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Overview of By-catch and Discards in the Maritimes Region Lobster Fishing Areas (LFAs) 27-33 based on *Species at Risk Act* (SARA) At-sea Sampling 2009-2010

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Foreword

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

Research documents are produced in the official language in which they are provided to the Secretariat.

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ABSTRACT

Initial estimates of the incidental catch in the Lobster Fishing Areas (LFAs) 27-33 lobster fishery are presented, including discarded and retained catch of the 50 species caught. The Maritimes Region lobster fishery (LFAs 27-34) was sampled as part of the *Species at Risk Act* (SARA) by-catch study, for levels of incidental catch and discards during 2009-2010. A total of 552 samples were taken on 370 vessels, and 178 mt of lobsters recorded. Species were identified and weights estimated. Lobsters were sexed and measured. Observed weights were expanded to total weight using the ratio of observed weight of incidental species to observed lobsters and total logbook lobster landings. The primary incidental species include Jonah crab and rock crab, of which males may be retained for bait and sale in most LFAs, and various sculpin/sea raven species. The presence and catch rates of species vary among LFAs. The non-lobster portion of the total catch ranged from 1.5% in LFA 31b to 13% in LFA 33. If legally retained crab species are not included, the discarded incidental catches range from 0.1% (LFA 32) to 7.5% (LFA 33). As traps are designed to catch bottom crawling crustaceans, the overall incidental catch, with the exception of crab species, was low. The occurrence of SARA-listed species was low. Lobster under legal size, berried females, v-notched females (LFAs 28-30, 31b-33), females above the maximum size (LFA 30), or in the window size range (LFA 31a) must be returned to the water. Overall lobster discard rates were highest in LFA 27, with an estimated discard rate of 1.27 kg of lobsters discarded for each kg of lobster landed, followed by LFA 32 (0.79 kg), LFA 34 (0.74 kg), LFA 33 (0.47 kg), and LFAs 30-31b (0.22-0.25 kg). Sublegal sized lobsters represent the majority of discards. In LFAs 27, 33, and 34, sublegals exceed 90% of the discards, while in LFAs 30-31b sublegals were 72-79% of the discards. In LFA 32, sublegals represented 53% of the discards.

Aperçu sur les prises accessoires et les rejets dans les zones de pêche du homard (ZPH) 27 à 33 de la région des Maritimes selon l'échantillonnage en mer 2009-2010 effectué en vertu de la *Loi sur les espèces en péril* (LEP)

RÉSUMÉ

Les estimations initiales des prises accessoires de la pêche du homard dans les zones de pêche du homard (ZPH) 27 à 33 sont présentées, y compris les rejets et les prises conservées des 50 espèces capturées. Un échantillonnage a été effectué durant la saison de pêche 2009-2010 dans les zones de pêche du homard (ZPH) 27 à 33 de la région des Maritimes dans le cadre d'une étude sur les prises accessoires menée en vertu de la *Loi sur les espèces en péril* (LEP) afin de déterminer le niveau de ces prises et celui des rejets. Au total, 552 échantillons ont été prélevés sur 370 bateaux, et 178 tm de homards ont été consignés. Les espèces ont été identifiées et les poids estimés. Les homards ont été mesurés et leur sexe a été déterminé. Les poids observés ont été élargis au poids total en utilisant le rapport poids observé des espèces capturées accidentellement sur le poids des homards observés et les débarquements totaux de homards consignés dans les journaux de bord. Les espèces dont les prises accidentelles ont été les plus nombreuses ont été le crabe nordique et le crabe commun, dont les mâles ont été retenus à titre d'appât ou pour la vente dans la plupart des ZPH, ainsi que différentes espèces de chaboisseaux et d'hémitriptères atlantiques. La présence des espèces ainsi que leur taux de prise variaient selon les ZPH. La part des espèces autres que les homards dans le total des prises a varié de 1,5 % dans la ZPH 31b à 13 % dans la ZPH 33. Si l'on ne tient pas compte des espèces de crabes qui ont été retenues légalement, les rejets des prises accidentelles ont varié de 0,1 % (ZPH 32) à 7,5 % (ZPH 33). Étant donné que les pièges sont conçus pour capturer les crustacés se déplaçant sur le fond, il y a eu peu de prises accessoires au total, à l'exception des espèces de crabes. La présence d'espèces inscrites sur la liste de la LEP a été faible. Les homards de taille inférieure à la taille réglementaire, les femelles œuvées, les femelles marquées d'une encoche en V (ZPH 28 à 30, 31b à 33), les femelles dont la taille était supérieure à la taille maximale (ZPH 30) ou dans la fenêtre de tailles interdite (ZPH 31a) ont dû être remis à l'eau. Dans l'ensemble, les taux de rejets ont été les plus élevés dans la ZPH 27, avec un taux de rejets estimé à 1,27 kg de homard rejeté pour chaque kilo de homard débarqué, puis dans la ZPH 32 (0,79 kg), la ZPH 34 (0,74 kg), la ZPH 33 (0,47 kg) et les ZPH 30 à 31b (0,22 à 0,25 kg). Les homards de taille inférieure à la taille réglementaire constituaient la majorité des rejets. Dans les ZPH 27, 33 et 34, les rejets de homards de taille inférieure à la taille réglementaire constituaient plus de 90 % des rejets, tandis que dans les ZPH 30 à 31b ils constituaient entre 72 % et 79 % des rejets. Dans la ZPH 32, les rejets de homards de taille inférieure à la taille réglementaire constituaient 53 % des rejets.

INTRODUCTION

Fishing gear is never 100% selective. In addition to the target species, other species referred to as the by-catch or incidental catch, are caught.

Fishing activity impacts target stocks, as well as other parts of the ecosystem. Additional mortality on other commercial species can undermine the health of those fisheries, while mortality of non-commercial species can impact the marine environment by disrupting the ecosystem balance and biodiversity.

While accounting for the incidental catch and non-retained incidental catch is important, obtaining the information can be difficult and expensive, particularly in the widely dispersed and diverse lobster fishery. While some species were historically recorded in lobster at-sea samples of the commercial catch, a systematic and quantitative examination of the incidental catch in the traps did not occur.

In recognition of the importance of incidental catch and non-retained incidental catch, policies and protocols are being developed in Canada (DFO 2012) and worldwide. Knowledge of the levels of incidental catch and non-retained incidental catch is also an important component of the Marine Stewardship Council (MSC) certification process.

DEFINITION

Several commonly used definitions of the term by-catch include:

- all non-target species whether retained and sold or discarded,
- non-target species which is retained and sold, or
- that part of the capture that is discarded at-sea, dead (or injured to an extent that death is the result).

The latter definition of by-catch and the term discards have a negative connotation for fishermen and environmentalists. Clear definitions are required when referring to the status of various portions of the catch.

To remove the negative connotations associated with the terms the following definitions are used in this report:

- Target species: Species targeted by the fishery. Throughout this report, lobster is the target species.
- Retained targeted species: The portion of target species catch retained for sale or for use and is monitored as fisheries landings.
- Non-retained or discarded targeted species: The portion of targeted species catch returned to the water to comply with management regulations. In the lobster fishery these include the mandated return of lobsters smaller than the minimum legal size (shorts), berried females, females within a windows size range, lobsters larger than a maximum size, and v-notched lobsters. Mortality amongst these discards is considered to be low based on tagging studies.
- Incidental catch or by-catch: The unintended incidental capture of species that are not the target of the fishery.
- Retained incidental catch or by-catch (when allowed by regulations): The portion of non-target species catch retained for sale or for use. Retained by-catch may be a source of bait or income. In the lobster fishery, these include Rock and Jonah crab, and sculpin species.
- Non-retained or discarded incidental catch or by-catch: The portion of non-target species catch not retained but returned to the ocean.

SPECIES AT RISK LOBSTER FISHERY SAMPLING

To address the incidental catch in the lobster fishery, special observer sampling was completed as part of a three-year *Species at Risk Act* (SARA) by-catch project to identify and address knowledge gaps in incidental catch in Maritimes fisheries. Three fisheries were identified as priorities for gathering incidental catch information: the inshore scallop fishery (Sameoto and Glass 2012), the lobster fishery, and the inshore groundfish fishery. Additional at-sea observer coverage was the major source of incidental catch information for this report. The additional observer coverage augmented the existing coverage paid for by various fleet sectors or other science activities. The lobster sampling mainly occurred during the 2009-2010 fishing season.

The primary objective of the sampling was to obtain information about incidental catch of non-target species in commercial lobster traps (LFAs 27-41). In addition, information on lobster and crab was also collected for analysis of population size structure, catch, and effort.

The primary objective of the SARA lobster fishery sampling was to collect length and weight information on the following SARA/COSEWIC (Committee on the Status of Endangered Wildlife in Canada) species, as well as sample every trap containing these species.

The list of SARA/COSEWIC species include: cusk, cod, skates, wolffish, haddock, salmon, pollock, monkfish, ocean pout, shad, flounders, American eel, and striped bass.

The goal of the sampling was to identify the primary species of incidental catch and to estimate the level of discard, by weight. Sampling occurred in LFAs 27, 30, 31a, 31b, and 32. However, in this initial study, priority was given to LFAs 33 and 34, which have the largest fisheries and occur in areas with the highest concern of SARA listed species capture. Sampling in LFA 41 was part of the ongoing industry funded sampling.

Reported estimates are for total non-retained incidental catch by the fishery during the 2009 (LFAs 27-32) and 2009-2010 (LFAs 33, 34) fishing seasons. Accounting and adjusting for post-release survival is beyond the scope of this work. Survival is believed to be high for most crustaceans and mollusks and lower for most fish species. Fish whose stomachs are extruded when brought to the surface from deeper water have little chance of survival.

DATA AND METHODS

At-sea observers are deployed to monitor and record fishing activities and record the location of the fishing activity and all associated catch information, including both retained and discarded incidental catch. At-sea observers record estimates of all species caught during fishery operations. Length measurements are taken of selected species including lobsters. The length measurements are not used in the determination of weights of the incidental catch but lobster length and sex are used in estimation of the various types of lobster discards. At-sea monitoring information is recorded in the Industry Surveys Database (ISDB) which is maintained by Fisheries and Oceans Canada (DFO), Maritimes Region.

Estimates are based on data obtained during the observed trips of a single fishing season. The marine ecosystem is dynamic and changes in species composition and abundance over time affect the species and their abundance in the incidental catch. Changes in timing and location of the observed trips, fishing distribution, practices, and gear would also influence incidental catch species and levels.

LFA 41 is the only LFA with an ongoing sampling program that could provide annual the estimates of incidental catch. To monitor and improve the estimates of incidental catch and non-retained incidental catch periodic sampling of other LFAs is recommended.

OBSERVER COVERAGE

The majority of samples were collected from LFA 33 and LFA 34. These LFAs have the longest season and the most diverse fisheries.

Sample locations are presented in Figure 1. Sample numbers, by LFA, are provided in Table 1. Sampling dates, weekly sampling levels, total reported landings, and effort in LFAs 27-32 are presented in Figure 2.

The lower sample number in LFAs 27-32 resulted in less precise estimates with wider standard errors (SE). Results from LFA 30, contained three samples concentrated in the eastern edge of the LFA, and must be used with caution. Similarly, there are large portions of LFA 27, LFA 31b, and LFA 32 with no samples. LFA 28 and LFA 29 were not sampled. Data is also not available for LFAs 35-38.

LANDINGS DATA

Lobster fishermen have been required to maintain logbooks by grid area since 1972 in LFA 41, 1998 in LFA 34, and 2003 in LFAs 27-33. Logbook records include boat name, date fished, location fished (LFAs 27-34 grid number; LFA 41 Latitude/Longitude), traps hauled, and weight landed.

TREATMENT OF DATA

LFAs 27-32 were analysed by LFA and treated as a single time period.

To account for potential spatial and season differences, LFA 33 was divided into four subareas: east nearshore, east offshore, west nearshore, and west offshore and two seasons: fall and spring (Tremblay et al. 2012).

LFA 34 was analysed by the 2006 assessment grid areas (1-7) (Pezzack et al. 2006) and three seasons: fall, winter, and spring.

The totals for LFAs 33 and 34 were obtained by combining the estimates, weighted by the proportion of the landings for each area and time period, for 2009-2010.

INCIDENTAL CATCHES AND NON-RETAINED INCIDENTAL CATCH ESTIMATION

The weight of incidental catch and non-retained incidental catch can be estimated from information collected by at-sea observers and the fishery logbook information (Gavaris et al. 2009). A ratio estimator method is used to estimate incidental catch and non-retained incidental catch. The incidental catch rate is based on the ratio of the observed weight of incidental catch and the observed weight retained lobster as estimated by the at sea observer. The ratio is applied to the lobster landings for the trip as recorded in the Maritimes Fisheries Information System (MARFIS) database to provide the estimated incidental catch for the trip.

Overall incidental catch is calculated by prorating the totals for the selected time periods and areas by total landings then summing them over the season and LFA. The Ratio method could use either effort or landings data to expand estimated incidental catch and non-retained incidental catch values to the total fishery. Both have advantages and disadvantages, but in this study, landings were used due to the greater reliability of total landings data.

RETAINED INCIDENTAL CATCH = LOBSTER LANDINGS (observer estimated retained incidental catch/observer estimated kept lobster)

NON-RETAINED INCIDENTAL CATCHES = LOBSTER LANDINGS (observer estimated non-retained incidental catch/observer estimated kept lobster)

TARGET SPECIES

The ratio of discarded lobsters to kept lobsters can be obtained using the same ratio method as the incidental catch.

$$\text{NON-RETAINED LOBSTER CATCHS} = \text{LOBSTER LANDINGS} \left(\frac{\text{observer estimated non-retained lobster catch}}{\text{observer estimated kept lobster}} \right)$$

At-sea observers did not always estimate weight of the following categories of lobster discards: undersized, berried females, maximum size (LFA 30), and window size (LFA 31a). Information recorded on lobster size and sex was used to partition the weight into the following categories: shorts, berried females, windows (LFA 31a), and maximum size (LFAs 30 and 41).

The individual size and sex data recorded by at-sea observers was converted to weight to calculate the proportion of each size/sex category in the total observer estimate of the non-retained lobster catch. V-notched females were not always recorded and, therefore, were not estimated. For most LFAs, the numbers of v-notched females are expected to be low; however, in LFAs 31b and 32, which have active v-notching programs, the numbers could be significant.

RESULTS AND DISCUSSION

SPECIES CAUGHT

The list of species identified by at-sea observers is provided in Table 2 and includes both the common and scientific name. Within subsequent tables and graphs, some related species were combined, most notably the flat fish, hake, and sculpin species.

ESTIMATED TOTAL WEIGHT OF DISCARD, KEPT AND TOTAL

The estimated total discard, kept, and total catch weight for each species by LFA is provided in Table 3. These represent an estimate of the totals for the 2009 (LFAs 27-32) or 2009-2010 (LFAs 33-34) seasons. The species are sorted from highest to lowest total weight caught in all LFAs. Estimates of LFAs 34 and 41 are preliminary and will be updated in future documents but are provided to allow comparisons of the LFAs.

Table 4 presents the same discard, kept and total catch data as in Table 3; however, the data are expressed as kilogram (kg) per metric ton of lobsters landed. This value allows for comparison of the relative by-catch levels in each LFA.

The retained and discarded non-lobster catch are presented graphically for each LFA in figures 3-7, discards (a) and retained (b) plotted separately.

To allow for the comparison of by-catch levels of major species between LFAs, estimated weight of discards and the estimated weight of discards / metric ton of lobsters landed are presented in figures 8 (a, b) and 9 (a, b).

The most common by-catch species, measured as kg/metric ton of lobster landed, include Jonah Crab, rock crab, sculpins, cod, cusk, and hermit crabs. The varying numbers of these species in the incidental catch between LFAs reflects differences in species distribution, fishing depths, and seasons. Jonah crab, for example, is more common to the west in LFAs 33-41. Cusk and goosefish are caught more frequently in the deeper waters in LFAs 34 and 41. Cunnners are caught in large numbers in LFA 27 but rarely in other LFAs.

RETAINED BY-CATCH

LFAs 31a and 31b have no recorded retained by-catch, and LFA 27 has little retained by-catch which is restricted to sculpins. These fisheries are permitted to retain rock crab and sculpins for

bait. The lack of retained rock crab in LFAs 27, 31a, and 31b is inconsistent with information previously obtained from fishermen, which indicated this species is widely used for bait. Whether fishing techniques differed in the presence of at-sea observers, the observer failed to record rock crab, or there is a low use of by-catch for bait warrants further investigation.

Similarly, there are cases where species which restricted from being retained were recorded by the observer as kept. However, recorded levels are very low and it is unclear if species were retained or a result of coding errors.

PERCENTAGE OF THE TOTAL CATCH THAT IS NOT LOBSTER

Table 5 gives the percentage of the total catch, by weight, that was not lobster and percentage of the total catch not a species that could be legally kept (depending upon the LFA, fishermen can legally retain rock crab, Jonah crab and sculpins).

Figure 10 shows the discard weight and kept weight of species other than lobsters per metric ton of lobster landings

The non-lobster portion of the total catch varies from 1.5% in LFA 31b to 15% in LFA 34. In LFA 41, it ranges from 13-23%, but in this fishery there is a quota for both lobster and Jonah crab.

If those species which can legally be kept for bait or sale are not included then the discarded by-catch ranges from less than 1% to 7.5% of the total catch.

LOBSTER DISCARD LEVELS

In the lobster fishery, lobsters under the legal size and berried females must be discarded. Depending upon the LFA, lobsters over a maximum size (LFA 30), in a window size (LFA 31a), or v-notched must also be discarded (Figure 11).

Overall lobster discard rates are highest in LFA 27, with an estimated discard rate of 1.27 kg of lobsters discarded for each 1 kg of lobster landed (Table 6), followed by LFA 32 (0.79 kg), LFA 34 (0.74 kg), LFA 41 5Zc (Georges Bank - 0.58kg) and LFA 33 (0.47 kg).

With the exception of LFA 41, sublegal sized lobsters represent the majority of discards. In LFAs 27, 33 and 34, sublegal sized lobsters exceed 90% of the discards while in LFAs 30-31b they range between 72-79%. In LFA 32, sublegal sized lobsters represent 53% of the discards.

In LFA 41, the catch is dominated by larger mature lobsters and the majority of discards are berried females and lobsters over 6 pounds (lbs). The 6 lb limit is not a condition of licence but company policy which is applied to most LFA 41 landings.

Lobster discard rates can be dependent upon the timing of the samples as illustrated in Figure 12, which presents the weekly ratio of Discard: Legal Kept lobsters in the Little River (LFA 27) at-sea samples. The early part of the season is dominated by legal lobsters and low discard levels. Toward the end of the season, the majority of remaining lobsters are sublegal or berried females which must be discarded. To accurately estimate the overall discard rate, estimates over the entire season are required.

High lobster discards in some areas and periods of the year could be an issue of concern. Although tagging studies have shown high survival rates of lobster, multiple captures could increase the potential for damage and stress on the lobster which could affect moulting or egg extrusion. The potential benefits of measures which help reduce the discard rate of undersized lobsters (i.e. escape vent modifications, season length and timing) and berried females. (i.e. timing of season) warrants further investigation.

UNCERTAINTY

At the Canadian Science Advisory Secretariat and LFA advisory meetings, conflicting reports on the quality of at-sea observers performance were presented. In light of these conflicting reports, the quality of the data requires further investigation. Additional data sources could be compared with some of the observer data (i.e. lobster at-sea sampling data, the Fishermen and Scientists Research Society/Fisheries and Oceans Canada ecosystem sampling (den Heyer et al. 2010), cusk sampling in LFA 34 (Harris and Hanke 2010)).

The lack of systematic sampling of spatial and temporal aspects of the fishery has resulted in data gaps with large areas and time periods not sampled. This increases the uncertainty of the estimates, especially in LFAs where sample numbers were low.

Trap design and bait were not recorded and thus cannot be assessed, but should be recorded if this study is repeated.

The use of landings to extrapolate total amounts from the collected samples was based on the greater completeness and accuracy of the landings data compared to the effort data; however, it was suggested that future analysis should also consider the use of effort data and expression of results in terms of effort levels (trap hauls).

CONCLUSIONS

Preliminary results from the 2009-2010 SARA by-catch study provided the first systematic data on by-catch and discards in LFAs 27-34, giving an overview of the species caught, the estimated by-catch and discard (kg) and the rate (kg/ton lobster landed) in the fishery (kg).

Species presence and catch rates vary greatly among LFAs. The non-lobster portion of the total catch varies from 1.5% in LFA 31b to 13% in LFA 33. If species that can be legally retained for bait or sale are excluded, discarded by-catch ranges from 0.1% (LFA 32) to 7.5% (LFA 33) of the total catch.

Incidental catch is generally low in the lobster fishery as the traps are designed to attract and retain lobsters. The dominant incidental catch are crab species which can legally be retained and if released are believed to have a high survival rate.

Low levels of SARA/COSEWIC species of concern were recorded (Table 7) and the observed levels in the lobster fishery do not offer a concern for these species.

The sampling of incidental catch varied with area and will likely vary over the season. A systematic and controlled sampling program is required to fully document the variability.

Overall lobster discard rates were highest in LFA 27 with an estimated discard rate of 1.27 kg of lobsters discarded for each kg of lobster landed, followed by LFA 32 (0.79 kg), LFA 34 (0.74 kg), LFA 33 (0.47 kg), and LFA 30-31b (0.22-0.25 kg).

Sublegal sized lobsters represent the majority of discards. In LFAs 27, 33, and 34 they exceed 90% of the discards, while in LFAs 30-31b they range between 72-79%. In LFA 32, sublegal sized lobsters represent 53% of the discards.

Periodic sampling of the fishery for incidental catch and lobster discard levels would provide important information on the effect of the fishery on the ecosystem.

REFERENCES

- den Heyer, C.E., Bundy, A., and MacDonald, C. 2010. At-sea catch analysis of inshore Scotian Shelf lobster fishery and 4VsW commercial index groundfish sentinel fishery. Can. Tech. Rep. Fish. Aquat. Sci. 2890: viii + 39 p.
- DFO. 2012. [Guidance related to bycatch and discards in Canadian commercial fisheries](#). DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2012/022. 17 p.
- Gavaris, S., Clark, K.J., Hanke, A.R., Purchase, C.F., and Gale, J. 2009. Overview of discards from the Canadian commercial fisheries in NAFO divisions 4V, 4W, 4X, 5Y and 5Z for 2002-2006. Can. Tech. Rep. Fish. Aquat. Sci. 2873: vi + 112 p.
- Harris, L.E., and Hanke, A.R. 2010. [Assessment of the status, threats and recovery potential of cusk \(*Brosme brosme*\)](#). DFO Can. Sci. Advis. Sec. Res. Doc. 2010/004. vi + 23 p.
- Pezzack, D.S., Tremblay, J., Claytor, R., Frail, C.M., and Smith, S. 2006. [Stock status and indicators for the lobster fishery in Lobster Fishing Area 34](#). DFO Can. Sci. Advis. Sec. Res. Doc. 2006/010. vi + 141 p.
- Sameoto, J.A., and Glass, A. 2012. An overview of discards from the Canadian inshore scallop fishery in SFA 28 and SFA 29 West for 2002 to 2009. Can. Tech. Rep. Fish. Aquat. Sci. 2979: vi + 39 p.
- Tremblay, M.J., Pezzack, D.S., Denton, C., Cassista-Da Ros, M., Smith, S.J., Reeves, A.R., Silva, A., and Armsworthy, S. 2012. [Assessment of lobster off the coast of eastern Cape Breton and the eastern and south shores of Nova Scotia \(LFAs 27-33\)](#). DFO Can. Sci. Advis. Sec. Res. Doc. 2012/022. iv + 114 p.

TABLES

Table 1. Summary of samples with number of observed trips, number of vessels observed, weight of kept lobster, weight of discarded lobsters, and subareas and time periods used in estimation of incidental catch numbers by LFA.

Data	LFA 27	LFA 30	LFA 31a	LFA 31b	LFA 32	LFA 33	LFA 34	LFA 41
Number of Observed Trips	40	3	15	23	11	172	288	48
Number of Vessels Observed	35 ¹	2 ²	11	17 ³	7 ⁴	111 ⁵	187 ⁶	2 ⁷
Weight of Kept Lobsters	4,262	1,407	5,448	8,922	1,269	17,023	64,570	329,228
Weight of Discarded Lobsters	5,464	363	1,248	1,975	1,002	13,555	51,250	146,530
Area and Subareas	LFA	LFA	LFA	LFA	LFA	East Inshore Offshore West Inshore Offshore	Grid Areas 1, 2a, 2b, 3, 4, 5-6, 7	Assessment Areas Crowell SW Browns SE Browns Georges Basin Georges Bank
Time Periods	Season	Season	Season	Season	Season	Fall Nov-Feb Spring Mar-May	Fall Nov-Jan Winter Feb-Mar Spring Apr-May	Quarters Jan-March April-June July-Sept Oct-Dec

Notes:

¹ 3 vessels sampled 2 days in a row.

² 1 vessel sampled 2 days in a row.

³ 1 vessel sampled 2 days in a row.

⁴ 3 vessels sampled 2 days in a row.

⁵ 10 vessels sampled 2 days in a row; 4 on 3 days in a row; 3 twice in 3 days.

⁶ 13 vessels sampled 2 days in a row; 1 on 4 days in a row; 11 twice in 3 days.

⁷ Only 2 vessels in the fishery.

Table 2. List of species, with common and scientific names and group names, which were combined for the reporting and estimating of incidental catch

Major Groups	Common Name	Scientific Name or Group
Lobster	Lobster	<i>Homarus americanus</i>
Crabs	Rock crab	<i>Cancer irroratus</i>
	Jonah crab	<i>Cancer borealis</i>
	Green crab	<i>Carcinus maenas</i>
	Snow crab	<i>Chionoecetes opilio</i>
	Spider crab (ns)	Spider Crab
	Toad crab	<i>Hyas araneus</i>
	Red deepsea crab	<i>Geryon quinquedens</i>
	Swimming crab (sp).	Portunidae
	Brachyuran crabs	Brachyuran crabs
	Northern stone crab	<i>Lithodes maja</i>
	Hermit crab	Paguridae
Squat lobster	<i>Munida valida</i>	
Shrimp	<i>Pandalus propinquus</i>	<i>Pandalus propinquus</i>
Gastropod	Whelk	<i>Buccinum undatum</i>
	Whelk	<i>Buccinum sp.</i>
	Periwinkles	Littorinidae.
	Snails and slugs	Snails and slugs
Bivalve	Mussels	Mytilidae
	Sea scallop	<i>Placopecten magellanicus</i>
Cephalopod	Squid flying	Squid flying
Sea urchin	Sea urchin	<i>Strongylocentrotus droebachiensis</i>
		<i>Strongylocentrotus sp.</i>
Sea cucumber	Sea cucumber	<i>Cucumaria frondosa</i>
Starfish	Starfish	<i>Asterias sp.</i>
		<i>Gorgonocephalus sp.</i>
		<i>Henricia sp.</i>
		<i>Pontaster sp.</i>
Miscellaneous Invertebrates	Hydrozoa c.	<i>Hydrozoa c.</i>
	Jellyfish	Jellyfish
	Sponges	Porifera
Cusk	Cusk	<i>Brosme brosme</i>
Cod	Cod	<i>Gadus morhua</i>
Haddock	Haddock	<i>Melanogrammus aeglefinus</i>
Pollock	Pollock	<i>Pollachius viren</i>
Gadiformes- Other	Greenland cod	<i>Gadus ogac</i>
	Tomcod (Atlantic)	<i>Microgadus tomcod</i>
	Eelpouts (ns)	Eelpouts (ns)
	Rock grenadier (round nose)	<i>Coryphaenoides rupestris</i>
Hake	Hake (ns)	<i>Hake (ns)</i>
	Squirrel / red hake	<i>Urophycis chuss</i>
	White hake	<i>Urophycis tenuis</i>
Goosefish	Goosefish	<i>Lophius americanus</i>
Cunner	Cunner	<i>Tautoglabrus adspersus</i>
	Perch like fish	Perch like fish

Major Groups	Common Name	Scientific Name or Group
Ocean pout	Ocean pout (common)	<i>Macrozoarces americanus</i>
Wolffish	Northern wolffish Spotted wolffish Striped Atlantic wolffish	<i>Anarhichas denticulatus</i> <i>Anarhichas minor</i> <i>Anarhichas lupus</i>
Perciformes- Other	Rock gunnel (eel) Sand perch White perch Mojarra (ns) Mackerel (atl)	<i>Pholis gunnellus</i> <i>Diplectrum formosum</i> <i>Morone americana</i> Mojarra (ns) <i>Scomber scrombus</i>
Halibut	Halibut	<i>Hippoglossus hippoglossus</i>
Flounder	Summer flounder Winter flounder Witch flounder Yellowtail flounder	<i>Paralichthys dentatus</i> <i>Pseudopleuronectes americanus</i> <i>Glyptocephalus cynoglossus</i> <i>Limanda ferruginea</i>
Sculpin / Sea Raven	Arctic staghorn sculpin Four horn sculpin Grubby or little sculpin Longhorn sculpin Sculpin Sea raven Sea robin Shorthorn sculpin	<i>Gymnocanthus tricuspis</i> <i>Myoxocephalus quadricornis</i> <i>Myoxocephalus aeneus</i> <i>Myoxocephalus octodecemspinosus</i> <i>Myoxocephalus sp.</i> <i>Hemitripterus americanus</i> <i>Prionotus carolinus</i> <i>Myoxocephalus scorpius</i>
Redfish	Redfish sp. Rosefish (black belly)	<i>Sebastes marinus</i> <i>Helicolenus dactylopterus</i>
Lumpfish	Lumpfish	<i>Cyclopterus lumpus</i>
Herring / Alewife	Alewife Herring (atl) Shad American	<i>Alosa pseudoharengus</i> <i>Clupea harengus</i> <i>Alosa sapidissima</i>
Miscellaneous Fish	Pipefish sp. Fin fishes (ns)	<i>Syngnathus sp.</i> Fin fishes (ns)
Spiny dogfish	Spiny dogfish	<i>Squalus acanthias</i>
Skate	Little skate Smooth skate Thorny skate Winter skate	<i>Raja erinacea</i> <i>Anacanthobatis sp.</i> <i>Amblyraja radiata</i> <i>Leucoraja ocellata</i>

Table 5. Percentage of the total catch of all species, by weight, that were not lobster and percentage of the total catch of species that could not be legally kept.

Fishing Area	Non lobster catch ¹	Non lobster catch less legally retained by-catch ²
LFA 27	3.9%	2.0%
LFA 30	2.2%	0.8%
LFA 31a	2.0%	0.9%
LFA 31b	1.5%	0.6%
LFA 32	6.9%	0.1%
LFA 33	13.4%	7.5%
LFA 34	15.0%	4.2%
LFA 41 4X	13.0%	3.4%
LFA 41 5Zc	23.0%	3.9%

Notes:

¹ Equals total - lobsters.

² Equals total minus (lobsters plus crab plus sculpins), i.e. rock crab, Jonah crab, sculpin.

Table 6. Estimated weight (kg) of lobsters that are discarded for each kg of lobster landed by LFA.

Fishing Area	Kg lobster discarded / Kg lobster landed
LFA 27	1.27
LFA 30	0.25
LFA 31a	0.25
LFA 31b	0.22
LFA 32	0.79
LFA 33	0.47
LFA 34	0.74
LFA 41 (4X)	0.30
LFA 41 (5Zc)	0.58

Table 7. Estimated total incidental catch (kg) of SARA/COSEWIC species of concern during the 2009 (LFAs 27-32) and 2009-2010 season (LFAs 33-34). Note that NC represents "none caught".

Common Name	LFA 27	LFA 30	LFA 31a	LFA 31b	LFA 32	LFA 33	LFA 34
Cusk	NC	NC	NC	NC	NC	8,326	219,490
Cod	17,613	374	2,092	3,504	6,066	96,055	210,930
Ocean pout	4,714	NC	NC	NC	NC	597	15,595
Wolfish	1,329	NC	NC	NC	NC	513	2,255
Flounders	6,185	NC	1,491	2,719	5,459	4,625	5,130
Haddock	NC	NC	NC	NC	NC	NC	2,970
Skates	NC	NC	NC	NC	NC	NC	2,900
Monkfish	NC	NC	NC	NC	NC	NC	NC
American eel	NC	NC	NC	NC	NC	NC	NC
Shad	NC	NC	NC	NC	NC	NC	NC
Striped bass	NC	NC	NC	NC	NC	NC	NC
Salmon	NC	NC	NC	NC	NC	NC	NC

FIGURES

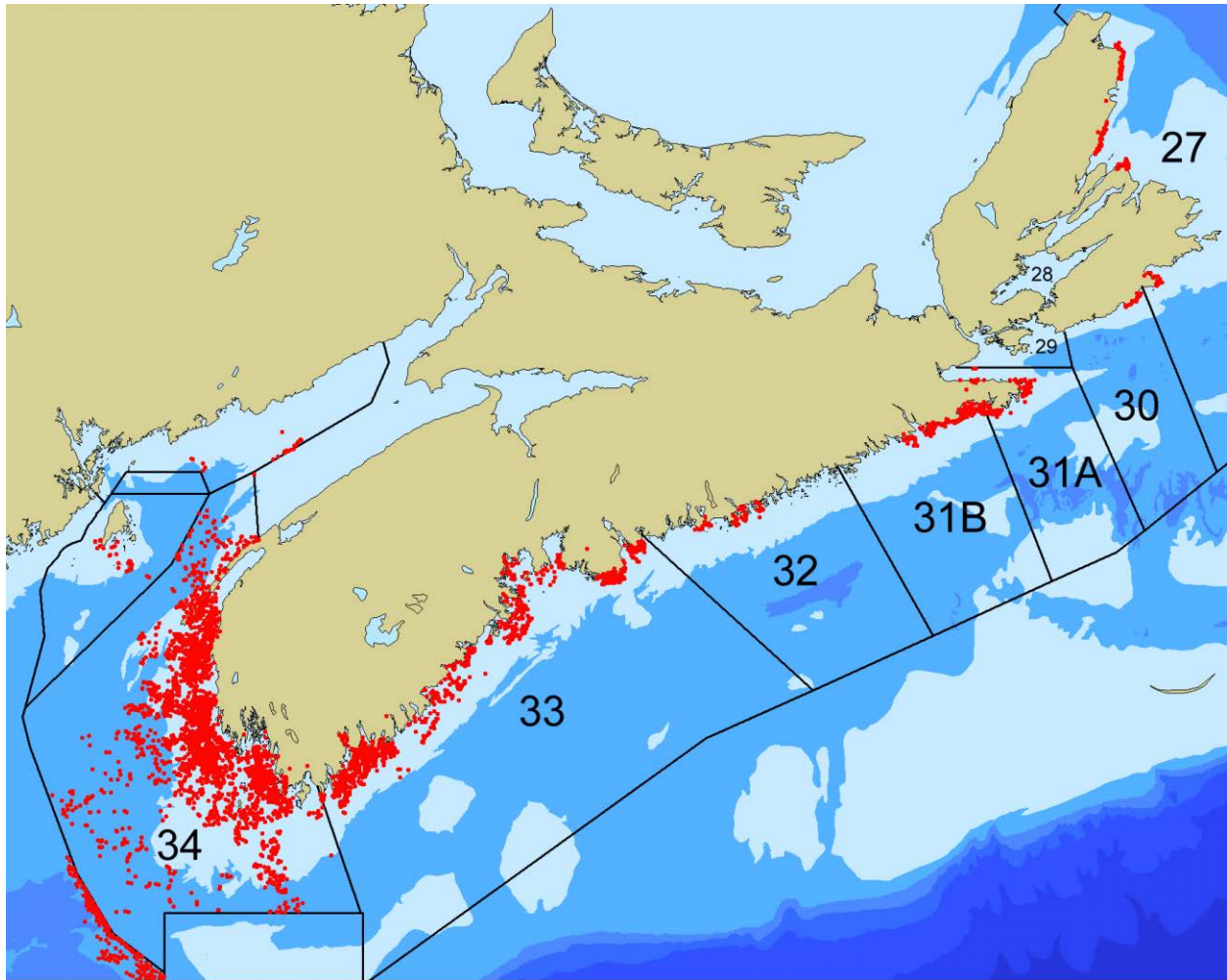
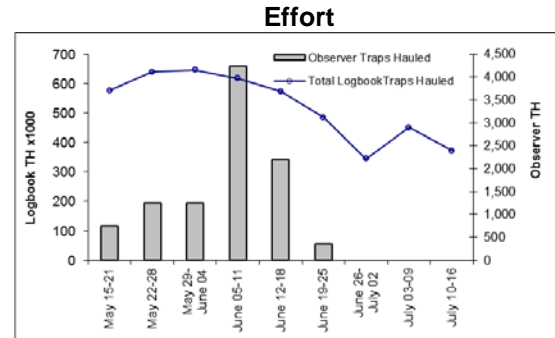
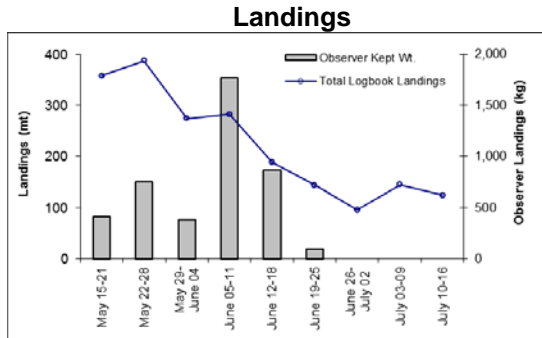
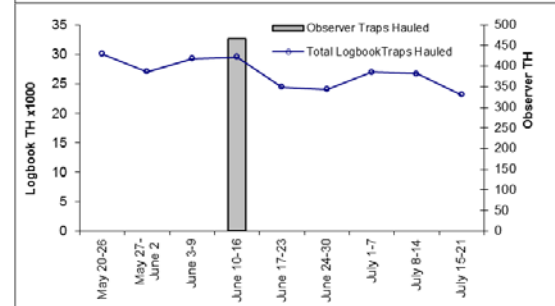
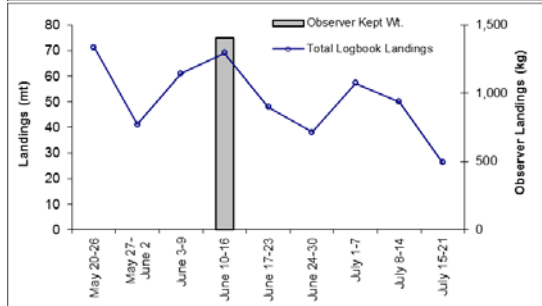


Figure 1. Map showing the distribution of sample locations within LFAs 27-34.

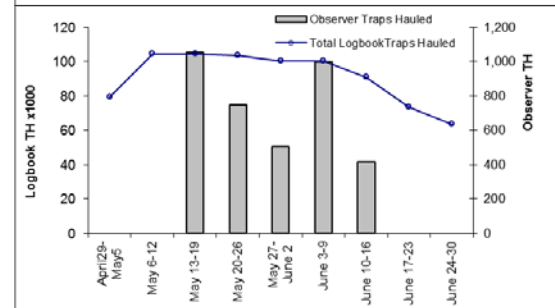
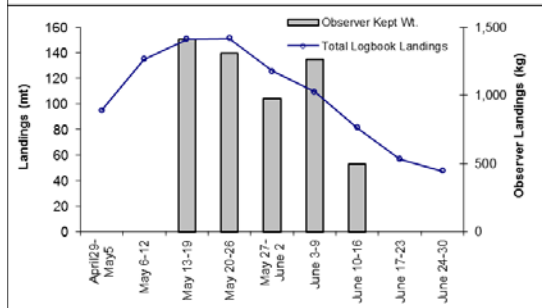
LFA
27



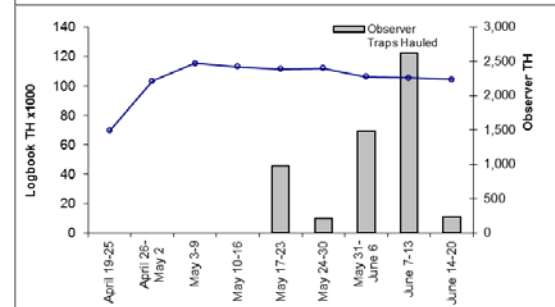
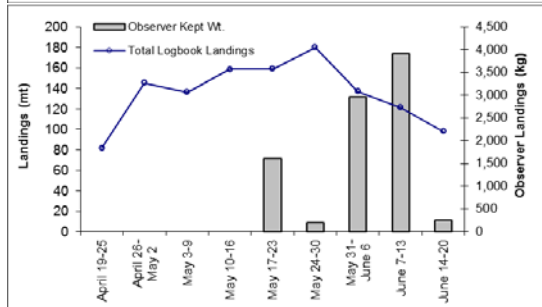
30



31a



31b



32

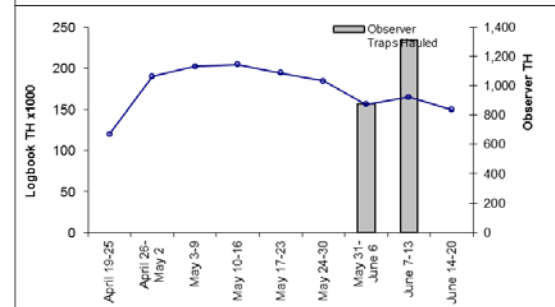
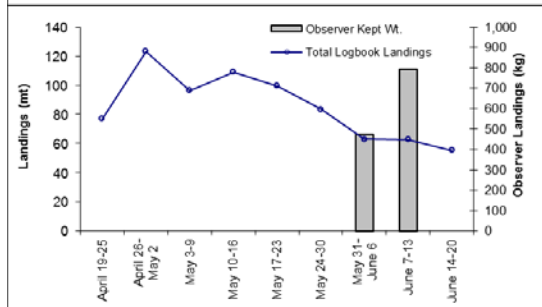


Figure 2. Distribution of sampling showing within LFAs 27-32, indicating weekly observed catch (kg), total landings (mt), and total effort (trap hauls).

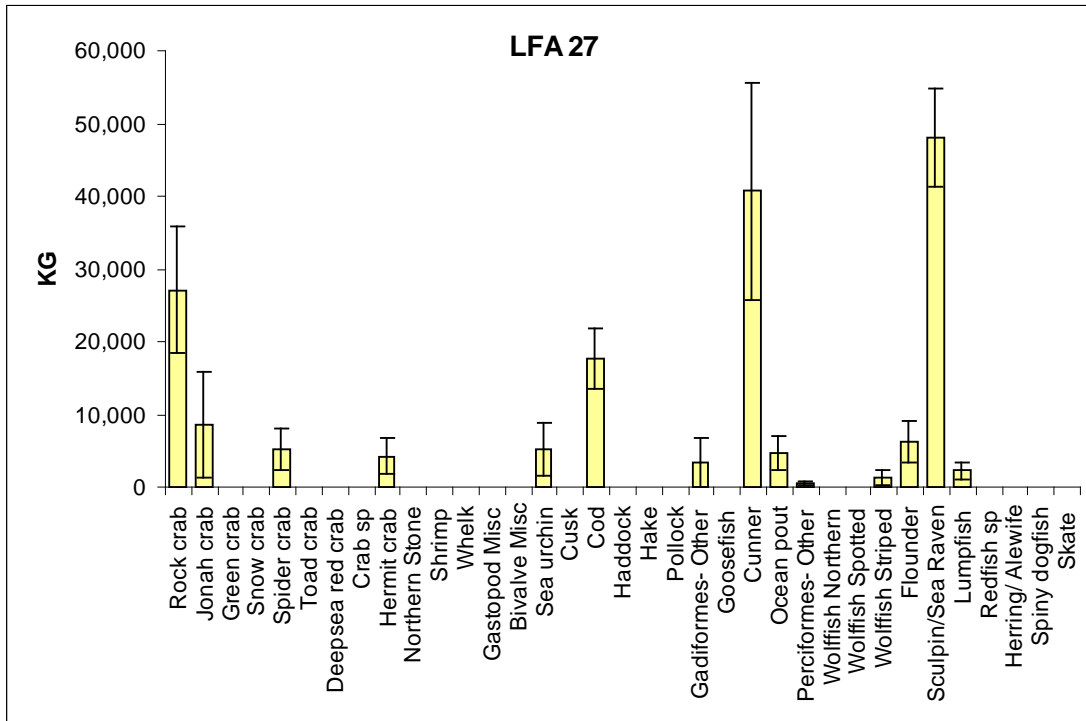


Figure 3a. Estimated total discard weight (in kg) and Standard Error, of each combined species group (Table 2) in the incidental catch in LFA 27 during 2009 fishing season.

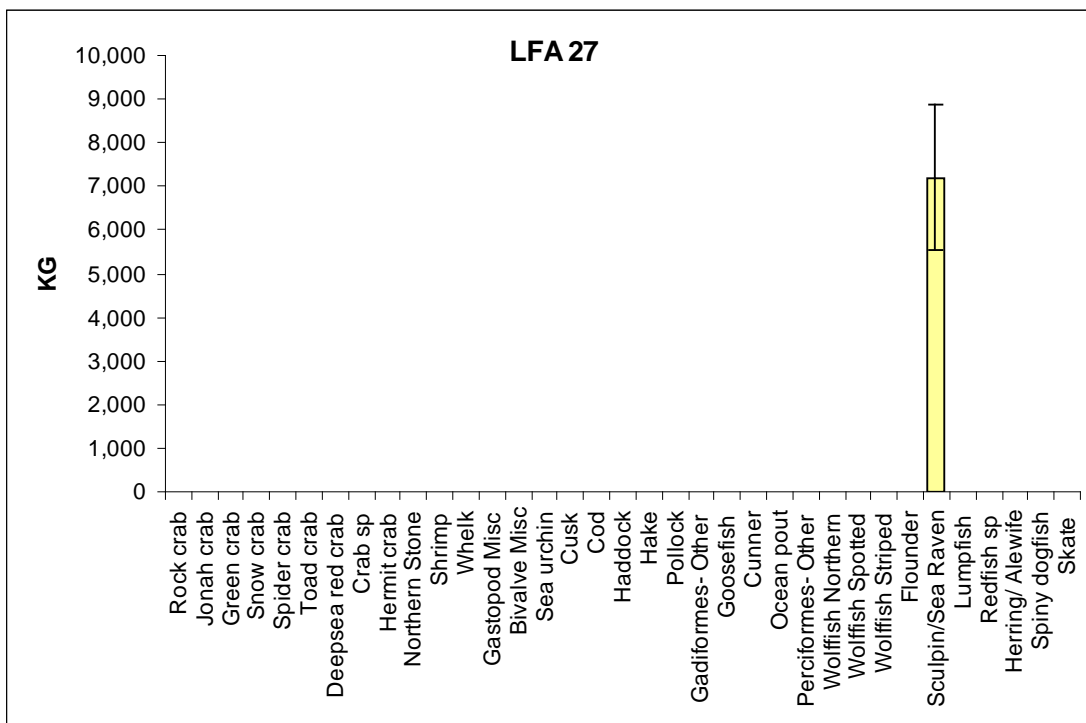


Figure 3b. Estimated total retained weight (in kg) and Standard Error, of each combined species group (Table 2) in the incidental catch in LFA 27 during 2009 fishing season.

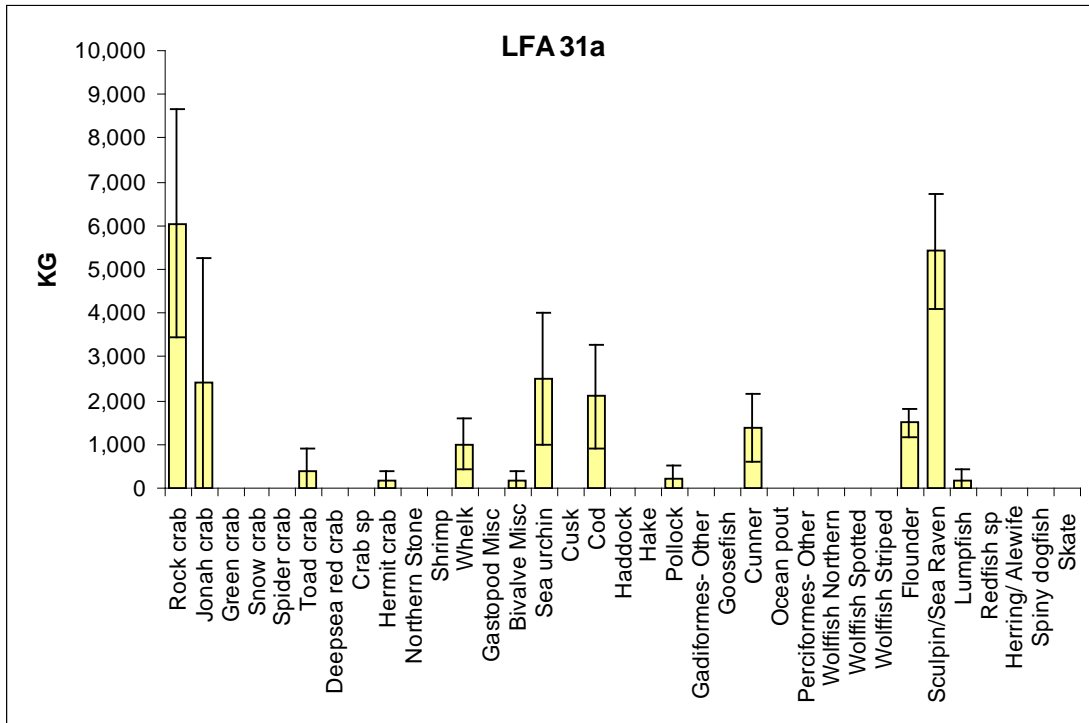


Figure 4a. Estimated total discard weight (in kg) and Standard Error, of each combined species group (Table 2) in the incidental catch in LFA 31a during 2009 fishing season.

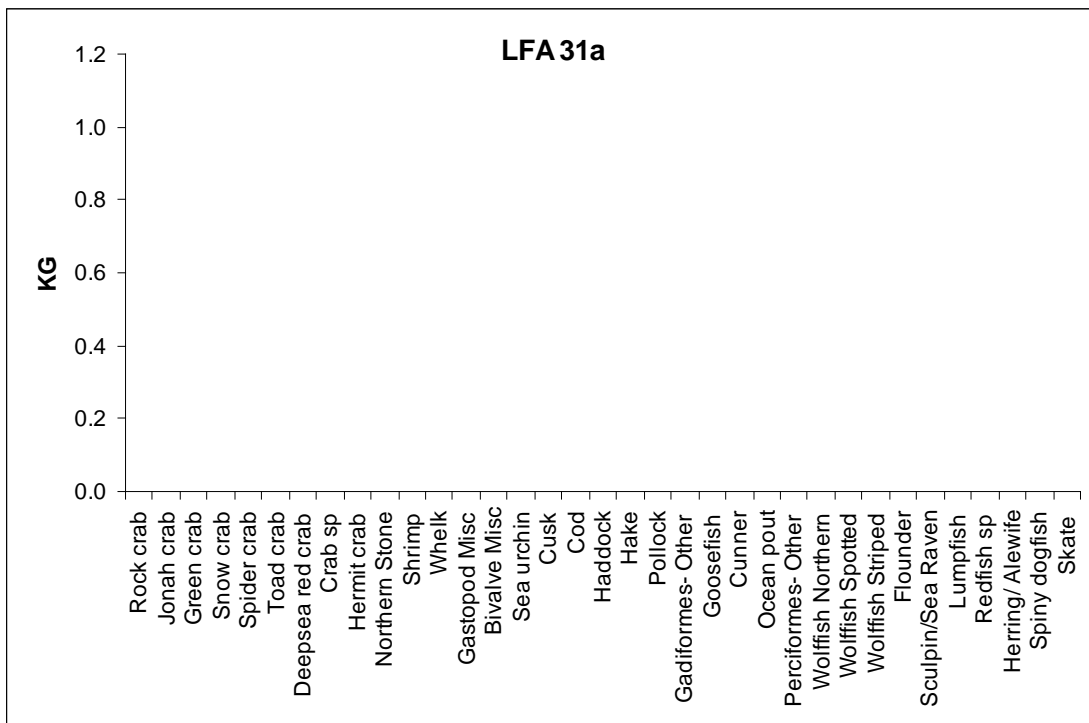


Figure 4b. Estimated total retained weight (in kg) and Standard Error, of each combined species group (Table 2) in the incidental catch in LFA 31a during 2009 fishing season.

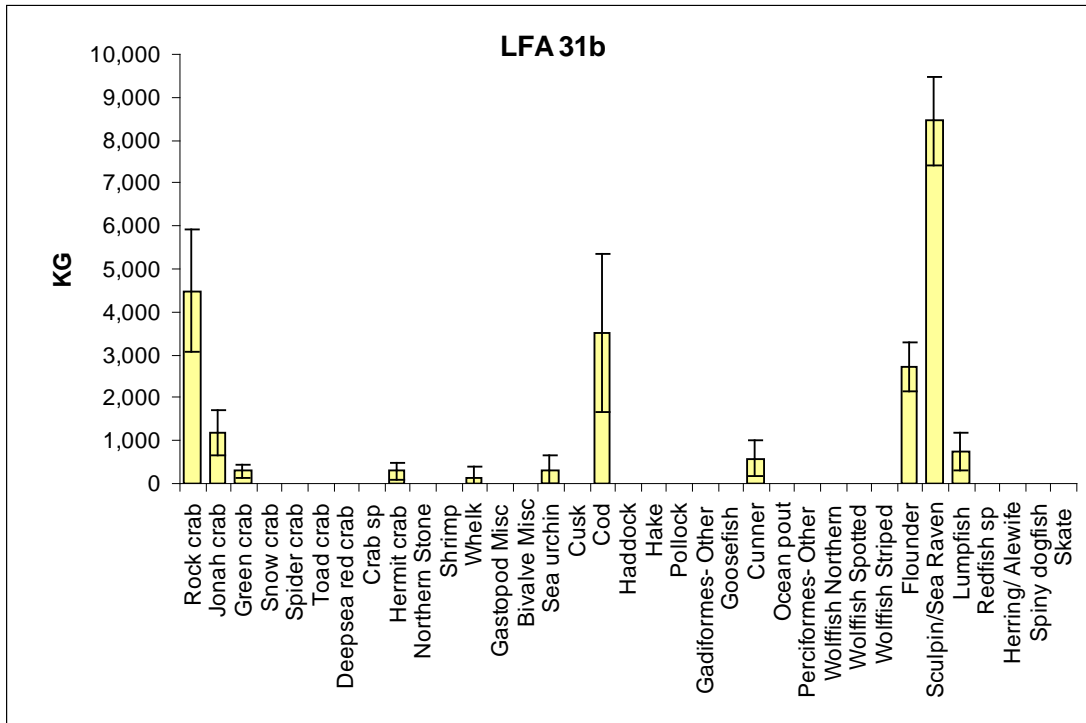


Figure 5a. Estimated total discard weight (in kg) and Standard Error, of each combined species group (Table 2) in the incidental catch in LFA 31b during 2009 fishing season.

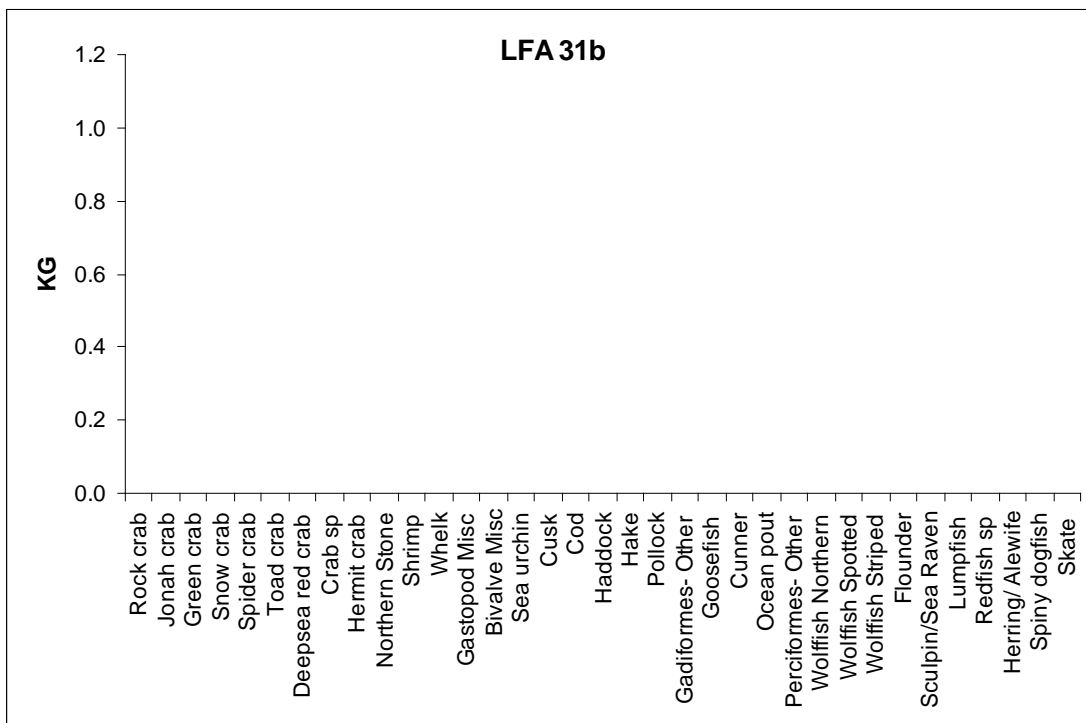


Figure 5b. Estimated total retained weight (in kg) and Standard Error, of each combined species group (Table 2) in the incidental catch in LFA 31b during 2009 fishing season.

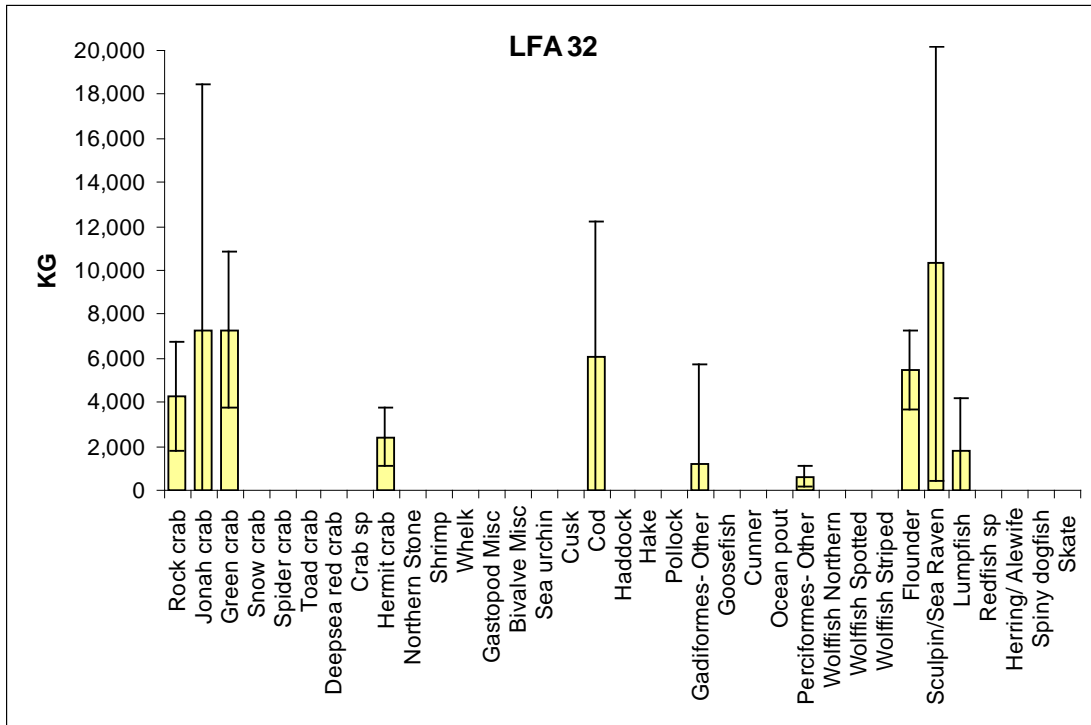


Figure 6a. Estimated total discard weight (in kg) and Standard Error, of each combined species group (Table 2) in the incidental catch in LFA 32 during 2009 fishing season.

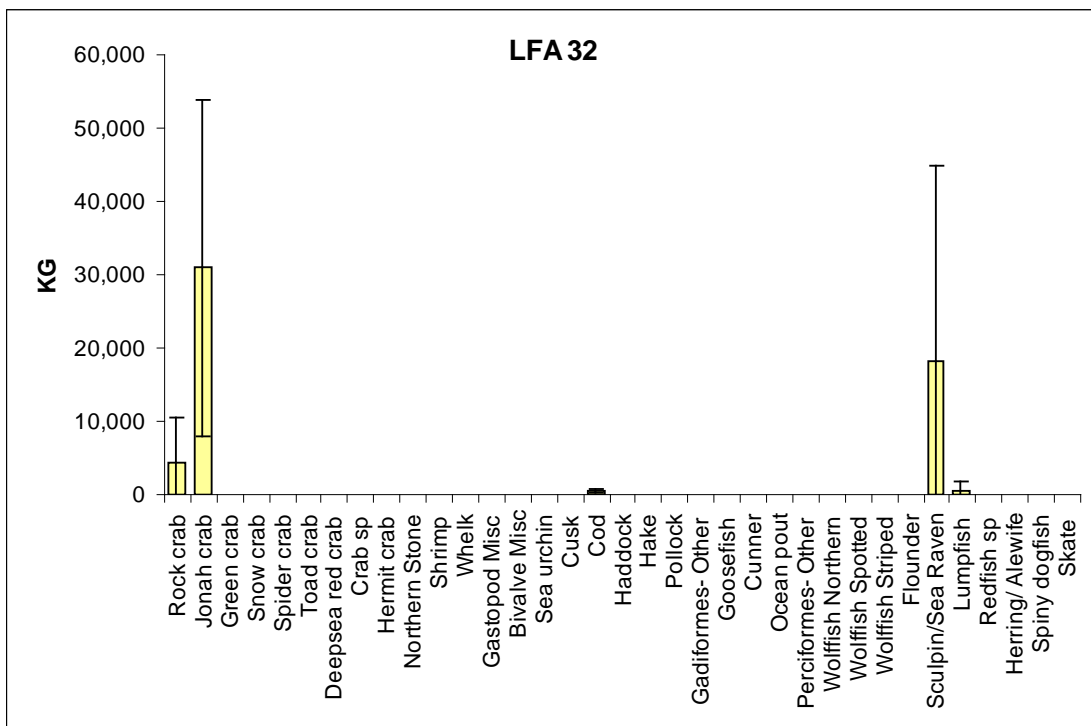


Figure 6b. Estimated total retained weight (in kg) and Standard Error, of each combined species group (Table 2) in the incidental catch in LFA 32 during 2009 fishing season.

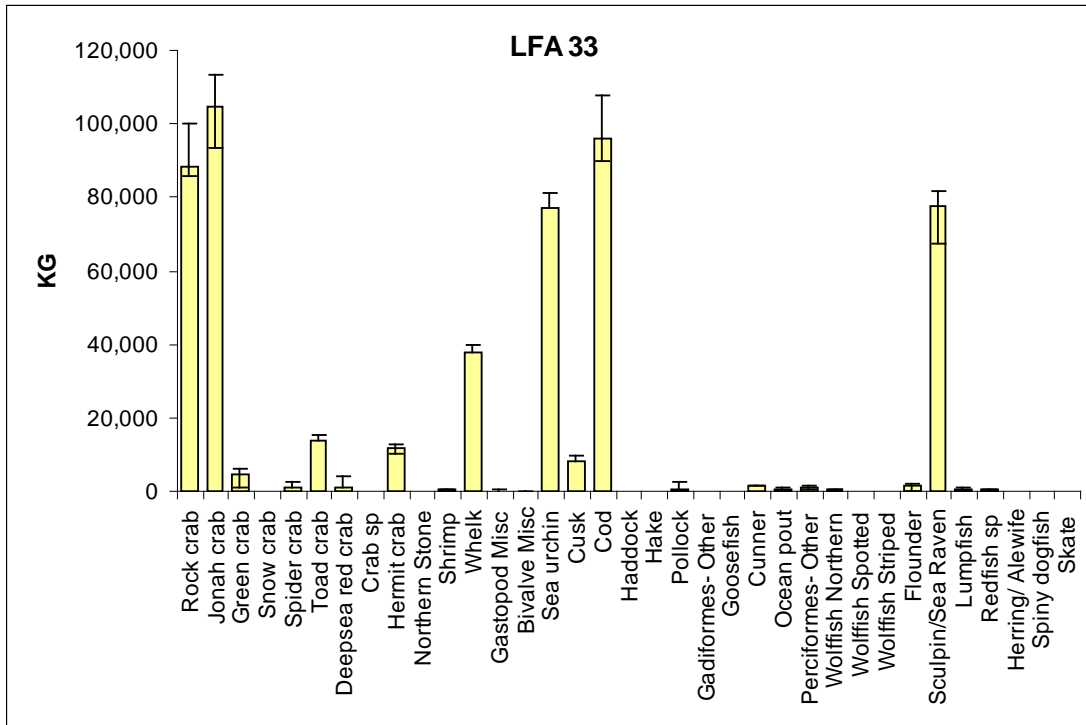


Figure 7a. Estimated total discard weight (in kg) and Standard Error, of each combined species group (Table 2) in the incidental catch in LFA 33 during 2009-2010 fishing season.

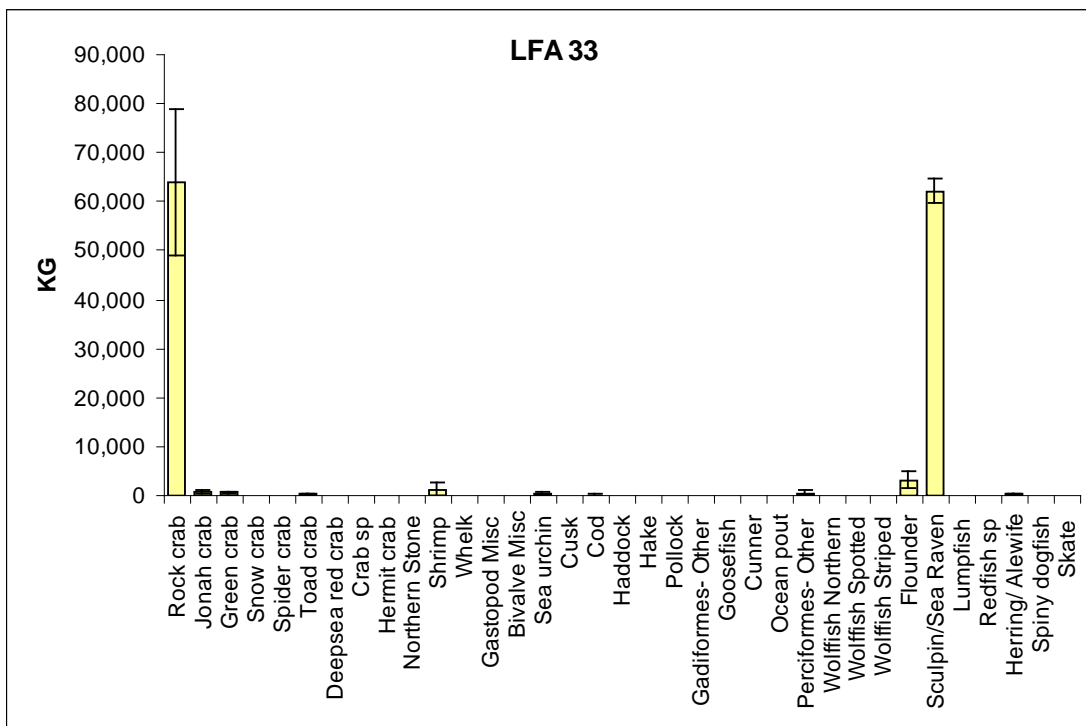


Figure 7b. Estimated total retained weight (in kg) and Standard Error, of each combined species group (Table 2) in the incidental catch in LFA 33 during 2009-2010 fishing season

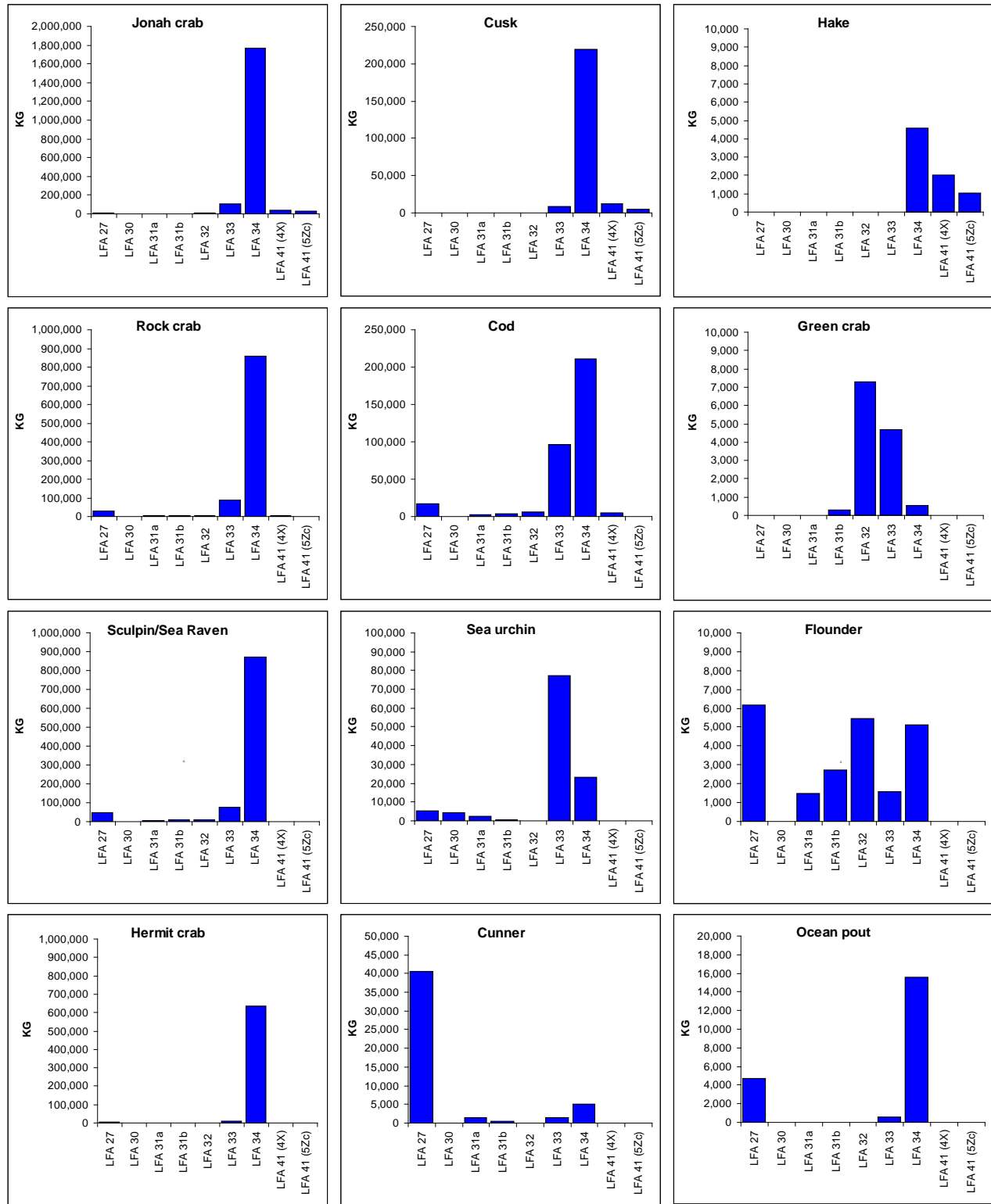


Figure 8. The estimated discard weight of major by-catch species by LFA including LFAs 27-34, and 41 (4X and 5Zc).

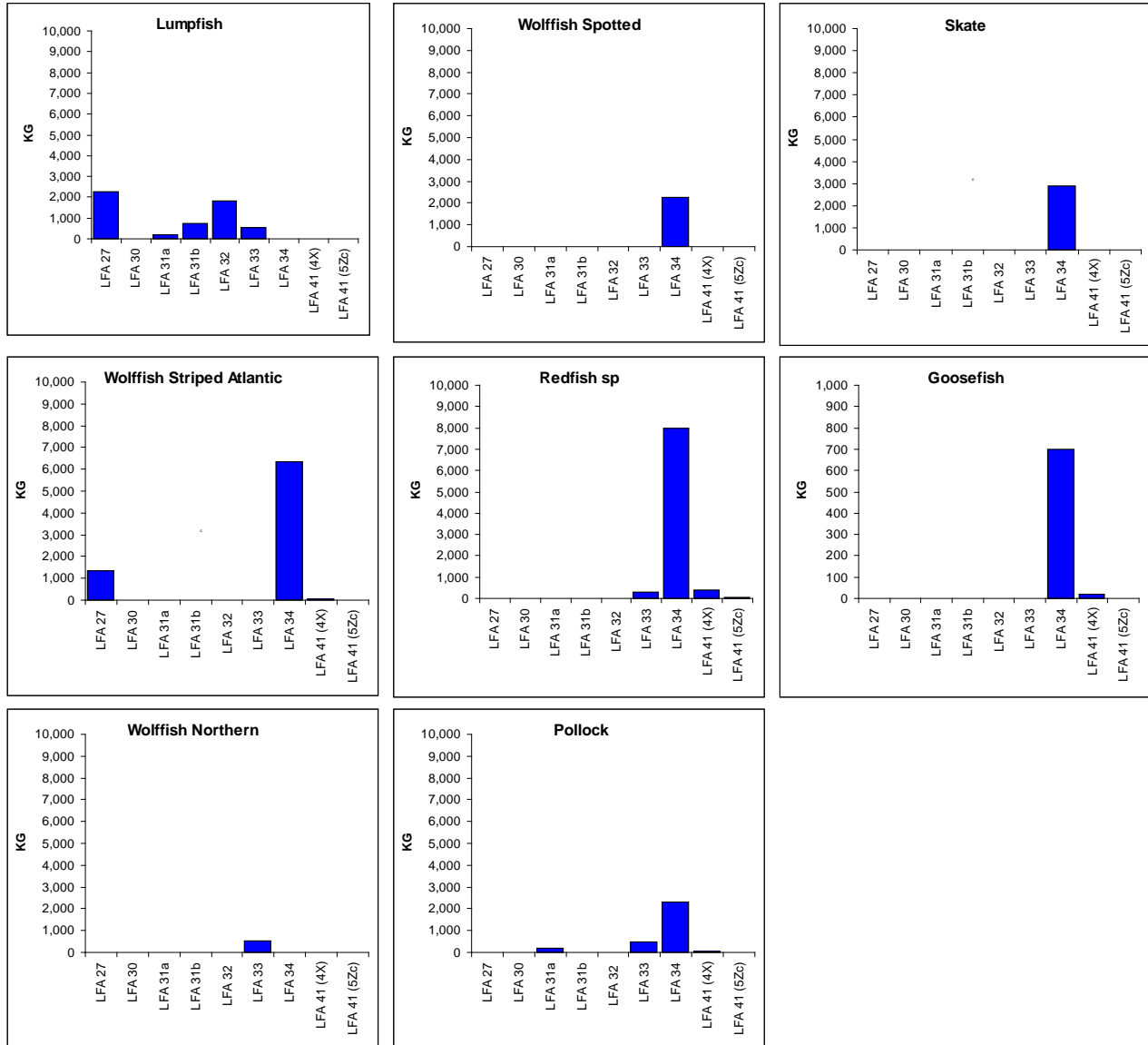


Figure 8 (continued). The estimated discard weight of major by-catch species by LFAs for LFA 27-34, and 41 (4X and 5Zc).

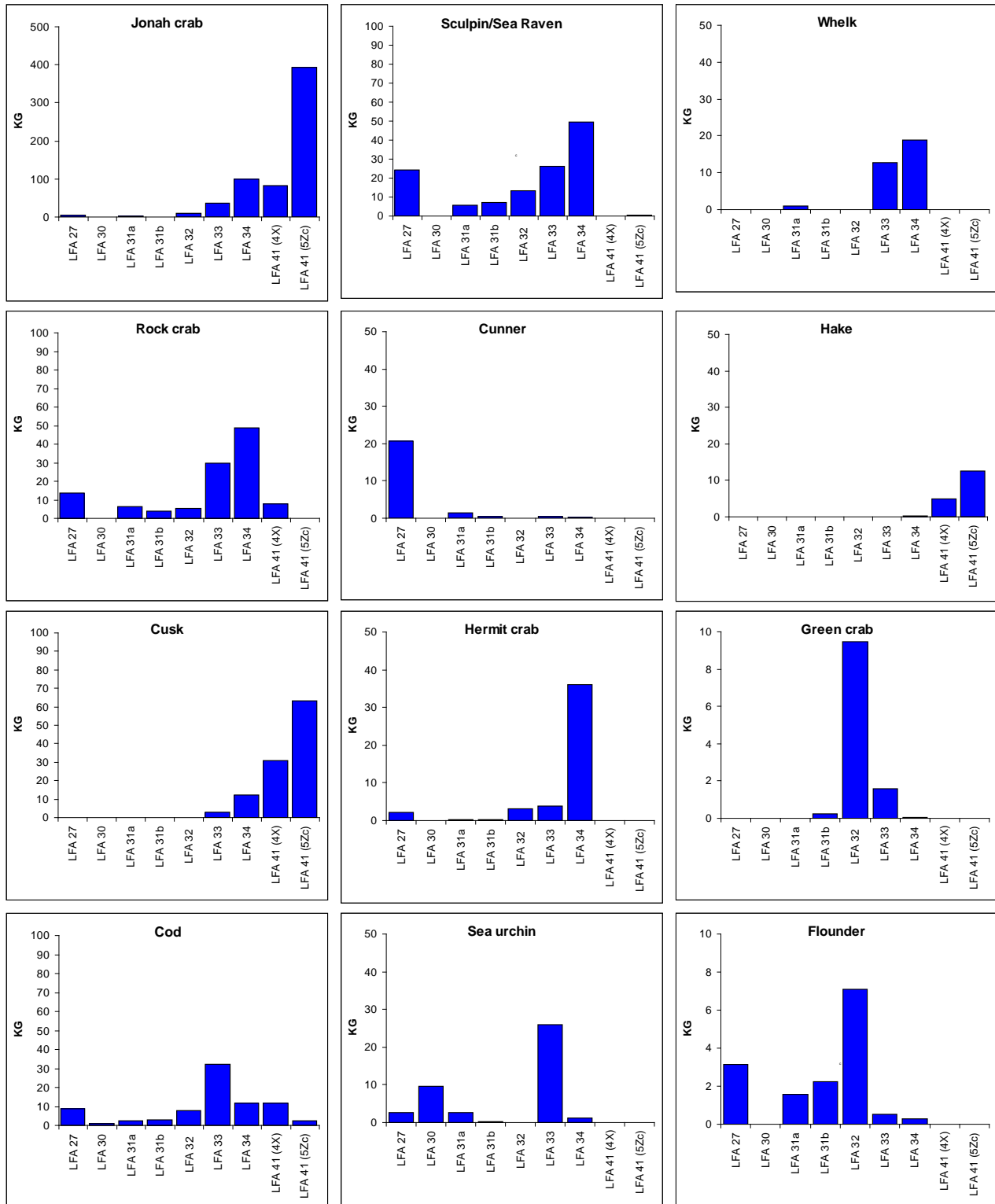


Figure 9. Estimated discard weight (kg) per metric ton of lobsters landed, of major by-catch species by LFAs for LFA 27-34, and 41 (4X and 5Zc).

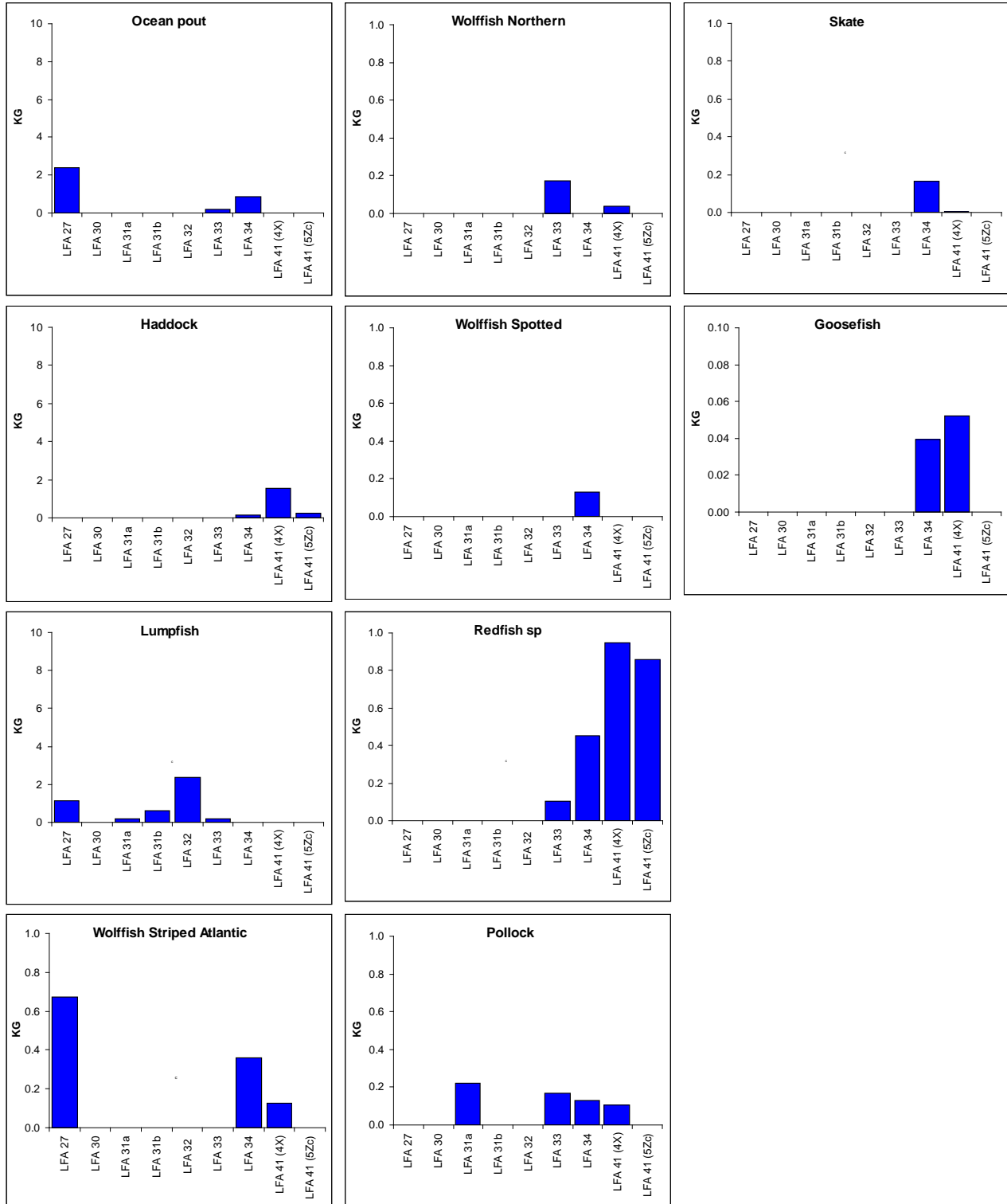


Figure 9 (continued). The estimated discard weight (kg) per metric ton of lobsters landed, of major by-catch species by LFAs for LFA 27-34, and 41 (4X and 5Zc).

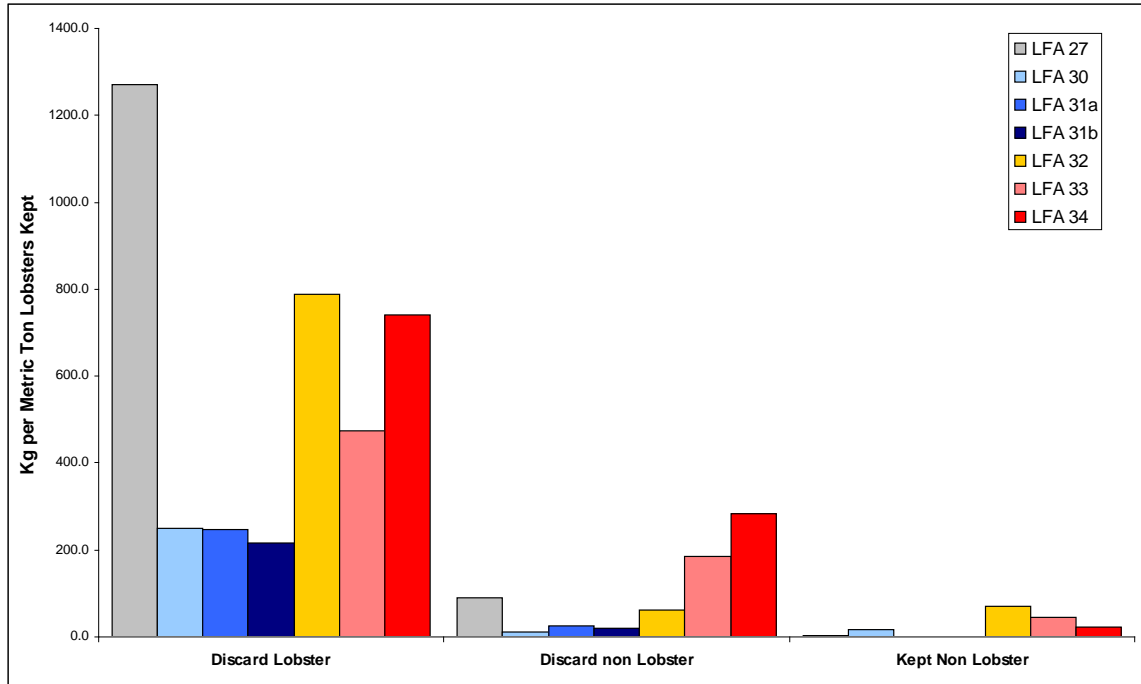


Figure 10. Summary of total kept and discarded lobster (kg) per metric ton of lobsters landed in LFAs 27-32 in 2009 season and LFA 33-34 in 2009-2010 season.

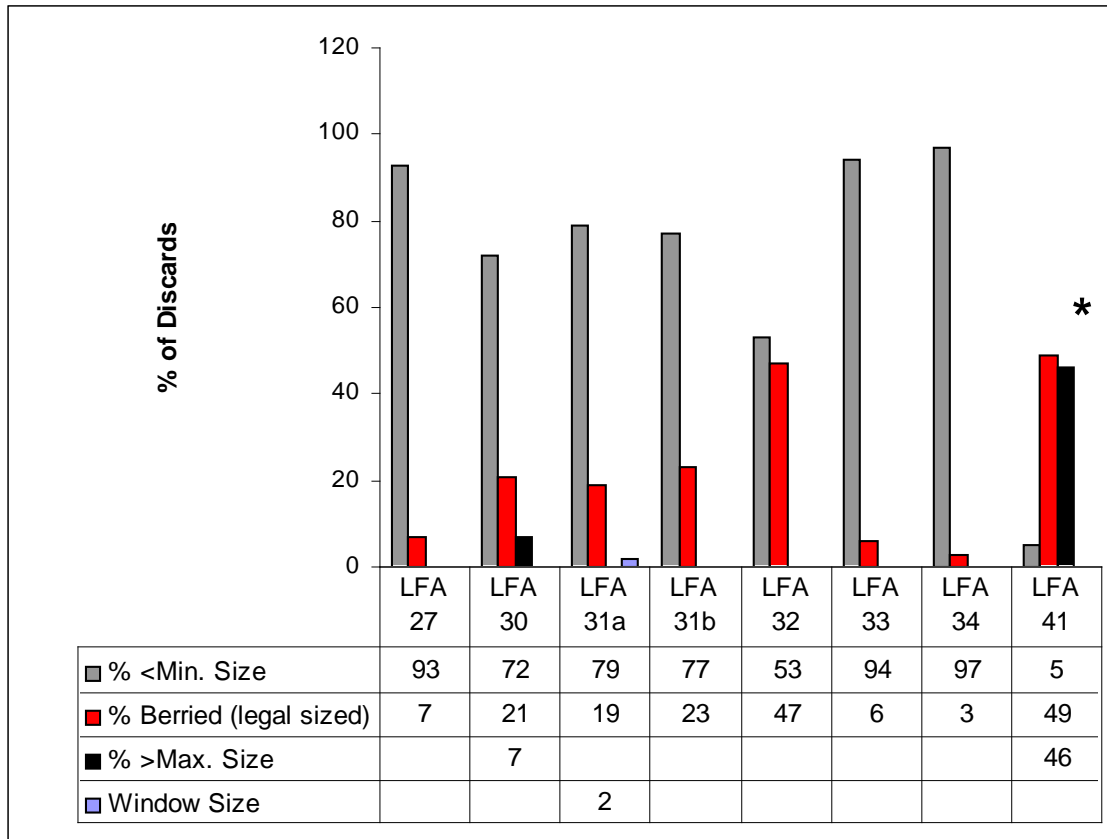


Figure 11. Estimated percentage of lobster discards by LFAs (27-41) which were less than minimum legal size, berried females, window size (LFA 31a) and lobsters exceeding maximum size (LFA 30 and 41). Note that the star (*) indicates maximum size of 6 lb is company policy and not a condition of licence.

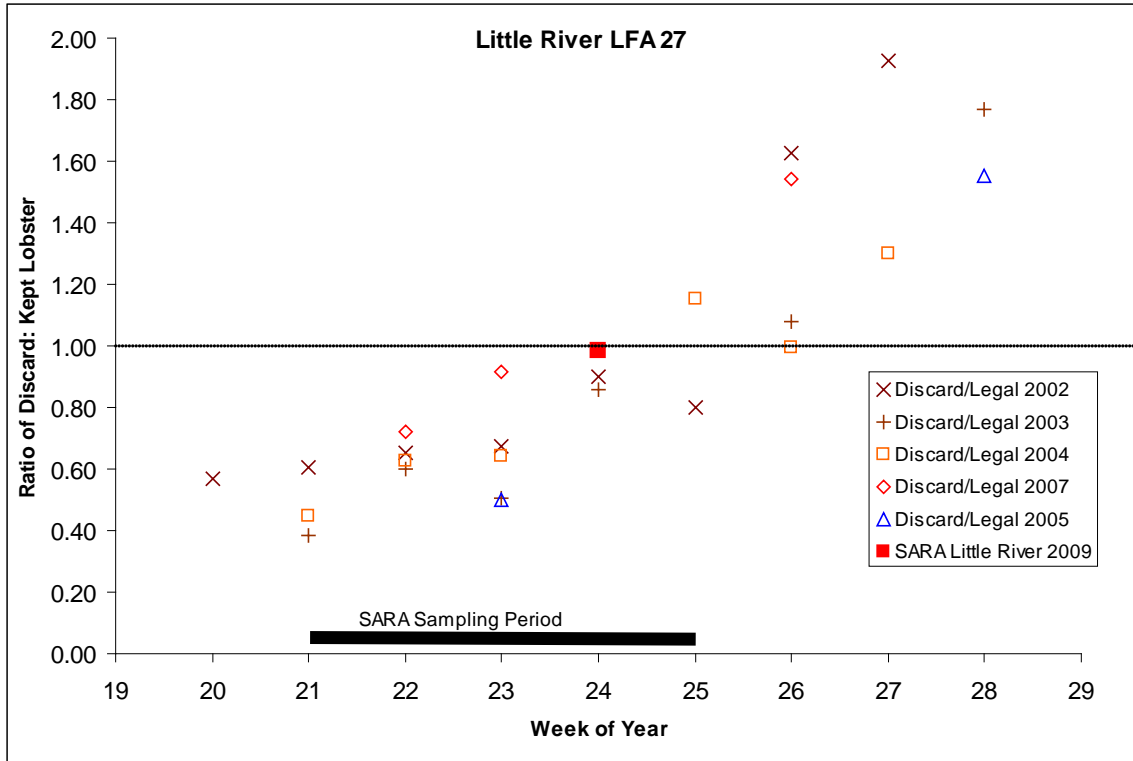


Figure 12. Weekly ratio of discard: retained lobsters from at-sea samples in Little River LFA 27 between 2002 to 2009).