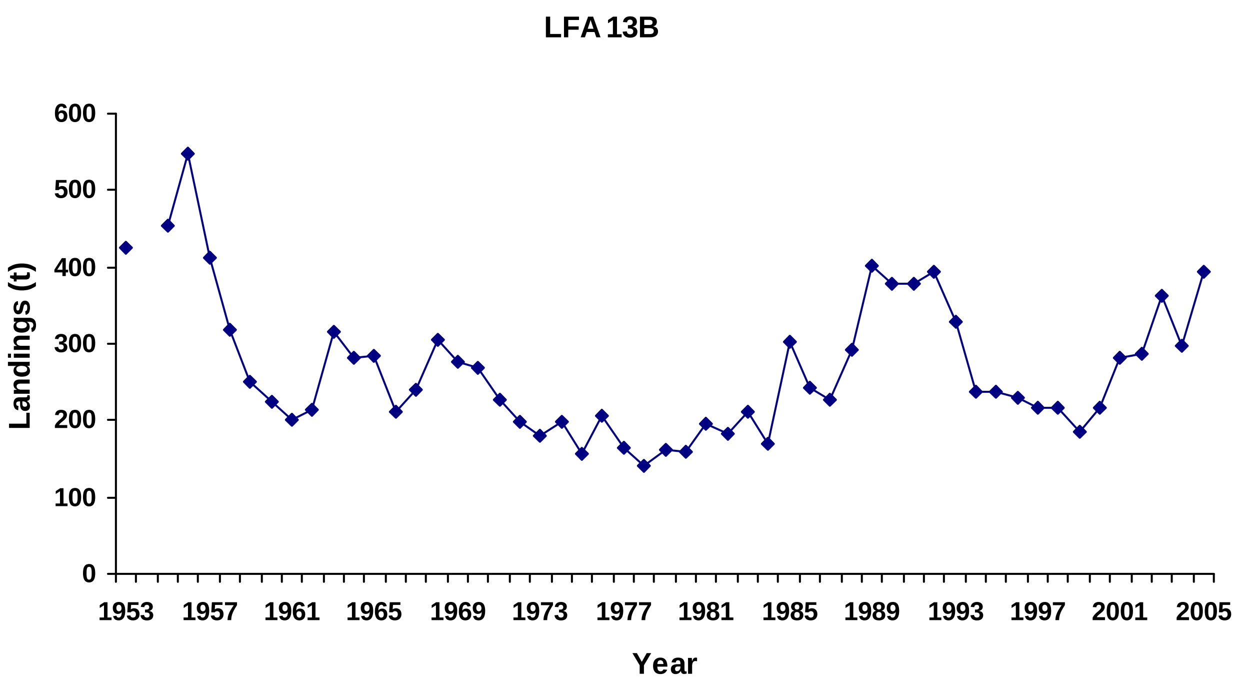

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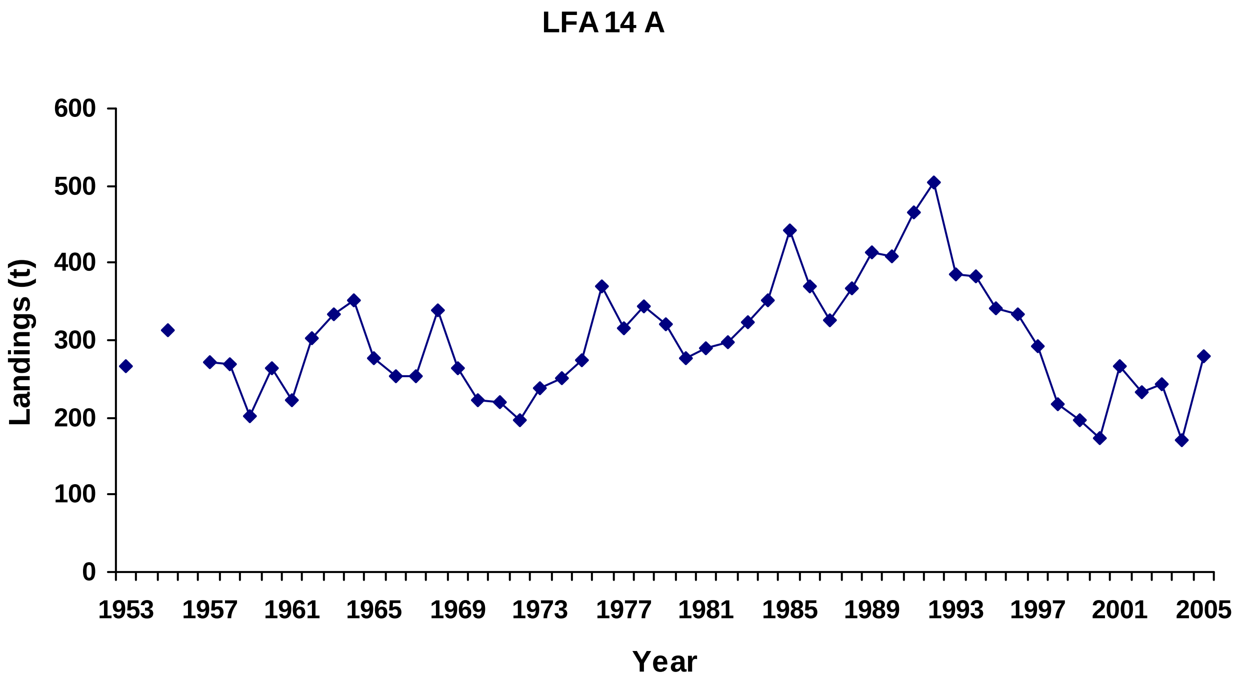

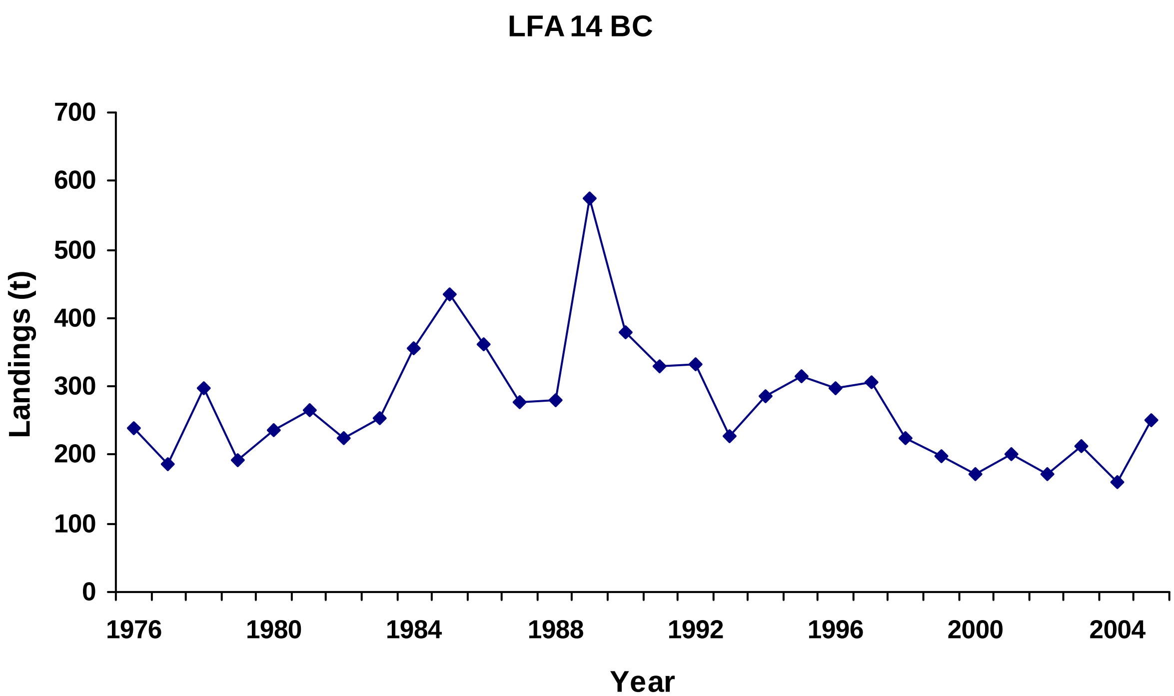

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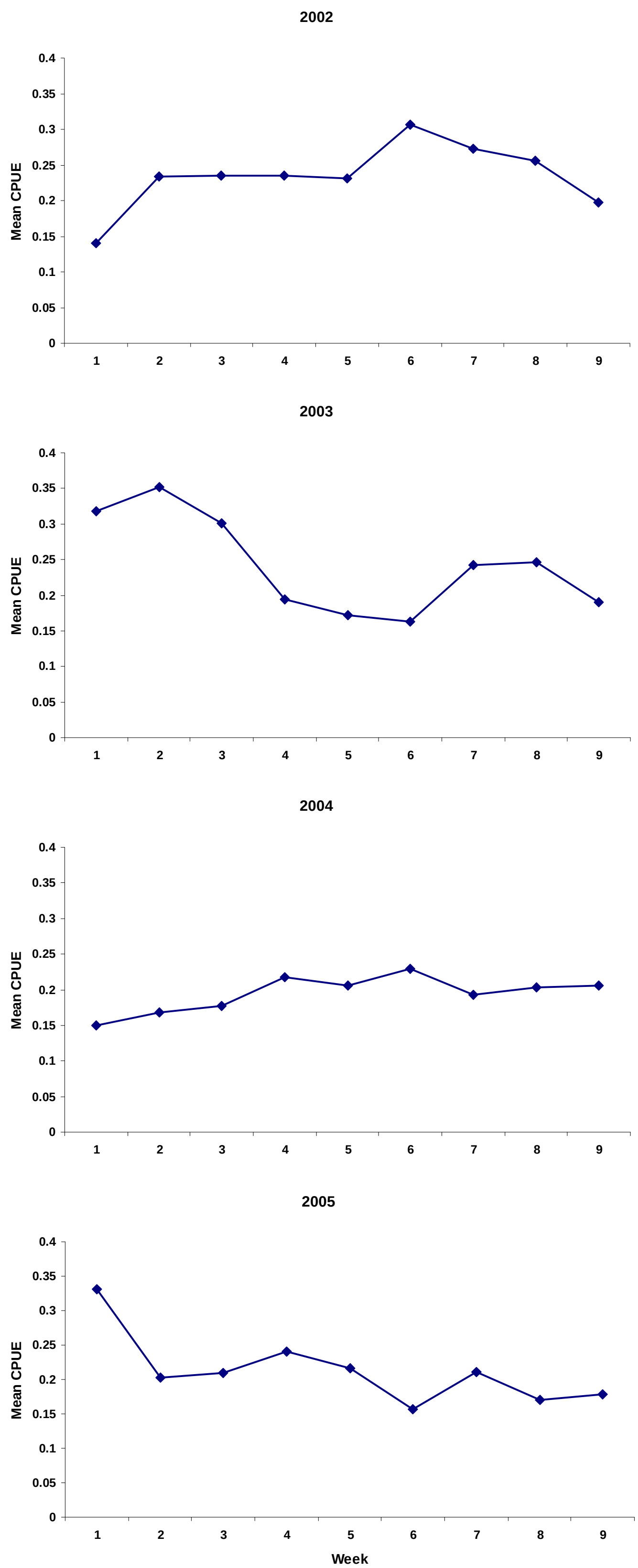


Figure 4: CPUE plots from logbook data collected at Eastport (LFA 5), 2002-05.

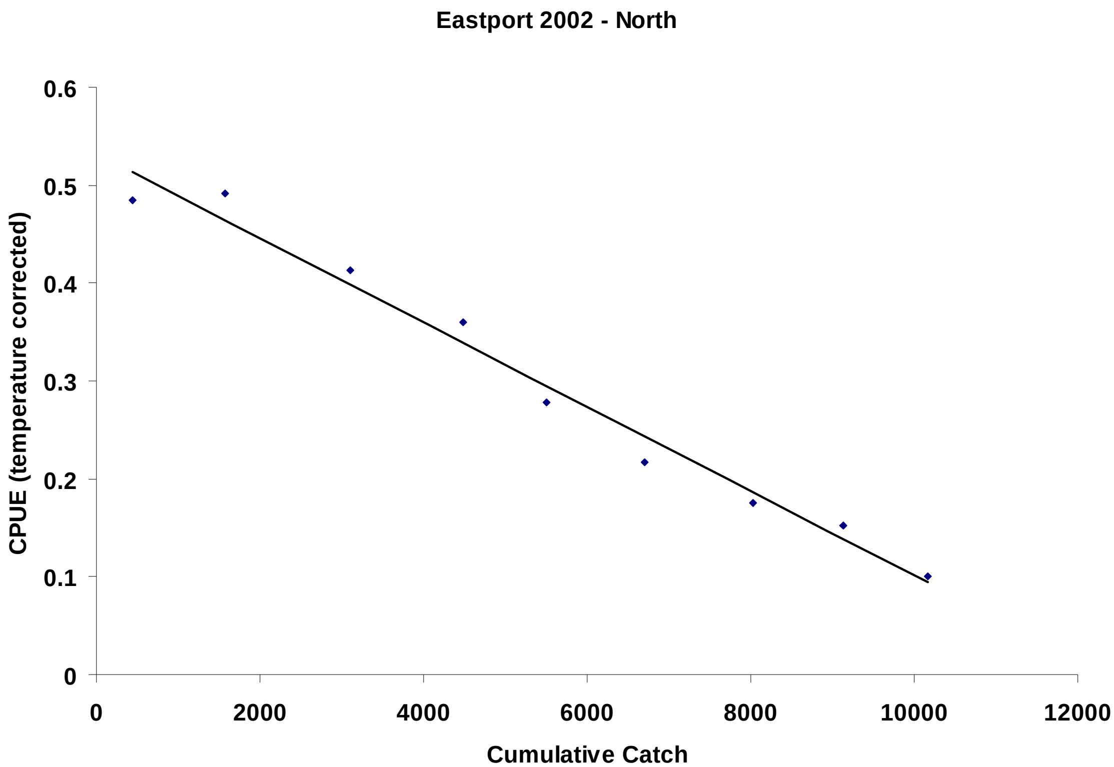


Figure 5: Example of a Leslie plot from 2002 logbook data, from which standing stock in the Eastport region was estimated.

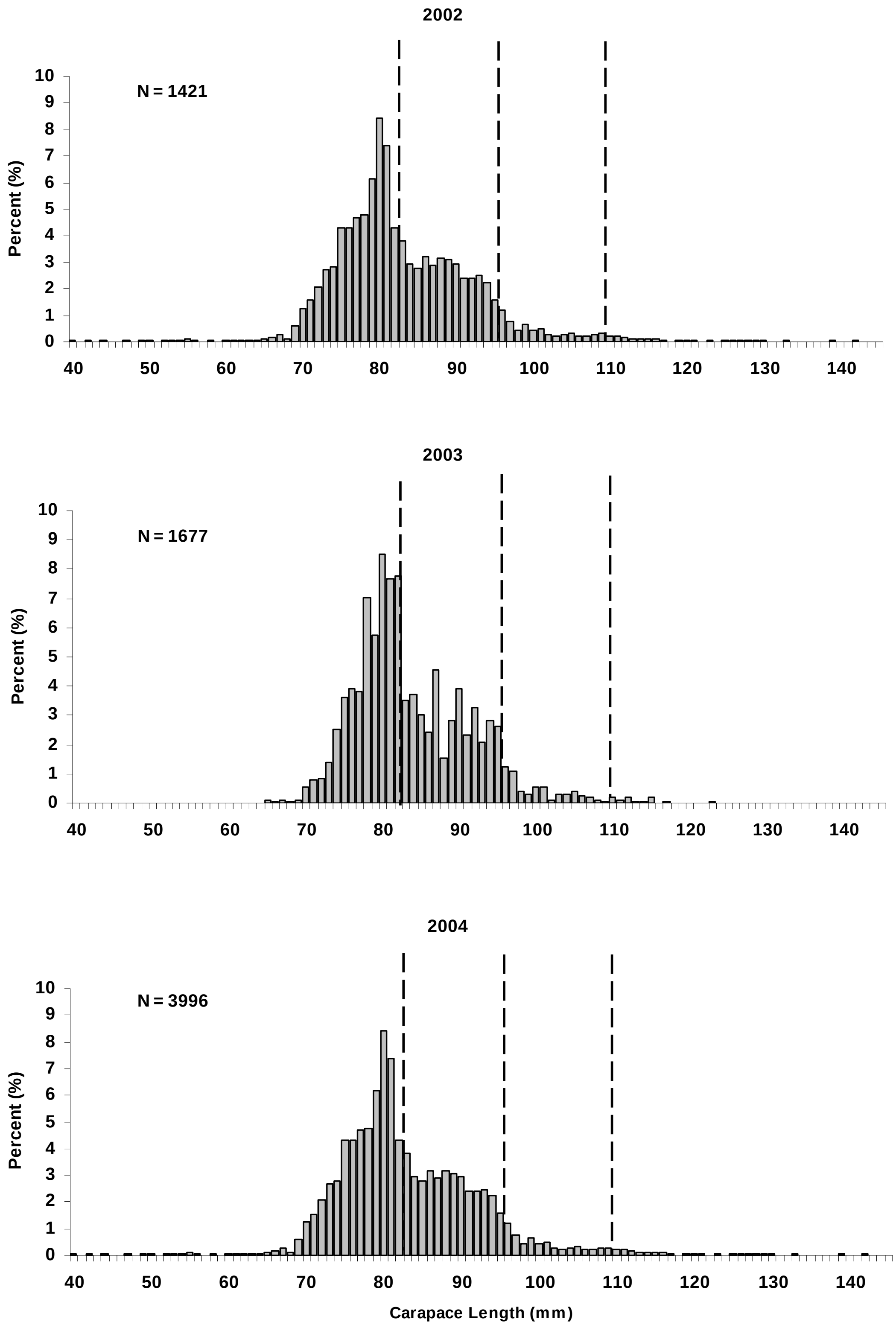


Figure 6: Size frequency distributions for the male component of at-sea sampling in Eastport, 2002-04. Dashed vertical lines indicate recruit and recruit + 1 size ranges.

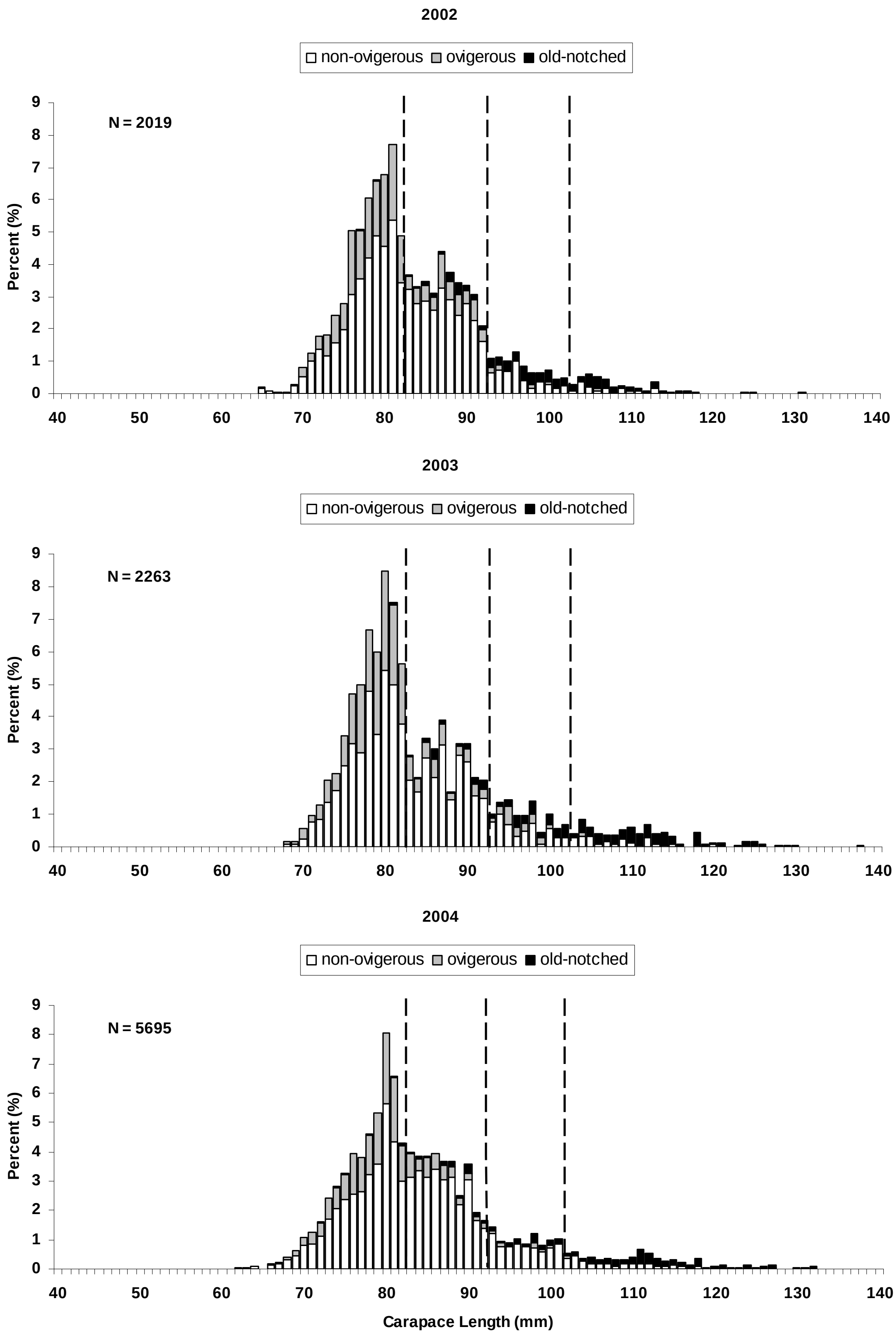


Figure 7: Size frequency distributions for the female component of at-sea sampling in Eastport, 2002-04. Dashed vertical lines indicate recruit and recruit + 1 size ranges.

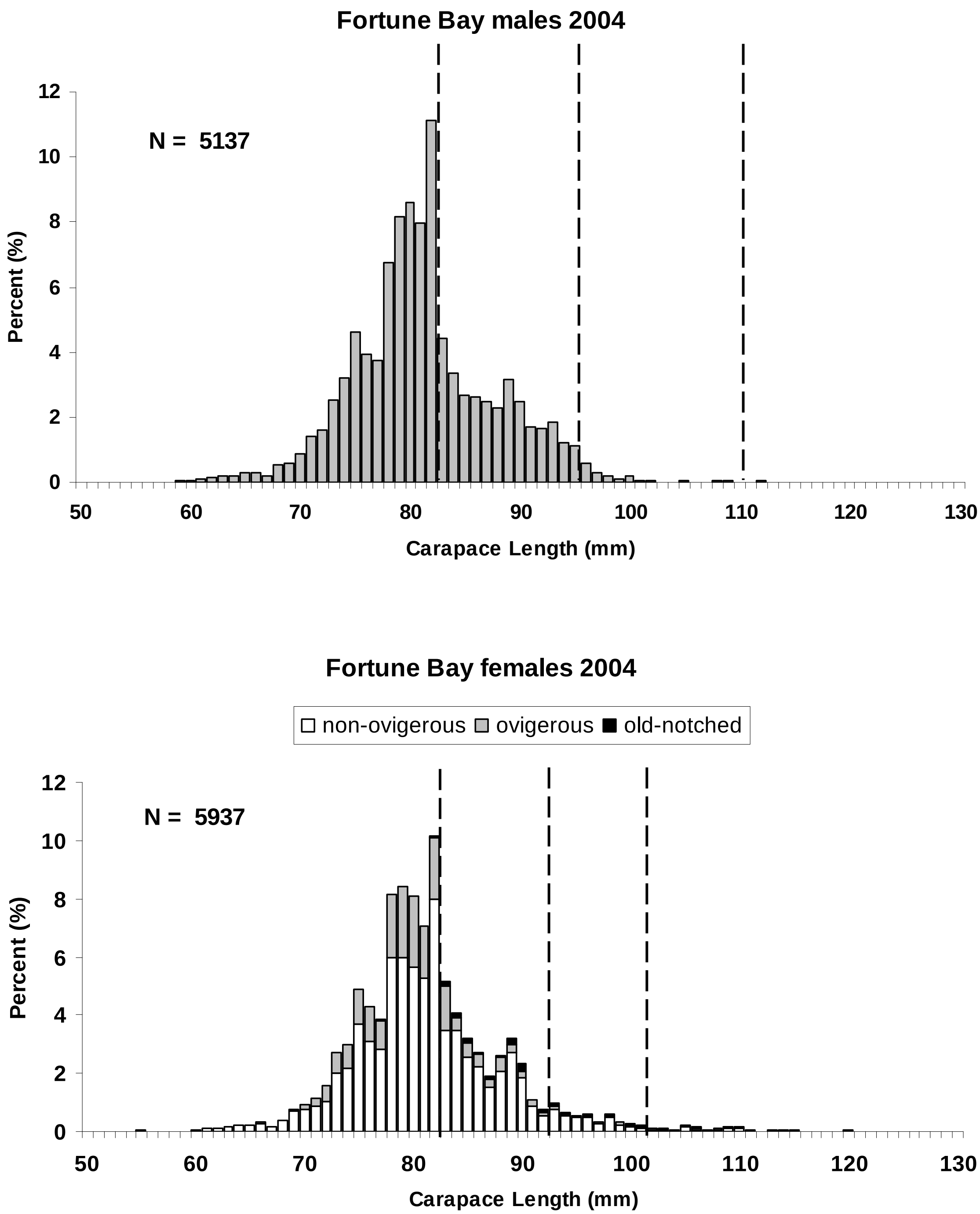
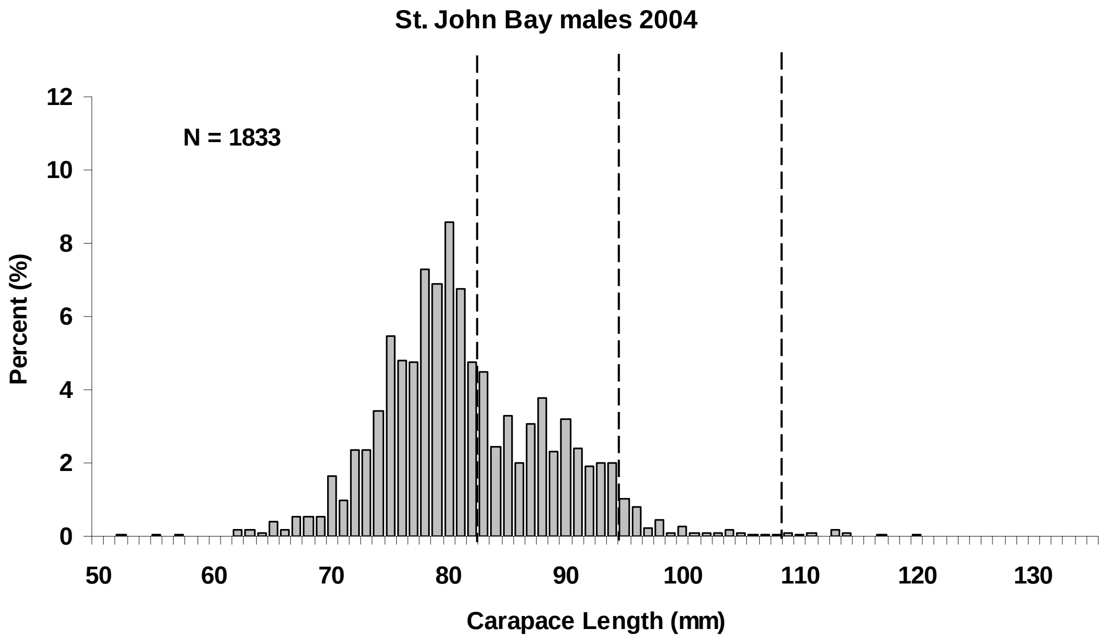


Figure 8: Size-frequency distributions for male and female components of at-sea sampling in Fortune Bay in 2004. Dashed vertical lines indicate recruit and recruit + 1 size ranges.



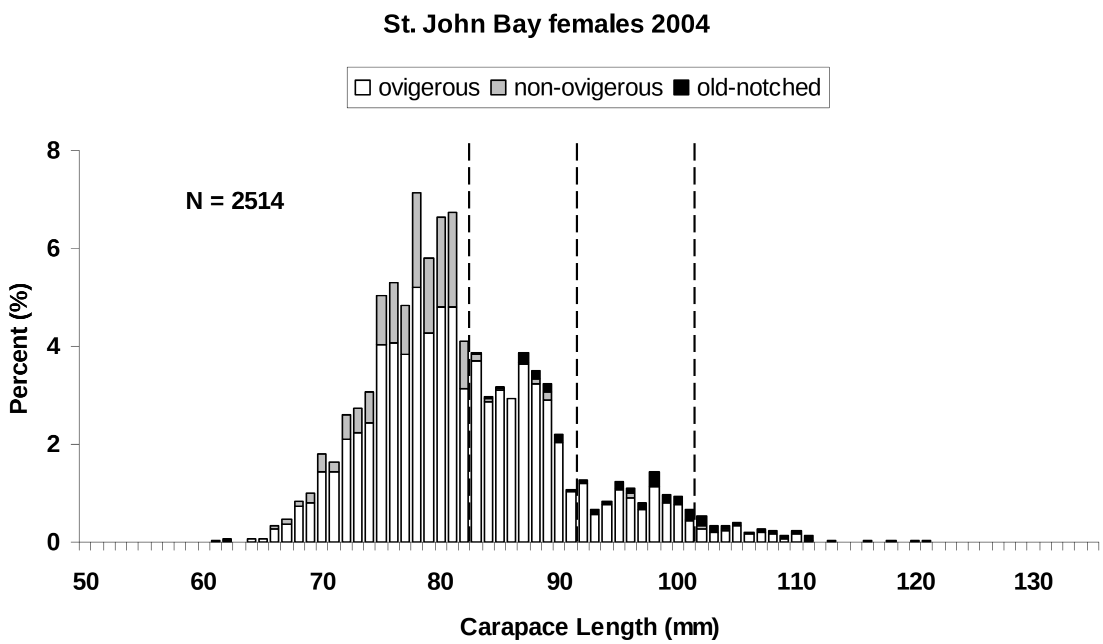


Figure 9: Size-frequency distributions for the male and female components of at sea sampling in St. John Bay (14B) in 2004. Dashed vertical lines indicate recruit and recruit + 1 size ranges.