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Evaluating the Efficacy of a Haddock Separator Trawl in Eliminating Cod Bycatch in Limited Areas within Closed Area I and Closed Area II

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SUBMITTED BY:

Christopher Glass
Manomet Center for Conservation Sciences
(currently at University of New Hampshire)

Laura Taylor Singer & Catherine Salerno
Gulf of Maine Research Institute

James Odlin
Atlantic Trawlers, Inc.

PREPARED BY:

Catherine Salerno
Project Coordinator
Gulf of Maine Research Institute
207-228-1625, csalerno@gmri.org

Date Submitted:
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350 Commercial Street, Portland, ME 04101 • tel: 207-772-2321 • fax: 207-772-6855 • www.gmri.org

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SUMMARY

Georges Bank (GB) haddock (*Melanogrammus aeglefinus*) has been identified as a healthy stock that can withstand additional fishing effort. However, commercial fishery landings of GB haddock in recent years have been significantly below identified Total Allowable Catch (TAC) limits. One reason the GB haddock TAC has not been fully utilized is that many of the management measures in the Northeast (NE) multispecies Fishery Management Plan (FMP) are applied over a wide geographic area and across many sectors of the fishing industry, restricting access to some healthy stocks. Specifically, many of the measures aimed at reducing fishing mortality for Atlantic cod (*Gadus morhua*) affect the ability of the industry to access the healthy GB haddock stock.

While cod and haddock are not always intermingled and experienced fishermen are adept at avoiding concentrations of intermingled cod and haddock, conventional otter trawl gear does not discriminate the catch of cod from haddock. Under these conditions, it seems likely that unless the industry can demonstrate a gear solution to avoid cod, regulations intended to reduce fishing mortality for cod will unnecessarily reduce the catch of haddock.

Separator trawl gears (i.e. trawl nets with a horizontal mesh panel sewn into the net body, extending through the net and ending in two separate codends) have proven effective in other fisheries around the world in successfully separating target from non-target species and thus aiding in bycatch reduction. Results of previous trials targeting haddock with separator trawls in the northwest Atlantic have shown promise but have not proven conclusive in terms of reducing the catch of cod.

In 2004, during the development of Amendment 13 to the NE multispecies FMP (Amendment 13), the New England Fishery Management Council (NEFMC) proposed a Special Access Program (SAP) that included the mandatory use of haddock separator trawl gear to provide the industry access to the healthy GB haddock stock without jeopardizing the recovery of GB cod. However, little data had been collected on catch and bycatch rates on Georges Bank using a haddock separator trawl. Questions as to how to define a separator trawl were also raised. Nonetheless, a pilot Haddock SAP was implemented on eastern Georges Bank in late 2004.

This project was designed to document the bycatch of Atlantic cod and other groundfish species in selected portions of Georges Bank while fishing for haddock using a haddock separator trawl. This information will allow managers and fishing communities to manage the pilot Haddock SAP on eastern Georges Bank with less uncertainty and greater stakeholder confidence. In addition, this project was designed to obtain information on the fine-scale distribution of haddock in selected areas of Closed Area I and evaluate the potential for a haddock SAP in that area.

The haddock separator trawl design tested in this experiment consisted of a conventional groundfish trawl net modified by a horizontal mesh panel sewn into the body of the net. Three lengths of chains connected the leading edge of the separator panel to the footrope and to some degree controlled the effective fishing height of the panel. The study area was composed of two discrete sub-areas encompassing portions of groundfish Closed Areas I and II on Georges Bank. A grid survey design was employed that divided the area into 22 blocks approximately 5 nm by 5 nm. Eight multi-day experimental fishing trips were conducted into the study area between June 2005 and May 2006. During each trip, one 20-minute tow was made inside each of the 22 grid blocks. After each haul, the catch was separated by codend and then

by species. Total weights were obtained for all species and length measurements of commercially important species were collected.

The results of this experiment show that this haddock separator trawl significantly reduces the bycatch of cod and virtually all other demersal species, including many other regulated species. Overall, 94% of the cod catch by weight ended up in the bottom codend where it would have escaped versus 6% in the top codend. This separator trawl was also effective at excluding other typical groundfish bycatch species. For all other regulated groundfish species by weight combined, 94% were captured in the bottom codend, 6% in the top. As expected, this gear proved most effective at excluding those species that are more exclusively bottom dwellers like flounders, monkfish and skates. Species composition in the top codend was primarily made up of species that tend to show a wider vertical distribution in the water column like haddock and pollock.

However, although results show that this gear is successful in eliminating most cod bycatch, the catch rates of haddock achieved by this study in Closed Area I with a haddock separator trawl are too low for a commercial SAP to be economically viable. The haddock separator trawl tested in this experiment excluded far more than it captured; 90% of the catch by weight overall was in the bottom codend. This also included more than half of the potential haddock catch. Overall by weight, 45% of the haddock catch was retained in the top codend, 55% in the bottom codend. Further, the mean weight per tow of legal sized haddock in top codend was only 6 lbs, equivalent to 18 lbs per hour. Catch rates for haddock were highly variable from grid block to grid block and month to month however. Comparisons of catch rates by month indicate that the best potential for a haddock SAP in Closed Area I is probably during summer months, especially June and July. Additional experiments in which the separator panel is set at different heights from the footrope are recommended to explore the potential of increasing the haddock catch rate while keeping the cod bycatch rate at a reasonable level.

INTRODUCTION

Georges Bank (GB) haddock has been identified as a healthy stock that can withstand additional fishing effort. While this stock has yet to be rebuilt to its target biomass and is therefore still considered overfished, the biological impact analysis prepared for Amendment 13 to the Northeast (NE) Multispecies Fishery Management Plan (FMP) (Amendment 13) (NEFMC/NMFS, 2004) suggested that increased fishing mortality can be accommodated without delaying the rebuilding program for the stock. This is due to lower than estimated fishing mortality in 2001 (0.22), compared to the 0.26 mortality necessary to rebuild the stock and other management measures implemented by Amendment 13 expected to further reduce fishing mortality on GB haddock. According to the NMFS' 2nd quarterly update on the Status of U.S. Fisheries for 2006, the stock remains in much the same condition today (NMFS OSF, 2006).

At the same time, commercial fishery landings of GB haddock in recent years have been below identified Total Allowable Catch (TAC) limits. Since GB haddock is a trans-boundary stock that is also harvested by Canada, TAC limits set by NMFS are developed in consultation with members of both countries according to the U.S./Canada Resource Sharing Understanding. The overall TAC for GB haddock in 2004 was set at 24,885 mt, with the U.S. share set at 14,955 mt. According to the NMFS Northeast Multispecies Preliminary Fisheries Statistics Report for fishing year 2004, 6.90 mt of GB haddock was harvested by U.S. fishermen representing only 46% of the TAC. A similar situation occurred in fishing year 2005 when U.S. fishermen landed only 42% (12,282 mt) of the 27,692 mt GB haddock TAC (NMFS NERO, 2006).

One reason the GB haddock TAC has not been fully utilized is that many of the management measures in the NE multispecies FMP are applied over a wide geographic area and across many sectors of the fishing industry, restricting access to some healthy stocks. Specifically, many of the measures aimed at reducing fishing mortality for Atlantic cod, currently identified as overfished and overfishing is occurring, affect the ability of the industry to access the healthy GB haddock stock.

Bottom trawl gear is the principal gear used to harvest GB haddock. While cod and haddock are not always intermingled, and experienced fishermen are adept at avoiding concentrations of intermingled cod and haddock, trawl gear does not discriminate the catch of cod from haddock. Under these conditions, it seems likely that unless the industry can demonstrate a gear solution to avoid cod, regulations intended to reduce fishing mortality for cod will unnecessarily reduce the catch of haddock.

Amendment 13 created a process under which Special Access Programs (SAPs) can be developed to allow access to multispecies stocks that are in good condition or to target non-multispecies stocks that can be harvested without affecting stocks of concern (stocks that are overfished or where overfishing is occurring). Four specific SAPs were also discussed during the development of Amendment 13, including a SAP that would allow targeted fishing for GB haddock on the eastern part of Georges Bank, inside the U.S./Canada Management Area, adjacent to Closed Area II and including a small portion of the northern part of Closed Area II (Figure 1). In order to address concerns about the potential bycatch of cod in this SAP, the New England Fishery Management Council proposed to include the mandatory use of gears that had been proven effective at avoiding cod. One of these proposed gears was a haddock separator trawl.

Haddock separator trawl gear (trawl nets with a horizontal separation panel splitting the net into an upper and lower portion leading to two separate upper and lower codends) has been tested previously in Europe and Canada (Galbraith and Main, 1989; Main and Sangster, 1982, 1985, 1986; Richard, 1999). In addition, separator trawl technology has been demonstrated to successfully separate target and non-target species and hence aid bycatch reduction in other fisheries (see Glass et al. 1999). Furthermore, in 2002, the Fisheries Resource Conservation Council of Canada recommended "the mandatory use of horizontal separator panels on all otter trawls in the directed haddock fishery to reduce catches of cod".

The haddock separator trawl has been found to reduce cod catches by up to 60% (NEFMC/NMFS 2004). In preliminary trials conducted by the Manomet Center for Conservation Sciences, over 60 hauls resulted in 75% of all cod (by weight and by number) being caught in the bottom codend and 66% of haddock in the top codend (Glass, pers. comm.) While the results of these trials show promise and merit further experimentation, they are not conclusive in terms of potentially reducing the catch of cod.

Due to the availability of little recent data or analysis on catch and bycatch rates on Georges Bank using haddock separator trawls as well as questions about how to define a haddock separator trawl, the Regional Administrator indicated that the proposed haddock SAP on eastern Georges Bank was unlikely to be approved in Amendment 13. At this time, groundfish vessel owner Jim Odlin of Atlantic Trawlers, Inc. approached the Gulf of Maine Research Institute to develop a study that would help provide answers to these questions. In addition, Mr. Odlin was interested in collecting information that could be used to evaluate the potential for a similar haddock SAP inside Closed Area I.

Together with Manomet Center for Conservation Sciences, GMRI and Atlantic Trawlers, Inc, requested and received funding through the NMFS' Northeast Cooperative Research Partners Program to evaluate the performance of a haddock separator trawl inside the proposed U.S./Canada Area Haddock SAP area as well as inside Closed Area I. In the meantime, Amendment 13 was implemented (May 2004), excluding the provision that would have created the U.S. Canada Area Haddock SAP. Shortly thereafter however, the NEFMC was able to conduct analyses on limited data on the catch and bycatch rates of cod in the proposed U.S./Canada Area Haddock SAP area. The Regional Administrator indicated that this analysis provided sufficient evidence that bycatch rates of cod would be within acceptable limits for this SAP to be implemented. Accordingly, in November 2004, Framework 40A to the NE Multispecies FMP instituted the U.S. Canada Area Haddock SAP Pilot Program to allow fishermen to seasonally target GB haddock on the eastern part of Georges Bank, adjacent to Closed Area II and including a small portion of the northern part of Closed Area II.

Once the U.S./Canada Area Haddock SAP Pilot Program was implemented, the scope of work for this project was revised to exclude much of the established U.S. Canada Area Haddock SAP area. Field testing was limited to a small portion of the area, inside the northern tip of Closed Area II, in expectation of routinely finding adequate quantities of both haddock and cod that would allow rigorous evaluation of the performance of this haddock separator trawl gear. It was also intended to provide a limited amount of data that could be compared to data from other sources including Vessel Trip Reports and Northeast Fishery Observer Program data and used to evaluate and manage the recently established SAP.

Goals and Objectives

This project was designed to document the bycatch of Atlantic cod and other groundfish species in selected portions of Closed Area I and Closed Area II on Georges Bank while fishing for haddock using a haddock separator trawl.

The specific objectives were to:

- Document and analyze the quality and composition of catch and bycatch, and the extent to which cod and haddock are separated in the catch in selected areas of Closed Area I and Closed Area II across seasons.
- Obtain information on the fine-scale distribution of haddock in selected areas of Closed Area I and Closed Area II.
- Provide a recommendation to NMFS and the NEFMC for use of haddock separator trawl gear.
- Provide management and fishing communities with information to manage proposed haddock SAPs with less uncertainty and greater stakeholder confidence.

METHODS

Study Area

The study area was composed of two discrete sub-areas encompassing portions of groundfish Closed Areas I and II on Georges Bank. The study area did not include any Habitat Closed Areas. Each study sub-area was divided up into square blocks approximately five miles by five miles square using a grid pattern (Figure 2). This resulted in 22 grid blocks total, 19 in Closed Area I and 3 in Closed Area II. Originally, the vessel aimed to conduct 9 trips lasting five days each into the study area between May 2005 and January 2006. During each 5 day trip, the vessel would complete one tow of 20-minutes in duration in each of the 22 grid squares. While the research team and vessel's crew worked diligently to complete the scheduled trips as planned, a few different factors led to unavoidable changes in this schedule. Table 1 presents a breakdown of trips and hauls accomplished.

Table 1. Trip and Haul Summary

		Number of Tows Completed		
Trip Number	**Month/Year**	**Total**	**Closed Area I**	**Closed Area II**
01	June 2005	21	19	2[1]
02	July 2005	22	19	3
03	Aug 2005	22	19	3
04	Oct 2005	13[2]	13	0
05	Nov 2005	19	19	0[3]
06	Dec 2005	20	19	1[3]
07	Jan 2005	20	19	1[3]
08	May 2006	21	18[4]	3
Total		**158**	**145**	**13**

[1] gear malfunction on last haul
[2] rough weather, return to port early
[3] fixed gear present in survey area
[4] gear hang after 9 mins.

Tow locations within each grid square for any given month were selected by the vessel captain to optimize haddock and cod catches. Tow locations for the month of June are given in Figure 3. In general, the captain followed these tow tracks for the duration of the project.

Vessel and Gear Description

Atlantic Trawlers, Inc. supplied the vessel used to conduct all field trials for this project, the F/V Teresa Marie IV (Fed. permit # 410537, ON 1089264) of Portland, ME. This vessel is a steel offshore stern trawler approximately 80 ft in length overall (Figure 4.) Originally, Atlantic Trawlers planned to use three different vessels for the project but decided to limit it to one to simplify trip scheduling and reduce variability associated with using different vessels, nets and crew.

The gear tested for this experiment was a haddock separator trawl built to standards articulated in the NE Multispecies FMP (50 CFR 648.85 (a)(3)(iii)(A)):

> *"(A) Haddock Separator Trawl. A haddock separator trawl is defined as a groundfish trawl modified to a vertically oriented trouser trawl configuration, with two extensions arranged one over the other, where a codend shall be attached only to the upper extension, and the bottom extension shall be left open and have no codend attached. A horizontal large mesh separating panel constructed with a minimum of 6.0 inch (15.2 cm) diamond mesh must be installed between the selvedges joining the upper and lower panels, as described in paragraph (a)(3)(iii)(A) and (B) of this section, extending forward from the front of the trouser junction to the aft edge of the first belly behind the fishing circle.*
>
> *(1) Two-seam bottom trawl nets—For two seam nets, the separator panel will be constructed such that the width of the forward edge of the panel is 80-85 percent of the width of the after edge of the first belly of the net where the panel is attached. For example, if the belly is 200 meshes wide (from selvedge to selvedge), the separator panel must be no wider than 160-170 meshes wide."*

The separator trawl tested in this project was a modified version of the vessel's normal groundfish trawl net, a simple two-seam design built by Jeff Flagg of Portland, ME. This net was approximately 130 ft long and constructed of polyethylene. The headrope and footrope lengths were 188 ft and 147 ft, respectively. One cookie covered ground cable 240 ft long was used. Two identical 6.5-inch diamond mesh codends were used; the bottom codend had chafing gear. A detailed net plan is given in Figure 5.

This net was modified by the addition of a horizontal mesh panel attached to the gore lines of the net, extending throughout the net body and ending in 2 codends, one on top of the other. At the leading edge of the panel, two lengths of chain attached the panel to the footrope to reduce movement of the panel during towing. The panel is designed to exploit observed behavioral differences in how cod and haddock enter a trawl net. Specifically, cod tend to enter the body of a trawl net low while haddock enter the net higher up in the water column. In theory, as the net is towed through the water, most haddock are guided by the panel into the top codend and captured. Conversely, most cod are guided by the panel into the lower codend, which would be left open to promote escapement. In this experiment the bottom codend was kept closed in order to observe and measure what would be escaping.

Separator Panel Height

Probably the most important characteristic of this gear is the height at which the separator panel is set relative to the footrope. Over the duration of this experiment, the separator panel was fished in two different configurations. In our "standard" separator panel configuration, the panel was rigged to fish approximately 5 ft from the footrope by placing two lengths of chain (60 inches each) at either end of the separator panel connecting it with the footrope. This configuration was used in 7 out of 8 trips. For one trip (July 2005), the panel configuration was changed. The two lengths of chain were shortened to 36 inches so that the distance between the leading edge of the separator panel and the footrope was approximately 3 ft.

For the first experimental fishing trip in June 2005, the separator panel in the trawl net was rigged in its standard configuration with 60-inch chains connecting the panel to the footrope. This configuration seemed to be effective at capturing most cod in the bottom codend (99%), but less than half of the haddock catch was captured in the top codend (54%) (see Figures 9 & 10.) The vessel owner expressed concern that too much haddock ended up in the bottom codend during this trip. He also indicated that business associates in Canada had been able to achieve adequate reduction of cod bycatch with the separator panel height set at 3 ft from the footrope. Although the objectives of this experiment did not include trying to determine an optimal separator panel height, it was acknowledged that higher catches of haddock in the top codend were indeed desirable.

Thus, for the next trip in July 2005, the separator panel was configured to fish closer to the footrope, at approximately 3 ft. This configuration obtained much different results, the amount of haddock captured in the top codend increased dramatically, from 46% to 83%, however the amount of cod captured in the top codend also increased dramatically, from 1% to 38% (see Figures 9 & 10.) Since the goal of reducing cod catch in the top codend was deemed more important than increasing the catch of haddock in the top codend, it was decided to return to the original configuration with 60-inch chains connecting the separator panel to the footrope for the duration of the experiment. For data analysis purposes, where catches are described by codend, tows conducted with the standard separator panel configuration (136 tows) are discussed separately from those conducted with the alternate configuration (22 tows).

For the following trip in August 2005, a 60-inch length of rope was also placed in the center of the separator panel connecting it to the footrope as an extra precaution to ensure that the leading edge of the panel was not "flapping" as it was being towed through the water. Following the August trip, it was discovered that this rope had parted during the trip. For the October trip and all subsequent trips (Nov, Dec, Jan, May), a length of chain replaced the rope in the center of the separator panel. While this extra chain in the center may have added some extra stability to the leading edge of the separator panel, there is no evidence from the previous trips that the leading edge of the panel was unstable. It is important to note that even though this separator trawl design incorporates the use of specific lengths of chain to connect the separator panel to the footrope (36 inches or 60 inches for this study), the actual height of the panel while it is fishing likely varies widely as the gear is towed across the bottom.

Gear Performance and Evaluation

Data on gear performance was collected using 'Netmind™', a trawl gear monitoring system manufactured by Northstar Technical, Inc., of St. John's, Newfoundland, Canada. This system was generously made available for project use during the first three experimental trips in June, July, and August 2005 by the Massachusetts Division of Marine Fisheries, Industry Based Survey for Gulf of Maine Cod. This system allowed the project partners to obtain real-time

measurements of the headrope height and wing spread of the net while it was fishing through strategic placement of acoustic sensors on the net. Measurements obtained from the monitoring system were compared to expected readings based on the net manufacturer's recommendations and the vessel captain's prior experience in order to insure that the gear was fishing in its optimal configuration.

While it was the intent of the project partners to standardize gear characteristics over the entire duration of the project, it was necessary to make some minor changes during the first experimental trip in June 2005 in order to adjust the gear to its optimal fishing configuration within the study area. This was largely due to the fact that the study area encompassed portions of two permanent groundfish closed areas, areas that the commercial groundfish fleet has been excluded from for nearly 10 years. Physical characteristics of these areas, hard bottom and strong currents, added further difficulties to evaluating and standardizing gear configuration. Still, gear changes made during the first trip were relatively minor and included switching trawl doors and adjusting ground cable length over several hauls.

These minor gear changes did not affect the ability of this study to achieve its objectives since the project was largely focused on giving managers an idea of what catch and bycatch rates would be for the commercial fleet on Georges Bank, using a haddock separator trawl. Under real world conditions, fishermen are constantly making small changes to the gear to improve performance. Further, despite these changes, Netmind™ readings remained relatively constant and within the ranges expected by the vessel captain.

The average Netmind™ readings observed in each grid square for each of the three trips are displayed in Figure 6. The headrope height remained relatively stable at about 6.5 m (approximately 21 ft). Wing spread varied more widely, likely due to the rough bottom the gear was encountering, but was typically around 19 m (approximately 62 ft). A copy of the gear data log documenting the standard gear characteristics used is included in Appendix I.

Sampling Protocols

Two trained field scientists accompanied the vessel on each survey trip to perform biological sampling duties. Data were collected on NMFS Fishery Observer Program data forms according to that program's protocols, with slight modifications for the purposes of this project. Time, position, duration, tow speed and bottom depth were recorded at the beginning of each haul. Tow begin time was defined as when the winch brakes were engaged; haul end time, when the winch breaks were disengaged.

The goal was a tow duration of 20 minutes for each haul. Actual tow length ranged from 14 minutes to 22 minutes, but only 12 of 158 tows varied from the 20-minute standard. Overall, the average tow duration was 20 minutes. Since the goals of this study did not include measuring absolute abundance or density distribution, catch weights and numbers of individuals at length were not expanded for data analysis purposes.

Gear condition was recorded following each tow and used in determining the suitability of including the haul in the data analysis. A "good" tow was defined as lasting 10 minutes or more, with no major obstructions or tear-ups exceeding 10% of the meshes in the net. Towing protocols and operations matched those typically employed by the commercial groundfish trawl fishery. Environmental data, including weather conditions, wave height, wind speed and direction were also collected at each sampling station.

After each haul, the catch from each codend was sorted on deck by species. Total weights (lbs) were obtained for each species by codend. Length measurements of commercially important species were obtained. All lobsters, scallops and undersized fish were returned to the sea as quickly as possible to minimize mortality. Illustrations of sampling protocols followed are provided in Figure 7. A list of operational protocols that were followed on each trip is included in Appendix I. All data collected was entered into a Microsoft Access database and is also included in Appendix I. Commercial catch was sold at the conclusion of each trip and proceeds were kept by the vessels as part of the vessel charter fee. Following each trip, catch weights were reported via NMFS Call-in Interactive Voice Response System.

Regulatory Permits

To conduct the experimental fishing trips for this study, project participants applied for an Experimental Fishing Permit (EFP) from the NMFS Northeast Regional Office (NERO) in April 2005, including the submission of an Environmental Assessment. An EFP was issued in late May 2005, which necessitated rescheduling the first planned trip from May 2005 to June 2005. The EFP application requested an exemption from days-at-sea (DAS) requirements of the NE multispecies FMP. This exemption was not granted and the vessel was required to use A category DAS to conduct project operations.

The original proposal and vessel charter agreement had anticipated that the research trips could be conducted outside of DAS. It further anticipated that through the sale of the catch from research trips, approximately $30,000 would be made and used to pay for one of the nine monthly survey trips. The vessel owner indicated that the average amount of money that his vessels made commercial fishing under an A DAS was significantly more than that charter fee per day he had agreed to for the project. The project partners renegotiated the terms of the vessel charter agreement in order to more fairly compensate the vessel owner for using an A DAS for research. Since the budget had already been finalized, the only option available to the partners was to allow the vessel to keep the proceeds from the sale of the catch to supplement the fixed, daily charter fee. As a result, there was only enough money in the budget to complete eight monthly survey trips instead of nine.

In September 2005, participants had to request an amendment to the original EFP in order to gain an additional regulatory exemption to the closure of the Eastern US/Canada Management Area to all limited access Northeast (NE) multispecies (DAS) vessels effective August 26, 2005. This exemption was granted in late October 2005. The new EFP issued set a cod catch cap for the project of 600 lbs. This cap was not reached and did not prevent the completion of any tows. Another EFP amendment request was made to NERO in February 2006, to extend the time period of the EFP to allow project participants to conduct the trip originally scheduled for May 2005 in May 2006.

Gear Conflicts

Prior to beginning field operations for this project, the Atlantic Offshore Lobstermen's Association (AOLA) was contacted to minimize any potential gear conflicts. The AOLA was provided with the dates and locations of the scheduled experimental fishing trips and agreed to try to limit the amount of lobster gear in the appropriate areas at the scheduled times. In addition, the AOLA was provided with detailed updates regarding the dates and times of project operations a few weeks prior to each individual trip. Nonetheless, the presence of large amounts of lobster gear in Closed Area II prevented the completion of 7 tows in November, December and January.

RESULTS

Trip and Haul Summary

In total, eight multi-day trips were conducted for this study between June 2005 and May 2006. One hundred and fifty-eight tows were included in the data analysis (see Table 1). All tows were conducted on Georges Bank inside Closed Area I (145 tows) or Closed Area II (13 tows), aboard the F/V Teresa Marie IV with the vessel's haddock separator trawl.

Catch summary

A total of 35,584 lbs of fish and shellfish were caught over the duration of the study. Overall catch rates for each species are given in Table 2. The data are presented as total weight (lbs) and as a percentage of the total catch. Little and winter skates combined resulted in the highest catch by weight and comprised a large proportion of the catch (39%). Overall, the target species haddock comprised only 12% of the catch, while cod accounted for 3%. Total catch weights (lbs) and percentages by month (trip) for each species are presented in Table 3. Examination of this table reveals that haddock catch percentages by month varied widely, ranging from less than 1% (October 2005) to 36% (June 2005), while cod catch percentages remained consistently low, ranging from 1% to 9%.

Overall, the primary species kept by weight were:

- winter flounder (4,756 lbs),
- haddock (3,821 lbs),
- monkfish (1,949 lbs), and
- Atlantic cod (838 lbs).

The primary species discarded by weight were:

- little + winter skates (13,994 lb),
- spiny dogfish (3,152 lb),
- barndoor skate (2,538 lb), and
- American lobster (981 lb).

Catch by Codend

When examining catch rates by codend, the data were grouped into two different categories according to the configuration of the separator panel. The panel in its standard configuration, with 60 inch chains connecting the panel to the footrope, was towed 136 times. The panel in its alternate configuration, with 36 inch chains connecting the panel to the footrope, was towed during the month of July only, for a total of 22 tows.

Catch weight totals by codend for each month and as a percentage of the total catch are presented in Table 4. For all trips where the separator panel was set 60 inches from the footrope, 93% of the total catch by weight was captured in the bottom codend, 7% was captured in the top codend. Low haddock catch rates for most months account for the low percentage of catch in the top codend relative to the bottom. Codend catch ratios for the months of June and July however, were the exception to this trend. For both months, 76% of the catch was in the bottom codend and 24% was in the top codend.

Table 4. Catch weight totals by codend.

		Catch weight (lb)			% of Catch	
Month/Year	**Number of Tows**	**Total**	**bottom codend**	**top codend**	**bottom codend**	**top codend**
June 2005	21	5,280.7	3,991.4	1,289.4	76%	24%
July 2005	22	5,440.0	4,120.7	1,319.3	76%	24%
Aug 2005	22	7,874.3	7,540.0	334.3	96%	4%
Oct 2005	13	2,657.5	2,604.8	52.8	98%	2%
Nov 2005	19	6,596.5	6,449.3	147.3	98%	2%
Dec 2005	20	2,243.0	2,089.4	153.6	93%	7%
Jan 2005	20	3,348.4	3,281.6	66.8	98%	2%
May 2006	21	2,144.0	1,960.5	183.5	91%	9%
All	**158**	**35,584.20**	**32,037.55**	**3,550.45**	**90%**	**10%**
All where sep. panel at 60" (excludes July)	**136**	**30,144.25**	**27,916.85**	**2,227.50**	**93%**	**7%**

The total percentages of each species caught by weight in each codend, for all trips the separator panel was set 60 inches from the footrope are shown in Figures 8a and 8b. The majority of the overall catch in the top codend was comprised of haddock (56%), with lesser amounts of other semi-pelagic species such as pollock (13%) and spiny dogfish (10%). A few other species weighed in at less than 5% each, including cod at 3%. The catch in the bottom codend was much more varied, although all skate species combined made up half of the catch (51%). Low cod catches overall resulted in this species comprising only 3% of the catch by weight in the bottom codend.

Total catch weights for each species by codend for all trips where the separator panel was set 60 inches from the footrope are given in Table 5. Data are again presented as total weight (lbs) and as a percentage of the total catch in each respective codend. A total of 2,228 lbs of fish and shellfish were captured in the top codend during these 7 trips, while 27,917 lbs were captured in the bottom codend. Table 6 presents these same data broken out by month (trip).

Separation of Cod and Haddock

The total percentages of cod caught by weight in each codend by month and overall are shown in Figure 9. For all trips where the separator panel was set 60 inches from the footrope, 94% of cod were caught in the bottom codend, 6% in the top. Month by month, the percentages of cod in the top codend ranged from 0% (October and November) to 11% (August). For the month of July, when the separator panel was lowered to 36 inches from the footrope, the percentage of cod caught in the top codend rose to 38%.

The total percentages of haddock caught by weight in each codend by month and overall are shown in Figure 10. For all trips where the separator panel was set 60 inches from the footrope, the haddock catch was split nearly even between top and bottom (45% top, 55% bottom overall). Month by month, discounting the months where less than 100 lbs of haddock were caught total, the percentages of haddock captured in the top codend ranged from 35% (May) to 53% (August). In July, with the separator panel set 36 inches from the footrope, the percentage of haddock catch in the top codend jumped to 83%.

Separation of Other Species

The total percentages of other commercially important species (winter flounder, yellowtail flounder and monkfish) and other species of concern caught in relatively large quantities (all skate species combined) caught by weight in each codend by month and overall are shown in Figure 11. For all these species, nearly all of the catch was in the bottom codend.

The total catch weight by codend for each month for all other regulated groundfish species combined are given in Table 7. Overall, 94% of these species were captured in the bottom codend, with percentages ranging from 77% to 99%. If the weight of pollock, a semi-pelagic species, is subtracted from the weights of the other regulated groundfish species that are more exclusively bottom dwellers (flounders, monkfish, hakes, redfish, ocean pout), the percentages caught in the bottom codend rise even higher. The percentages for all tows combined climb into the 90's, and overall reach 98% (Table 8).

Figure 12 illustrates the typical species composition of catch in the top codend versus catch in the bottom.

Length Frequency Distributions

Haddock

The aggregate length frequency distribution of haddock is shown in Figure 13. Figure 14 shows these data in standardized form. In total, 1,023 individual haddock were measured over the duration of this study. The mean length of haddock captured was 54 cm. The largest haddock captured was 78 cm, corresponding to the upper limit of haddock typically caught by Northeast Fishery Science Center (NEFSC) resource assessment surveys (Collette and Klein-MacPhee, 2002). The figures reveal a bi-modal length distribution, with one group slightly under minimum landing size and one slightly over. Overall, in terms of numbers of individuals, 25% of haddock captured were below the minimum legal landing size of 48 cm. Length distributions by month are presented in Appendix II.

<u>By codend:</u>

Examination of haddock length frequencies by codend given in Figure 15 yields interesting results. For all trips where the separator panel was set 60 inches from the footrope (136 tows), more legal sized haddock were caught in the top codend, 74% were of legal landing size and 26% were undersized. In the bottom codend however, only 68% of haddock were of legal landing size, 32% were undersized. While nearly equal numbers of haddock were captured in each codend (347 in the top and 387 in the bottom), this discrepancy could be due merely to the overall low numbers of haddock caught.

Cod

In total, 241 individual cod were measured. Figures 16 and 17 present the aggregate length frequency distribution data. The mean length overall was 57 cm, slightly above the minimum legal landing size of 56 cm. However, in terms of numbers of individuals, only 49% of the cod captured were of legal landing size (Figure 18). By codend, for all months where the separator panel was set 60 inches from the footrope (136 tows), only 14 individual cod were captured in the top codend. Cod length frequency distribution by month and by codend overall are given in Appendix II.

Other species
Length frequency distributions by month are given in Appendix II for species caught in adequate numbers: winter flounder, yellowtail flounder, and monkfish. For other commercially important species caught in lower numbers (white hake, summer flounder, witch flounder, American plaice, and pollock), aggregate length frequency distribution plots are given.

Haddock CPUE

Overall, haddock catch per unit of effort (CPUE) in the top codend was very low, although there was high variability in catches both grid block to grid block and month to month.

Tows where the separator panel was set 60 inches from the footrope:

For all trips where the separator panel was set 60 inches from the footrope (136 tows), the mean weight per tow was only 9 lbs of legal-sized haddock in top codend (or 26 lbs/ hour), (see Table 9). By month, the highest CPUE was achieved in June (39 lbs/tow or 117/hour). The biggest catch of haddock by weight also occurred during the month of June, 303.5 lb in one 20-minute tow. The CPUE for all months other than June were much lower. The month with the next highest CPUE overall was November with 6 lbs/ tow, or 18 lbs/ hour.

Table 9. CPUE for kept haddock in top codend, for all tows where the separator panel was set 60 inches from the footrope.

MONTH	May	Jun	Aug	Oct	Nov	Dec	Jan	**All combined**
total (lbs)	58	821.5	121.5	0	114.5	26	15	**1156.5**
number of tows	21	21	22	13	19	20	20	**136**
mean catch per **tow** (lbs)	3	39	6	0	6	1	1	**9**
mean catch per **hour** (lbs)	**8**	**117**	**17**	**0**	**18**	**4**	**2**	**26**

June also shows the highest haddock CPUE if tows are separated by study sub-area. For all tows inside Closed Area I with the separator panel at 60 inches (126 tows), mean haddock CPUE in June was 29 lbs/ tow, or 86 lbs/ hour (see Table 10.). Inside Closed Area II (10 tows), mean haddock CPUE in June was the highest by far (139/ tow, 416 lbs/ hour) (see Table 11). However, a relatively low number of tows were completed inside Closed Area II; only two occurred in fall or winter months.

Table 10. CPUE for kept haddock in top codend in **CA I**, for all tows where the separator panel was set 60 inches from the footrope.

MONTH	May	Jun	Aug	Oct	Nov	Dec	Jan	**All combined**
total weight (lbs)	52.5	544.5	11	0	114.5	17	15	754.5
tows	18	19	19	13	19	19	19	126
mean catch per **tow** (lbs)	3	29	1	0	6	1	1	6
mean catch per **hour** (lbs)	**9**	**86**	**2**	**0**	**18**	**3**	**2**	**18**

Table 11. CPUE for kept haddock in top codend in **CA II**, for all tows where the separator panel was set 60 inches from the footrope.

MONTH	May	Jun	Aug	Oct	Nov	Dec	Jan	**All combined**
total weight (lbs)	5.5	277	110.5	0	0	9	0	402
number of tows	3	2	3	0	0	1	1	10
mean catch per **tow** (lbs)	2	139	37			9	0	40
mean catch per **hour** (lbs)	**6**	**416**	**111**			**27**	**0**	**121**

Tows where the separator panel was set 36 inches from the footrope:

Haddock CPUE in the top codend for July was highest of all months sampled, which was to be expected given that the separator panel was fishing closer to the bottom (Table 12). The mean overall CPUE of haddock in July was 47 lbs/ tow or 142 lbs/ hour. By study sub-area, the mean CPUE inside Closed Area I was 52 lbs/ tow or 155 lbs/ hour, inside Closed Area II it was 22 lbs/ tow or 65 lbs/ hour.

Table 12. CPUE for kept haddock in top codend, for all tows where the separator panel was set 36 inches from the footrope.

	OVERALL	CA I	CA II
total (lbs)	1044.5	979.5	65
number of tows	22	19	3
mean catch per **tow** (lbs)	47	52	22
mean catch per **hour** (lbs)	**142**	**155**	**65**

Cod CPUE

Cod catch rates remained consistently low across time and space, irrespective of haddock catch rates. For all trips where the separator panel was set 60 inches from the footrope, the mean catch per tow in the top codend was less than 0.5 lbs/tow or an average of 1 lb/ hour (see Table 13). In October and November, no cod were captured in the top codend at all in 32 hauls. During the month of June, when the highest haddock catch rates were achieved, less than 0.5 lbs/tow and per hour of cod were captured. This represents only two individuals captured in top codend, both on the same haul.

Table 13. Cod CPUE in the top codend, for all tows where the separator panel was set 60 inches from the footrope.

MONTH	May	Jun	Aug	Oct	Nov	Dec	Jan	**All combined**
total weight (lbs)	4	2.5	30	0	0	6	20	**62.5**
tows	21	21	22	13	19	20	20	**136**
mean catch per **tow** (lbs)	0	0	1	0	0	0	1	**0**
mean catch per **hour** (lbs)	**1**	**0**	**4**	**0**	**0**	**1**	**3**	**1**

For the month of July, when the separator panel was set 36 inches from the footrope, more cod ended up in the top codend, as was expected. Over 22 hauls, 54 lbs of cod were captured in the top codend. The mean catch per tow was 2 lbs, or 7 lbs an hour.

CPUE Haddock vs. Cod

Since one of the goals of this project was to reduce the catch of cod as much as possible while still retaining enough haddock to make this gear economically viable, the catch of legal-sized haddock was compared to the total catch of cod in the top codend (Figure 19). This clearly illustrates the relatively wide fluctuations of haddock catches from month to month compared to the consistently low cod catch rates in the study area.

Fish Distribution

The spatial distribution of fish of selected species was plotted for each sample grid block, overall and by month. For each plot, the weight of fish caught for a given species is represented by a circle whose diameter is proportional to the weight of the catch. In this case, data are assigned to one of three weight-class categories: 1-10 lbs, 11-50 lbs, and > 50 lbs. Each data point is centered within the respective grid block and does not necessarily correspond to the actual tow begin position.

A map of the study area showing selected depth contours is given in Figure 65. Inside Closed Area I, tow depths ranged from 25 to 52 fm. Depths were generally greater in the northwest portion of the study area and shallowest in the southeastern most portion. Inside Closed Area II, depths were significantly greater, ranging from 100 fm in the south, to 150 fm in the north.

Haddock distribution

Closed Area I

The haddock distribution plot for all months combined (Figure 20) shows consistently low catches in the southeast corner of study area. This was also the shallowest portion of the study area, with depths typically between 25 and 35 fathoms (fm). There were no haddock caught at all in grid block 17 over the duration of the study. For the months of June and July, when the highest catch rates of the study were achieved, haddock were distributed differently. In June, the highest catches were concentrated in the northeastern-most portion of the study area (Figure 21). In July, the highest catches were concentrated in west-central portion (Figure 22). For all other months (Figures 23 – 28), less than 300 lbs of haddock were caught per month. They seemed to be sparsely distributed throughout study area, with no real patterns evident.

Closed Area II

Inside Closed Area II, the largest quantities of haddock were also found during summer months (June, July, and August), and were present in all blocks sampled (Figures 22-24). Grid block numbers 2 and 3 saw higher catches than block 1 overall. Blocks 2 and 3 were of similar depths (around 100 fm), deeper water was found in block 1 (around 140 fm). It is hard to infer too much from data collected in this portion of the study area as only 13 tows were completed, most of which occurred in spring and summer months (11 of 13).

Cod distribution

Cod were present at least once in every grid block sampled, as shown in the distribution plot for all months combined (Figure 29). Catch weights per month were fairly consistent, averaging about 150 lb per month, but distribution plots by month show no temporal or spatial distributional patterns (Figures 30-37). Catches per haul were all less than 50 lbs for all but four (out of 158) individual hauls.

Little and winter skate distribution

Distribution plots were created for little and winter skate species combined, for all months combined and for each month (Figures 38-46). These species made up a large portion of the

catch in the bottom codend in all months sampled. As shown in Figure 38, they were present at least once in every block sampled. Catch weights were typically higher in Closed Area I than in Closed Area II, as would be expected given their preferred depth range (Collette and Klein-MacPhee, 2002). No temporal distribution patterns were evident.

Barndoor skate distribution

Distribution plots were also created for barndoor skates for all months combined and for each month (Figures 47-55). This skate species was most abundant in the study area during the months of July, August, October and November. As with little and winter skates, catch weights were typically higher in Closed Area I than in Closed Area II, as would be expected given their preferred depth range (Collette and Klein-MacPhee, 2002).

Winter flounder distribution

Distribution plots for all months combined and for each month for winter flounder are given in Figures 56-64. For all months combined, winter flounder were caught in relatively large quantities in all blocks in Closed Area I except for one. By individual month, they were fairly evenly distributed throughout Closed Area I. No winter flounder were caught in Closed Area II for the duration of the study, as would be expected given their preferred depth range (Collette and Klein-MacPhee, 2002).

DISCUSSION

The main goal of this project was to document the performance of a haddock separator trawl in eliminating cod and other groundfish bycatch while targeting haddock on Georges Bank in selected portions of Closed Areas I and II. The results of this work show that this separator trawl design, consisting of a conventional groundfish trawl net modified by a horizontal mesh panel sewn into the gore ropes, significantly reduces the bycatch of cod and virtually all other demersal species, including many other regulated species. Overall, with the separator panel in its standard configuration (set approximately 5 ft from the footrope), 94% of the cod catch by weight ended up in the bottom codend where it would have escaped versus 6% in the top codend. This separator trawl was also effective at excluding other typical groundfish bycatch species. For all other regulated groundfish species[5] by weight combined, 94% were captured in the bottom codend, 6% in the top.

As expected, this gear proved most effective at excluding those species that are more exclusively bottom dwellers like flounders, monkfish and skates. Only 1% by weight of both monkfish and all skate species combined were caught in the top codend when the separator panel was set approximately 5 ft from the footrope. Likewise, 3% of all flounders by weight ended up in the top codend. While it was somewhat surprising to achieve a percentage even this high for flounders, it could be indicative of the rough bottom in Closed Area I. There is likely more opportunity for capture if there is significant gear movement, especially bouncing up and over bottom features. It is unlikely that they could pass through the horizontal separator panel while being guided towards the back of the net, most were legal-sized flounders and the separator panel is composed of 6.5 inch mesh.

Also as expected, species composition in the top codend was primarily made up of species that tend to show a wider vertical distribution in the water column. Haddock accounted for 56% by weight of all species captured, pollock 13%, spiny dogfish 10%, a few other species including

[5] "other regulated groundfish species" include: monkfish, pollock, redfish, ocean pout, hakes: white, red, silver; flounders: winter, witch, yellowtail, American plaice, windowpane.

bluefish and Atlantic herring weighed in at less than 5% each, and cod equaled 3%. Still, this gear excluded far more than it captured; 90% of the catch by weight overall was in the bottom codend. This also includes about half of the potential haddock catch. Therefore, high densities of haddock would be needed to achieve commercially viable catch rates. This compromise was expected and is common in gear designed to be more selective. In order to reduce bycatch, it is also often necessary to accept a loss of target species.

This separator trawl design has practical and economic advantages over other types of trawl nets aimed at capturing haddock and not cod because it involves fairly simple modifications to gear already used, rather than the purchase or construction of a whole other net. It also allows for flexibility while on fishing grounds, a vessel's crew could easily sew the panel into, or cut it out of, its normal groundfish net as conditions warranted. A mesh panel takes up little additional room in the hold.

Potential for a SAP in CA I

Although results show the gear is successful in eliminating most cod bycatch, the CPUE of haddock achieved by this study in Closed Area I with a haddock separator trawl is too low for a commercial SAP to be economically viable. With the separator panel in its standard configuration, set approximately 5 ft from footrope, the mean weight per tow of legal sized haddock in top codend was only 6 lbs, equivalent to 18 lbs per hour (see Table 10). The CPUE for haddock was highly variable from grid block to grid block and month to month however. Comparisons of catch rates by month indicate that the best potential for a haddock SAP in Closed Area I is probably during summer months, especially June and July.

With the separator panel in its standard configuration, the highest haddock CPUE in Closed Area I for the study was achieved in June (39 lbs per tow or 117 per hour). The highest haddock catch in the top codend for any one tow was also achieved in June, 303.5 lbs in 20 minutes. Haddock catch rates for the other months field testing was conducted with the separator panel in its standard configuration are significantly lower. The next highest CPUE for any given month occurred in November with 6 lbs per tow, or 18 lbs per hour.

The CPUE of haddock inside Closed Area I was also relatively high during the month of July as compared with other months. Since the separator panel was rigged in an alternate configuration, approximately 3 ft from footrope, catch rates of haddock in top codend were higher than when the panel was rigged approximately 5 ft from the footrope. Over 22 tows, the mean CPUE was 52 lbs per tow or 155 lbs per hour.

While it is not possible to make a direct comparison of catch rates in June versus July since the separator panel was rigged to fish at different heights from the footrope, a qualitative comparison is useful. In June, 46% of the haddock catch by weight was captured in the top codend. In July, 83% of haddock were captured in the top codend. Thus, in June, approximately 38% more of the haddock were captured in the top codend than in July. If the haddock catch in the top codend for July is reduced by 38%, the catch rate is slightly lower than that achieved in June but very similar at 32 lbs per tow or 96 lbs per hour.

Closed Area II SAP

Since a low number of tows were made in this area (13) over fewer months than in Closed Area I (see Table 1), a comparison of haddock catch rates by month is less useful. Nonetheless, it is noteworthy that the highest haddock catch rates inside Closed Area II were generally experienced in the same months as in Closed Area I. June had the highest CPUE by far at 139

lbs per tow, or 416 lbs per hour. July haddock CPUE in this area was less similar to that achieved in Closed Area I, at only 14 lbs per tow or 40 lbs per hour. Haddock catch rates in August also proved relatively high in this area (37 lbs per tow or 111 lbs per hour), in contrast to catch rates in Closed Area I (1 lb per tow or 2 lbs per hour).

Haddock catch disposition

Over all tows where the separator panel was set at 5 ft from the footrope, 92% of haddock by weight captured in top codend were of legal size. The discard rate of 8% achieved by this study is slightly higher than the 2-5% fishery discard rate estimated by the NEFSC for fishing years 2001- 2004 but still seems reasonable. This could be a function of the noted large 2003 year class of haddock, which probably comprised a large portion of the haddock catch. The 2003 haddock year class has been identified by NEFSC as having highest recruitment on record but is also very slow growing (Brodziak et al. 2005). The pooled haddock length frequency data shows a bi-modal distribution with one group legal-sized and one just under (Figure 15).

Cod CPUE

In comparison to fluctuating haddock catch rates, cod catch rates remained consistently low both temporally and spatially. The overall mean catch per tow in the top codend was less than 0.5 lbs per tow or an average of 1 lb per hour. In October and November, no cod were captured in the top codend at all in 32 tows. For the month of June, when the highest haddock CPUE was achieved, cod CPUE was less than 0.5 lbs per tow and per hour. This represents only two individuals captured in the top codend over 22 tows, both on same tow. For the month of July which also saw relatively high haddock catch rates, the overall cod catch was also very similar, 188.5 lbs in June versus 143.5 lbs July. Since separator panel was closer to the footrope in July (approximately 3 ft versus 5 ft), more of these cod ended up in the top codend, but similar results would be expected at 5 ft.

Results from this study suggest that the best potential timing for a haddock SAP on Georges Bank would be during summer months, particularly June and July. However, these results present only a snapshot in time of the species present in the study area, it is difficult to know if this will be representative of fish abundance or distribution patterns in subsequent years. It should also be noted that experimental trips during the months of May and June did not occur chronologically, because of EFP delays, the June trip was conducted in 2005, the May trip in 2006.

Problems encountered

The most significant problem encountered during this study was the low catch rates of haddock in the study area, particularly in Closed Area I. This problem was unexpected and remains unexplained. One potential reason is that the topography and physical characteristics of the study area have changed during the 10 years it has been closed to bottom trawling. It is also possible that haddock were simply not present in the study area in commercially exploitable densities, at least not size classes that would lend themselves to be captured in 6.5-inch mesh codends. It is worth noting that most of the field work for this project was conducted in 2005, prior to when most of the large but slow growing 2003 year class of haddock would have been expected to be recruited into the fishery.

Thus, while results from this study indicate that this net design is successful at excluding most of the cod encountered, it would be difficult to predict degree of separation likely to be achieved on large schools of intermingled cod and haddock. The ability of researchers to find adequate quantities of target fish species remains a key challenge in evaluating new fishing gear designs.

This is at least partially due to the significant investment of time and resources needed to design, coordinate and conduct studies of this nature and the inflexibility of the process once it is begun. Project details must be fixed long before implementation and few mechanisms exist that allow modifications based on current conditions once operations are underway.

This project, like others, assumed there would be high concentrations of fish found in closed areas without the advantage of recent commercial experience to back up this assumption. In order to collect better data on separator trawl performance this project would have benefited from the ability to go where fish were based on real time conditions and information from the rest of the fleet. However, this would have compromised another goal of assessing the potential for a haddock SAP in Closed Area I.

Gear standardization was also a challenge for this project. Changes, albeit minor ones, were made to the gear configuration following five of the 22 tows completed in June. For scientific purposes, in order to measure the effectiveness and/ or magnitude of a change in gear configuration, standardization is essential. However, this remains a challenge for many studies, especially ones which involve fishing in areas that have been closed to the commercial fleet for over 10 years. Many studies including this one, would likely benefit from dedicating a limited amount of time at the beginning of the project to determine the best gear configuration and protocols for the study area before conducting experimental fishing trips.

Regardless, the minor adjustments made to the gear configuration for this study did not affect the ability of this study to achieve its objectives since they were largely focused on giving managers an idea of what catch and bycatch rates would be for the commercial fleet inside Closed Area I, using a haddock separator trawl. Under real world conditions, fishermen are constantly making small changes to the gear to improve performance. The changes made were relatively minor and unlikely to have major effects on separation of cod and haddock, as indicated by relatively stable readings from the Netmind™ trawl performance monitoring system.

Other factors that negatively affected project operations included the presence of large amounts of fixed gear (lobster trawls) within the study area and regulatory changes implemented within the project timeline. As discussed previously, fixed gear prevented the completion of 7 out of 9 tows scheduled for the months of November, December and January in Closed Area II. The regulatory closure of the Eastern U.S./Canada Management Area in August 2005 also would have prevented the completion of 3 tows in Closed Area II in October, but unfavorable weather conditions experienced during this trip resulted in the vessel returning to port early anyway.

Recommendations for further work

It would be useful to conduct additional experiments in which the separator panel is set at different heights from the footrope to explore the potential of increasing the haddock catch rate while keeping the cod bycatch rate at a reasonable level. Behavioral similarities between haddock and cod make the possibility of designing a trawl net that would retain all of the haddock and release all of the cod unlikely. In setting the height of the separator panel at 5 ft from the footrope for the majority of testing during this experiment, the objective of significantly reducing cod bycatch was achieved but the objective of retaining marketable quantities of haddock was not. However, the opposite conditions seemed to hold for the limited number of tows conducted with the separator panel set at three feet from the footrope. In this case, catch rates of haddock seemed adequate but bycatch rates of cod were unacceptably high. It appears likely that setting the panel somewhere in between three and five feet could achieve better catch rates of haddock, while at the same time excluding an acceptable proportion of the cod bycatch.

It is important to note that even though this separator trawl design incorporates the use of very specific lengths of chain to connect the separator panel to the footrope (36 inches or 60 inches), the actual height of the panel while it is fishing likely varies widely as the gear is towed across the bottom. Future studies that include placing a video camera in the net or an acoustic sensor on the panel while it is fishing would be very useful in helping to understand the relationship of these connecting chains to the effective fishing height of the panel.

Further, while haddock catch rates in the top codend with the separator panel set at five feet from the footrope were too low in this experiment to be economically viable in a commercial sense, this does not necessarily mean that this gear design would achieve the same results in another area or under different conditions. Additional information on the performance of this gear when encountering high densities of intermingled cod and haddock is highly desirable for managers to effectively evaluate the implications of this gear being used fleet wide.

Additionally, this project is one of many that have been funded by the NMFS and others over the past few years to develop trawl gear that is effective at capturing haddock while keeping the cod catch at a minimum. This report presents an evaluation of only one trawl gear design in one specific area among many. The greatest benefits of this study will be achieved if its results are viewed collectively with those of similar studies. To this end, participants in this study are aware and supportive of University of New Hampshire researcher Dr. Pingguo He's efforts to organize a collaborative haddock workshop to review and synthesize the results of this and similar studies in the near future.

REFERENCES

Brodziak, J., M. Traver, and L. Col. (2005). Georges Bank haddock. In NEFSC, *An assessment of 19 Northeast groundfish stocks through 2004.*, pp. 30-35. NEFSC Ref. Doc. 05-13. Retrieved September 30, 2006, from http://www.nefsc.noaa.gov/nefsc/publications/crd/crd0513/

Collette, B. B. and G. Klein-McPhee (eds.). (2002). *Bigelow and Schroeder's Fishes of the Gulf of Maine* (3rd ed.). Washington D.C.: Smithsonian Institution Press.

Galbraith, R.D. and Main, J. (1989). *Separator panels for dual purpose fish/prawn trawls*. Scottish Fisheries Information Pamphlet No. 16.

Glass,C.W. Sarno,B. Milliken,H.O. Morris,G.D. & Carr,H.A., (1999). *Bycatch reduction in Massachusetts inshore squid (loligo pealeii) trawl fisheries*. Marine Technology Society Journal. Vol. 33, No. 2. 35-42.

Main, J. and Sangster, G.I. (1982). *A study of a multi-level bottom trawl for species separation using direct observation techniques*. Scottish Fisheries Research Report, (27), 17 pp.

Main, J. and Sangster, G.I. (1985). *Trawling experiments with a two-level trawl to minimize the undersized gadoid by-catch in a Nephrops fishery*. Fisheries Research 3, 131-145.

Main, J. and Sangster, G.I. (1986). *Are separator trawls effective?* Scottish Fisheries bulletin, 49, 3-7.

Richard, G. (1999). *An assessment of trawling technology in Canada. Conservation technology in trawls: horizontal separator trawls*. P 31. Published by Program Planning and Coordination, Fisheries and Oceans, Canada. Ottawa, Ontario. 45 pp.

National Marine Fisheries Service, Northeast Regional Office (NMFS NERO), Fisheries Monitoring and Analysis Section. (2006). *Northeast Multispecies Preliminary Fisheries Statistics Reports*. Retrieved September 30, 2006, from http://www.nero.noaa.gov/ro/fso/mul.htm

National Marine Fisheries Service, Office of Sustainable Fisheries (NMFS OSF). (2006). *Status of U.S. Fisheries 2nd quarter update for 2006*. Retrieved September 30, 2006, from http://www.nmfs.noaa.gov/sfa/domes_fish/StatusoFisheries/2006/2ndQuarter/TablesA_B2.pdf

New England Fishery Management Council and National Marine Fisheries Service. (2004). *Final Amendment 13 to the Northeast Multispecies Fishery Management Plan*.

Figure 1. U.S./Canada Area Haddock SAP, proposed under Amendment 13 (May 2004), implemented under Framework 40A (November 2004).

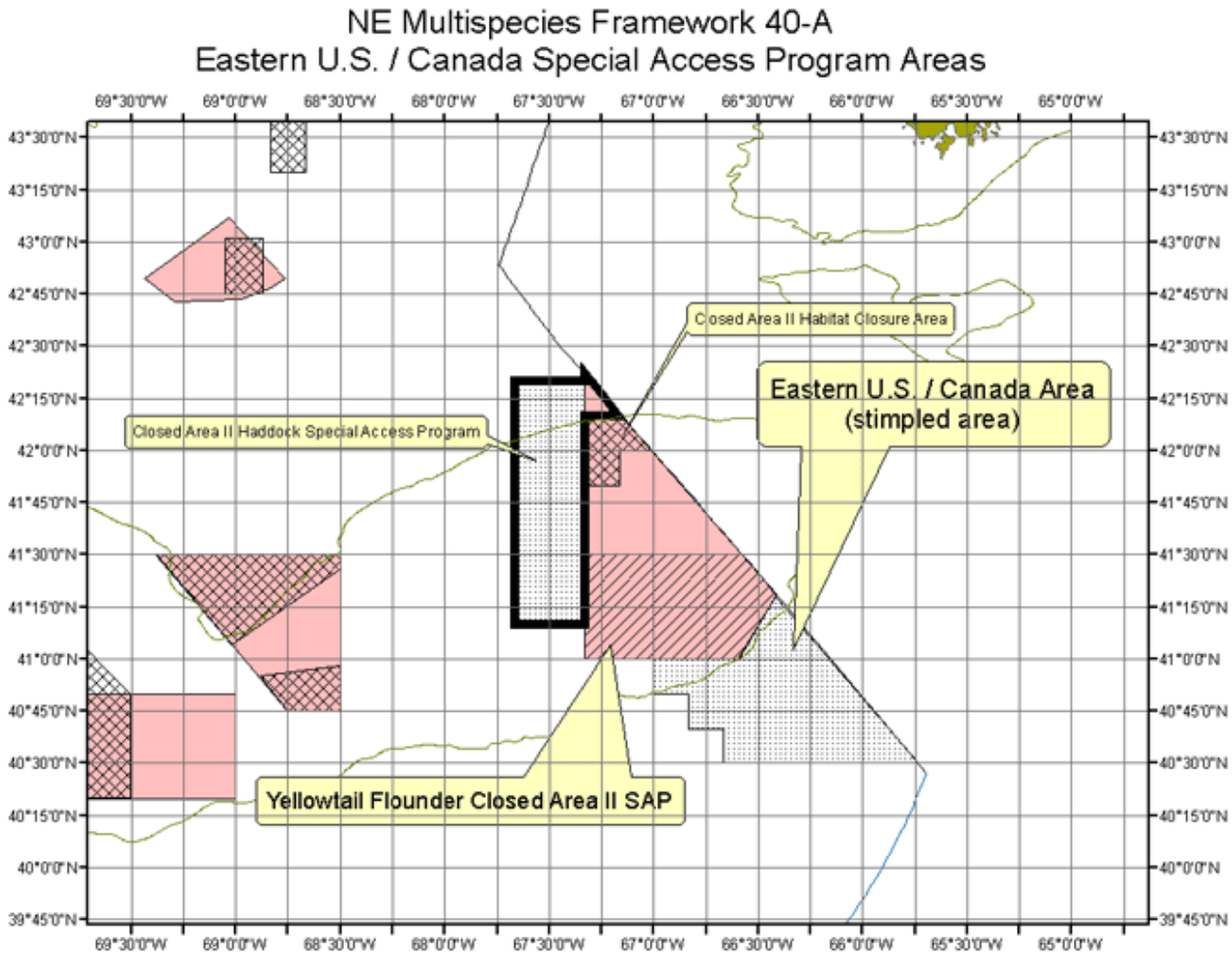


Figure 2. Study areas on Georges Bank with survey grid overlaid.

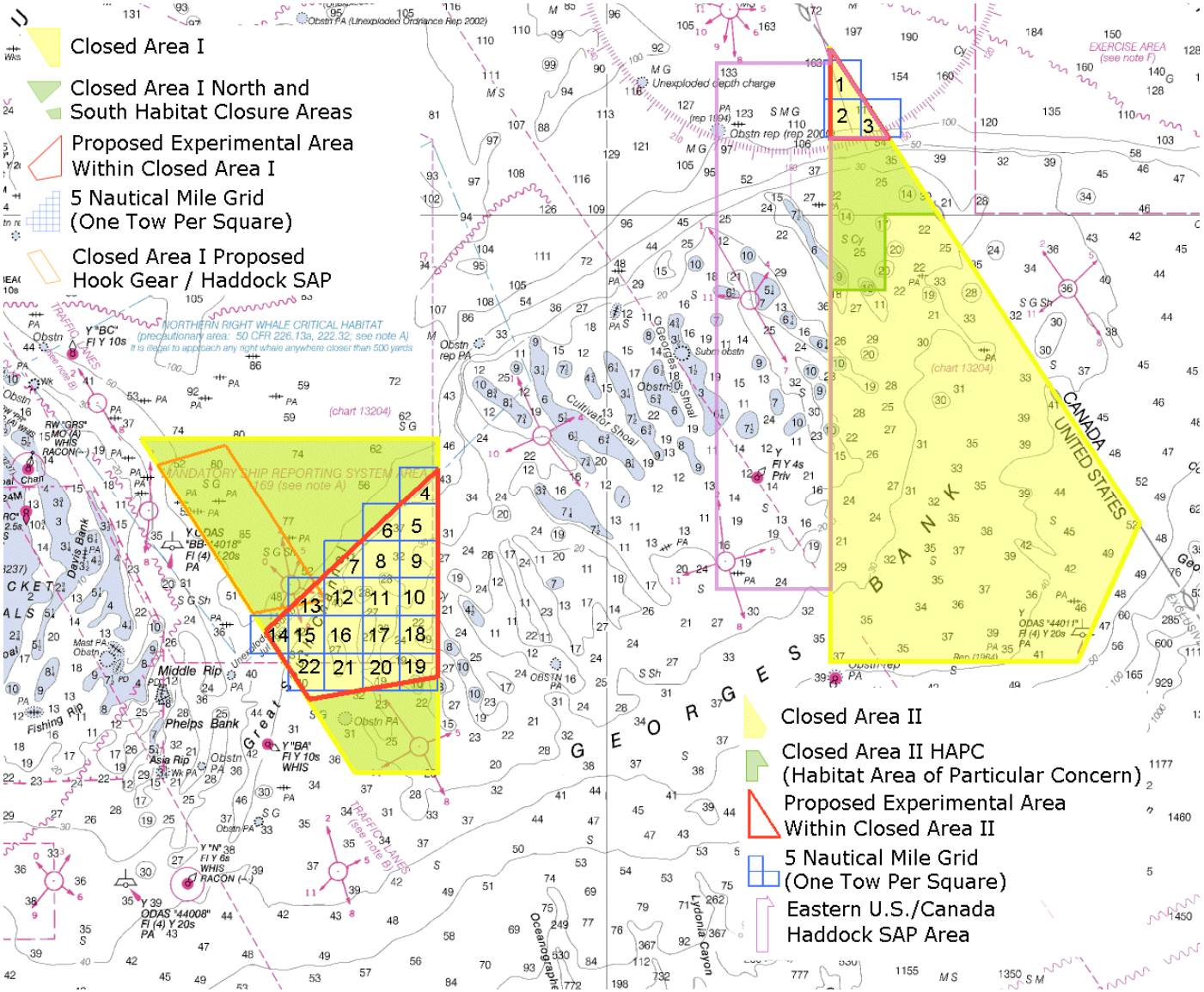
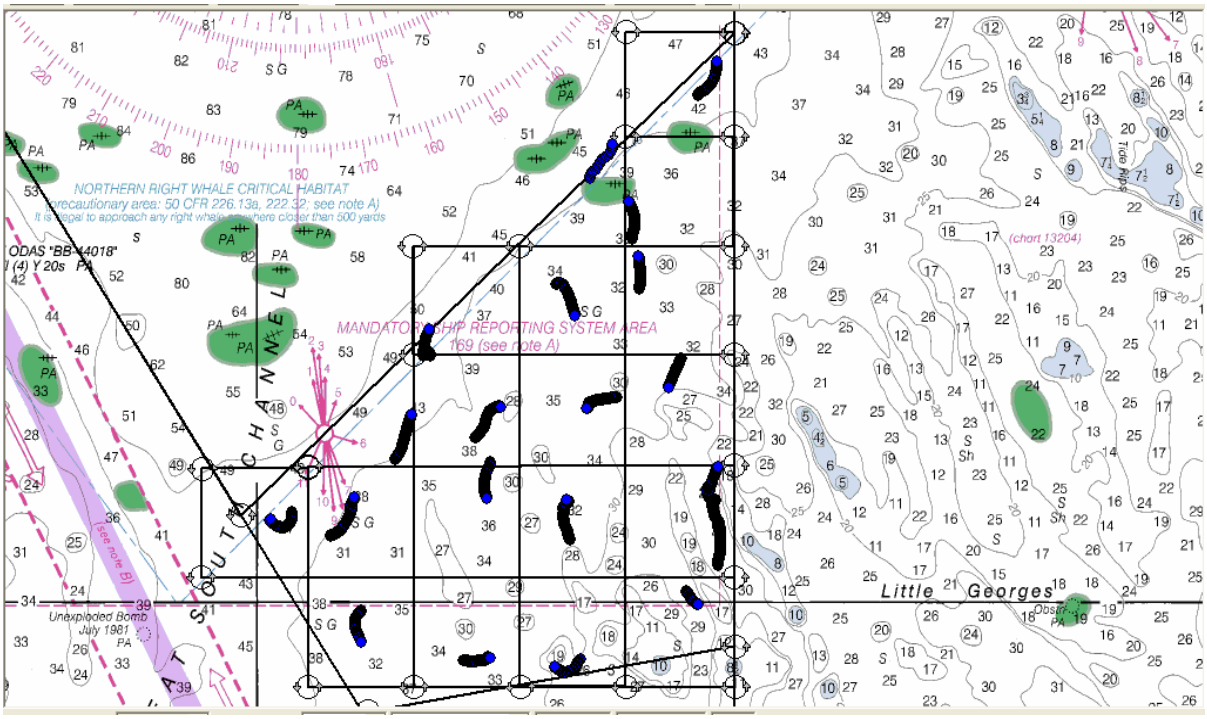


Figure 3. Typical tow locations.



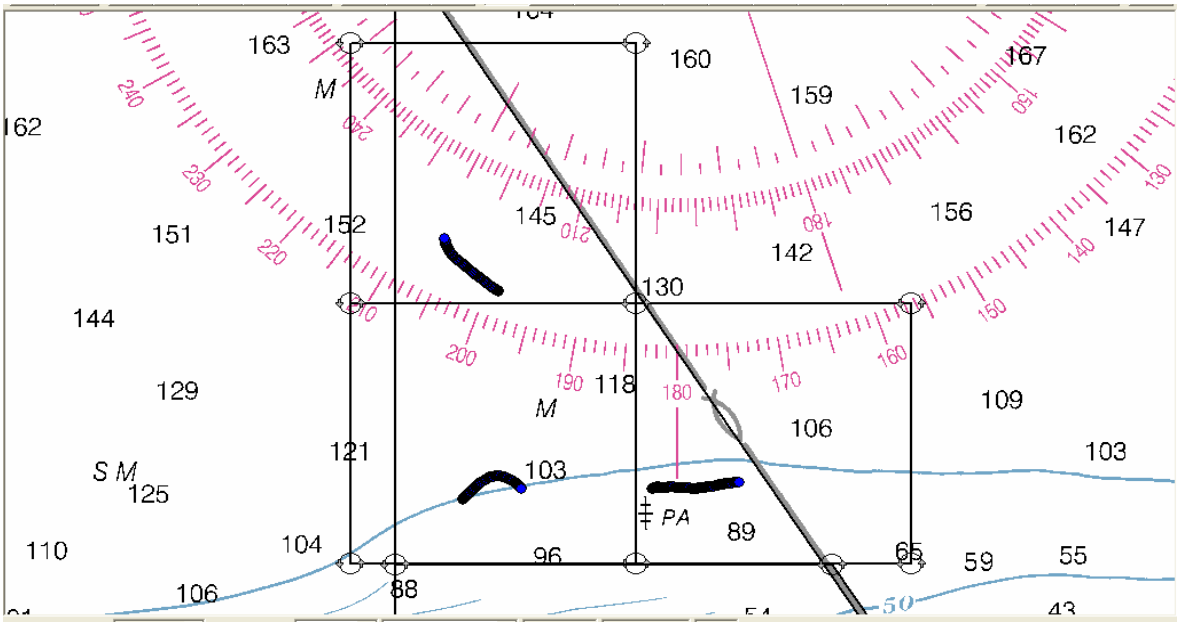


Figure 4. F/V Teresa Marie IV of Portland, ME conducted all experimental fishing trips.

Figure 5. Net plan: haddock separator trawl, F/V Teresa Marie IV.

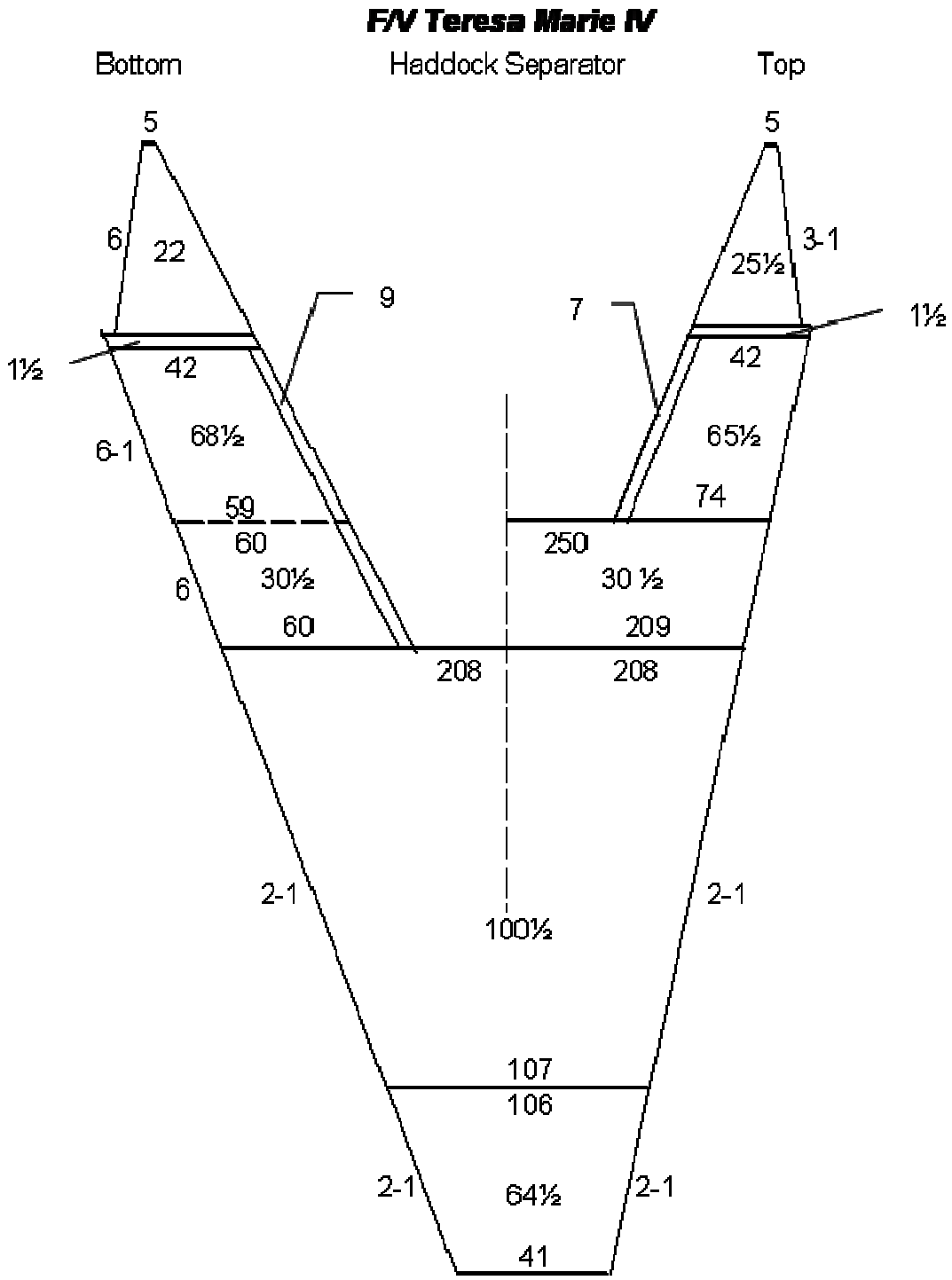


Figure 6. Trawl performance monitoring data.

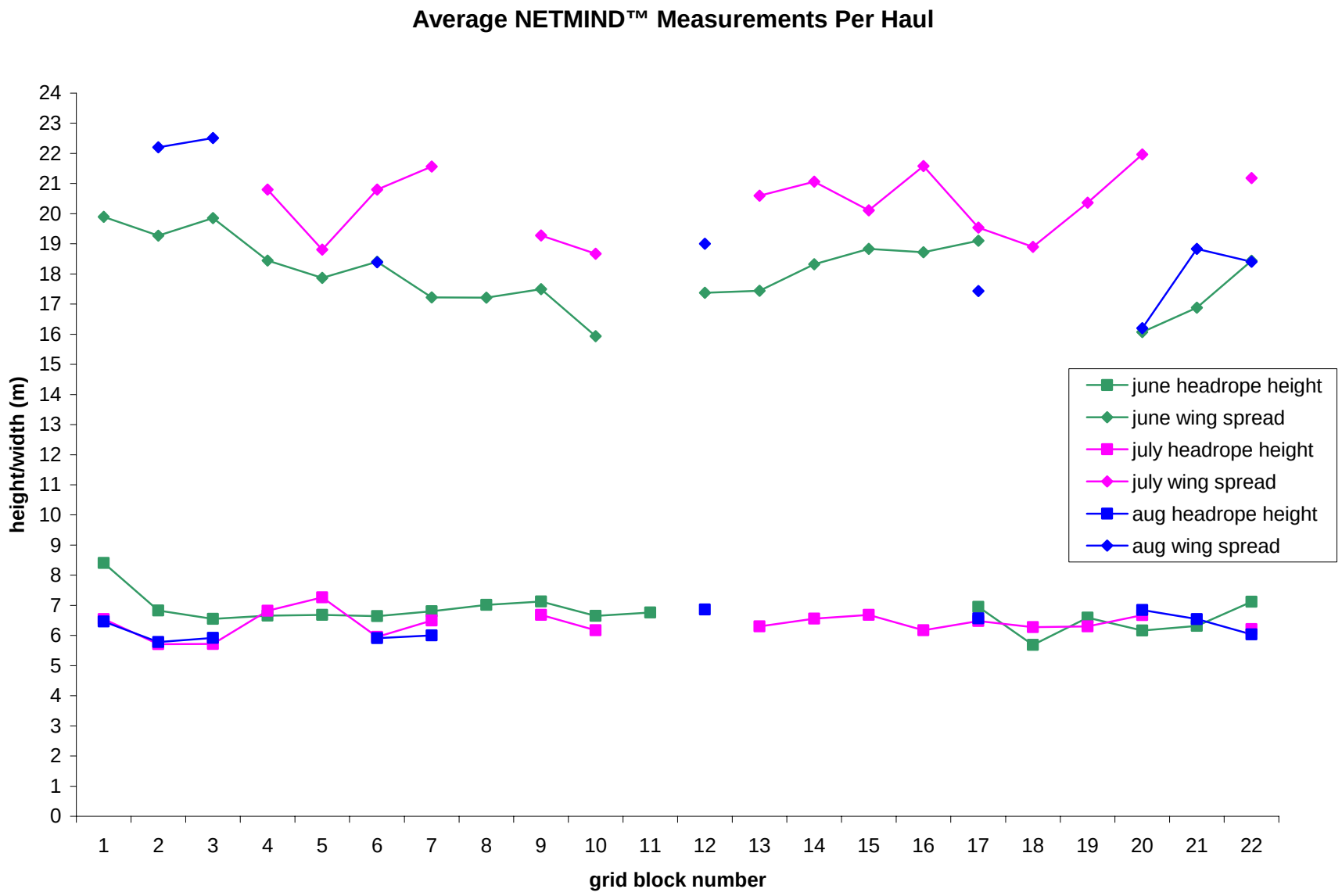


Figure 7. Documentation of sampling protocols.

Sorting the catch by codend and by species.

Collecting weights by species.

Taking length measurements.

The vessel's crew assisting with sampling.

Table 2. Total catch weights (lbs) by species.

Species Common Name	Species Scientific Name	Total Weight (LBS)	Percentage of Total Weight
ALEWIFE	*Alosa pseudoharengus*	0.3	0%
BLUEFISH	*Pomatomus saltatrix*	93.0	0%
BUTTERFISH	*Peprilus triacanthus*	0.8	0%
COD, ATLANTIC	***Gadus morhua***	**1,171.0**	**3%**
CUNNER	*Tautogolabrus adspersus*	7.5	0%
CUSK	*Brosme brosme*	72.0	0%
DOGFISH, SMOOTH	*Mustelus canis*	8.0	0%
DOGFISH, SPINY	*Squalus acanthias*	3,152.0	9%
FLOUNDER, AMERICAN PLAICE (DAB)	*Hippoglossoides platessoides*	89.6	0%
FLOUNDER, FOURSPOT	*Paralichthys oblongus*	43.0	0%
FLOUNDER, SUMMER (FLUKE)	*Paralichthys dentatus*	202.5	1%
FLOUNDER, WINDOWPANE (SAND DAB)	*Scophthalmus aquosus*	53.3	0%
FLOUNDER, WINTER (BLACKBACK)	*Pseudopleuronectes americanus*	4,757.0	13%
FLOUNDER, WITCH (GREY SOLE)	*Glyptocephalus cynoglossus*	104.0	0%
FLOUNDER, YELLOWTAIL	*Limanda ferruginea*	424.3	1%
GRENADIER, COMMON (MARLIN SPIKE)	*Nezumia bairdi*	0.5	0%
HADDOCK	***Melanogrammus aeglefinus***	**4,103.5**	**12%**
HAKE, RED (LING)	*Urophycis chuss*	21.1	0%
HAKE, SILVER (WHITING)	*Merluccius bilinearis*	23.7	0%
HAKE, WHITE	*Urophycis tenuis*	149.8	0%
HERRING, ATLANTIC	*Clupea harengus*	80.4	0%
LOBSTER, AMERICAN	*Homarus americanus*	981.3	3%
MACKEREL, ATLANTIC	*Scomber scombrus*	0.2	0%
MONKFISH, WHOLE	*Lophius americanus*	2,039.8	6%
OCEAN POUT	*Macrozoarces americanus*	28.3	0%
POLLOCK	*Pollachius virens*	455.5	1%
REDFISH, ACADIAN (OCEAN PERCH)	*Sebastes fasciatus*	9.5	0%
ROSEFISH, BLACK BELLY	*Helicolenus dactylopterus*	5.0	0%
SCALLOP, SEA	*Placopecten magellanicus*	147.8	0%
SCULPIN, LONGHORN	*Myoxocephalus octodecemspinosus*	167.1	0%
SEA RAVEN	*Hemitripterus americanus*	608.5	2%
SEA ROBIN, NORTHERN	*Prionotus carolinus*	2.0	0%
SKATE, BARNDOOR	*Raja laevis*	2,537.8	7%
SKATE, WINTER + LITTLE	*Raja erinacea + Raja ocellata*	13,994.0	39%
SKATE, SMOOTH	*Raja senta*	7.5	0%
SKATE, THORNY	*Raja radiata*	5.0	0%
SQUID, LONG FINNED (LOLIGO)	*Loligo pealeii*	25.8	0%
SQUID, SHORT FINNED (ILLEX)	*Illex illecebrosus*	12.4	0%
TOTAL		**35,584.2**	

Table 3. Total catch weights (lbs) by month and species.

	JUNE 2005		JULY 2005		AUG 2005		OCT 2005		NOV 2005		DEC 2005		JAN 2006		MAY 2006	
SPECIES	**Total**	**% of total**	**Total**	**% of total**	**Total**	**% of total**	**Total**	**% of total**	**Total**	**% of total**	**Total**	**% of total**	**Total**	**% of total**	**Total**	**% of total**
ALEWIFE	0.0	0%	0.0	0%	0.3	0%	0.0	0%	0.0	0%	0.0	0%	0.0	0%	0.0	0%
BLUEFISH	0.0	0%	11.0	0%	46.5	1%	8.0	0%	27.5	0%	0.0	0%	0.0	0%	0.0	0%
BUTTERFISH	0.0	0%	0.0	0%	0.3	0%	0.3	0%	0.3	0%	0.0	0%	0.0	0%	0.0	0%
COD, ATLANTIC	**188.5**	**4%**	**143.5**	**3%**	**266.0**	**3%**	**20.0**	**1%**	**102.0**	**2%**	**73.5**	**3%**	**191.5**	**6%**	**186.0**	**9%**
CUNNER	0.0	0%	0.0	0%	0.0	0%	3.5	0%	2.0	0%	2.0	0%	0.0	0%	0.0	0%
CUSK	0.0	0%	5.0	0%	30.0	0%	0.0	0%	0.0	0%	0.0	0%	24.0	1%	13.0	1%
DOGFISH, SMOOTH	0.0	0%	0.0	0%	0.0	0%	8.0	0%	0.0	0%	0.0	0%	0.0	0%	0.0	0%
DOGFISH, SPINY	879.0	17%	7.0	0%	393.0	5%	165.0	6%	1180.5	18%	354.5	16%	75.5	2%	97.5	5%
FLOUNDER, AMERICAN PLAICE (DAB)	20.5	0%	20.0	0%	12.0	0%	0.0	0%	0.0	0%	1.5	0%	17.0	1%	18.6	1%
FLOUNDER, FOURSPOT	12.0	0%	0.5	0%	5.0	0%	6.5	0%	13.5	0%	5.0	0%	0.0	0%	0.5	0%
FLOUNDER, SUMMER (FLUKE)	1.5	0%	13.0	0%	83.5	1%	55.0	2%	24.5	0%	0.0	0%	0.0	0%	25.0	1%
FLOUNDER, WINDOWPANE (SAND DAB)	2.0	0%	0.5	0%	13.3	0%	6.0	0%	5.5	0%	8.8	0%	16.8	1%	0.5	0%
FLOUNDER, WINTER (BLACKBACK)	397.0	8%	816.5	15%	975.5	12%	403.5	15%	1579.5	24%	212.5	9%	168.5	5%	204.0	10%
FLOUNDER, WITCH (GREY SOLE)	48.5	1%	15.5	0%	32.5	0%	0.0	0%	0.0	0%	0.0	0%	0.0	0%	7.5	0%
FLOUNDER, YELLOWTAIL	71.5	1%	47.0	1%	19.0	0%	20.5	1%	94.0	1%	36.0	2%	78.3	2%	58.0	3%
GRENADIER, COMMON (MARLIN SPIKE)	0.0	0%	0.0	0%	0.0	0%	0.0	0%	0.0	0%	0.5	0%	0.0	0%	0.0	0%
HADDOCK	**1902.0**	**36%**	**1321.3**	**24%**	**234.5**	**3%**	**12.0**	**0%**	**219.5**	**3%**	**52.5**	**2%**	**78.3**	**2%**	**283.5**	**13%**
HAKE, RED	1.5	0%	3.5	0%	11.8	0%	2.0	0%	1.3	0%	1.0	0%	0.0	0%	0.1	0%
HAKE, SILVER (WHITING)	0.6	0%	2.6	0%	16.5	0%	2.0	0%	1.8	0%	0.0	0%	0.3	0%	0.0	0%
HAKE, WHITE	11.0	0%	45.0	1%	35.0	0%	1.5	0%	15.5	0%	0.0	0%	28.0	1%	13.8	1%
HERRING, ATLANTIC	79.4	2%	0.0	0%	0.0	0%	0.5	0%	0.0	0%	0.3	0%	0.0	0%	0.3	0%
LOBSTER, AMERICAN	103.5	2%	99.0	2%	131.5	2%	85.0	3%	272.5	4%	46.5	2%	64.0	2%	179.3	8%
MACKEREL, ATLANTIC	0.0	0%	0.0	0%	0.0	0%	0.0	0%	0.0	0%	0.2	0%	0.0	0%	0.0	0%
MONKFISH, WHOLE	328.5	6%	329.3	6%	445.5	6%	76.5	3%	691.0	10%	17.0	1%	53.0	2%	99.0	5%
OCEAN POUT	11.5	0%	4.0	0%	2.8	0%	0.0	0%	0.0	0%	0.0	0%	4.0	0%	6.0	0%
POLLOCK	134.0	3%	49.0	1%	0.0	0%	0.0	0%	27.5	0%	176.0	8%	12.0	0%	57.0	3%
REDFISH, ACADIAN (OCEAN PERCH)	0.0	0%	7.0	0%	1.5	0%	0.0	0%	0.0	0%	0.0	0%	0.0	0%	1.0	0%
ROSEFISH, BLACK BELLY	0.0	0%	0.0	0%	1.0	0%	0.0	0%	0.0	0%	4.0	0%	0.0	0%	0.0	0%
SCALLOP, SEA	4.0	0%	0.0	0%	0.0	0%	3.3	0%	128.0	2%	0.0	0%	0.0	0%	12.5	1%
SCULPIN, LONGHORN	18.0	0%	24.0	0%	24.0	0%	15.5	1%	29.0	0%	27.0	1%	7.1	0%	22.5	1%
SEA RAVEN	78.3	1%	118.0	2%	104.0	1%	12.0	0%	71.0	1%	28.5	1%	105.0	3%	91.8	4%
SEA ROBIN, NORTHERN	0.0	0%	0.0	0%	0.0	0%	0.0	0%	0.0	0%	0.0	0%	0.0	0%	2.0	0%
SKATE, BARNDOOR	47.0	1%	871.0	16%	1016.5	13%	251.0	9%	285.5	4%	52.5	2%	14.3	0%	0.0	0%
SKATE, LITTLE + WINTER	936.8	18%	1481.5	27%	3970.0	50%	1495.5	56%	1806.5	27%	1134.0	51%	2410.0	72%	759.8	35%
SKATE, SMOOTH	0.0	0%	2.0	0%	0.0	0%	0.0	0%	0.0	0%	3.5	0%	1.0	0%	1.0	0%
SKATE, THORNY	0.0	0%	0.0	0%	0.0	0%	0.0	0%	0.0	0%	5.0	0%	0.0	0%	0.0	0%
SQUID, LONG FINNED	0.0	0%	0.0	0%	0.3	0%	3.5	0%	17.3	0%	0.8	0%	0.0	0%	4.0	0%
SQUID, SHORT FINNED (ILLEX)	4.3	0%	3.4	0%	2.8	0%	1.0	0%	1.0	0%	0.0	0%	0.0	0%	0.0	0%
TOTALS	**5280.7**		**5440.0**		**7874.3**		**2657.5**		**6596.5**		**2243.0**		**3348.4**		**2144.0**	

Table 5. Total catch weights (lbs) by codend for each species.

	ALL TRIPS WHERE SEPARATOR PANEL AT 60" (excludes July)					
	TOTAL		Bottom Codend		Top Codend	
Species Common Name	LBS	% of total	LBS	% of total	LBS	% of total
ALEWIFE	0.3	0%	0.3	0%	0.0	0%
BLUEFISH	82.0	0%	52.0	0%	30.0	1%
BUTTERFISH	0.8	0%	0.3	0%	0.5	0%
COD, ATLANTIC	**1,027.5**	**3%**	**965.0**	**3%**	**62.5**	**3%**
CUNNER	7.5	0%	7.5	0%	0.0	0%
CUSK	67.0	0%	67.0	0%	0.0	0%
DOGFISH, SMOOTH	8.0	0%	8.0	0%	0.0	0%
DOGFISH, SPINY	3,145.0	10%	2,913.5	10%	231.5	10%
FLOUNDER, AMERICAN PLAICE (DAB)	69.6	0%	69.1	0%	0.5	0%
FLOUNDER, FOURSPOT	42.5	0%	42.0	0%	0.5	0%
FLOUNDER, SUMMER (FLUKE)	189.5	1%	136.0	0%	53.5	2%
FLOUNDER, WINDOWPANE (SAND DAB)	52.8	0%	49.8	0%	3.0	0%
FLOUNDER, WINTER (BLACKBACK)	3,940.5	13%	3,882.5	14%	58.0	3%
FLOUNDER, WITCH (GREY SOLE)	88.5	0%	88.0	0%	0.5	0%
FLOUNDER, YELLOWTAIL	377.3	1%	366.3	1%	11.0	0%
GRENADIER, COMMON (MARLIN SPIKE)	0.5	0%	0.5	0%	0.0	0%
HADDOCK	**2,782.3**	**9%**	**1,526.3**	**5%**	**1,256.0**	**56%**
HAKE, RED (LING)	17.6	0%	15.4	0%	2.3	0%
HAKE, SILVER (WHITING)	21.1	0%	12.0	0%	9.1	0%
HAKE, WHITE	104.8	0%	99.8	0%	5.0	0%
HERRING, ATLANTIC	80.4	0%	21.6	0%	58.8	3%
LOBSTER, AMERICAN	882.3	3%	877.3	3%	5.0	0%
MACKEREL, ATLANTIC	0.2	0%	0.1	0%	0.1	0%
MONKFISH, WHOLE	1,710.5	6%	1,699.5	6%	11.0	0%
OCEAN POUT	24.3	0%	24.3	0%	0.0	0%
POLLOCK	406.5	1%	115.0	0%	291.5	13%
REDFISH, ACADIAN (OCEAN PERCH)	2.5	0%	2.3	0%	0.3	0%
ROSEFISH, BLACK BELLY	5.0	0%	1.5	0%	3.5	0%
SCALLOP, SEA	147.8	0%	146.8	1%	1.0	0%
SCULPIN, LONGHORN	143.1	0%	137.1	0%	6.0	0%
SEA RAVEN	490.5	2%	479.8	2%	10.8	0%
SEA ROBIN, NORTHERN	2.0	0%	2.0	0%	0.0	0%
SKATE, BARNDOOR	1,666.8	6%	1,655.0	6%	11.8	1%
SKATE, WINTER + LITTLE	12,512.5	42%	12,422.5	44%	90.0	4%
SKATE, SMOOTH	5.5	0%	5.5	0%	0.0	0%
SKATE, THORNY	5.0	0%	5.0	0%	0.0	0%
SQUID, LONG FINNED (LOLIGO)	25.8	0%	18.5	0%	7.3	0%
SQUID, SHORT FINNED (ILLEX)	9.0	0%	2.3	0%	6.8	0%
TOTAL	**30,144.2**		**27,916.8**		**2,227.5**	

Table 6. Total catch weights (lbs) by codend for each species by month.

	MAY 2006				JUNE 2005				JULY 2005				AUGUST 2005			
	Bottom Codend		Top Codend		Bottom Codend		Top Codend		Bottom Codend		Top Codend		Bottom Codend		Top Codend	
SPECIES	**LBS**	**% of total**	**LBS**	**% of total**	**LBS**	**% of total**	**LBS**	**% of total**	**LBS**	**% of total**	**LBS**	**% of total**	**LBS**	**% of total**	**LBS**	**% of total**
ALEWIFE	0.0	0%	0.0	0%	0.0	0%	0.0	0%	0.0	0%	0.0	0%	0.3	0%	0.0	0%
BLUEFISH	0.0	0%	0.0	0%	0.0	0%	0.0	0%	0.0	0%	11.0	1%	16.5	0%	30.0	9%
BUTTERFISH	0.0	0%	0.0	0%	0.0	0%	0.0	0%	0.0	0%	0.0	0%	0.3	0%	0.0	0%
COD, ATLANTIC	**182.0**	**9%**	**4.0**	**2%**	**186.0**	**5%**	**2.5**	**0%**	**89.5**	**2%**	**54.0**	**4%**	**236.0**	**3%**	**30.0**	**9%**
CUNNER	0.0	0%	0.0	0%	0.0	0%	0.0	0%	0.0	0%	0.0	0%	0.0	0%	0.0	0%
CUSK	13.0	1%	0.0	0%	0.0	0%	0.0	0%	5.0	0%	0.0	0%	30.0	0%	0.0	0%
DOGFISH, SMOOTH	0.0	0%	0.0	0%	0.0	0%	0.0	0%	0.0	0%	0.0	0%	0.0	0%	0.0	0%
DOGFISH, SPINY	74.0	4%	23.5	13%	671.0	17%	208.0	16%	7.0	0%	0.0	0%	393.0	5%	0.0	0%
FLOUNDER, AMERICAN PLAICE (DAB)	18.6	1%	0.0	0%	20.5	1%	0.0	0%	17.0	0%	3.0	0%	12.0	0%	0.0	0%
FLOUNDER, FOURSPOT	0.5	0%	0.0	0%	12.0	0%	0.0	0%	0.5	0%	0.0	0%	5.0	0%	0.0	0%
FLOUNDER, SUMMER (FLUKE)	25.0	1%	0.0	0%	1.5	0%	0.0	0%	13.0	0%	0.0	0%	59.0	1%	24.5	7%
FLOUNDER, WINDOWPANE (SAND DAB)	0.5	0%	0.0	0%	1.0	0%	1.0	0%	0.5	0%	0.0	0%	13.0	0%	0.3	0%
FLOUNDER, WINTER (BLACKBACK)	204.0	10%	0.0	0%	397.0	10%	0.0	0%	792.5	19%	24.0	2%	926.0	12%	49.5	15%
FLOUNDER, WITCH (GREY SOLE)	7.5	0%	0.0	0%	48.5	1%	0.0	0%	12.5	0%	3.0	0%	32.0	0%	0.5	0%
FLOUNDER, YELLOWTAIL	58.0	3%	0.0	0%	69.5	2%	2.0	0%	44.3	1%	2.8	0%	17.0	0%	2.0	1%
GRENADIER, COMMON (MARLIN SPIKE)	0.0	0%	0.0	0%	0.0	0%	0.0	0%	0.0	0%	0.0	0%	0.0	0%	0.0	0%
HADDOCK	**185.5**	**9%**	**98.0**	**53%**	**1029.5**	**26%**	**872.5**	**68%**	**230.0**	**6%**	**1091.3**	**83%**	**110.5**	**1%**	**124.0**	**37%**
HAKE, RED (LING)	0.1	0%	0.0	0%	1.5	0%	0.0	0%	1.8	0%	1.8	0%	9.8	0%	2.0	1%
HAKE, SILVER (WHITING)	0.0	0%	0.0	0%	0.0	0%	0.6	0%	0.4	0%	2.3	0%	10.0	0%	6.5	2%
HAKE, WHITE	13.8	1%	0.0	0%	8.0	0%	3.0	0%	44.0	1%	1.0	0%	33.0	0%	2.0	1%
HERRING, ATLANTIC	0.0	0%	0.3	0%	21.4	1%	58.0	4%	0.0	0%	0.0	0%	0.0	0%	0.0	0%
LOBSTER, AMERICAN	179.3	9%	0.0	0%	103.5	3%	0.0	0%	98.0	2%	1.0	0%	129.5	2%	2.0	1%
MACKEREL, ATLANTIC	0.0	0%	0.0	0%	0.0	0%	0.0	0%	0.0	0%	0.0	0%	0.0	0%	0.0	0%
MONKFISH, WHOLE	99.0	5%	0.0	0%	328.5	8%	0.0	0%	317.3	8%	12.0	1%	445.5	6%	0.0	0%
OCEAN POUT	6.0	0%	0.0	0%	11.5	0%	0.0	0%	4.0	0%	0.0	0%	2.8	0%	0.0	0%
POLLOCK	7.0	0%	50.0	27%	6.0	0%	128.0	10%	0.0	0%	49.0	4%	0.0	0%	0.0	0%
REDFISH, ACADIAN (OCEAN PERCH)	1.0	0%	0.0	0%	0.0	0%	0.0	0%	2.0	0%	5.0	0%	1.3	0%	0.3	0%
ROSEFISH, BLACK BELLY	0.0	0%	0.0	0%	0.0	0%	0.0	0%	0.0	0%	0.0	0%	0.5	0%	0.5	0%
SCALLOP, SEA	12.5	1%	0.0	0%	4.0	0%	0.0	0%	0.0	0%	0.0	0%	0.0	0%	0.0	0%
SCULPIN, LONGHORN	22.5	1%	0.0	0%	16.3	0%	1.8	0%	20.5	0%	3.5	0%	23.5	0%	0.5	0%
SEA RAVEN	91.8	5%	0.0	0%	75.5	2%	2.8	0%	116.0	3%	2.0	0%	96.0	1%	8.0	2%
SEA ROBIN, NORTHERN	2.0	0%	0.0	0%	0.0	0%	0.0	0%	0.0	0%	0.0	0%	0.0	0%	0.0	0%
SKATE, BARNDOOR	0.0	0%	0.0	0%	47.0	1%	0.0	0%	835.0	20%	36.0	3%	1010.0	13%	6.5	2%
SKATE, LITTLE + WINTER	754.5	38%	5.3	3%	931.5	23%	5.3	0%	1466.0	36%	15.5	1%	3926.5	52%	43.5	13%
SKATE, SMOOTH	1.0	0%	0.0	0%	0.0	0%	0.0	0%	2.0	0%	0.0	0%	0.0	0%	0.0	0%
SKATE, THORNY	0.0	0%	0.0	0%	0.0	0%	0.0	0%	0.0	0%	0.0	0%	0.0	0%	0.0	0%
SQUID, LONG FINNED (LOLIGO)	1.5	0%	2.5	1%	0.0	0%	0.0	0%	0.0	0%	0.0	0%	0.3	0%	0.0	0%
SQUID, SHORT FINNED (ILLEX)	0.0	0%	0.0	0%	0.3	0%	4.0	0%	2.1	0%	1.3	0%	1.0	0%	1.8	1%
TOTALS	**1960.5**		**183.5**		**3991.4**		**1289.4**		**4120.7**		**1319.3**		**7540.0**		**334.3**	

Table 6. (continued).

	OCTOBER 2005				NOVEMBER 2005				DECEMBER 2005				JANUARY 2006			
	Bottom Codend		Top Codend		Bottom Codend		Top Codend		Bottom Codend		Top Codend		Bottom Codend		Top Codend	
SPECIES	**LBS**	**% of total**	**LBS**	**% of total**	**LBS**	**% of total**	**LBS**	**% of total**	**LBS**	**% of total**	**LBS**	**% of total**	**LBS**	**% of total**	**LBS**	**% of total**
ALEWIFE	0.0	0%	0.0	0%	0.0	0%	0.0	0%	0.0	0%	0.0	0%	0.0	0%	0.0	0%
BLUEFISH	8.0	0%	0.0	0%	27.5	0%	0.0	0%	0.0	0%	0.0	0%	0.0	0%	0.0	0%
BUTTERFISH	0.0	0%	0.3	0%	0.0	0%	0.3	0%	0.0	0%	0.0	0%	0.0	0%	0.0	0%
COD, ATLANTIC	**20.0**	**1%**	**0.0**	**0%**	**102.0**	**2%**	**0.0**	**0%**	**67.5**	**3%**	**6.0**	**4%**	**171.5**	**5%**	**20.0**	**30%**
CUNNER	3.5	0%	0.0	0%	2.0	0%	0.0	0%	2.0	0%	0.0	0%	0.0	0%	0.0	0%
CUSK	0.0	0%	0.0	0%	0.0	0%	0.0	0%	0.0	0%	0.0	0%	24.0	1%	0.0	0%
DOGFISH, SMOOTH	8.0	0%	0.0	0%	0.0	0%	0.0	0%	0.0	0%	0.0	0%	0.0	0%	0.0	0%
DOGFISH, SPINY	165.0	6%	0.0	0%	1180.5	18%	0.0	0%	354.5	17%	0.0	0%	75.5	2%	0.0	0%
FLOUNDER, AMERICAN PLAICE (DAB)	0.0	0%	0.0	0%	0.0	0%	0.0	0%	1.5	0%	0.0	0%	16.5	1%	0.5	1%
FLOUNDER, FOURSPOT	6.5	0%	0.0	0%	13.0	0%	0.5	0%	5.0	0%	0.0	0%	0.0	0%	0.0	0%
FLOUNDER, SUMMER (FLUKE)	31.0	1%	24.0	45%	19.5	0%	5.0	3%	0.0	0%	0.0	0%	0.0	0%	0.0	0%
FLOUNDER, WINDOWPANE (SAND DAB)	5.0	0%	1.0	2%	5.5	0%	0.0	0%	8.0	0%	0.8	0%	16.8	1%	0.0	0%
FLOUNDER, WINTER (BLACKBACK)	403.5	15%	0.0	0%	1574.5	24%	5.0	3%	212.5	10%	0.0	0%	165.0	5%	3.5	5%
FLOUNDER, WITCH (GREY SOLE)	0.0	0%	0.0	0%	0.0	0%	0.0	0%	0.0	0%	0.0	0%	0.0	0%	0.0	0%
FLOUNDER, YELLOWTAIL	18.5	1%	2.0	4%	94.0	1%	0.0	0%	32.0	2%	4.0	3%	77.3	2%	1.0	1%
GRENADIER, COMMON (MARLIN SPIKE)	0.0	0%	0.0	0%	0.0	0%	0.0	0%	0.5	0%	0.0	0%	0.0	0%	0.0	0%
HADDOCK	**12.0**	**0%**	**0.0**	**0%**	**105.0**	**2%**	**114.5**	**78%**	**20.5**	**1%**	**32.0**	**21%**	**63.3**	**2%**	**15.0**	**22%**
HAKE, RED (LING)	2.0	0%	0.0	0%	1.0	0%	0.3	0%	1.0	0%	0.0	0%	0.0	0%	0.0	0%
HAKE, SILVER (WHITING)	0.0	0%	2.0	4%	1.8	0%	0.0	0%	0.0	0%	0.0	0%	0.3	0%	0.0	0%
HAKE, WHITE	1.5	0%	0.0	0%	15.5	0%	0.0	0%	0.0	0%	0.0	0%	28.0	1%	0.0	0%
HERRING, ATLANTIC	0.0	0%	0.5	1%	0.0	0%	0.0	0%	0.3	0%	0.0	0%	0.0	0%	0.0	0%
LOBSTER, AMERICAN	82.0	3%	3.0	6%	272.5	4%	0.0	0%	46.5	2%	0.0	0%	64.0	2%	0.0	0%
MACKEREL, ATLANTIC	0.0	0%	0.0	0%	0.0	0%	0.0	0%	0.1	0%	0.1	0%	0.0	0%	0.0	0%
MONKFISH, WHOLE	76.5	3%	0.0	0%	691.0	11%	0.0	0%	17.0	1%	0.0	0%	42.0	1%	11.0	16%
OCEAN POUT	0.0	0%	0.0	0%	0.0	0%	0.0	0%	0.0	0%	0.0	0%	4.0	0%	0.0	0%
POLLOCK	0.0	0%	0.0	0%	13.0	0%	14.5	10%	77.0	4%	99.0	64%	12.0	0%	0.0	0%
REDFISH, ACADIAN (OCEAN PERCH)	0.0	0%	0.0	0%	0.0	0%	0.0	0%	0.0	0%	0.0	0%	0.0	0%	0.0	0%
ROSEFISH, BLACK BELLY	0.0	0%	0.0	0%	0.0	0%	0.0	0%	1.0	0%	3.0	2%	0.0	0%	0.0	0%
SCALLOP, SEA	3.3	0%	0.0	0%	127.0	2%	1.0	1%	0.0	0%	0.0	0%	0.0	0%	0.0	0%
SCULPIN, LONGHORN	13.5	1%	2.0	4%	29.0	0%	0.0	0%	25.8	1%	1.3	1%	6.6	0%	0.5	1%
SEA RAVEN	12.0	0%	0.0	0%	71.0	1%	0.0	0%	28.5	1%	0.0	0%	105.0	3%	0.0	0%
SEA ROBIN, NORTHERN	0.0	0%	0.0	0%	0.0	0%	0.0	0%	0.0	0%	0.0	0%	0.0	0%	0.0	0%
SKATE, BARNDOOR	249.0	10%	2.0	4%	285.5	4%	0.0	0%	52.5	3%	0.0	0%	11.0	0%	3.3	5%
SKATE, LITTLE + WINTER	1480.5	57%	15.0	28%	1805.0	28%	1.5	1%	1126.5	54%	7.5	5%	2398.0	73%	12.0	18%
SKATE, SMOOTH	0.0	0%	0.0	0%	0.0	0%	0.0	0%	3.5	0%	0.0	0%	1.0	0%	0.0	0%
SKATE, THORNY	0.0	0%	0.0	0%	0.0	0%	0.0	0%	5.0	0%	0.0	0%	0.0	0%	0.0	0%
SQUID, LONG FINNED (LOLIGO)	3.3	0%	0.3	0%	12.8	0%	4.5	3%	0.8	0%	0.0	0%	0.0	0%	0.0	0%
SQUID, SHORT FINNED (ILLEX)	0.3	0%	0.8	1%	0.8	0%	0.3	0%	0.0	0%	0.0	0%	0.0	0%	0.0	0%
TOTALS	**2604.8**		**52.8**		**6449.3**		**147.3**		**2089.4**		**153.6**		**3281.6**		**66.8**	

Figure 8a. Total percentages of each species caught by weight in the bottom codend, for all trips where the separator panel was 60 inches from the footrope.

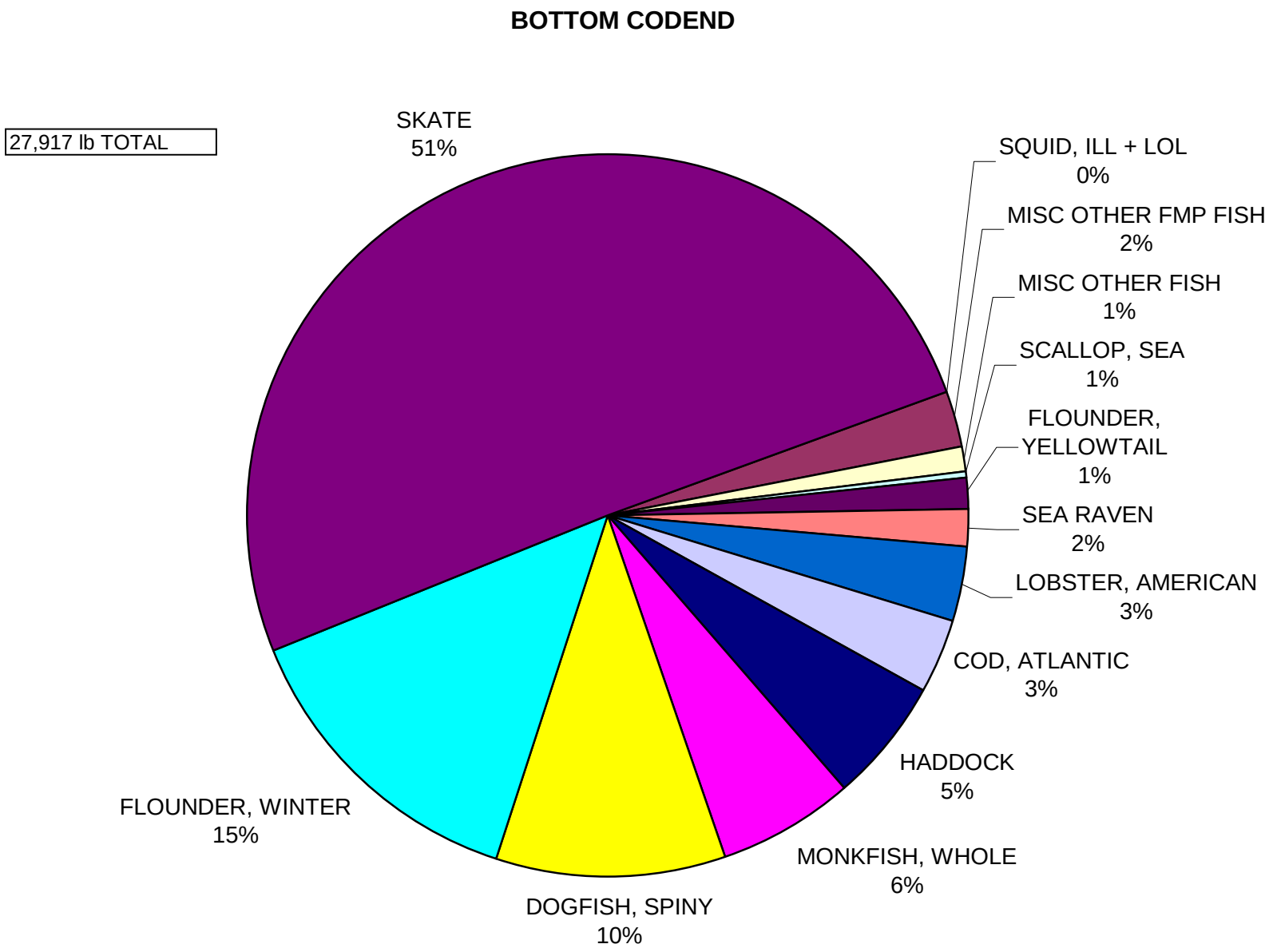


Figure 8b. Total percentages of each species caught by weight in the top codend, for all trips where the separator panel was 60 inches from the footrope.

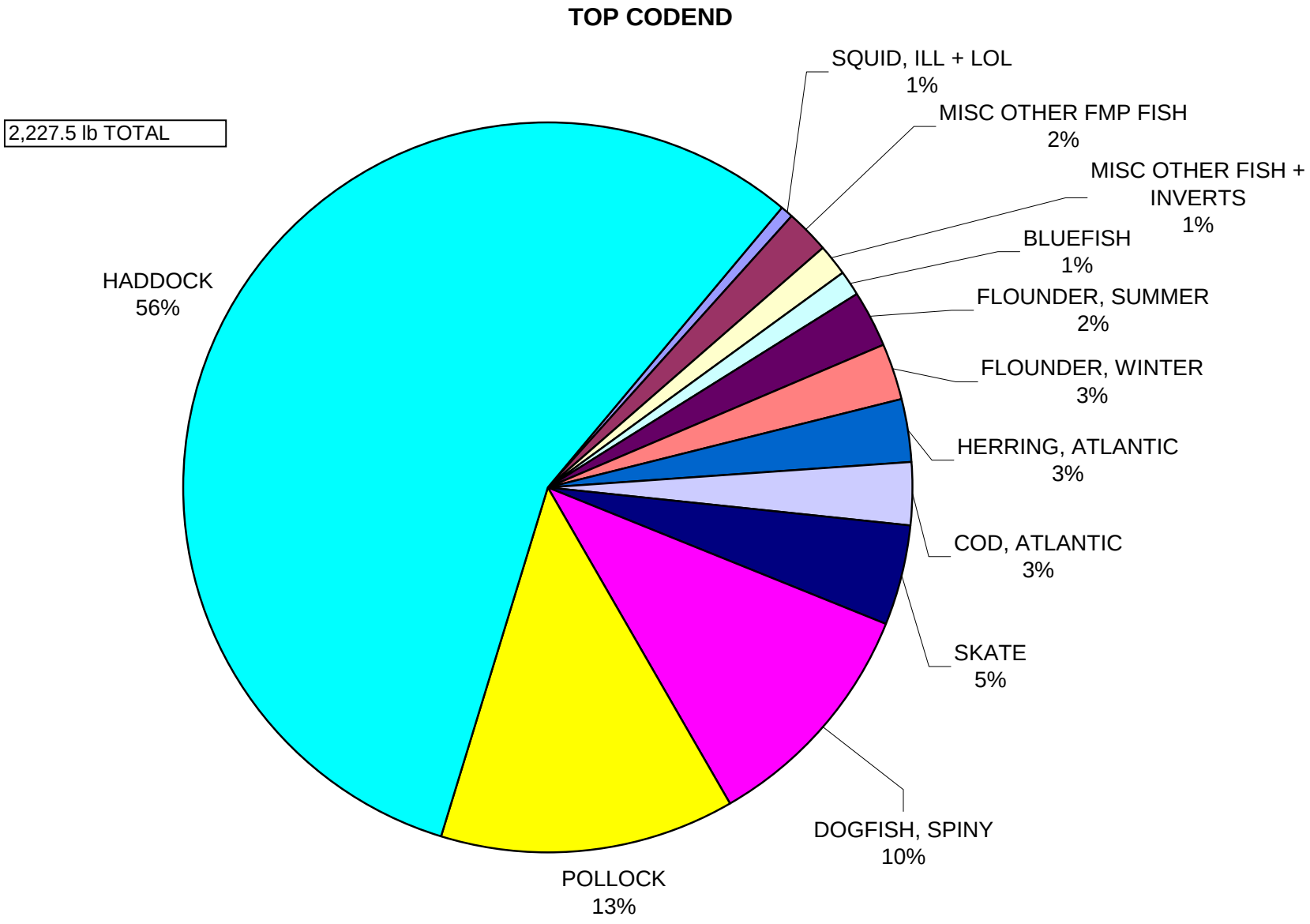


Figure 9. Percentages of cod total weight by codend.

Figure 10. Percentages of haddock total weight by codend.

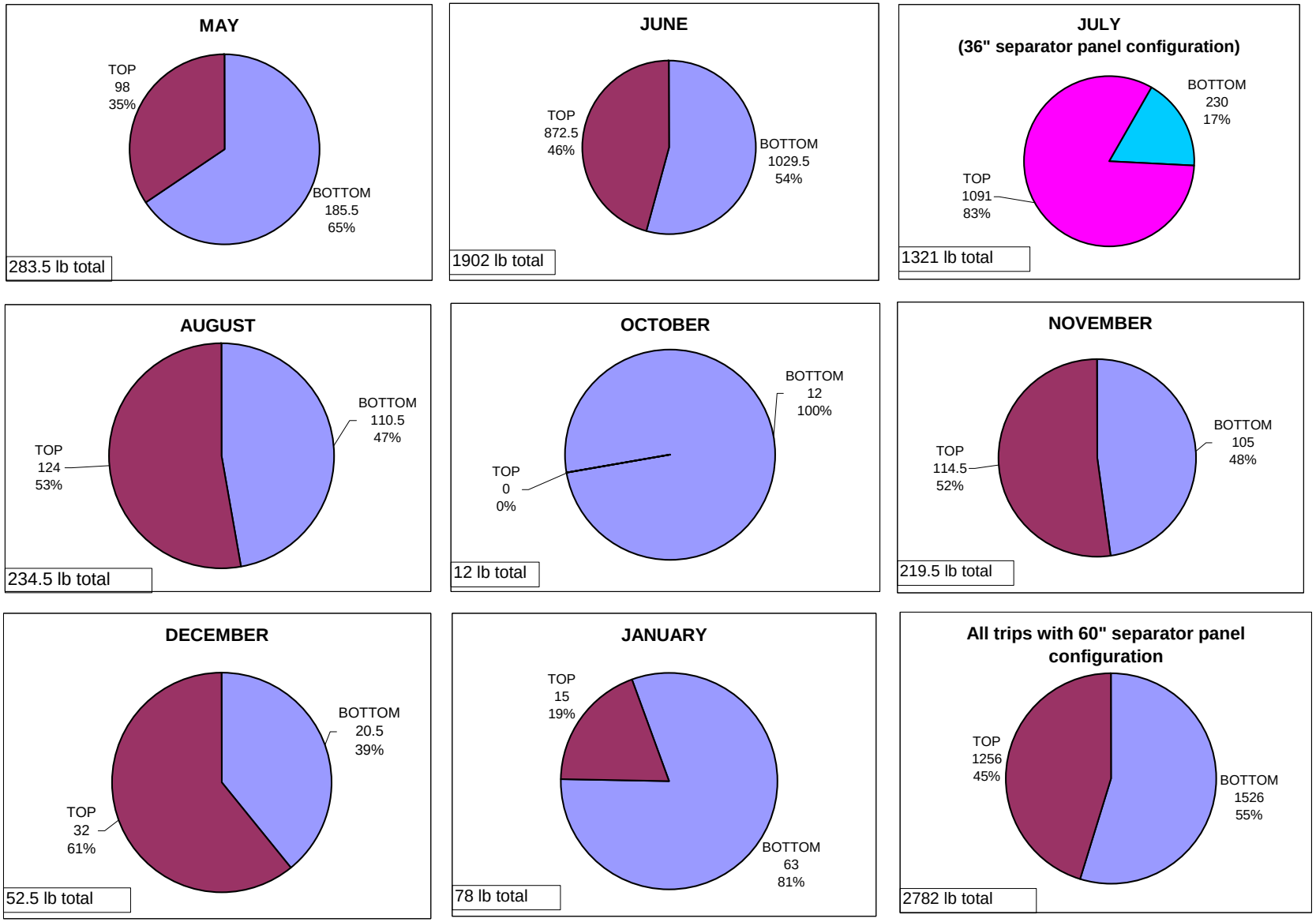


Table 7. Total catch weights for all other regulated groundfish species (except cod and haddock) by month and by codend.

	All other Regulated NE Multispecies (lbs)		% of All other Regulated NE Multispecies (lbs)	
Month/Year	**bottom codend**	**top codend**	**bottom codend**	**top codend**
June 2005	892.0	134.6	87%	13%
July 2005	1236.1	103.8	92%	8%
Aug 2005	1502.3	63.0	96%	4%
Oct 2005	507.0	5.0	99%	1%
Nov 2005	2396.3	19.8	99%	1%
Dec 2005	349.0	103.8	77%	23%
Jan 2005	361.8	16.0	96%	4%
May 2006	415.5	50.0	89%	11%
All	**7,659.8**	**495.9**	**94%**	**6%**
All where sep. panel at 60" (excludes July)	**6,423.7**	**392.1**	**94%**	**6%**

All other regulated NE multispecies include:

- monkfish
- winter flounder
- yellowtail flounder
- witch flounder
- American plaice
- windowpane flounder
- red hake
- white hake
- silver hake
- redfish
- ocean pout
- pollock

Table 8. Total catch weights for all other regulated groundfish species (except cod, haddock, and pollock) by month and by codend.

	All other Regulated NE Multispecies (lbs)		% of All other Regulated NE Multispecies (lbs)	
Month/Year	**bottom codend**	**top codend**	**bottom codend**	**top codend**
June 2005	886.0	6.6	99%	1%
July 2005	1236.1	54.8	96%	4%
Aug 2005	1502.3	63.0	96%	4%
Oct 2005	507.0	5.0	99%	1%
Nov 2005	2383.3	5.3	100%	0%
Dec 2005	272.0	4.8	98%	2%
Jan 2005	349.8	16.0	96%	4%
May 2006	408.5	0.0	100%	0%
All	**7544.8**	**155.4**	**98%**	**2%**
All where sep. panel at 60" (excludes July)	**6308.7**	**100.6**	**98%**	**2%**

Figure 11. Percentages of total weight by codend for other selected species.

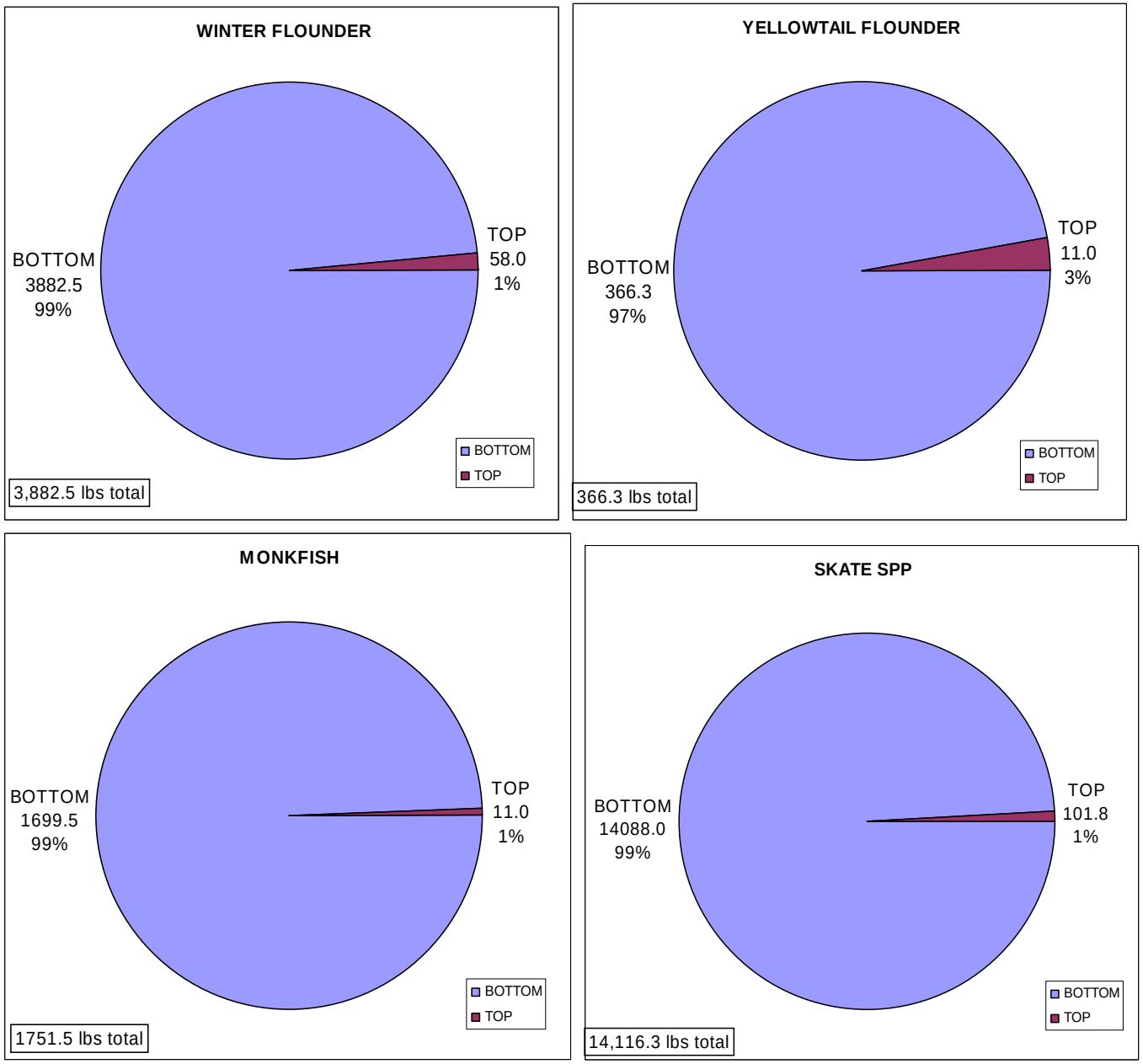


Figure 12. Photo of the catch from a typical tow, separated by codend. The catch from the bottom codend is in the tote on the left and is composed of a variety of species, including skates, cod, spiny dogfish, and haddock. The catch in the basket on the right is from the top codend and is composed exclusively of haddock.

Figure 13. Length frequency distribution for haddock.

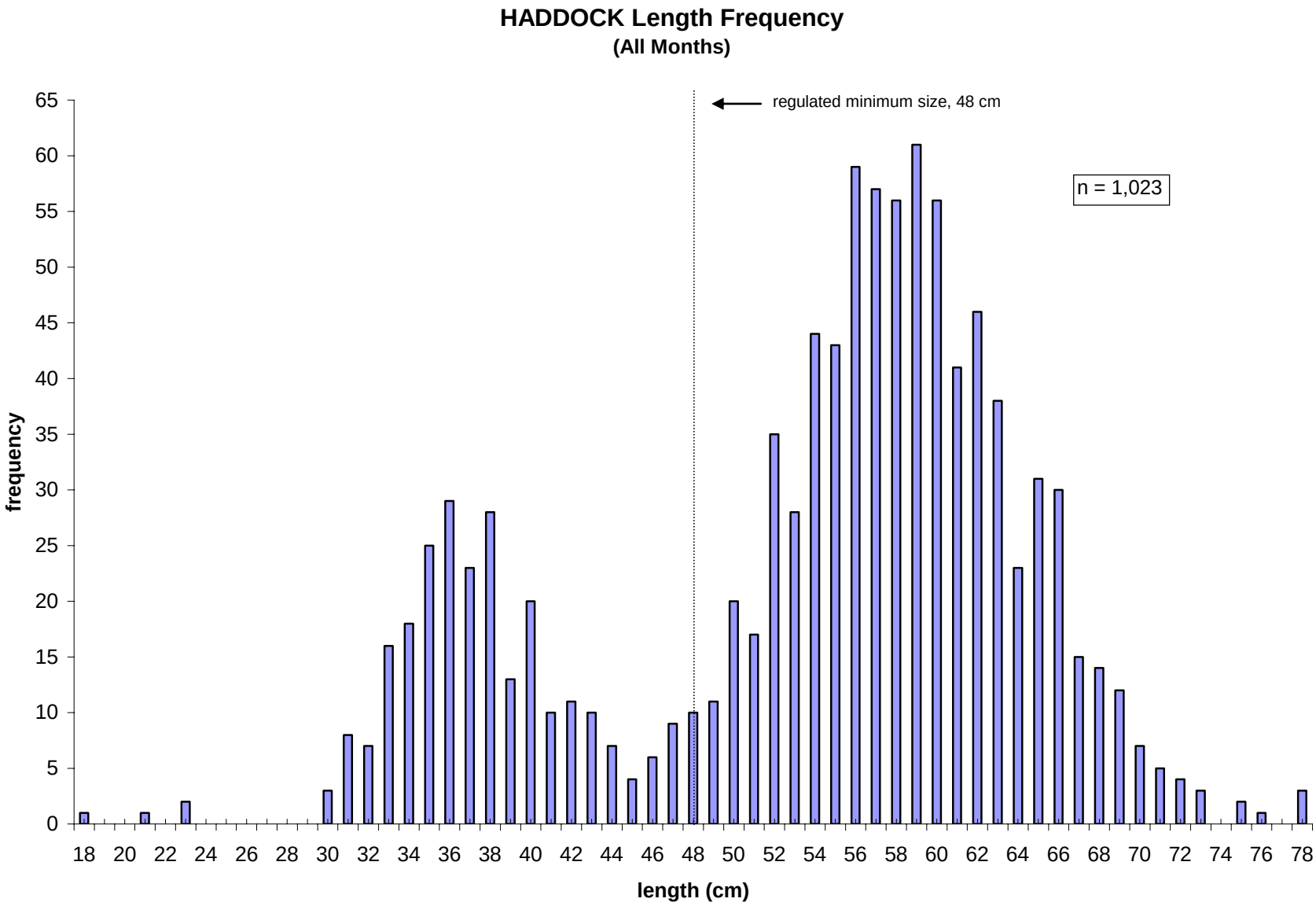


Figure 14. Standardized length frequency distribution for haddock.

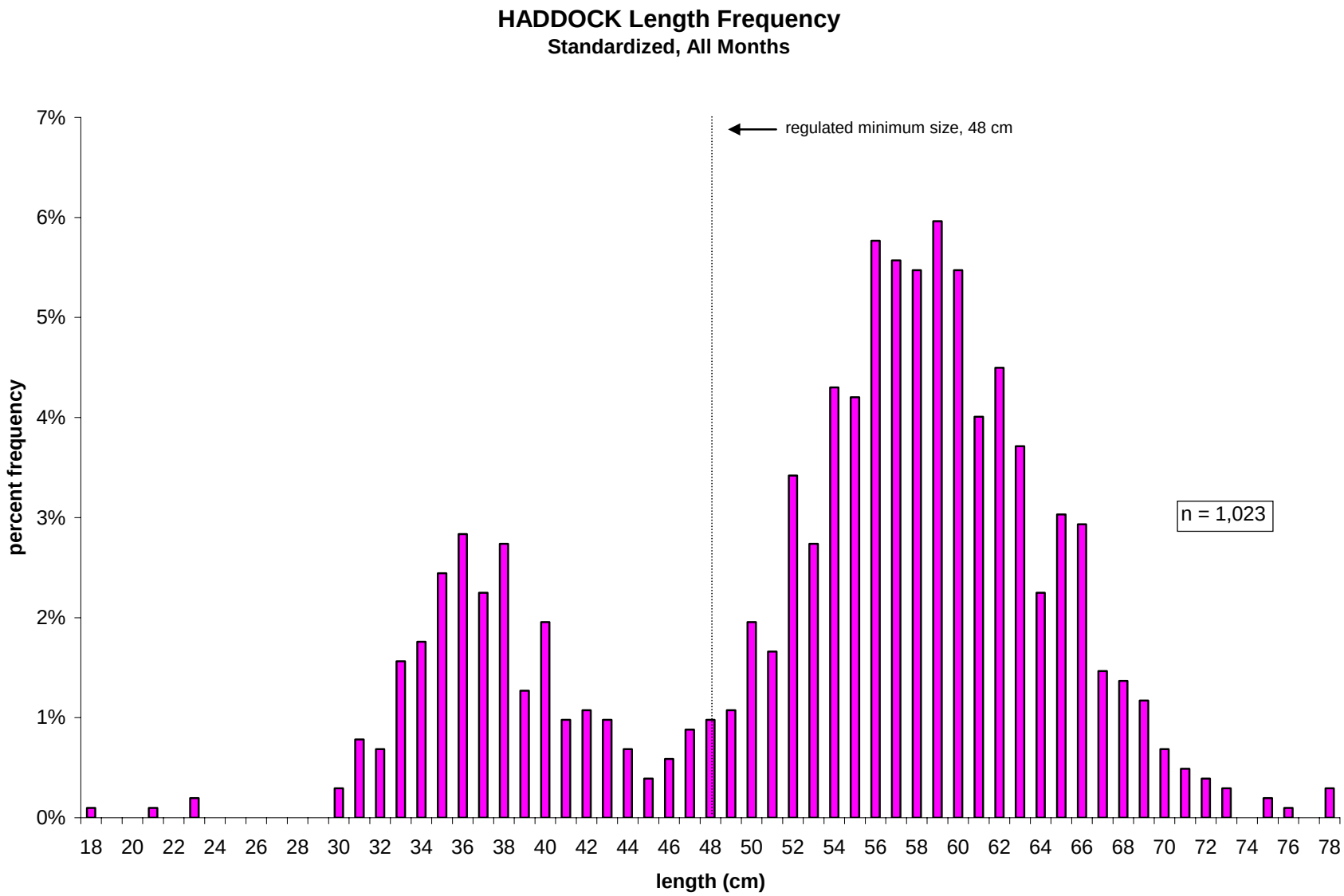


Figure 15. Length frequency distribution for haddock, by codend.

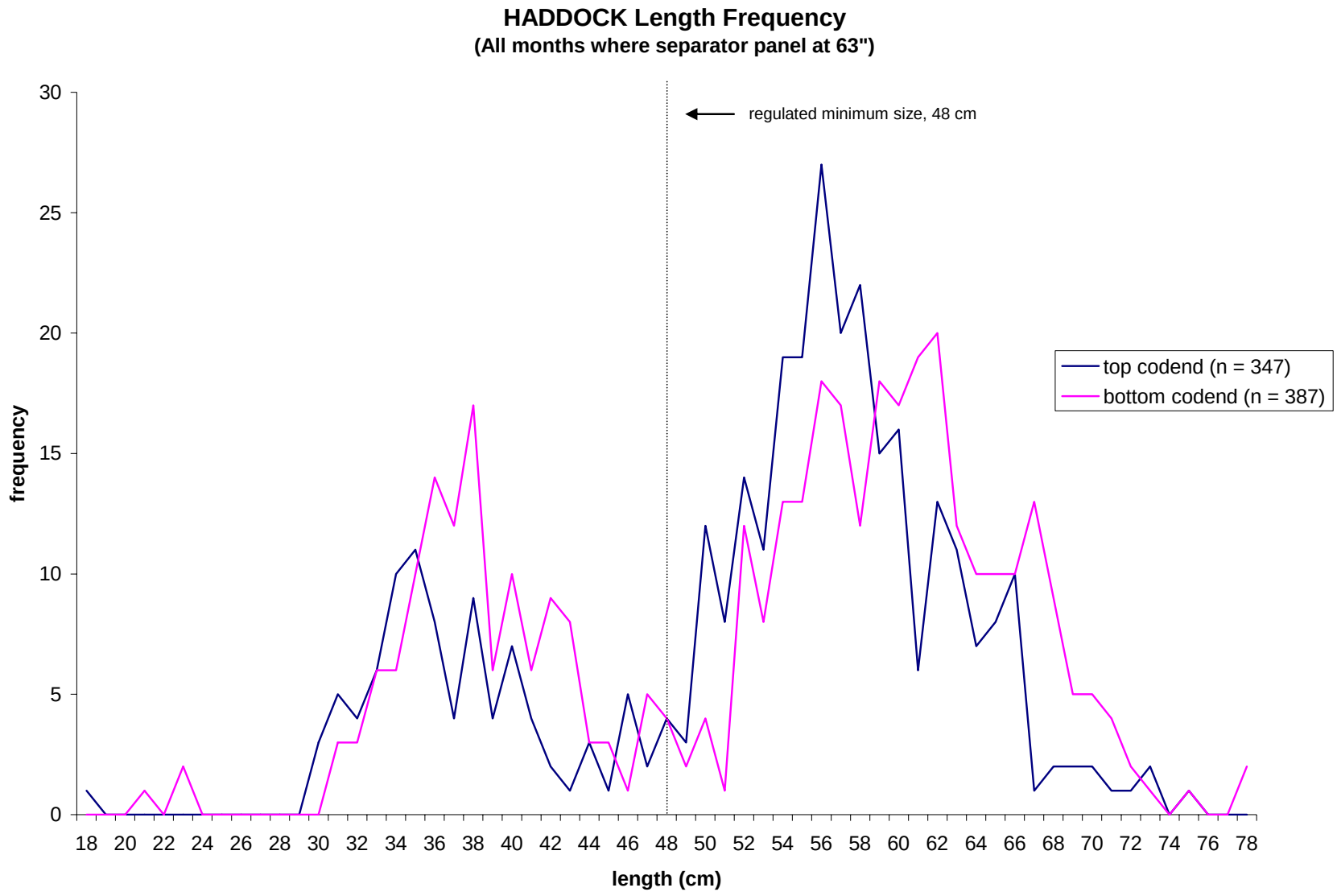


Figure 16. Length frequency distribution for cod.

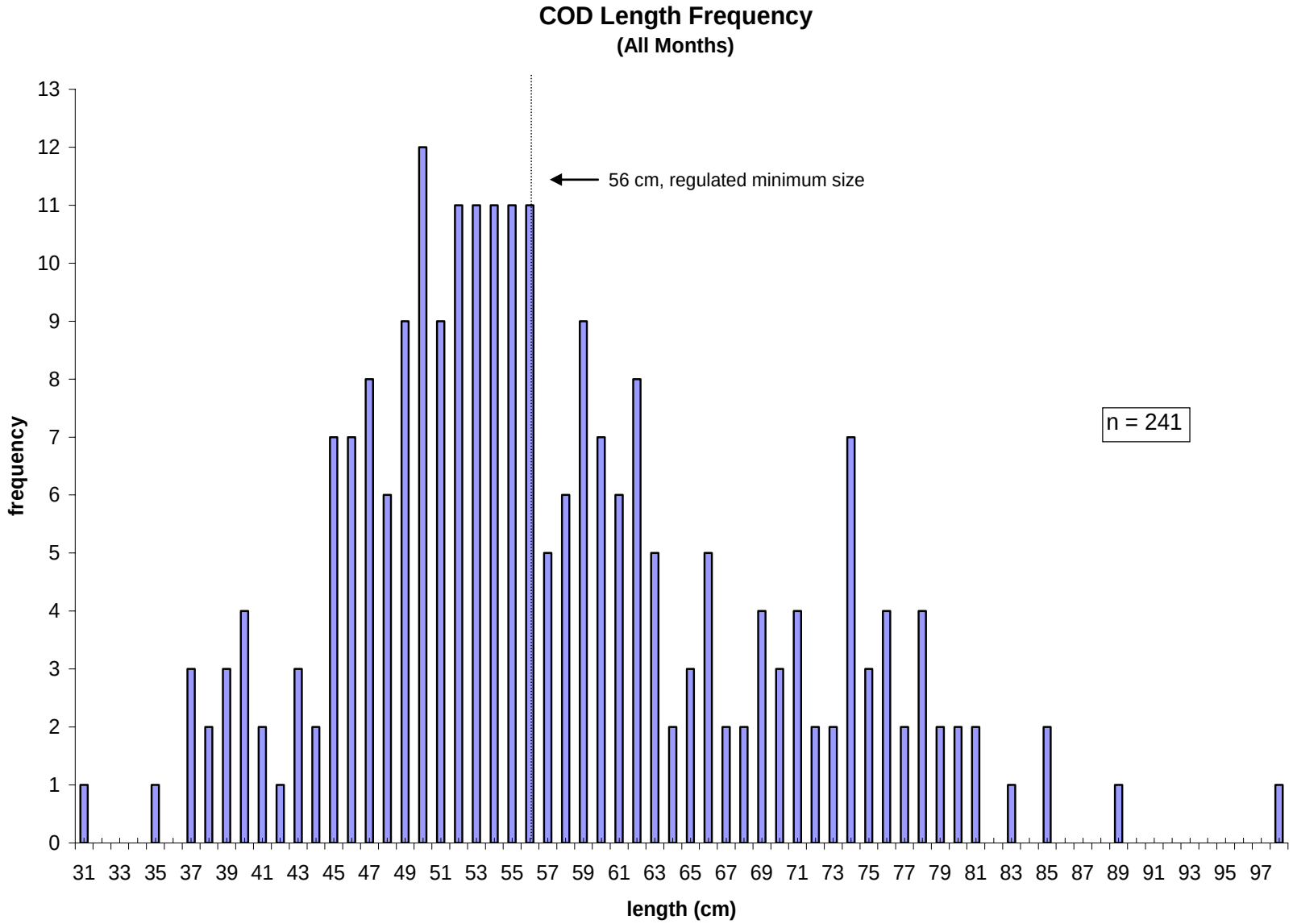


Figure 17. Standardized length frequency distribution for cod.

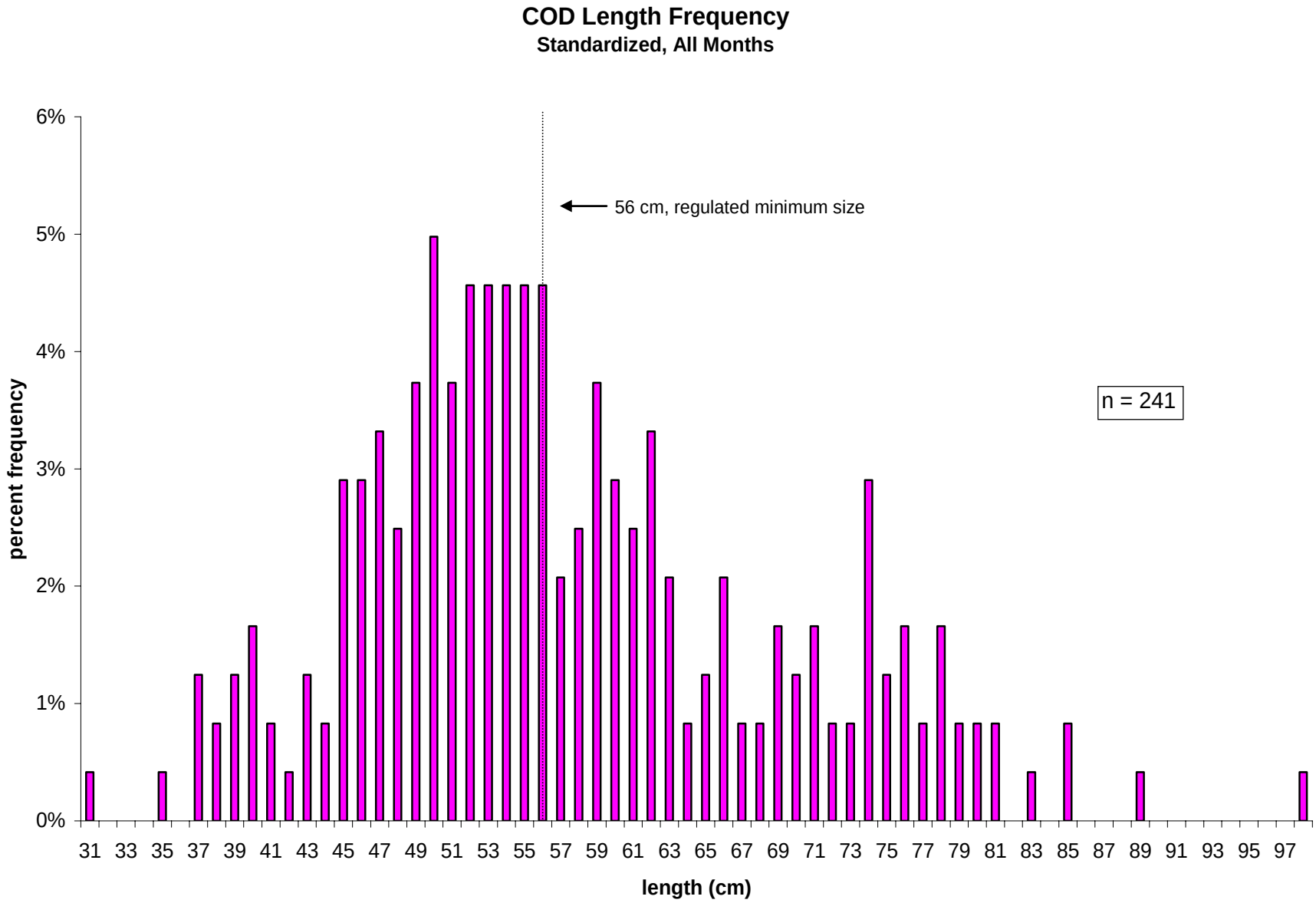


Figure 18. Percentage of legal sized cod captured vs. percentage of undersized cod captured, number of individuals.

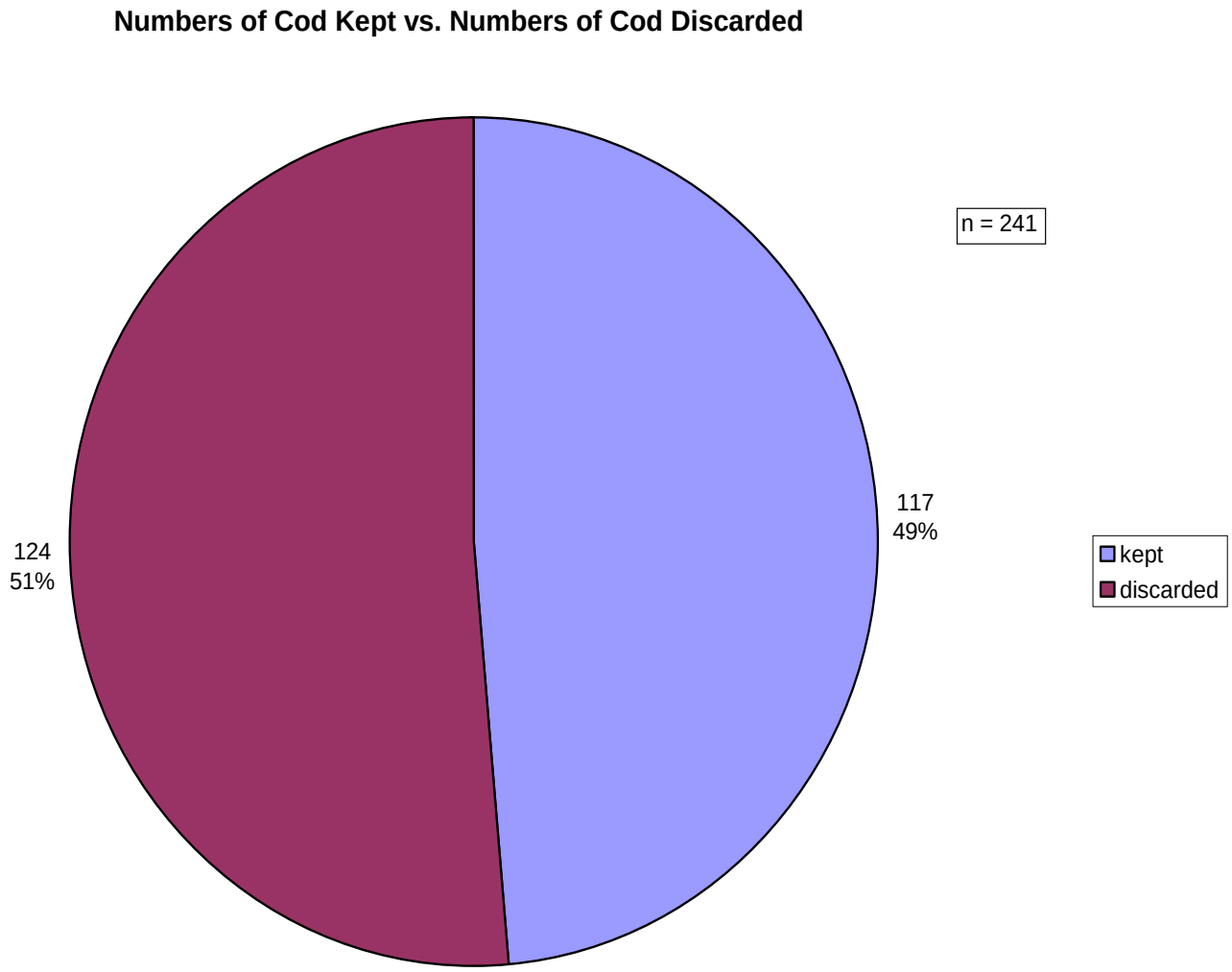
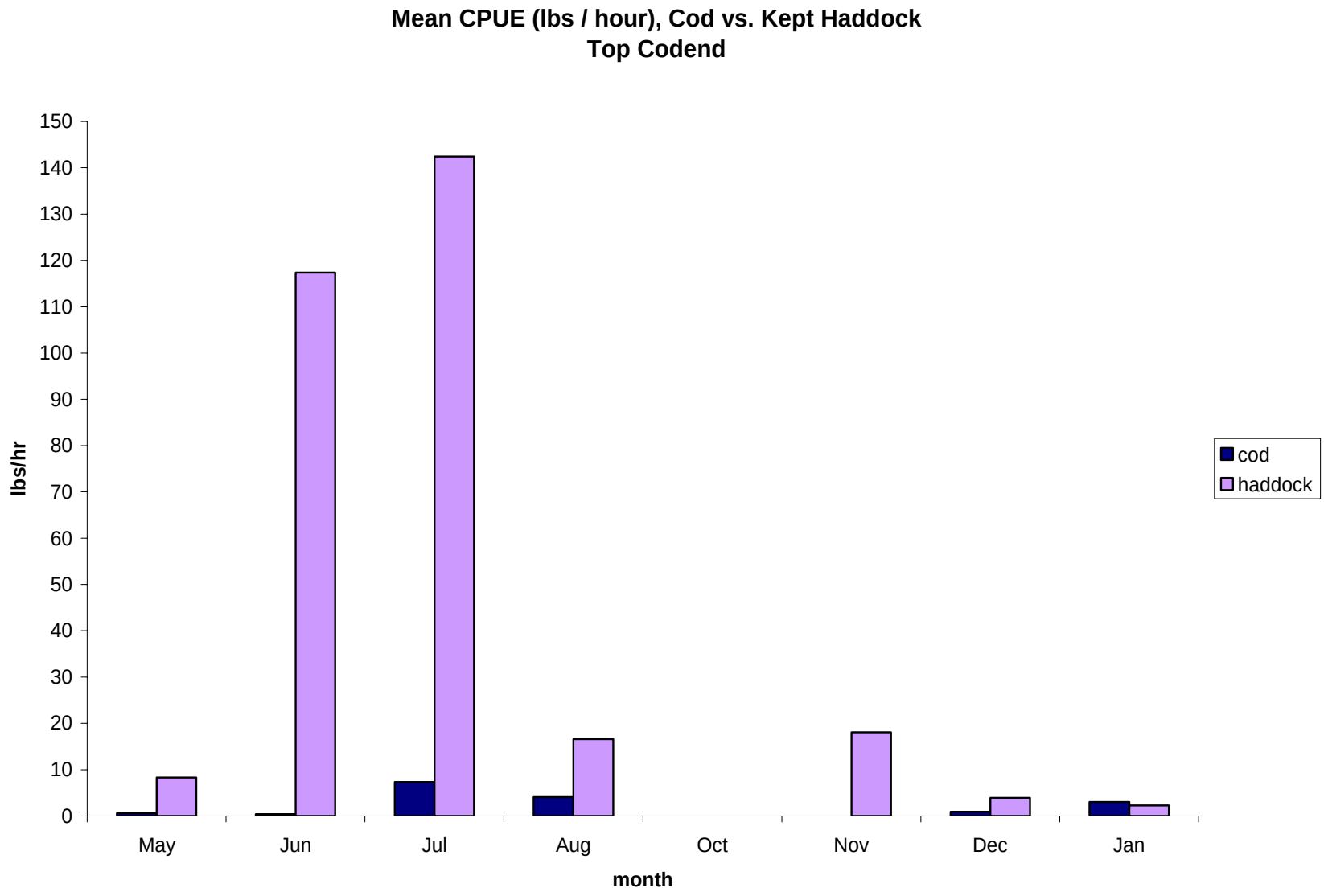
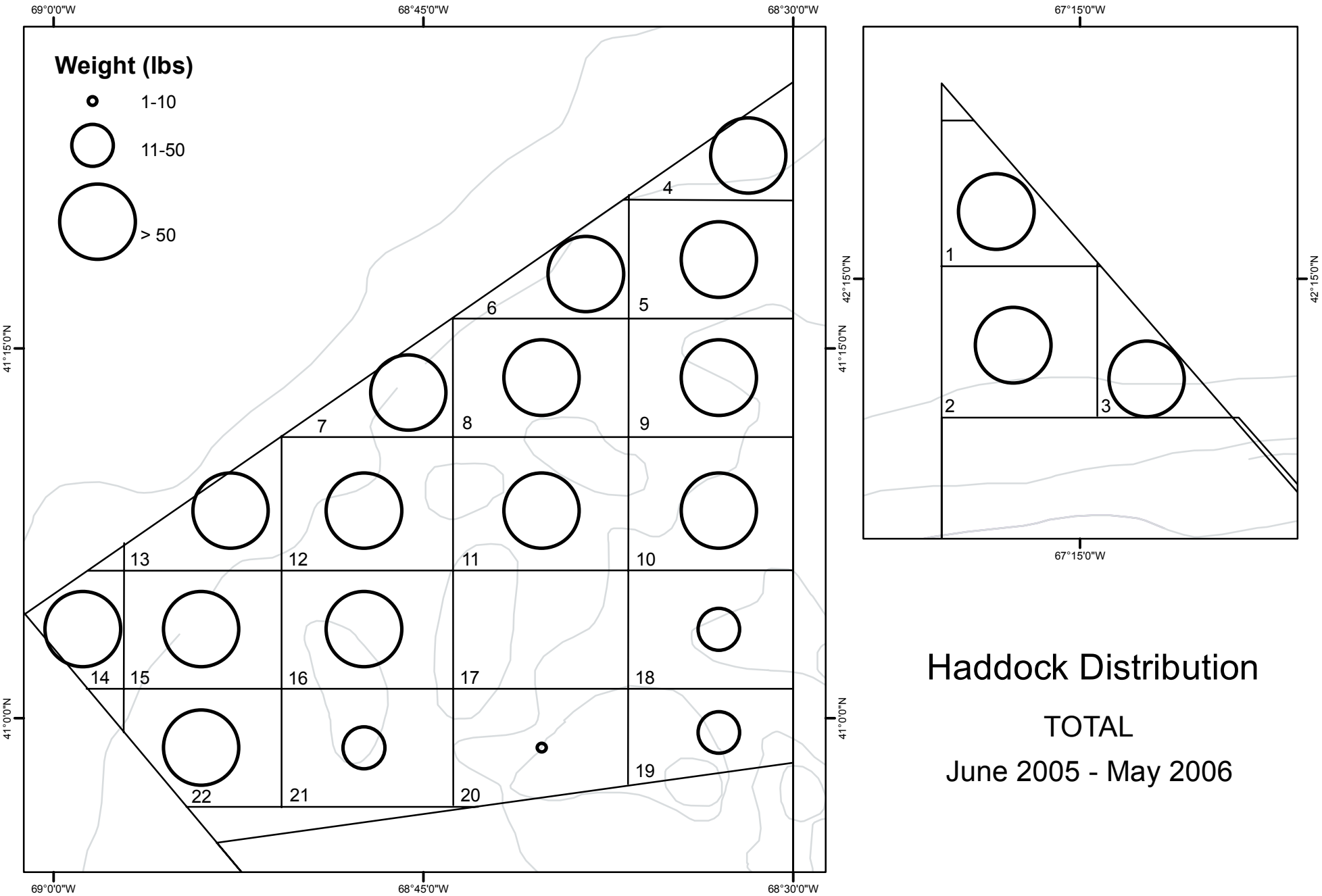


Figure 19. Comparison of CPUE in top codend for all cod and kept haddock.



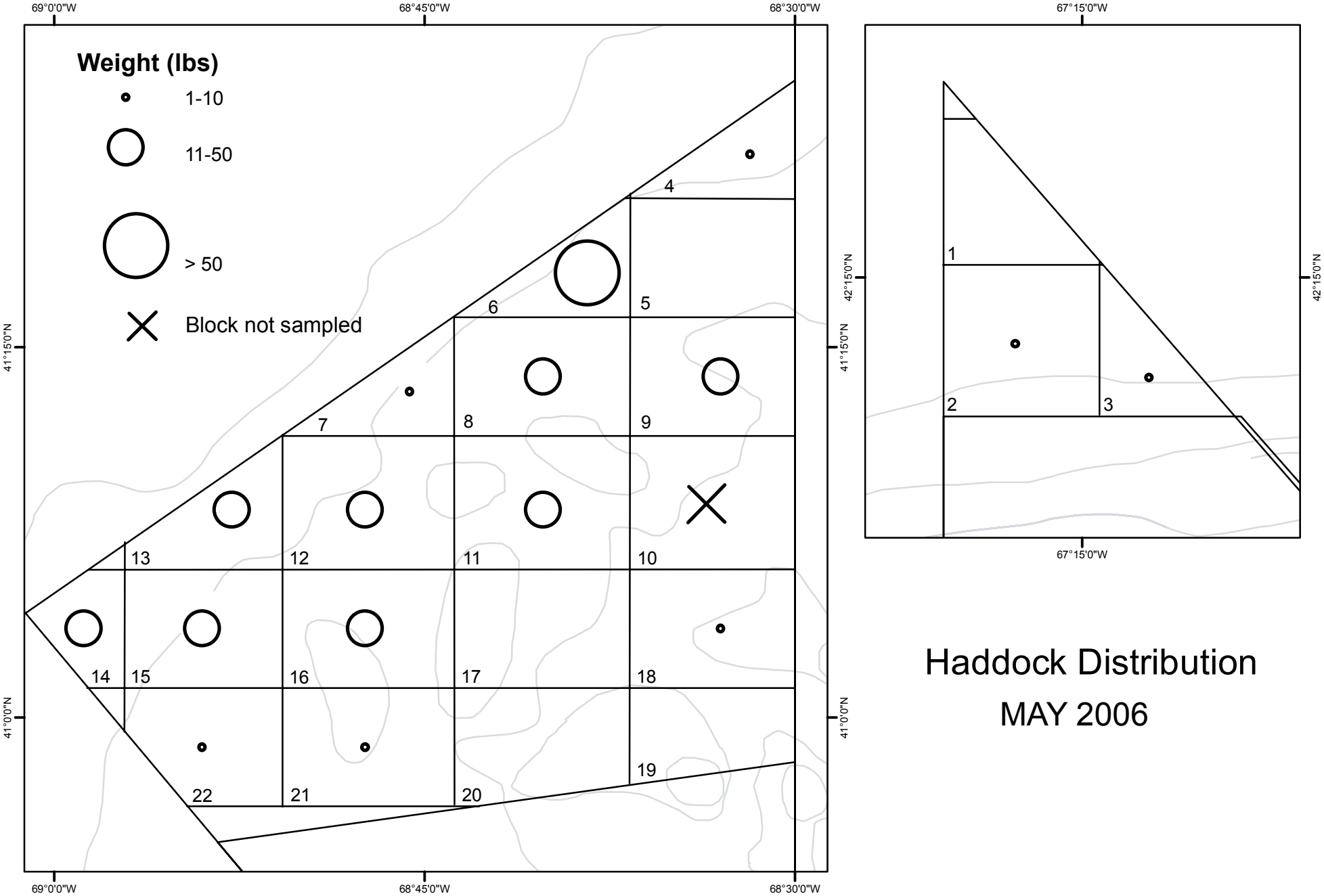


Haddock Distribution

TOTAL

June 2005 - May 2006

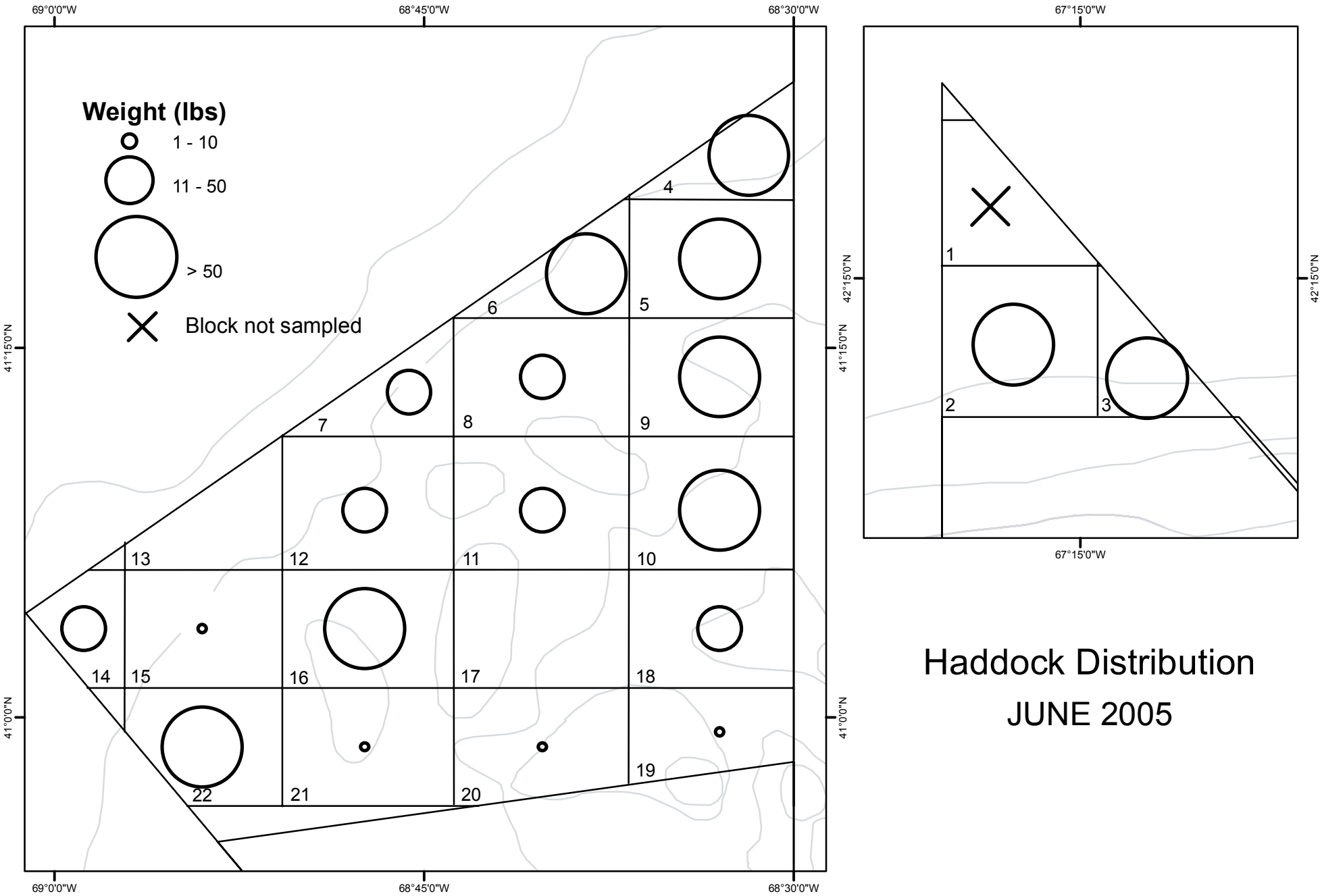
Figure 20



Haddock Distribution

MAY 2006

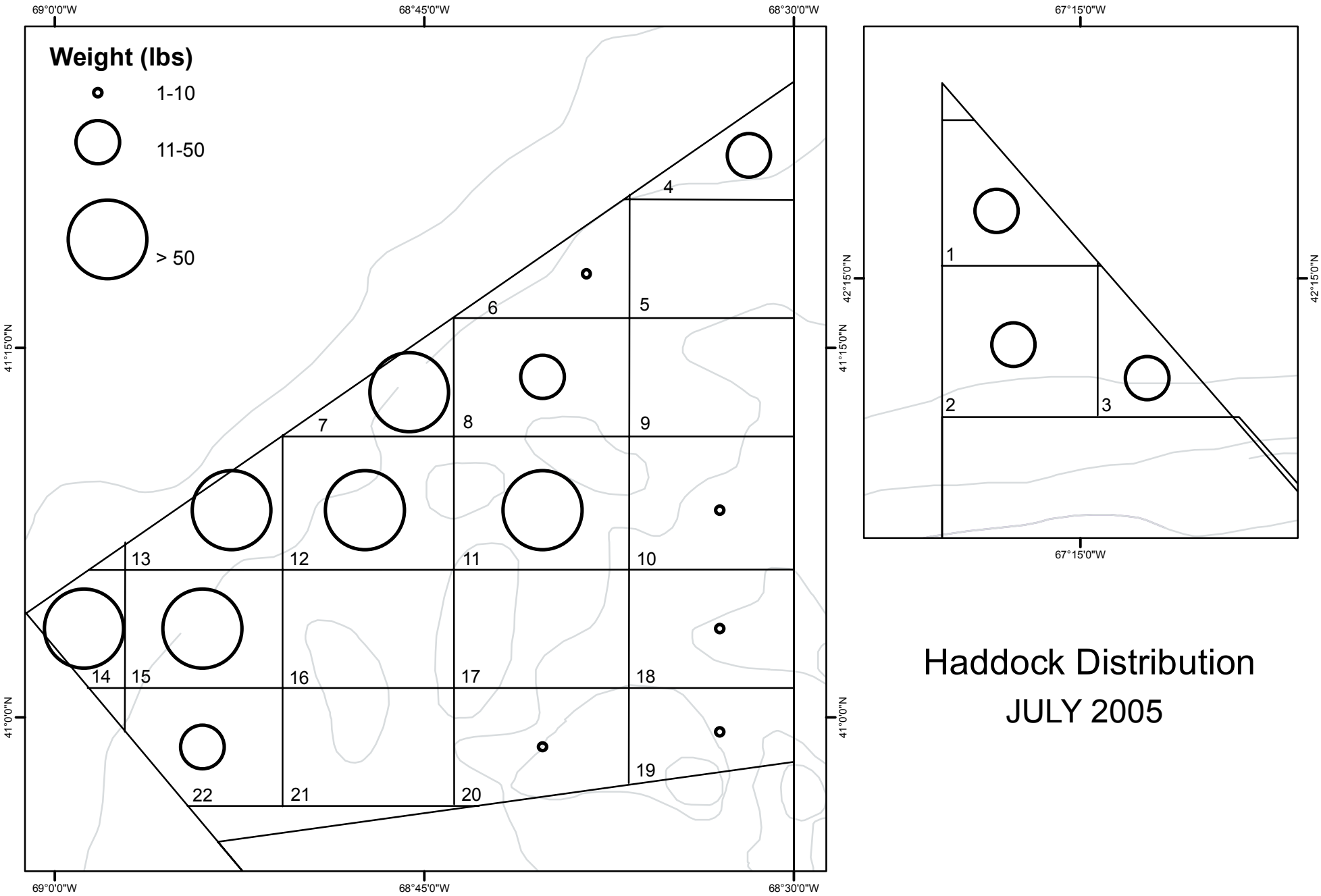
Figure 21



Haddock Distribution

JUNE 2005

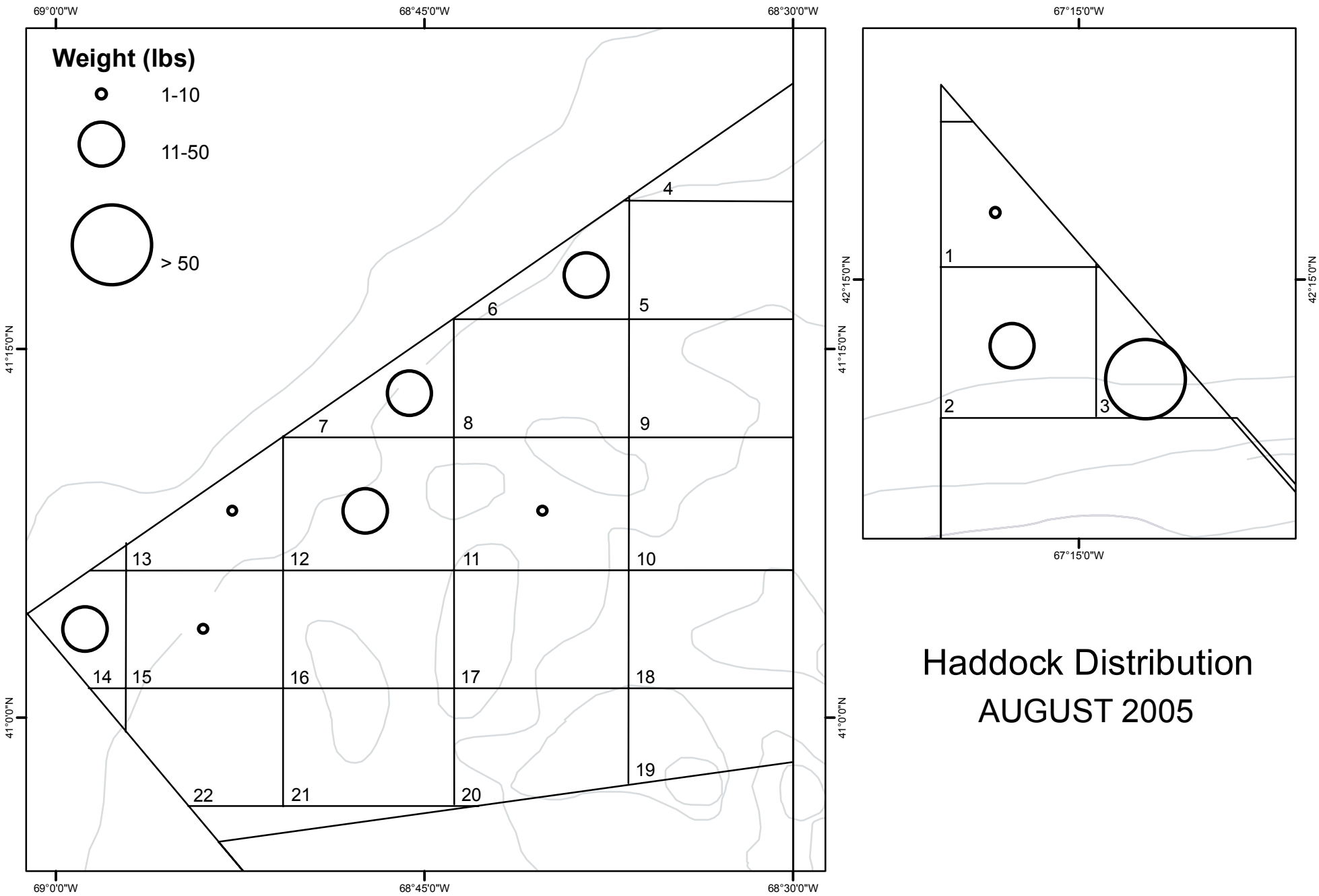
Figure 22



Haddock Distribution

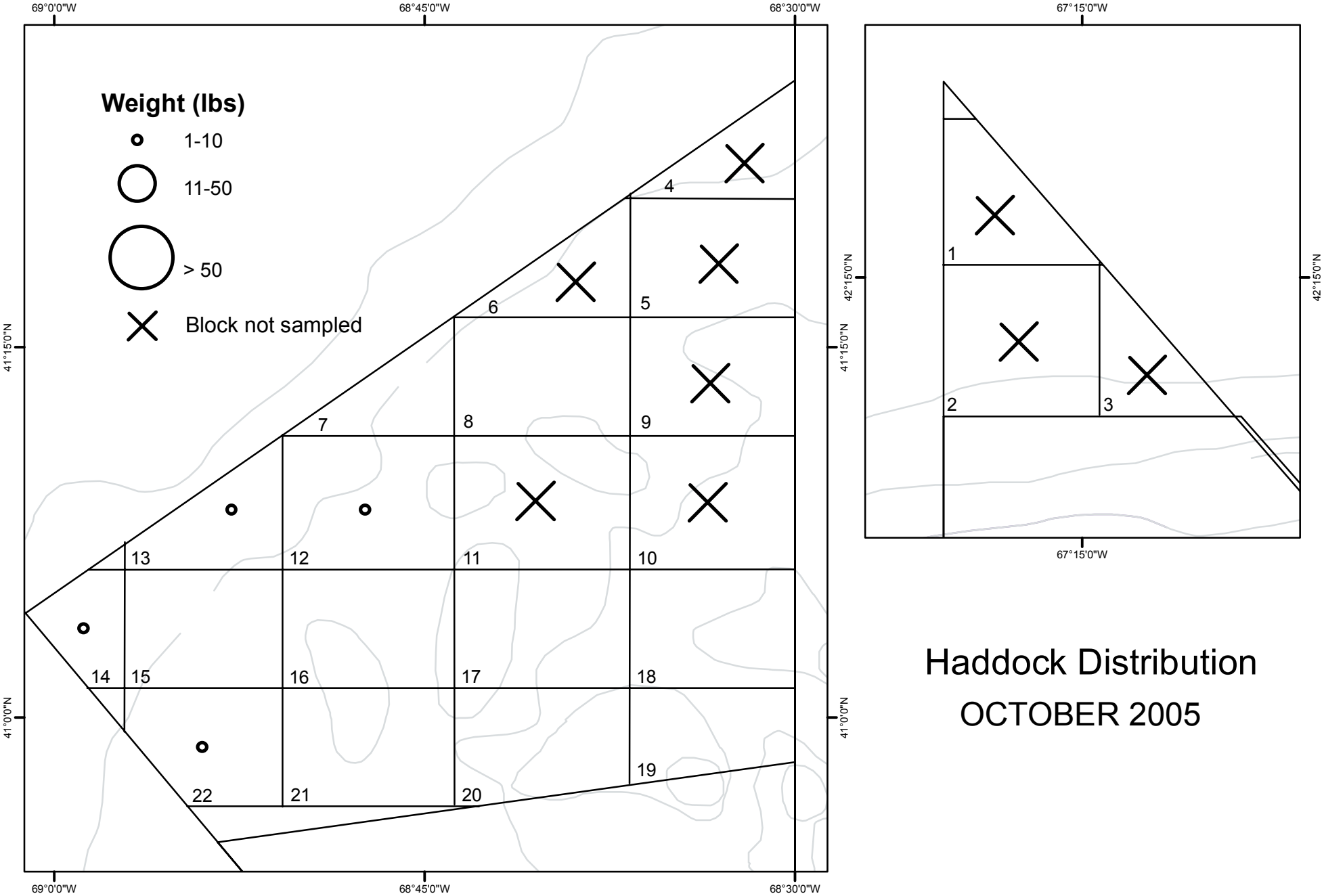
JULY 2005

Figure 23



Haddock Distribution
AUGUST 2005

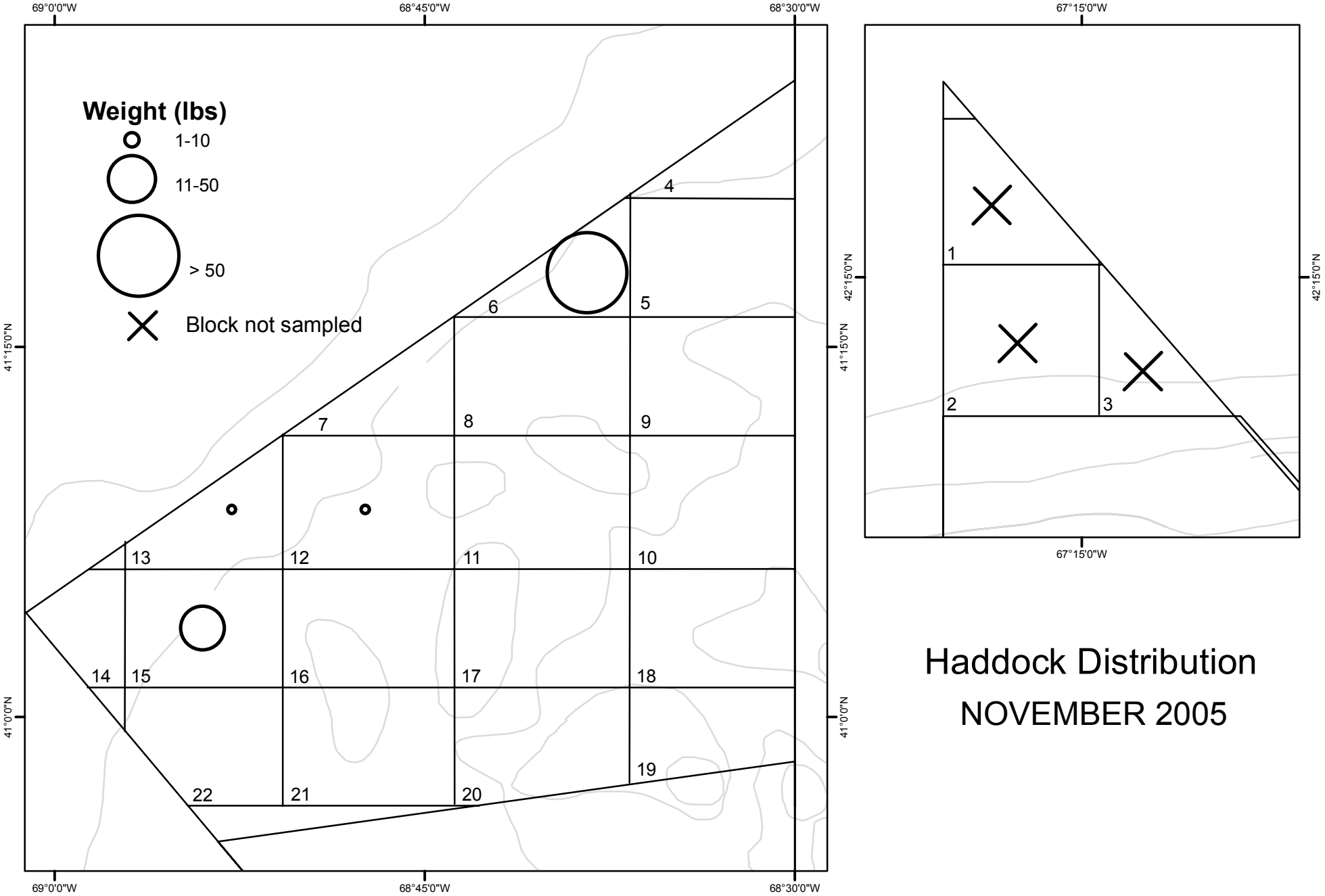
Figure 24



Haddock Distribution

OCTOBER 2005

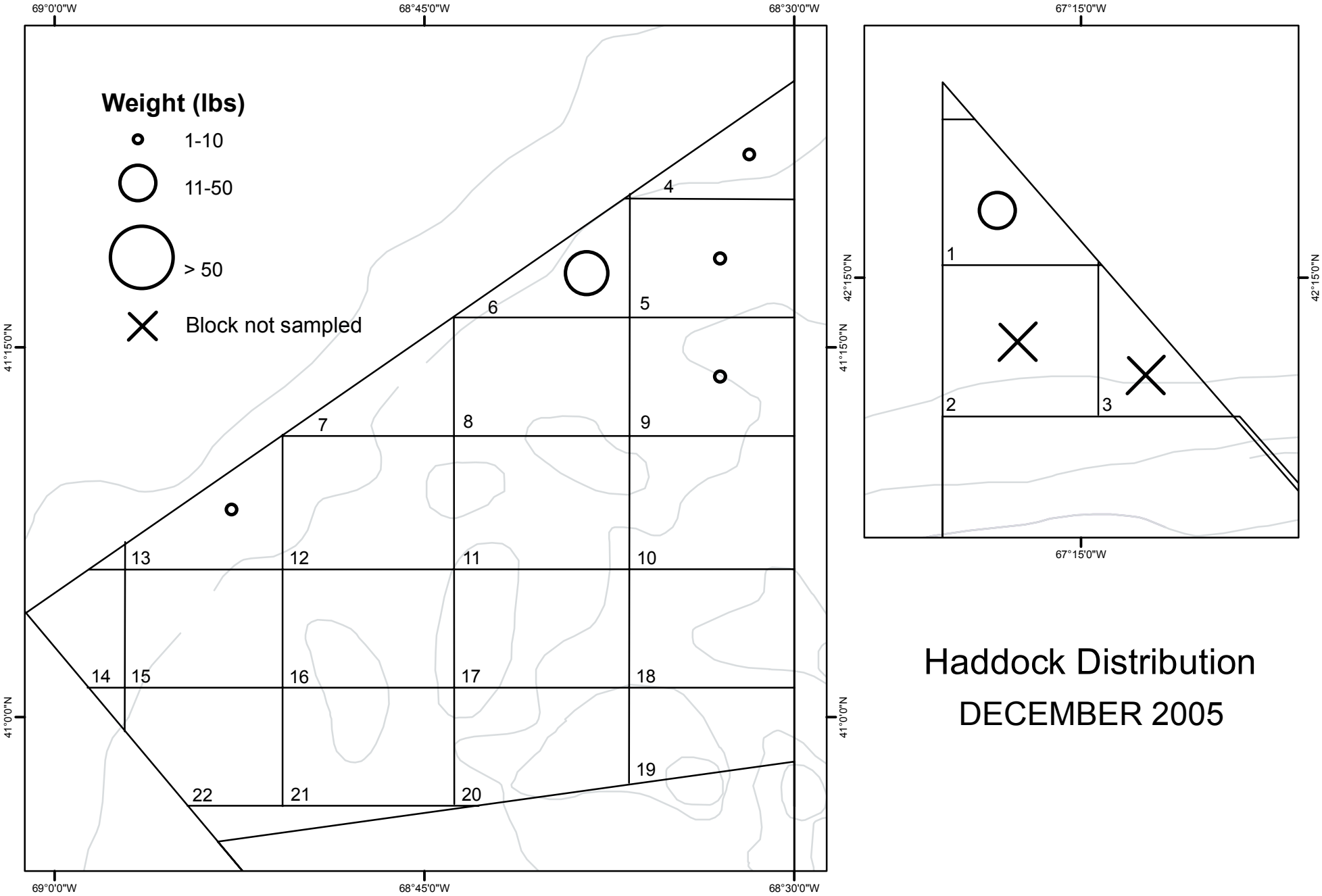
Figure 25



Haddock Distribution

NOVEMBER 2005

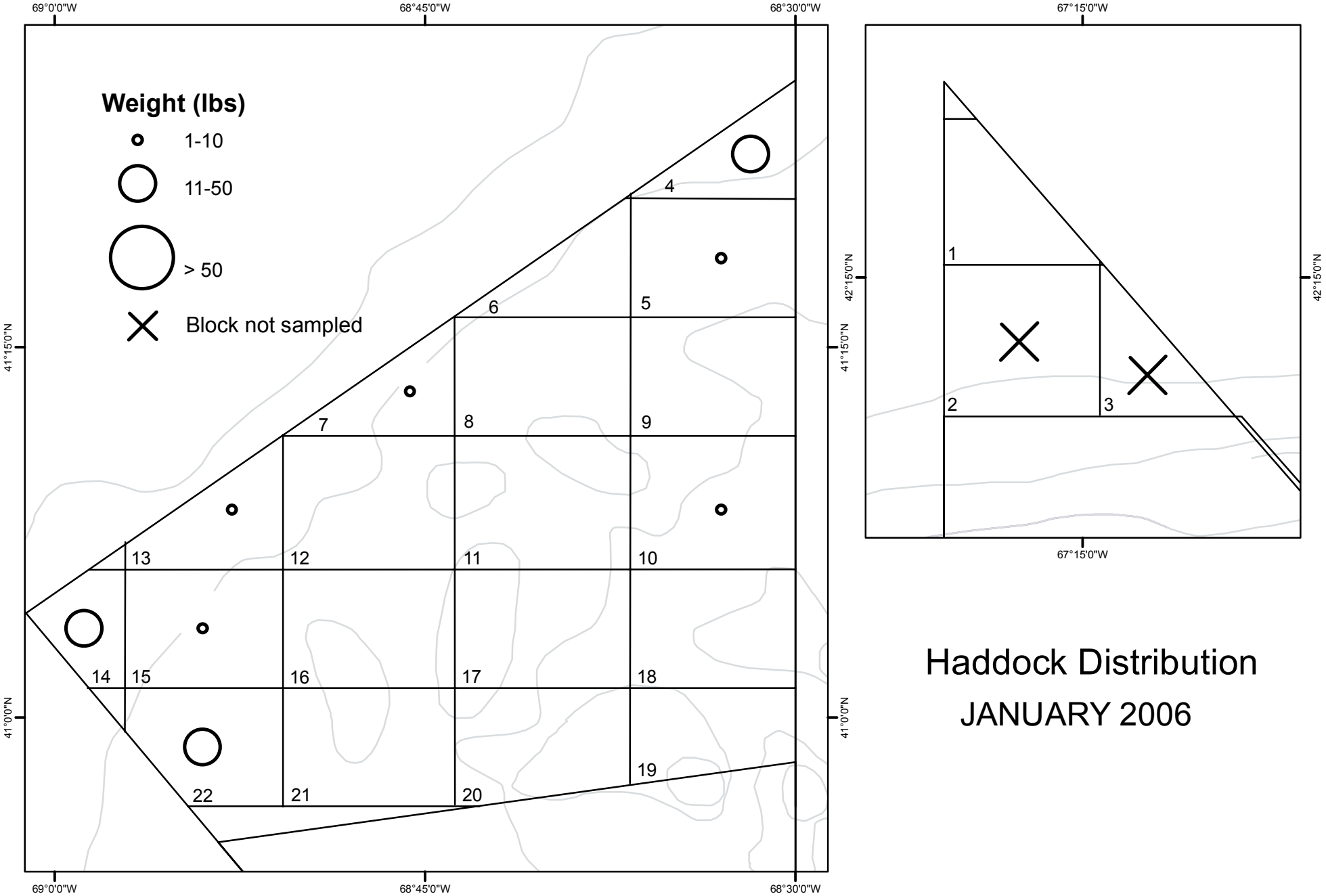
Figure 26



Haddock Distribution

DECEMBER 2005

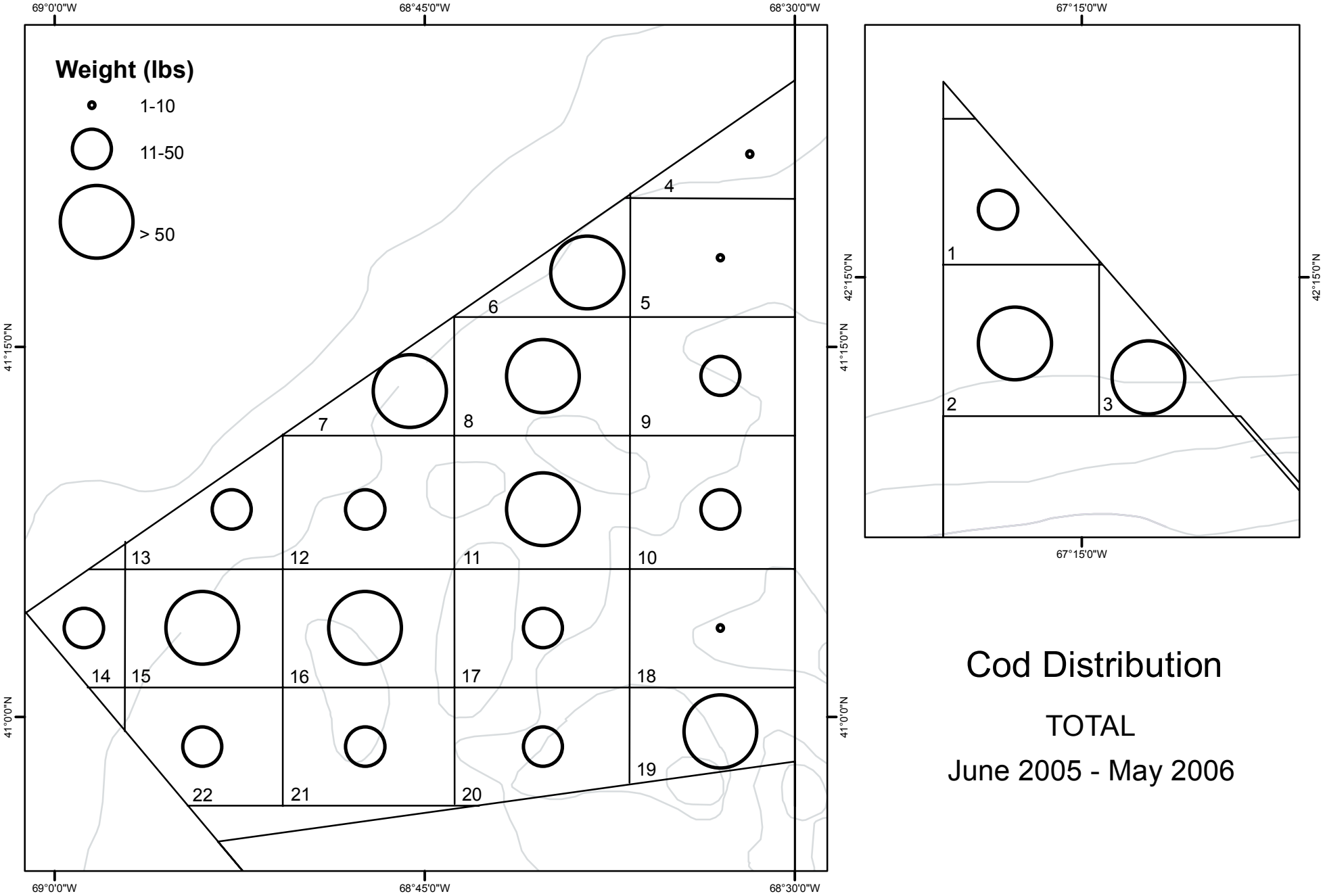
Figure 27



Haddock Distribution

JANUARY 2006

Figure 28

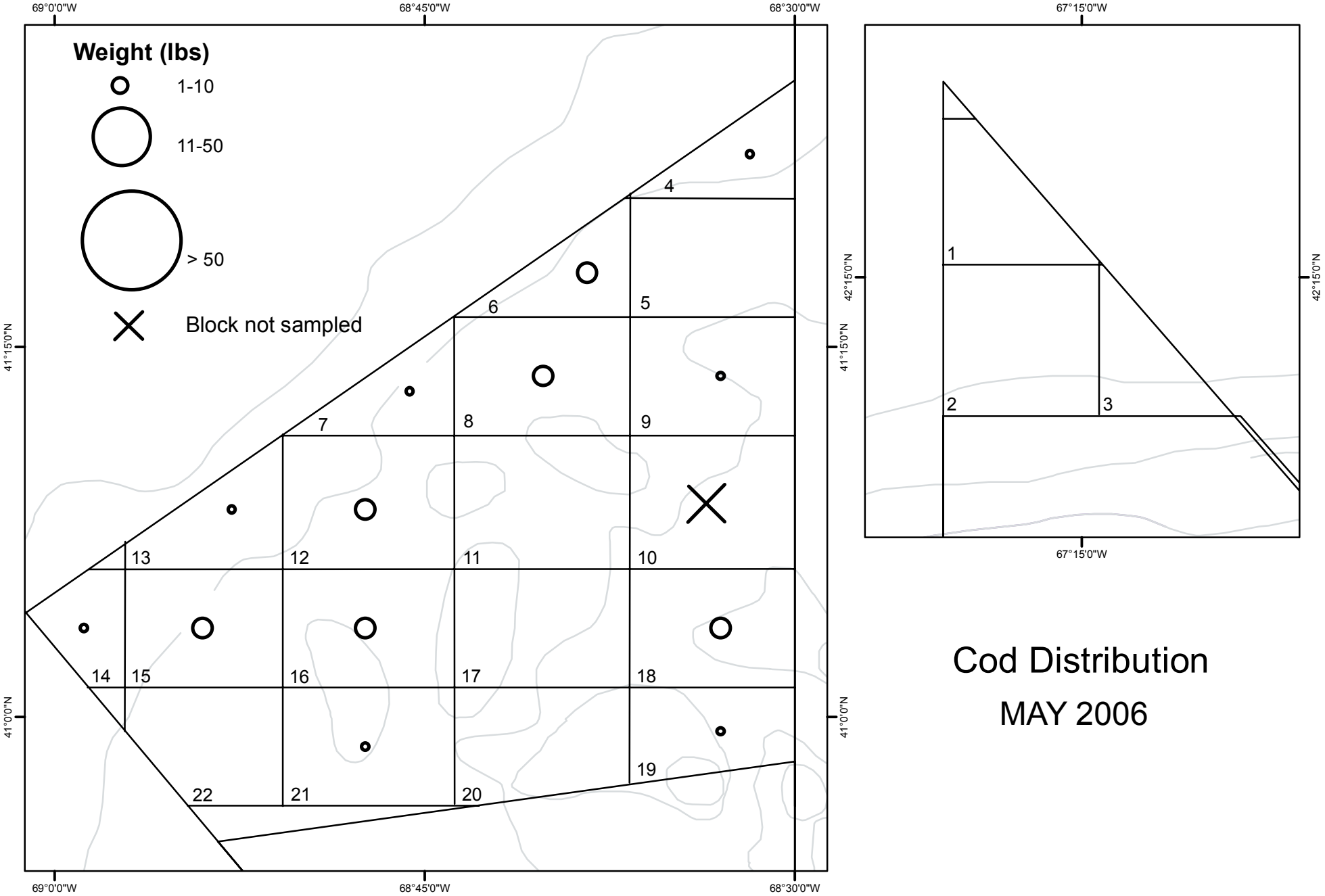


Cod Distribution

TOTAL

June 2005 - May 2006

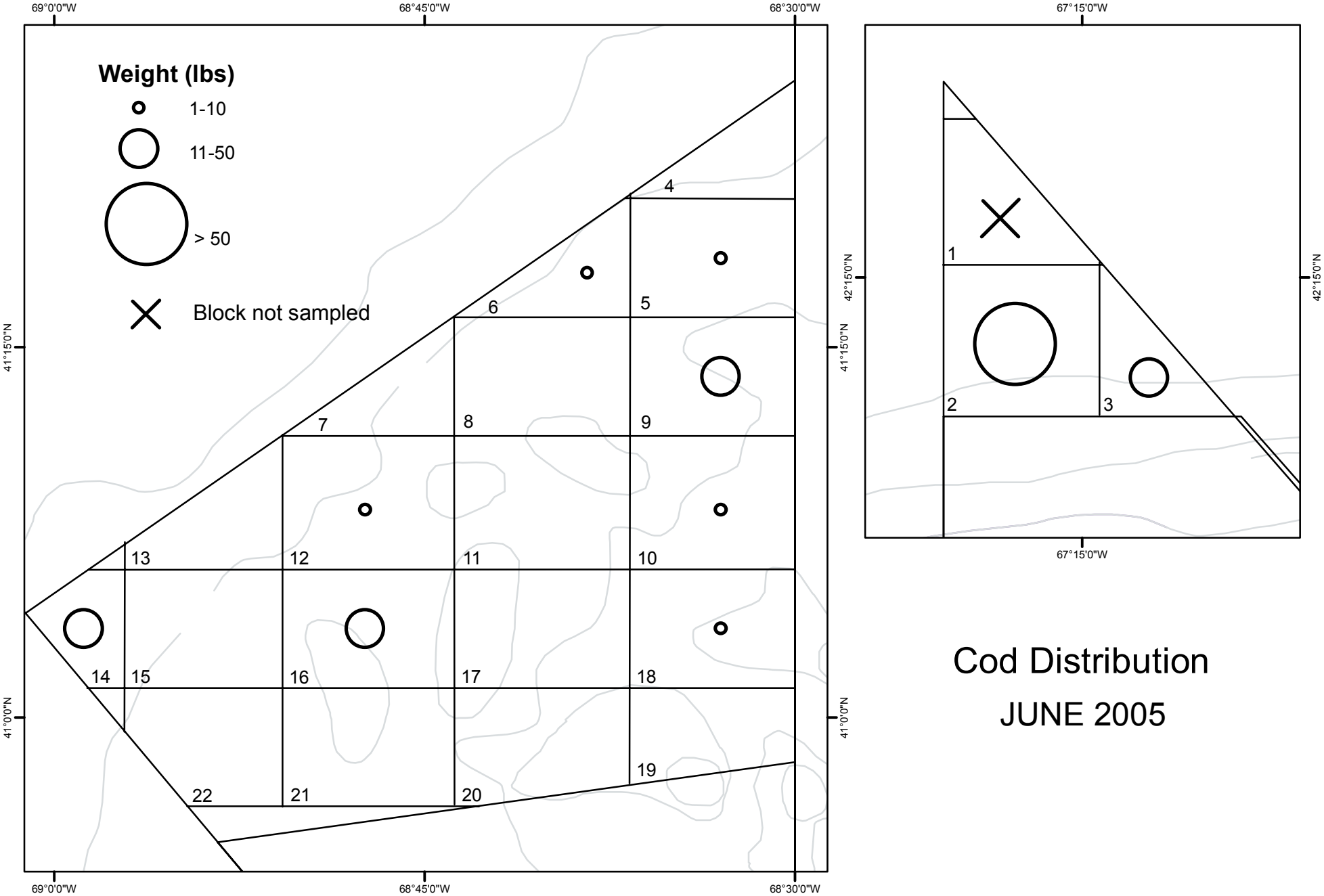
Figure 29



Cod Distribution

MAY 2006

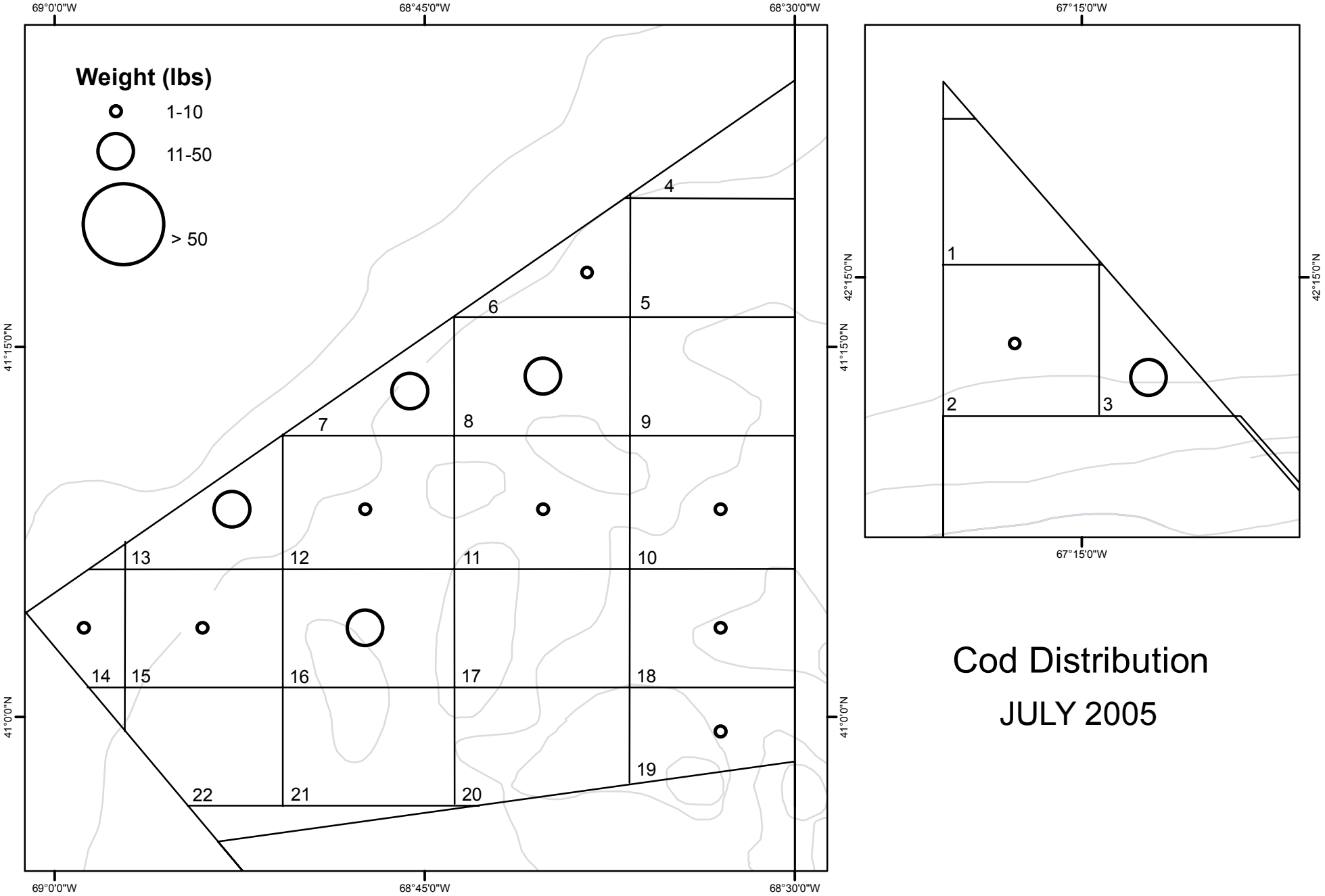
Figure 30



Cod Distribution

JUNE 2005

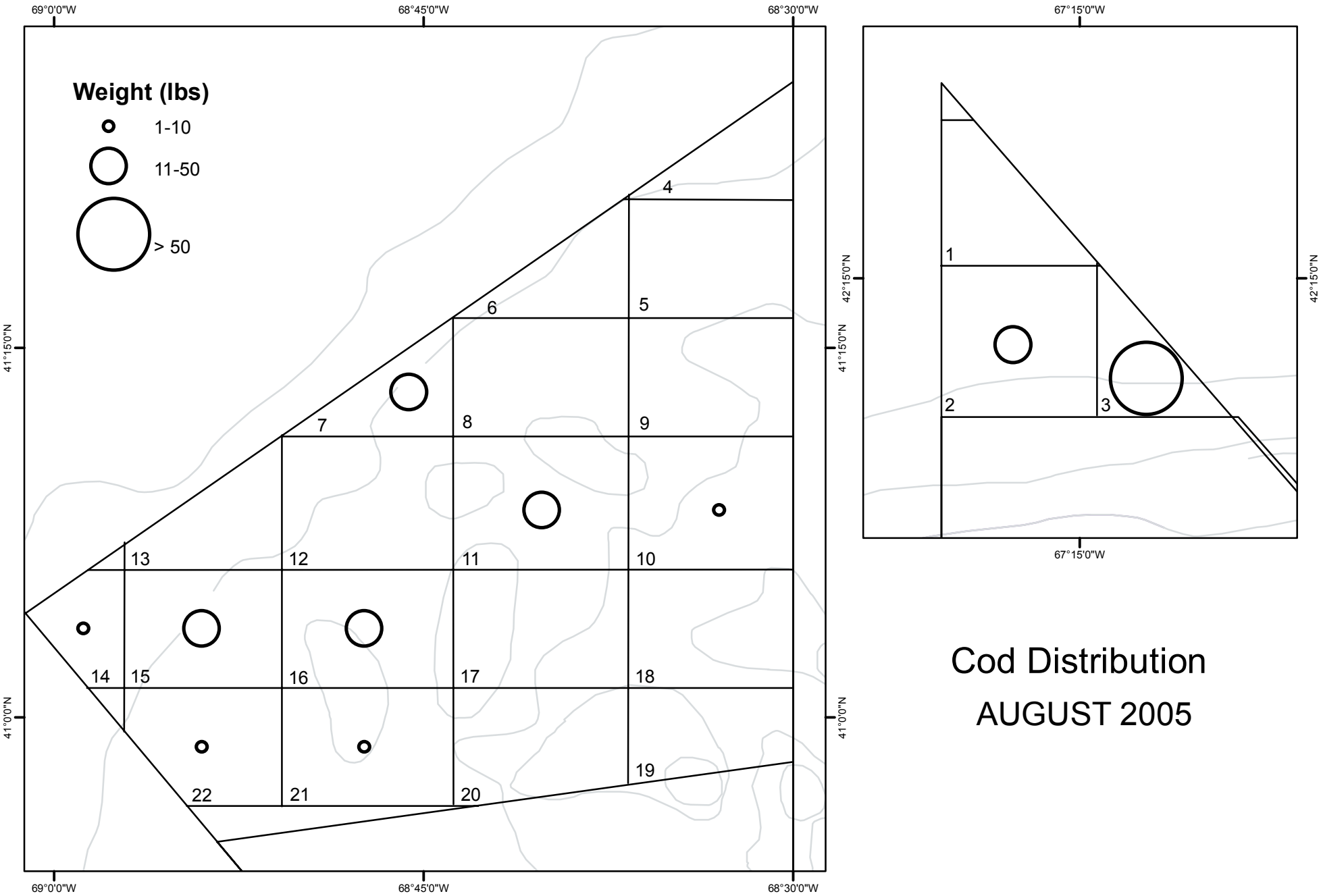
Figure 31



Cod Distribution

JULY 2005

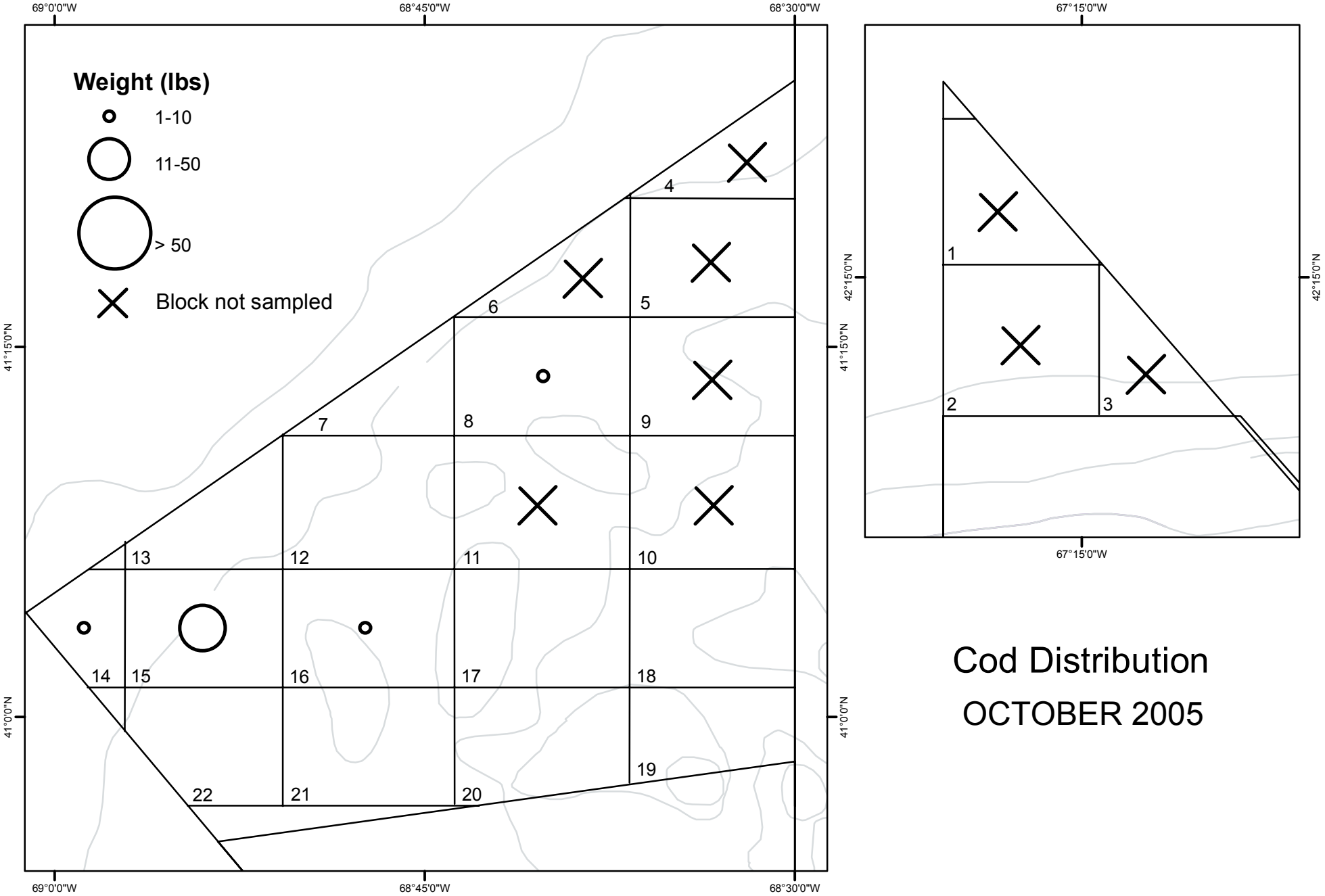
Figure 32



Cod Distribution

AUGUST 2005

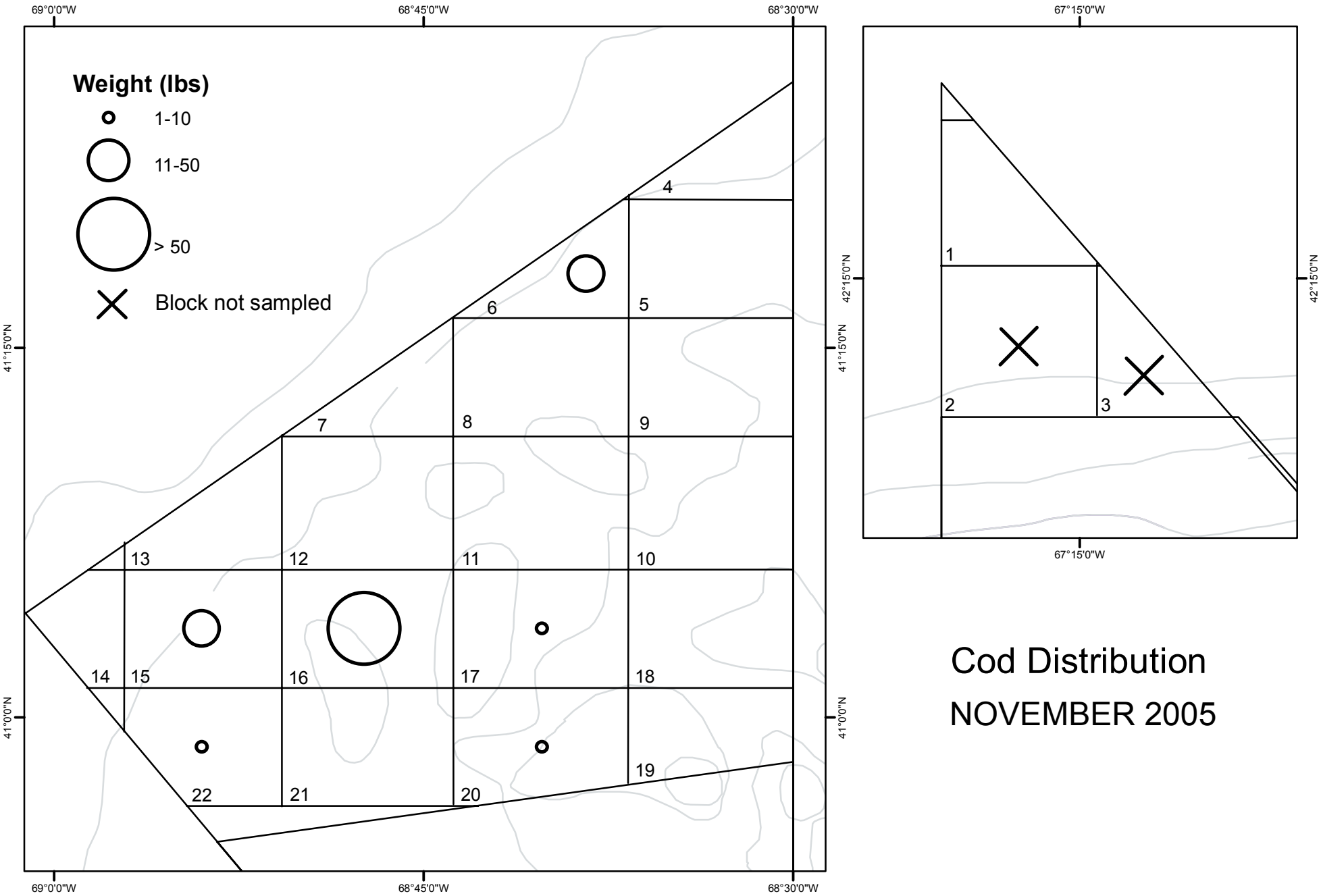
Figure 33



Cod Distribution

OCTOBER 2005

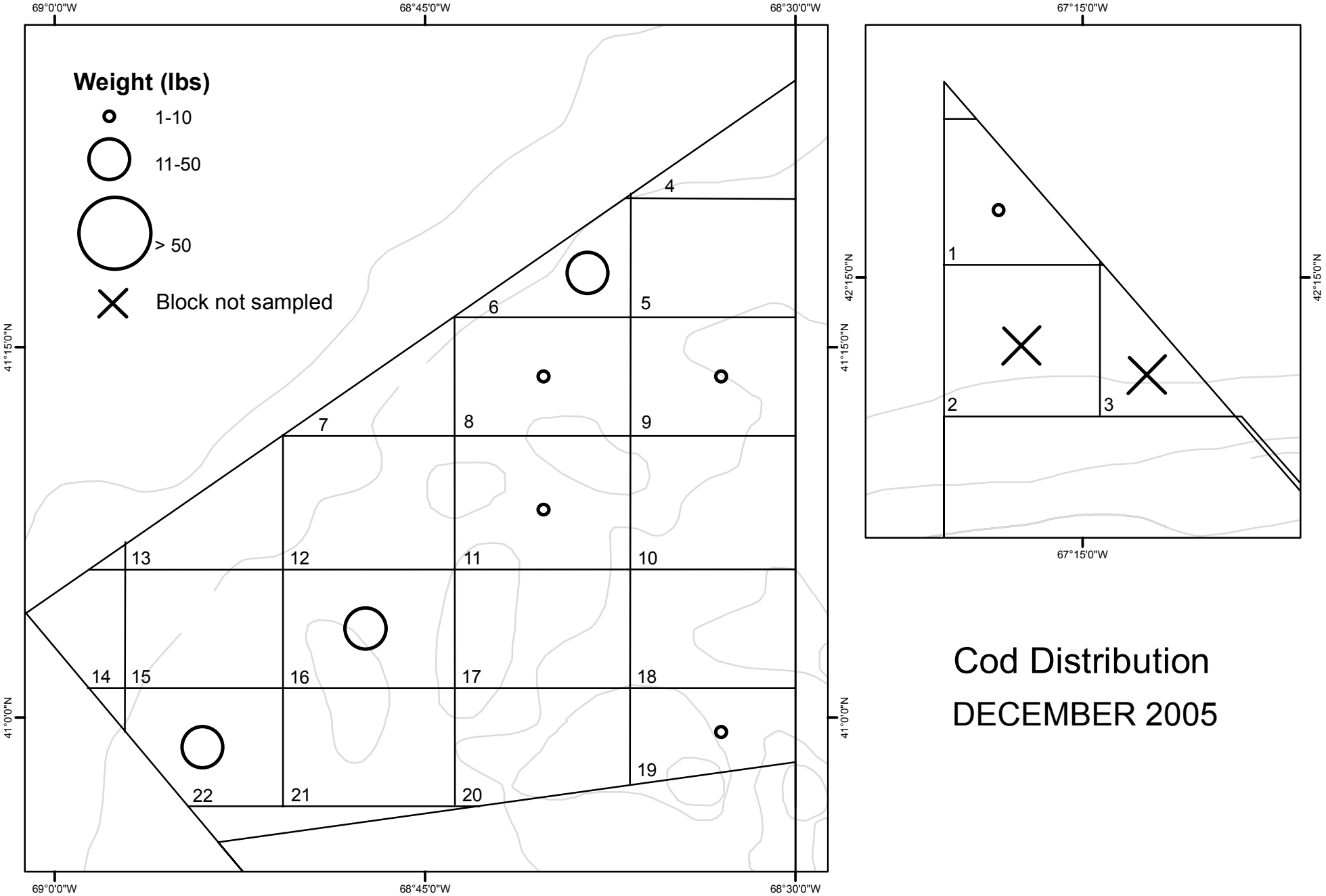
Figure 34



Cod Distribution

NOVEMBER 2005

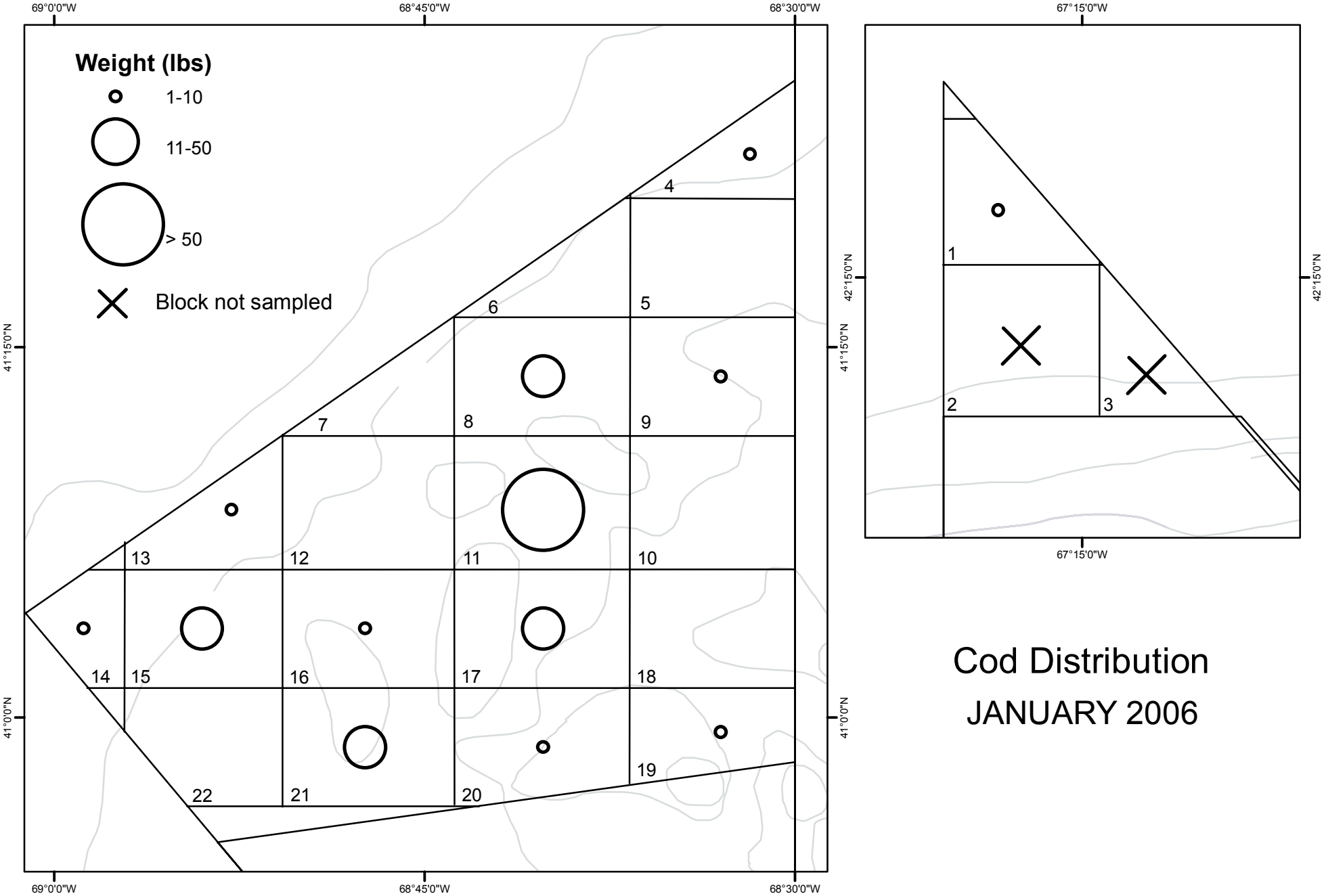
Figure 35



Cod Distribution

DECEMBER 2005

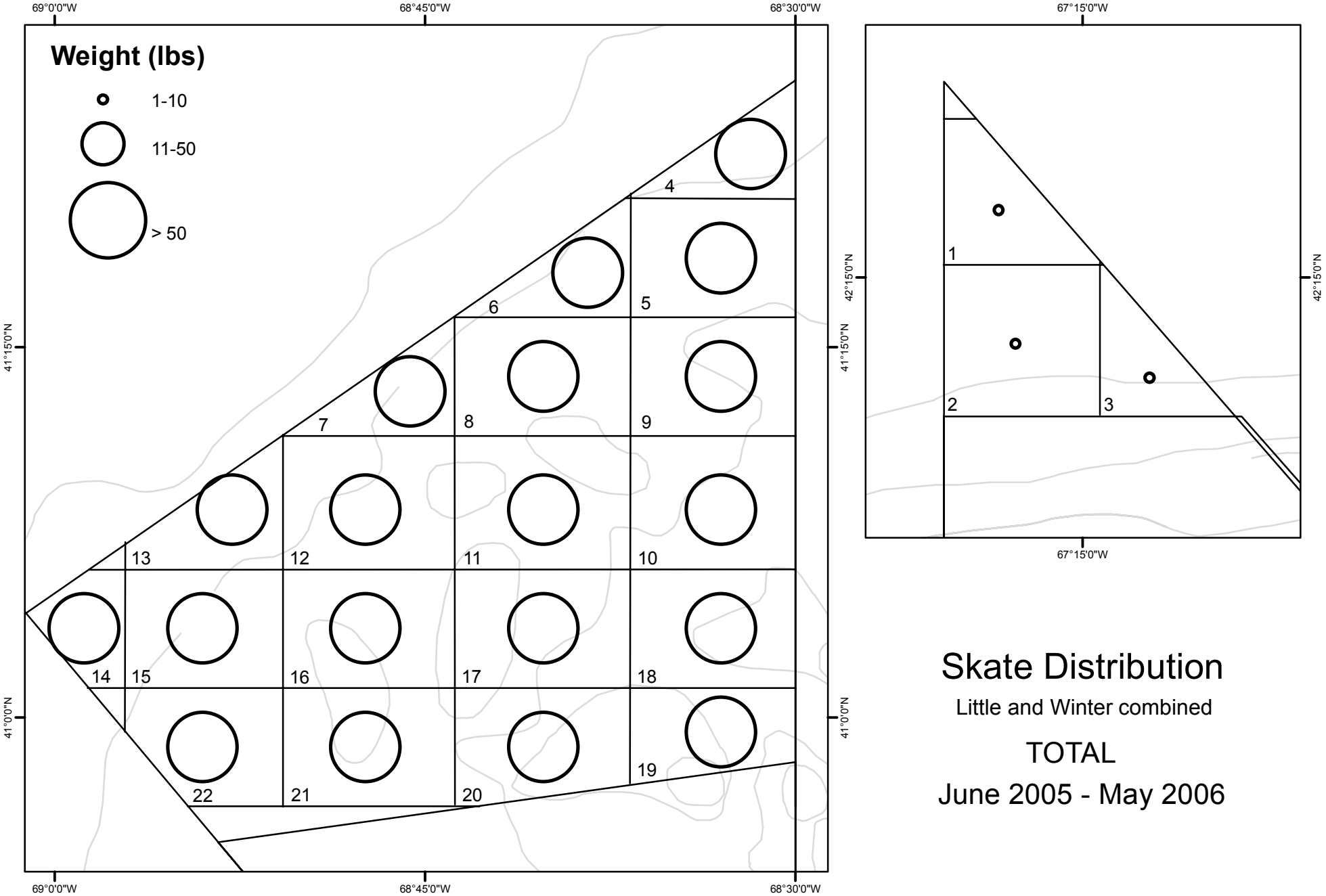
Figure 36



Cod Distribution

JANUARY 2006

Figure 37



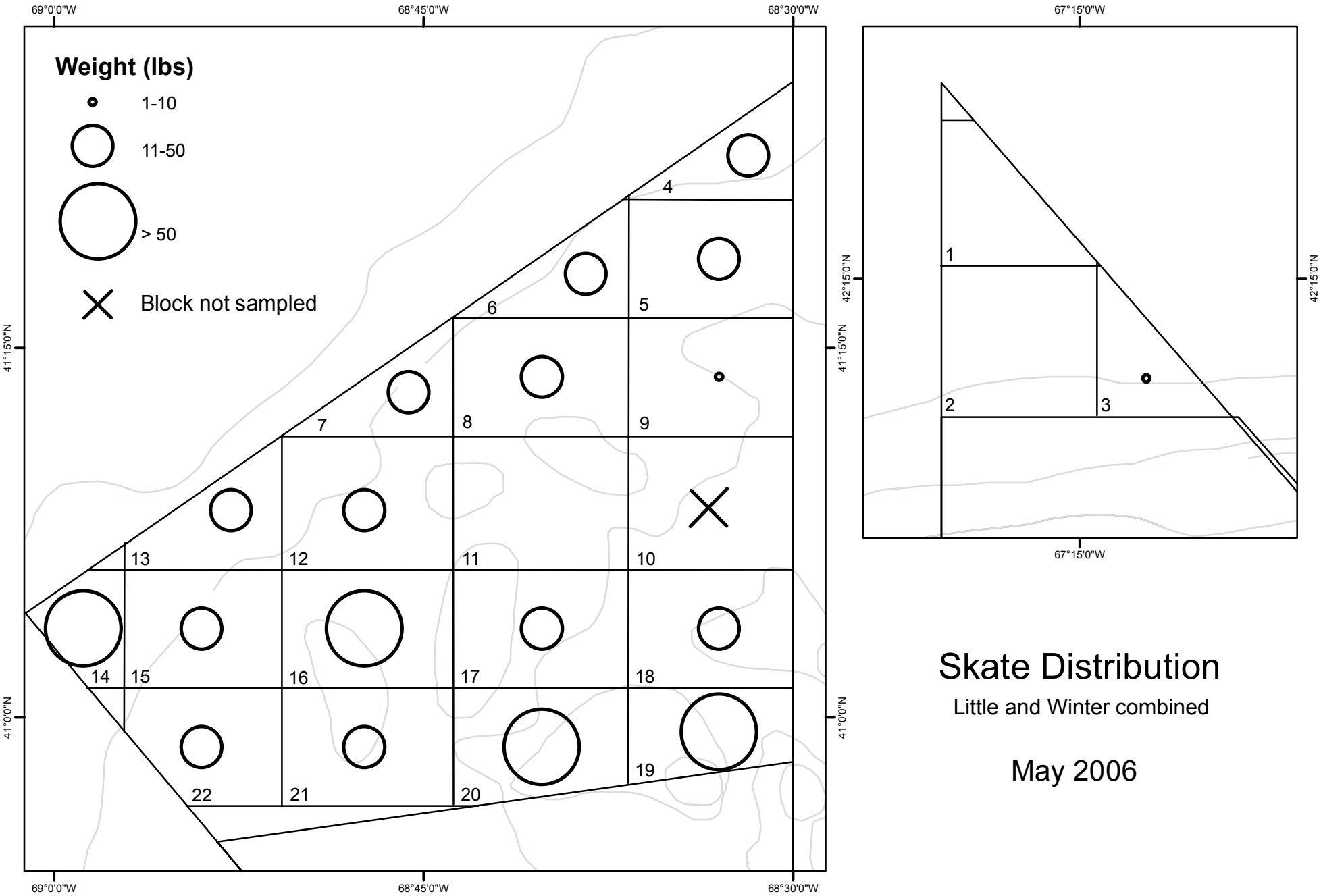
Skate Distribution

Little and Winter combined

TOTAL

June 2005 - May 2006

Figure 38

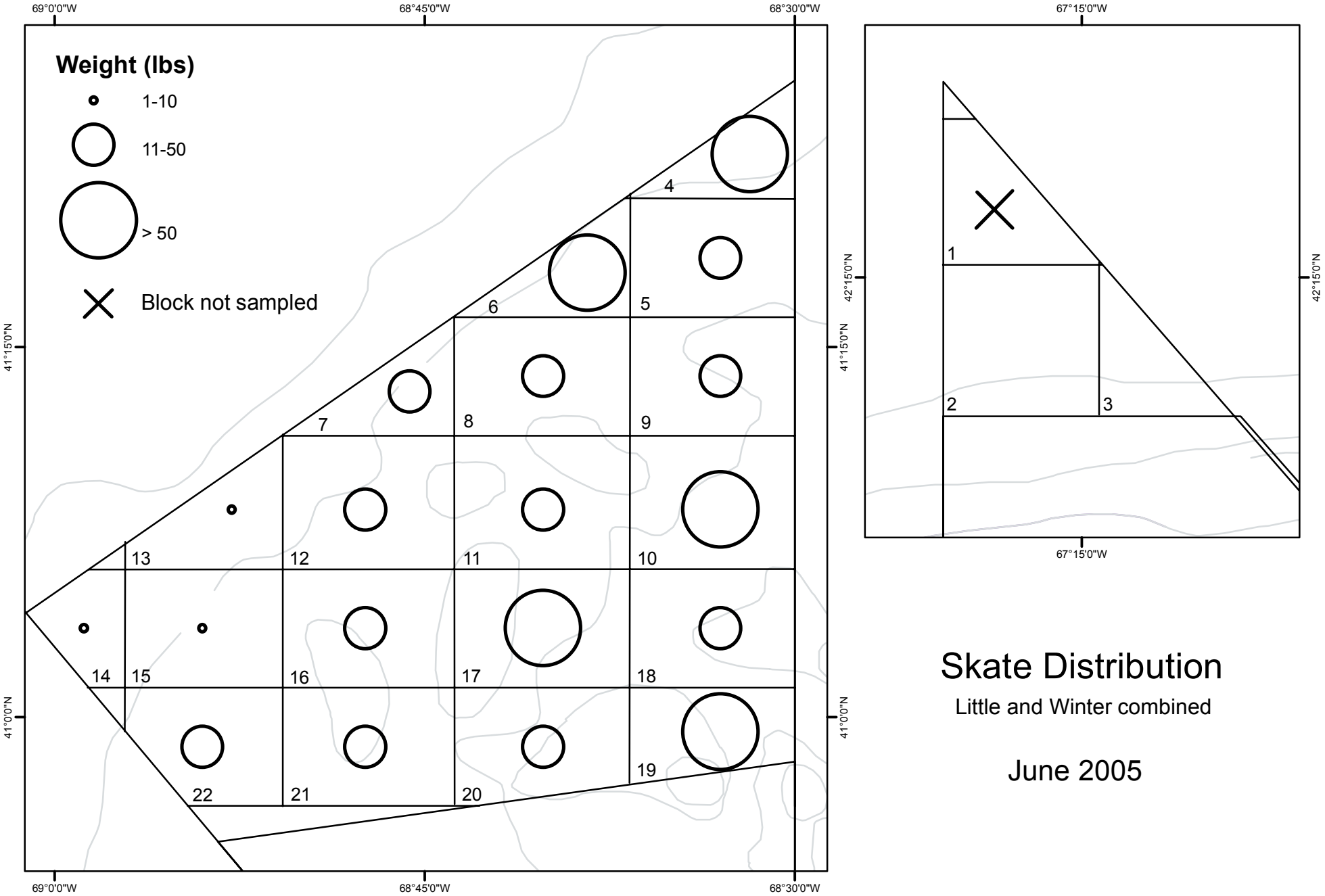


Skate Distribution

Little and Winter combined

May 2006

Figure 39

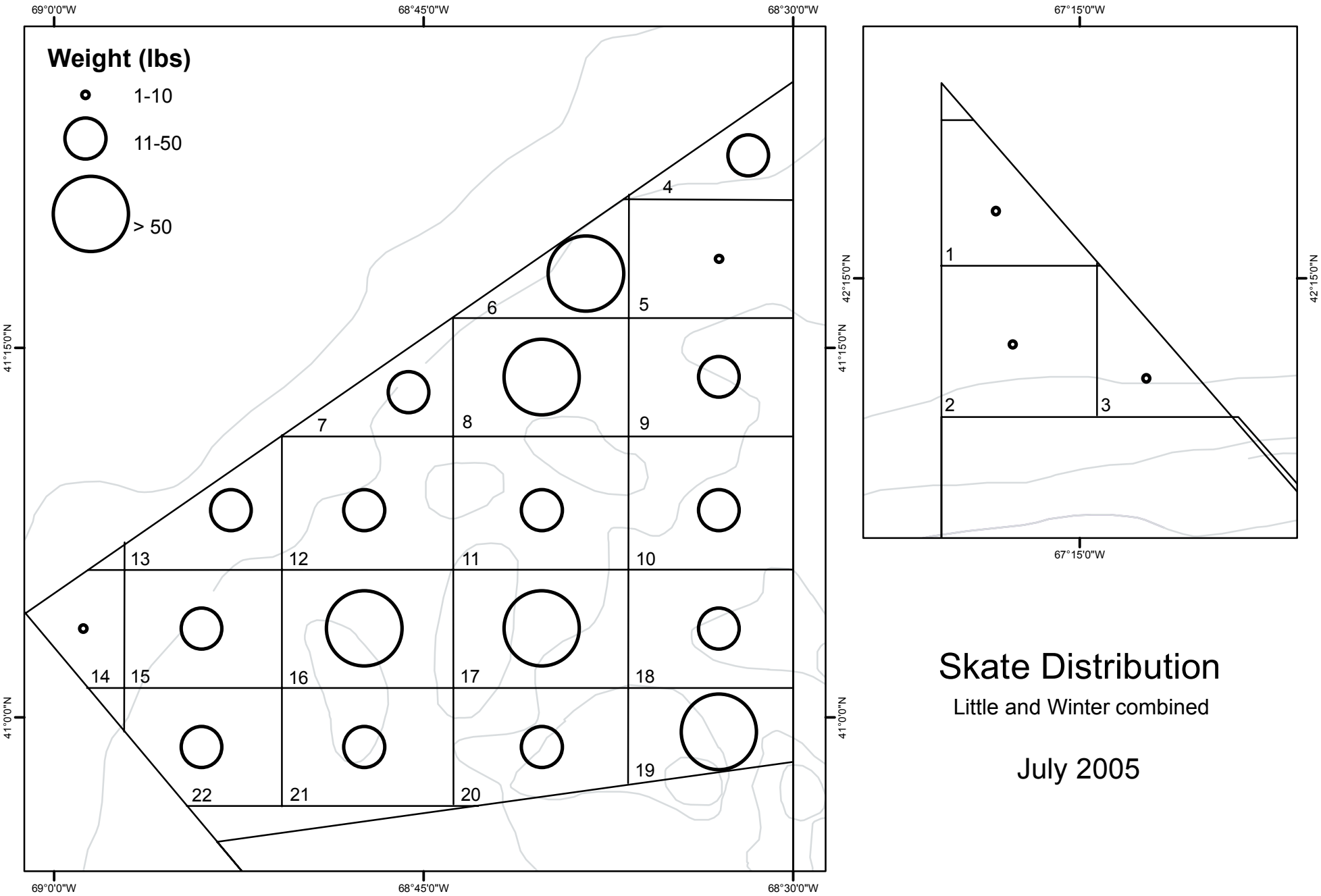


Skate Distribution

Little and Winter combined

June 2005

Figure 40

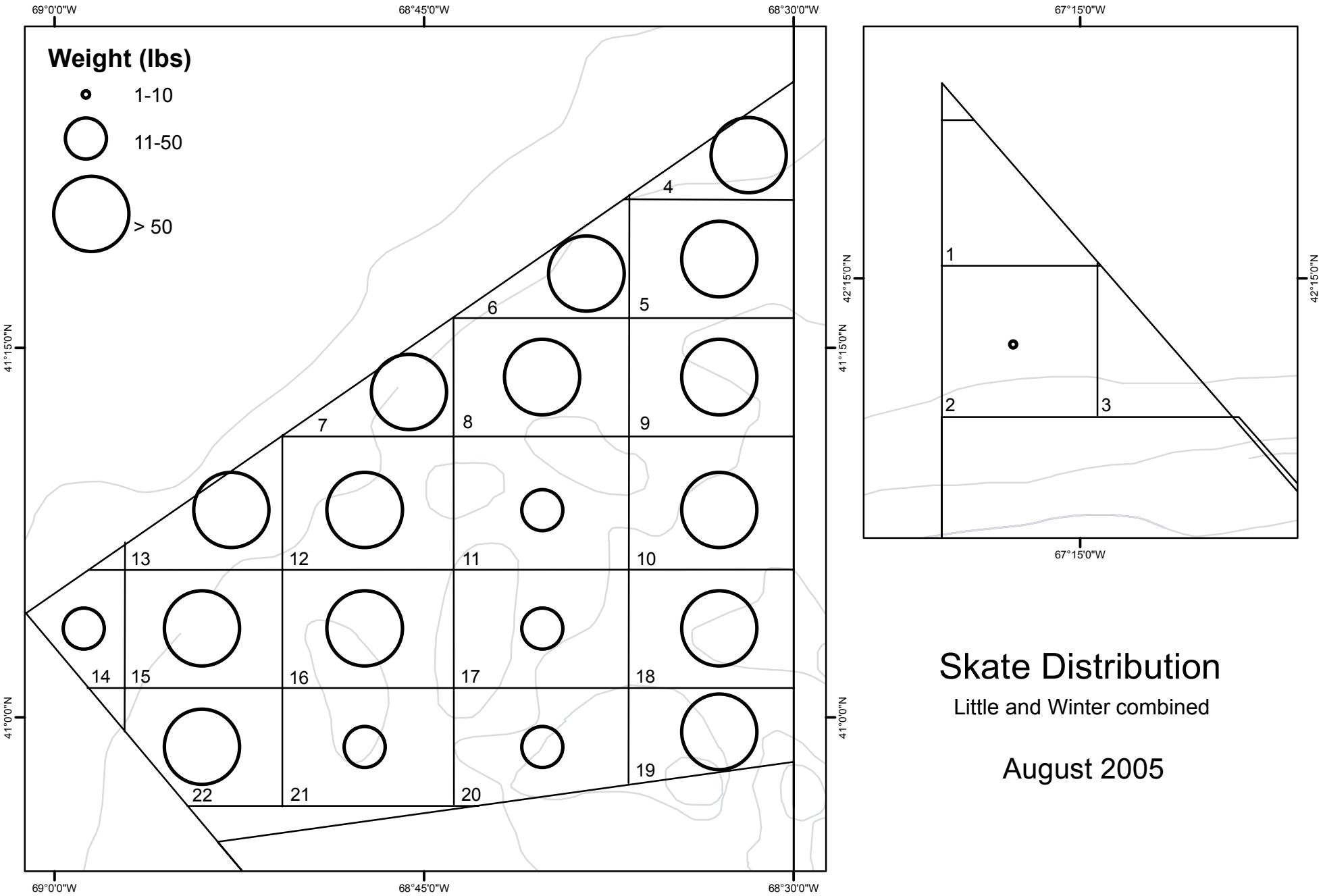


Skate Distribution

Little and Winter combined

July 2005

Figure 41

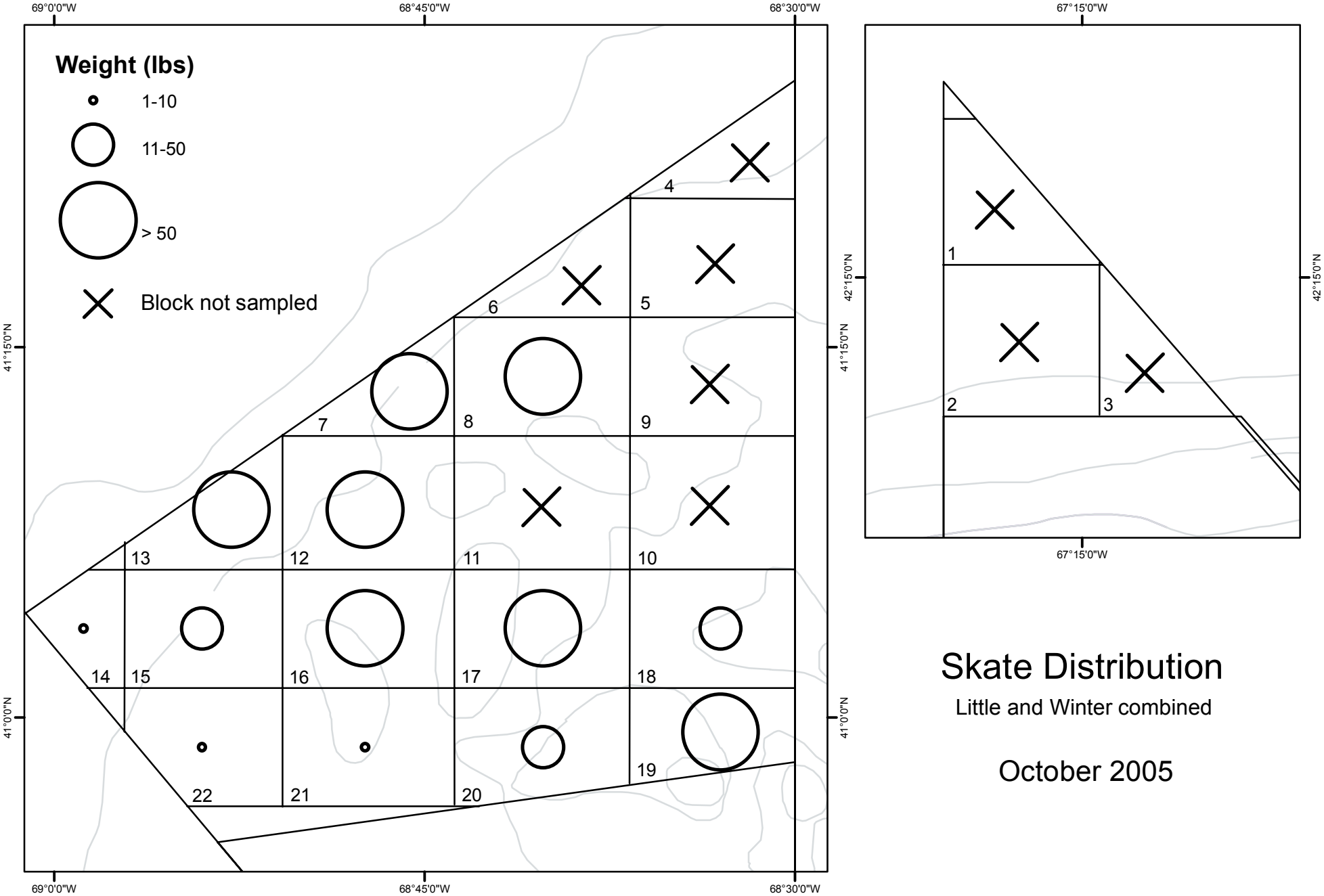


Skate Distribution

Little and Winter combined

August 2005

Figure 42

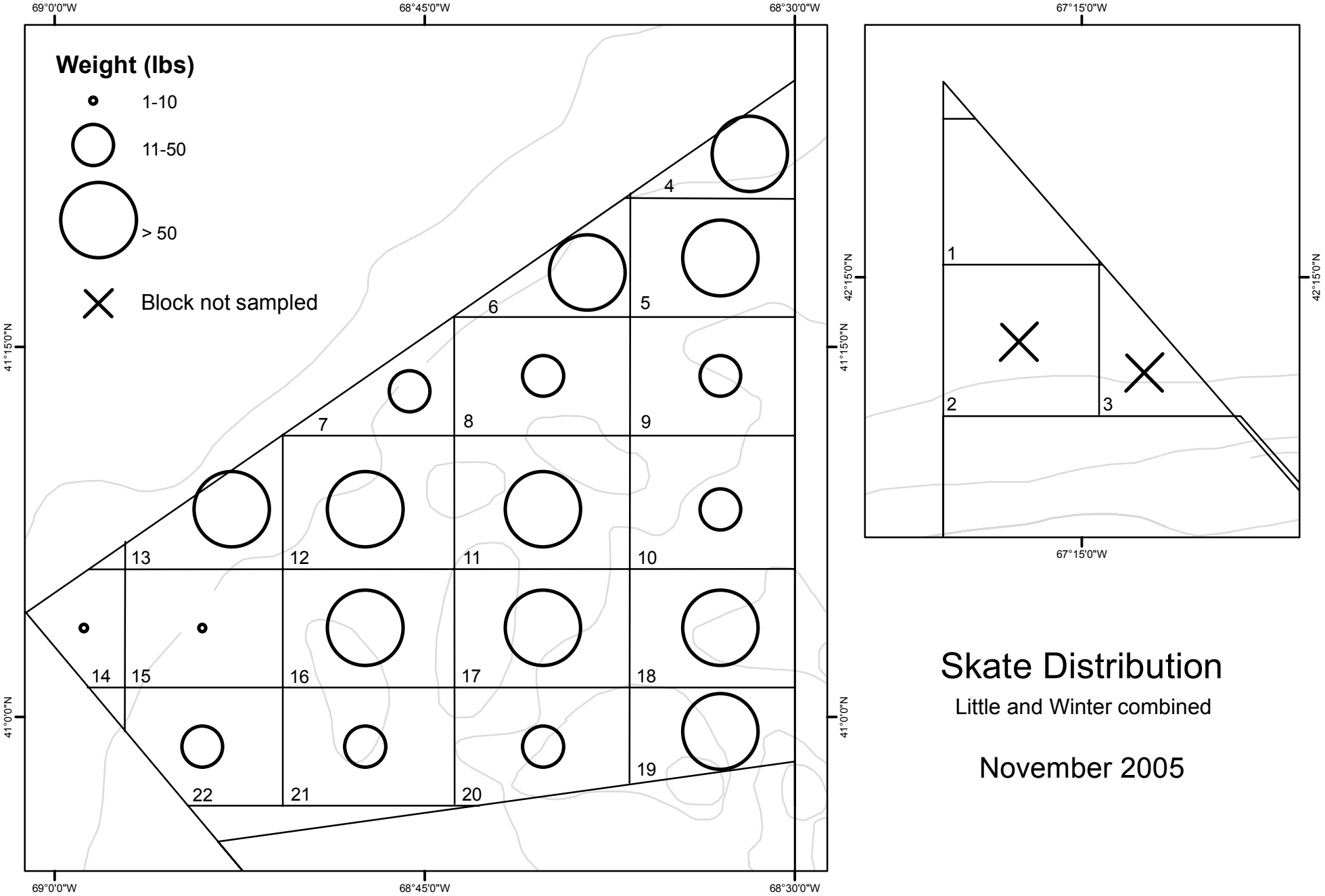


Skate Distribution

Little and Winter combined

October 2005

Figure 43

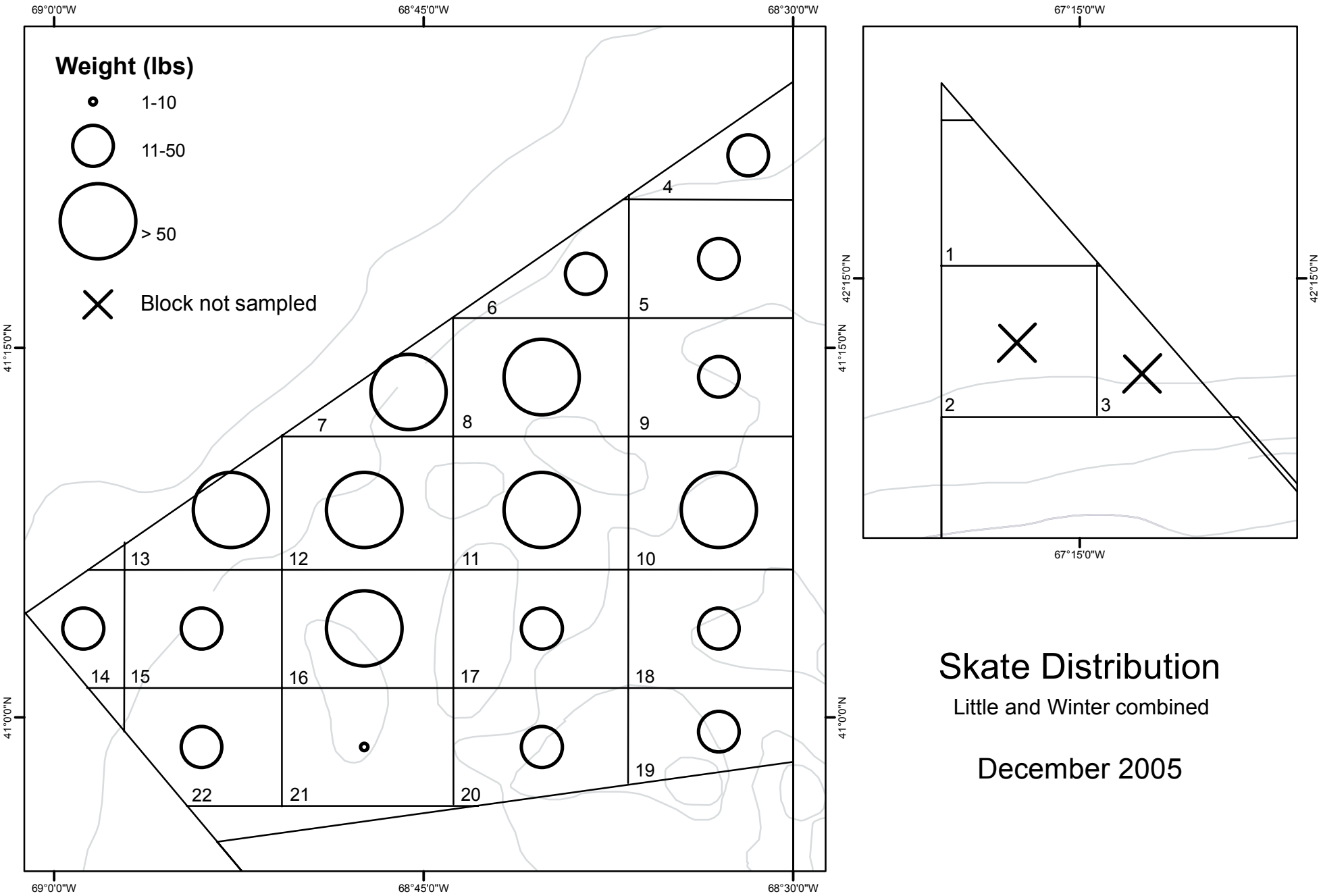


Skate Distribution

Little and Winter combined

November 2005

Figure 44

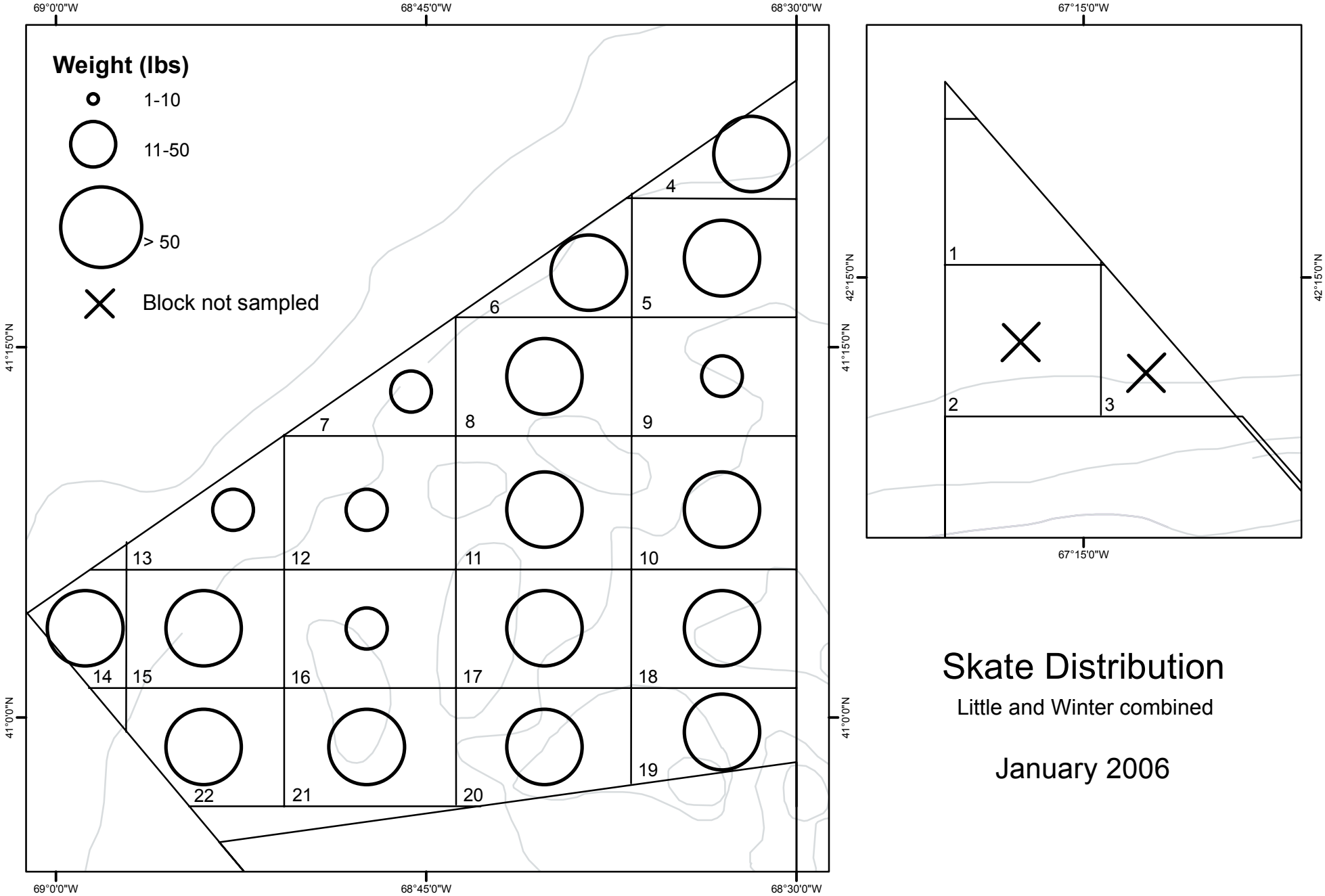


Skate Distribution

Little and Winter combined

December 2005

Figure 45

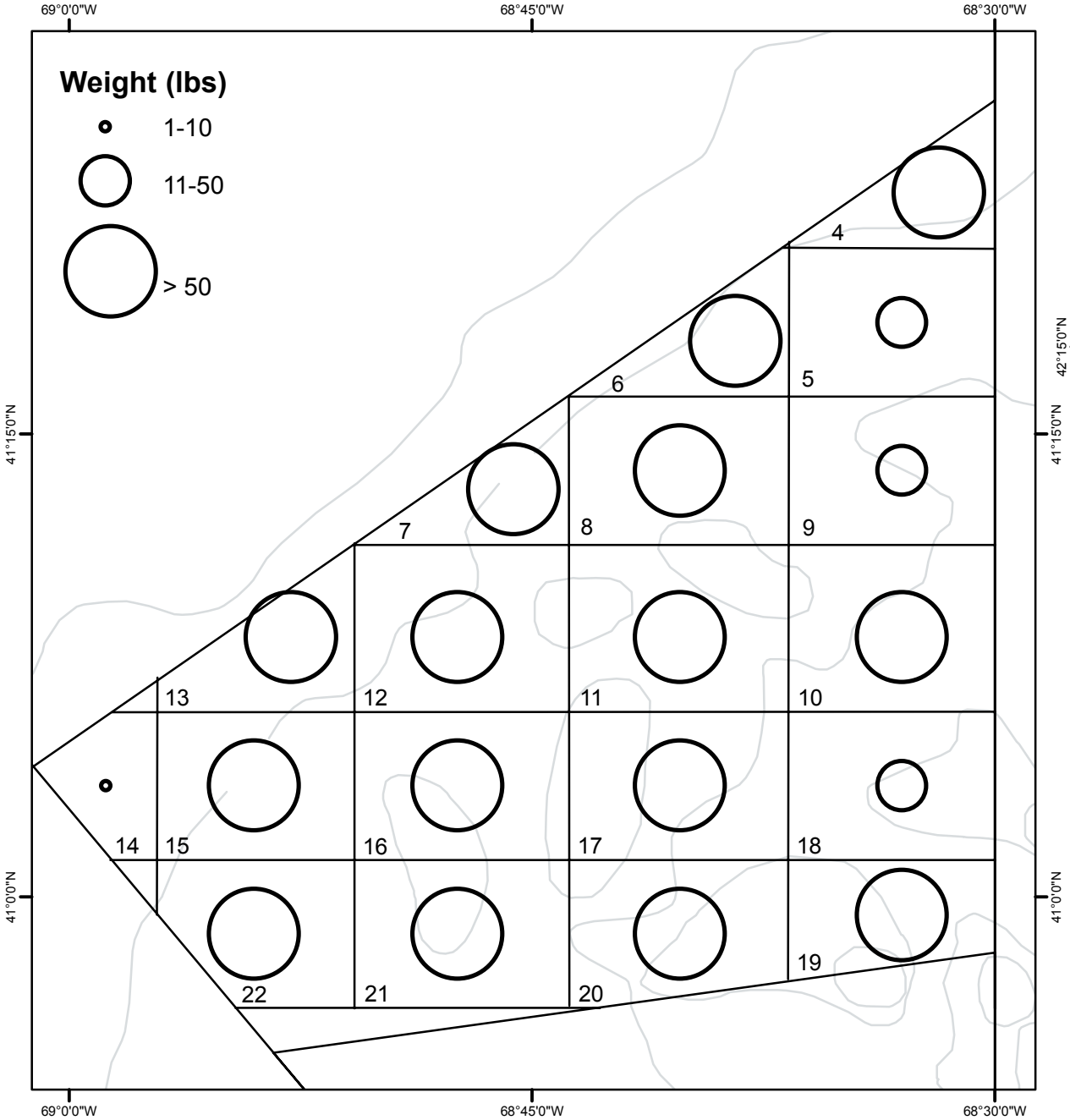


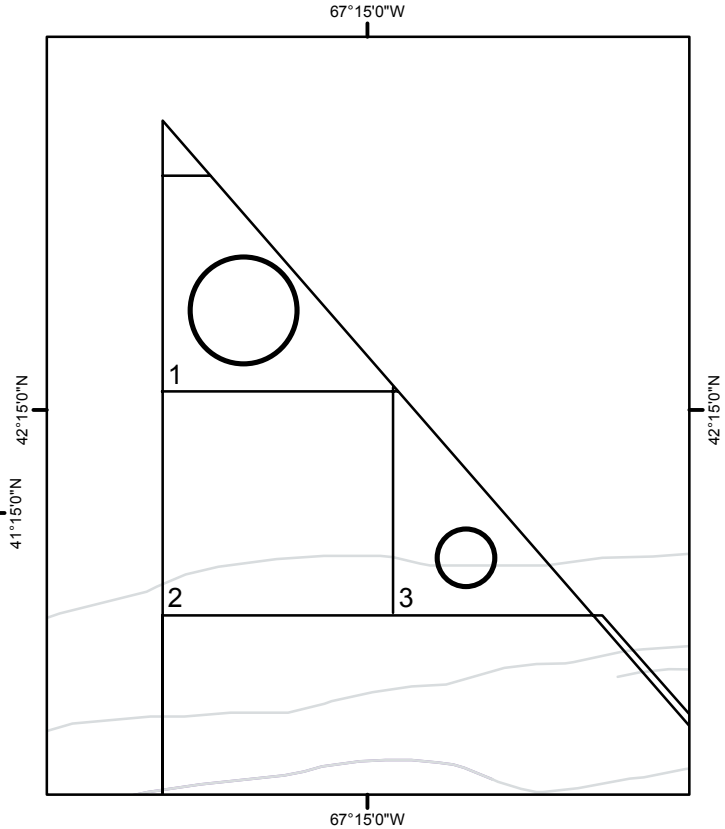
Skate Distribution

Little and Winter combined

January 2006

Figure 46



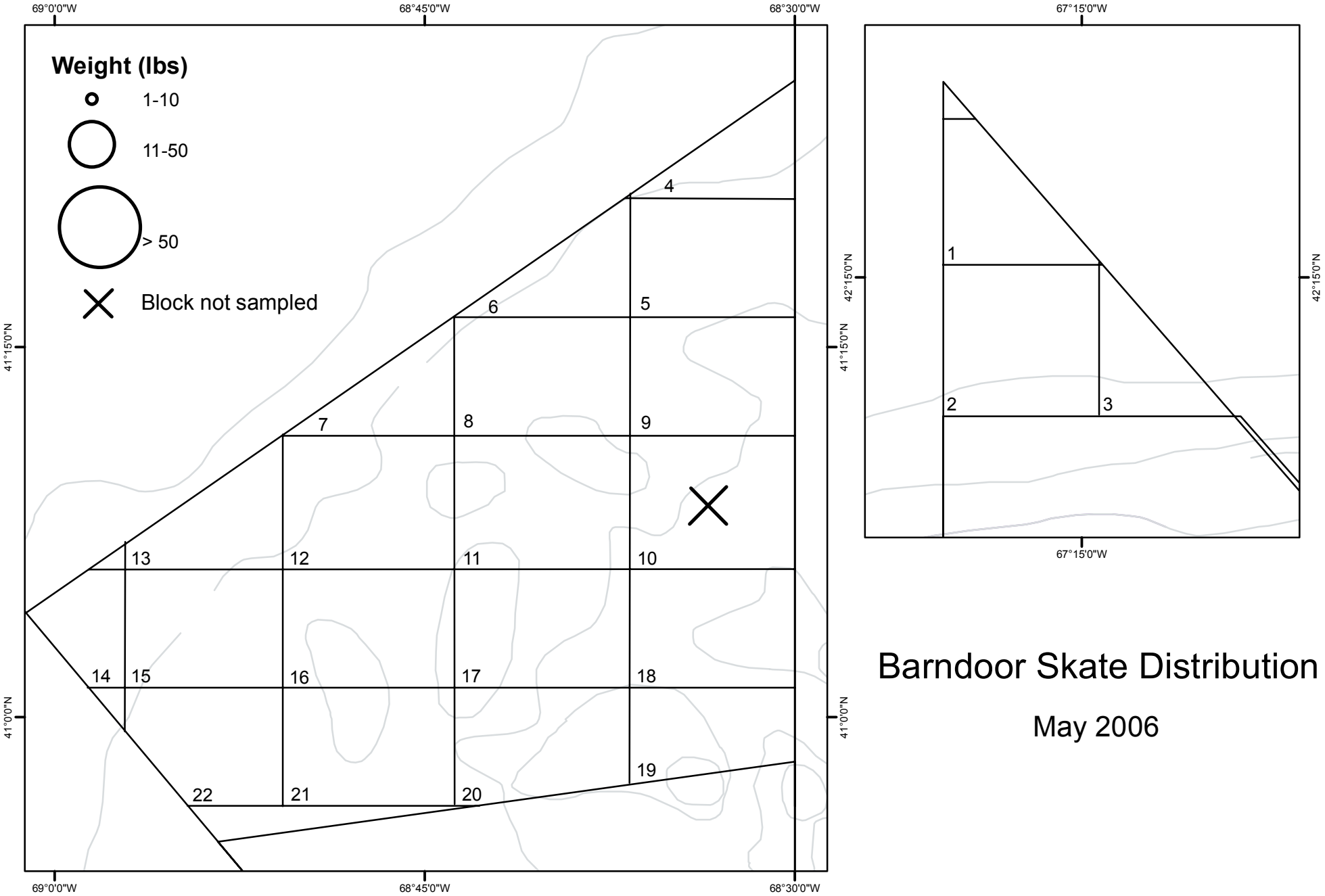


Barndoor Skate Distribution

TOTAL

June 2005 - May 2006

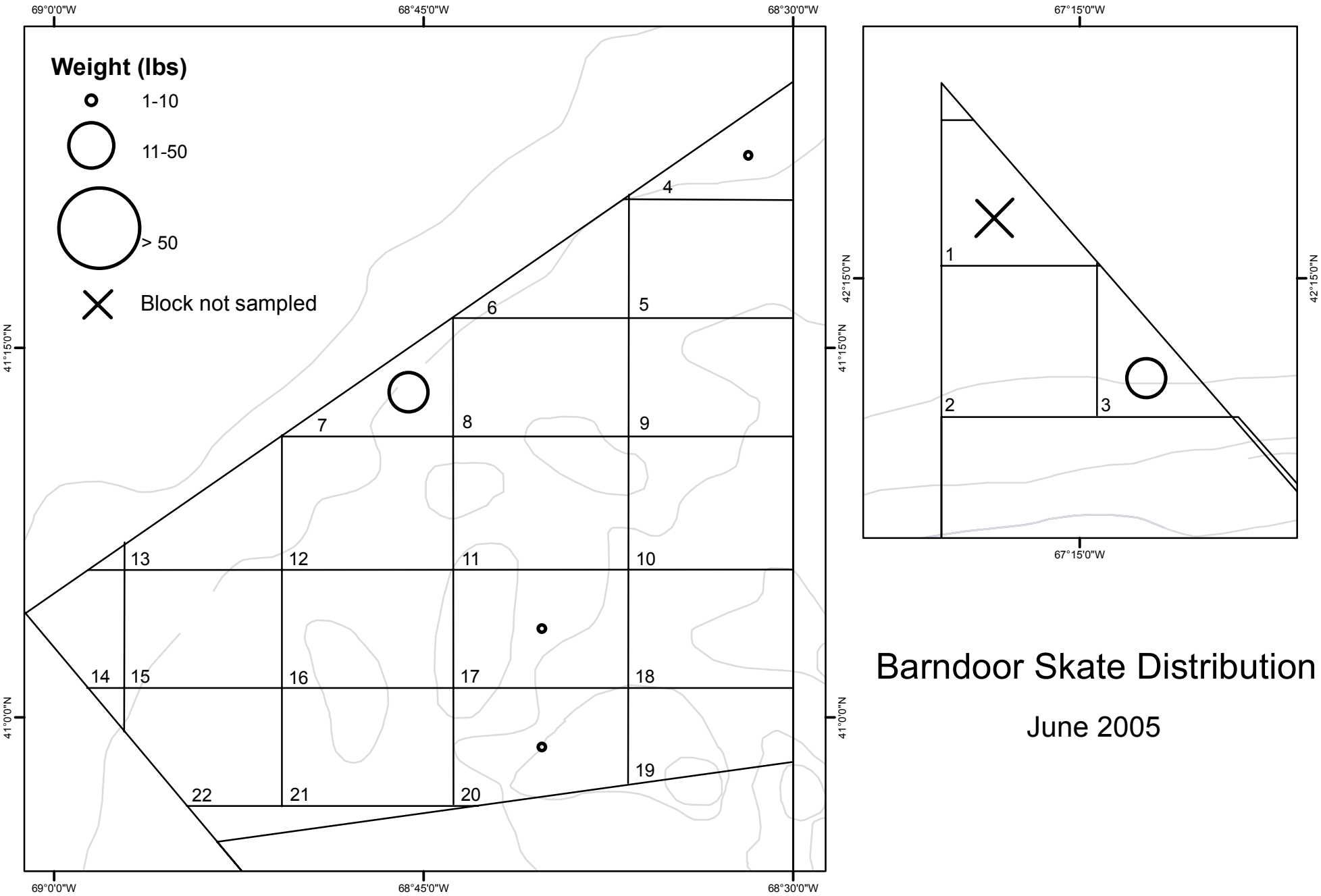
Figure 47



Barndoor Skate Distribution

May 2006

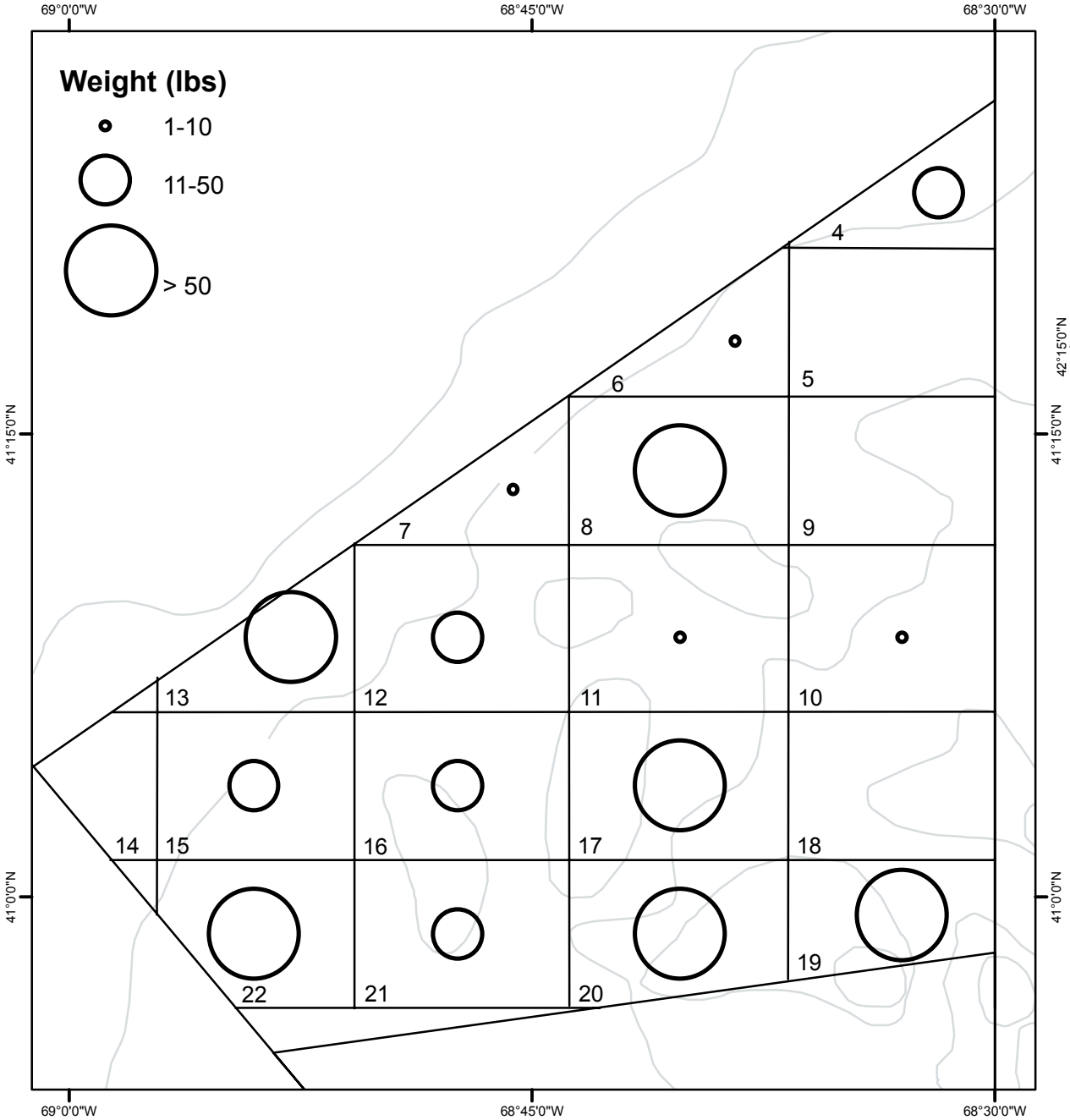
Figure 48

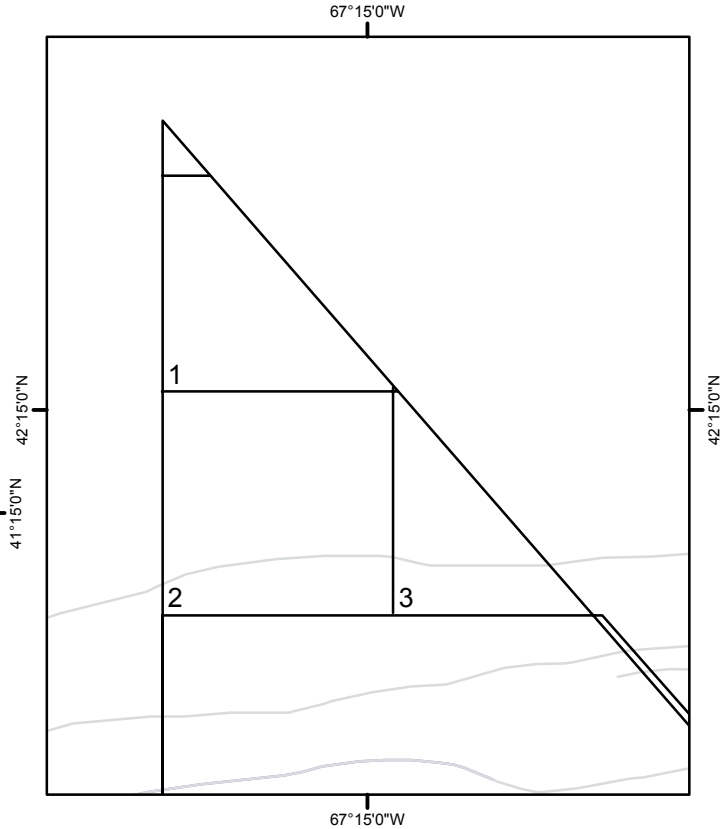


Barndoor Skate Distribution

June 2005

Figure 49

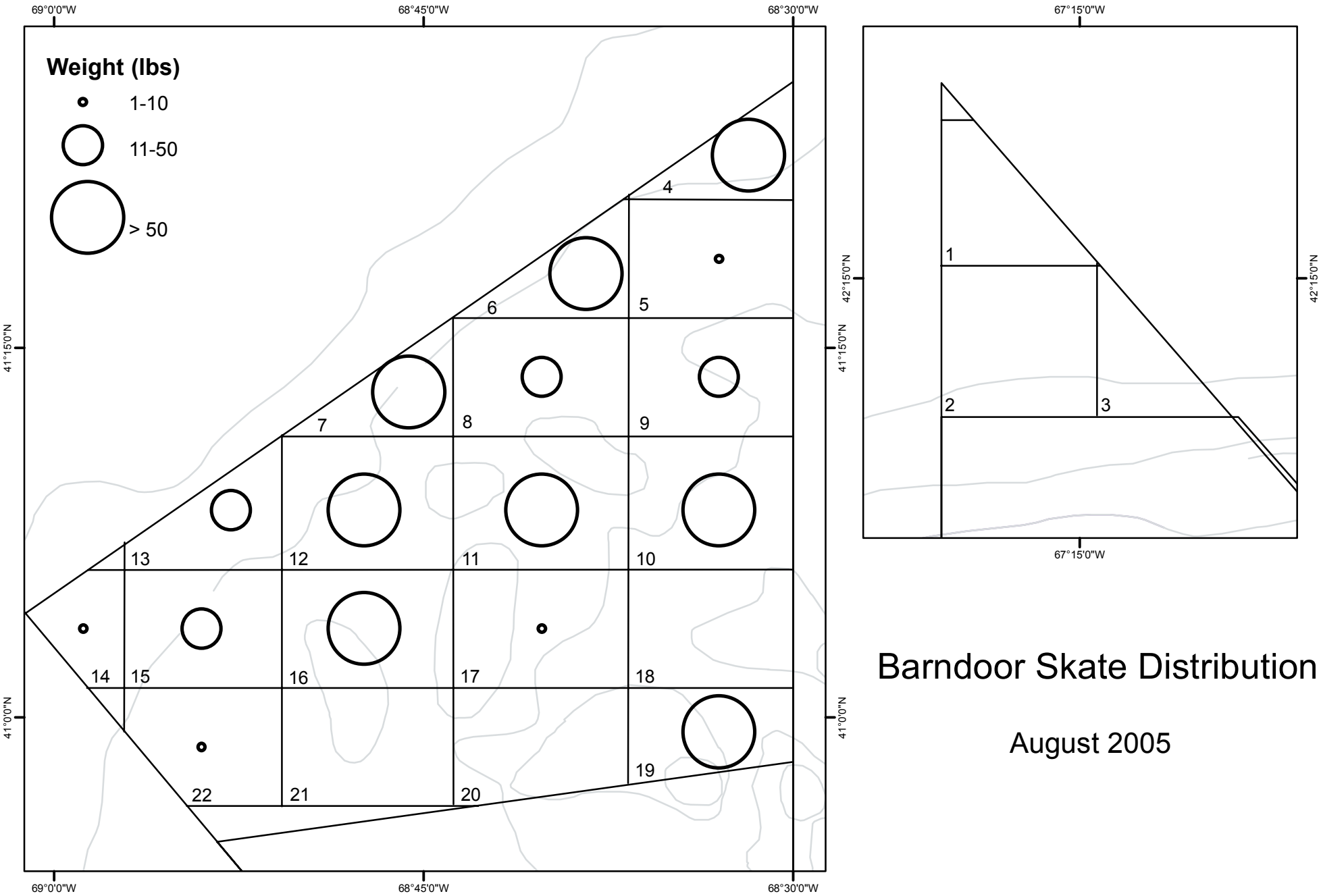




Barndoor Skate Distribution

July 2005

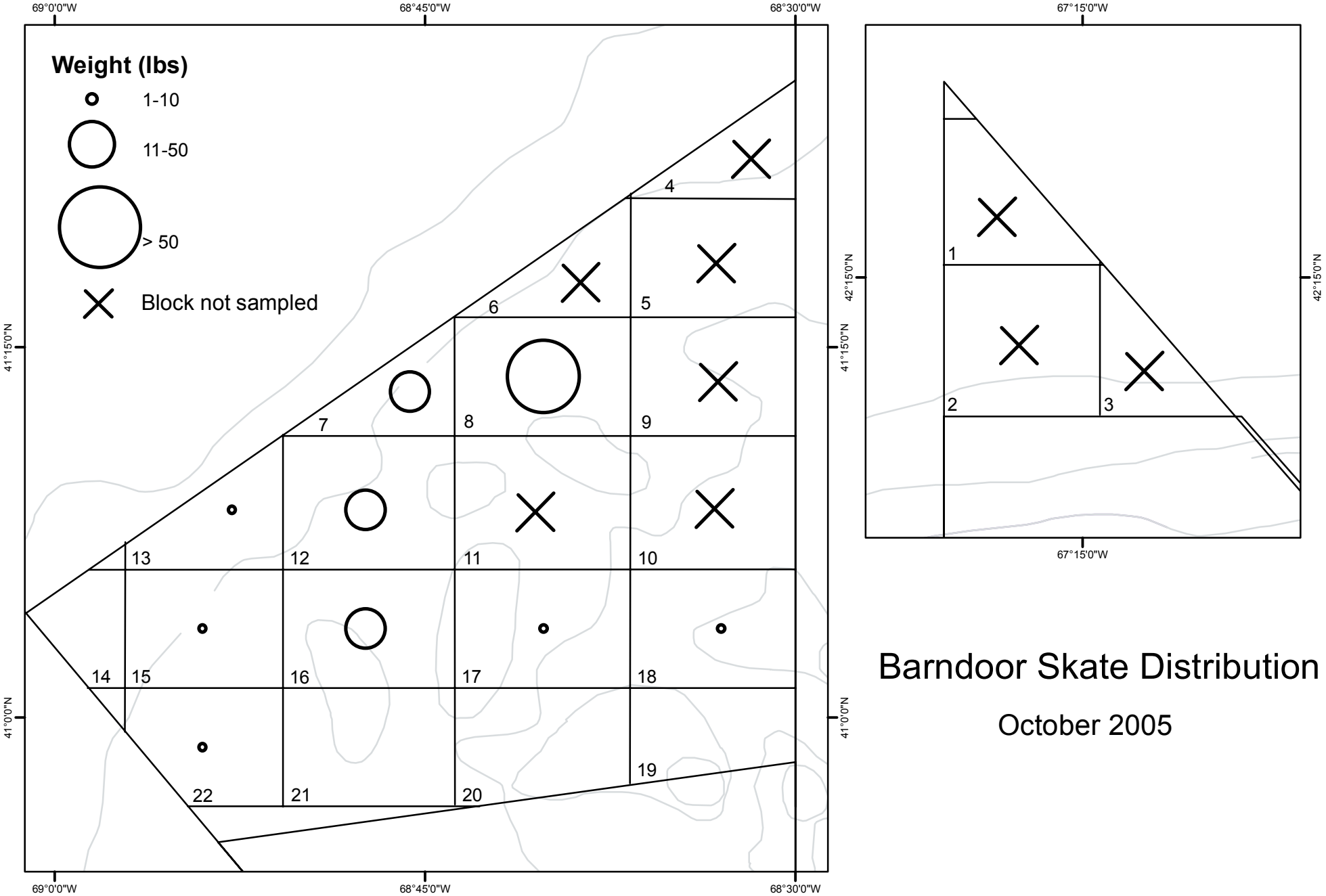
Figure 50



Barndoor Skate Distribution

August 2005

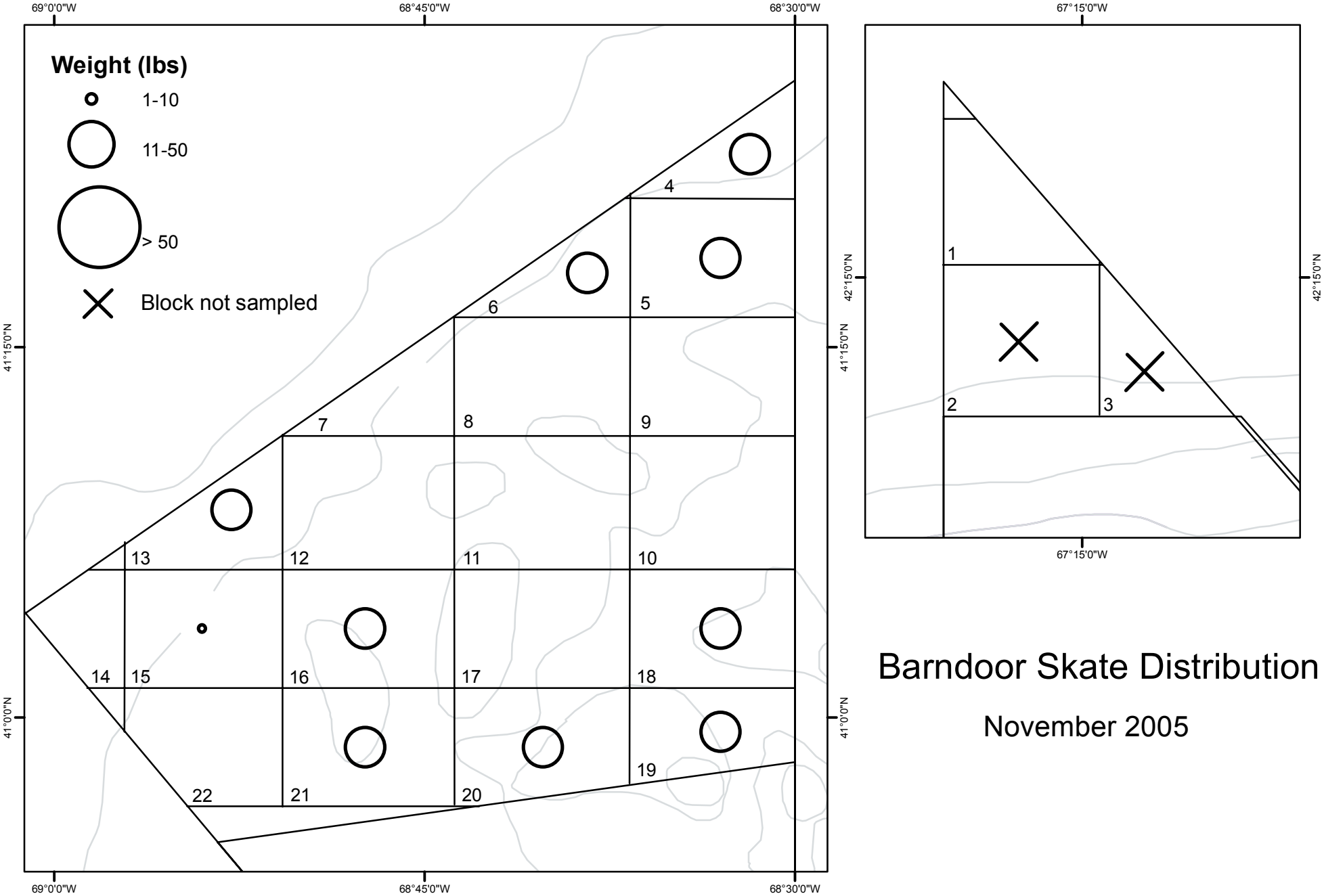
Figure 51



Barndoor Skate Distribution

October 2005

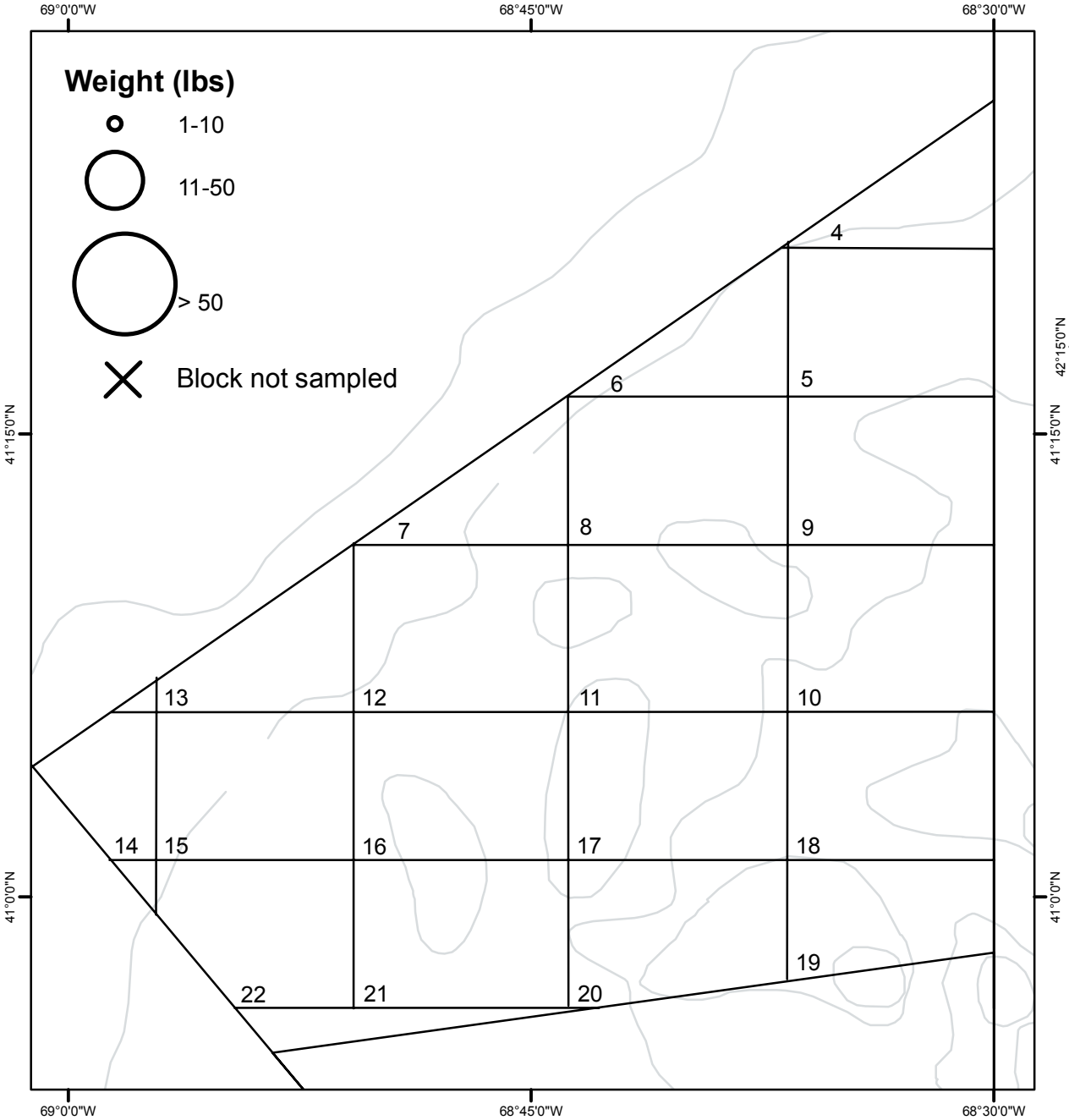
Figure 52

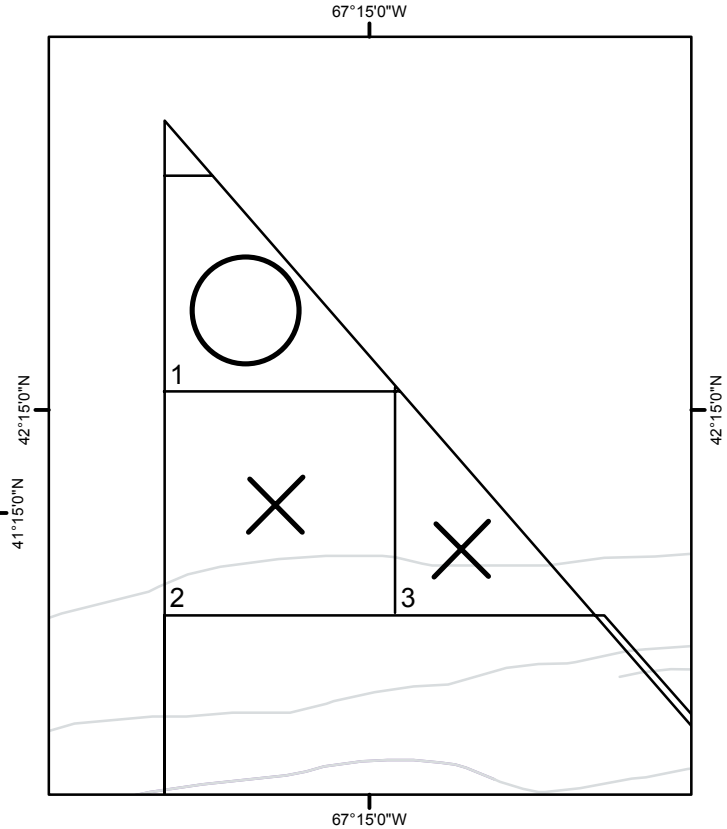


Barndoor Skate Distribution

November 2005

Figure 53

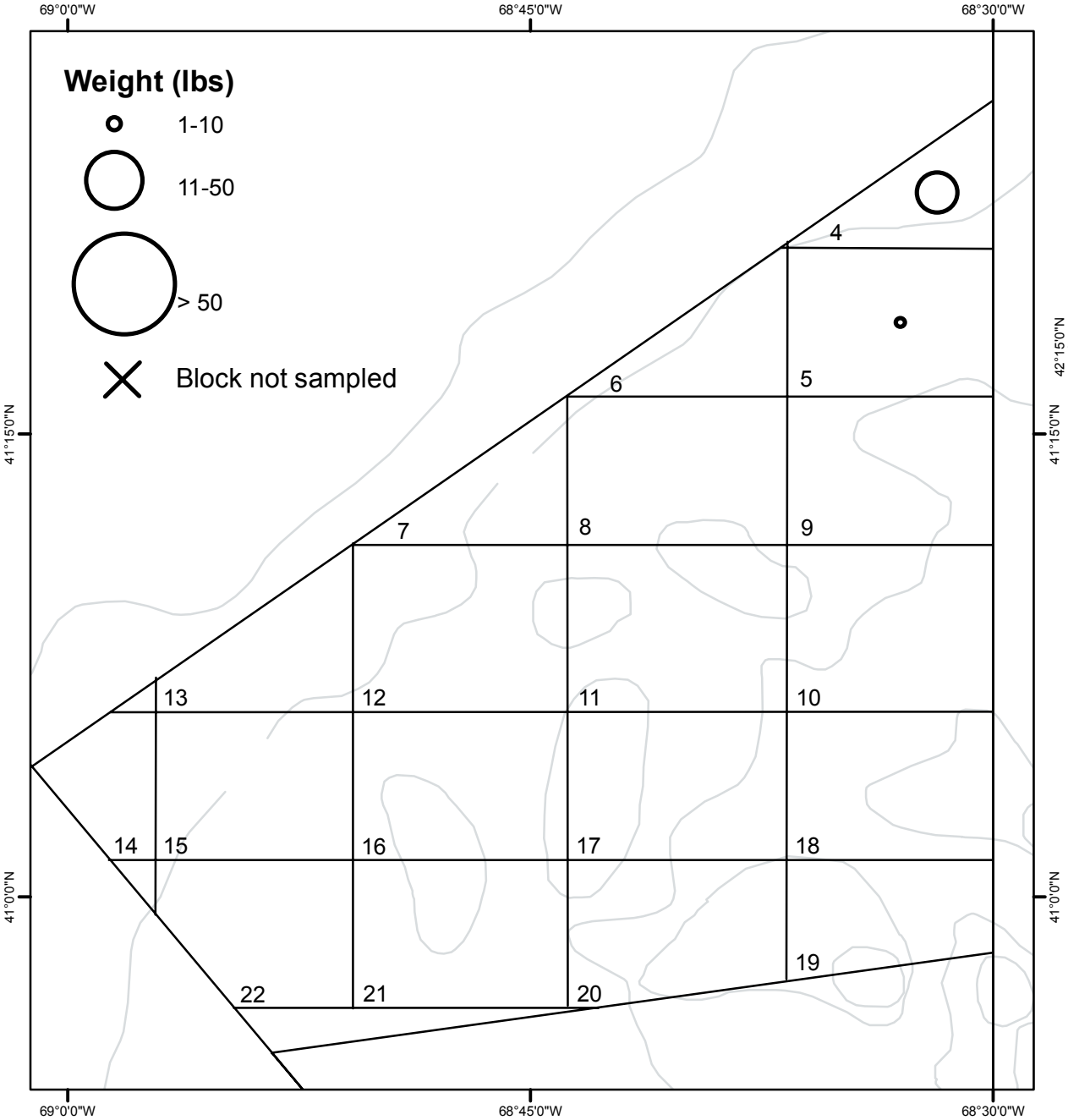


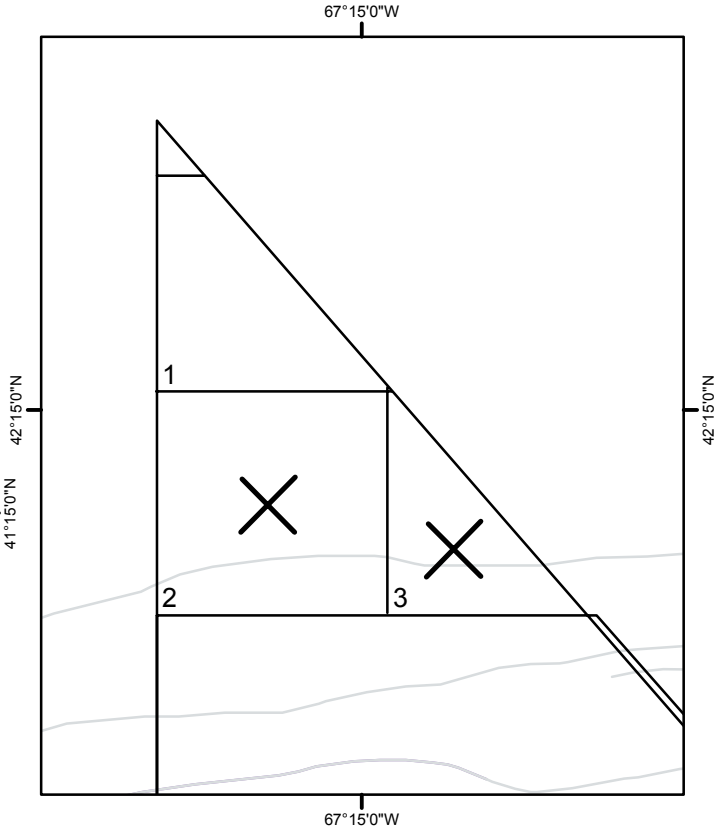


Barndoor Skate Distribution

December 2005

Figure 54

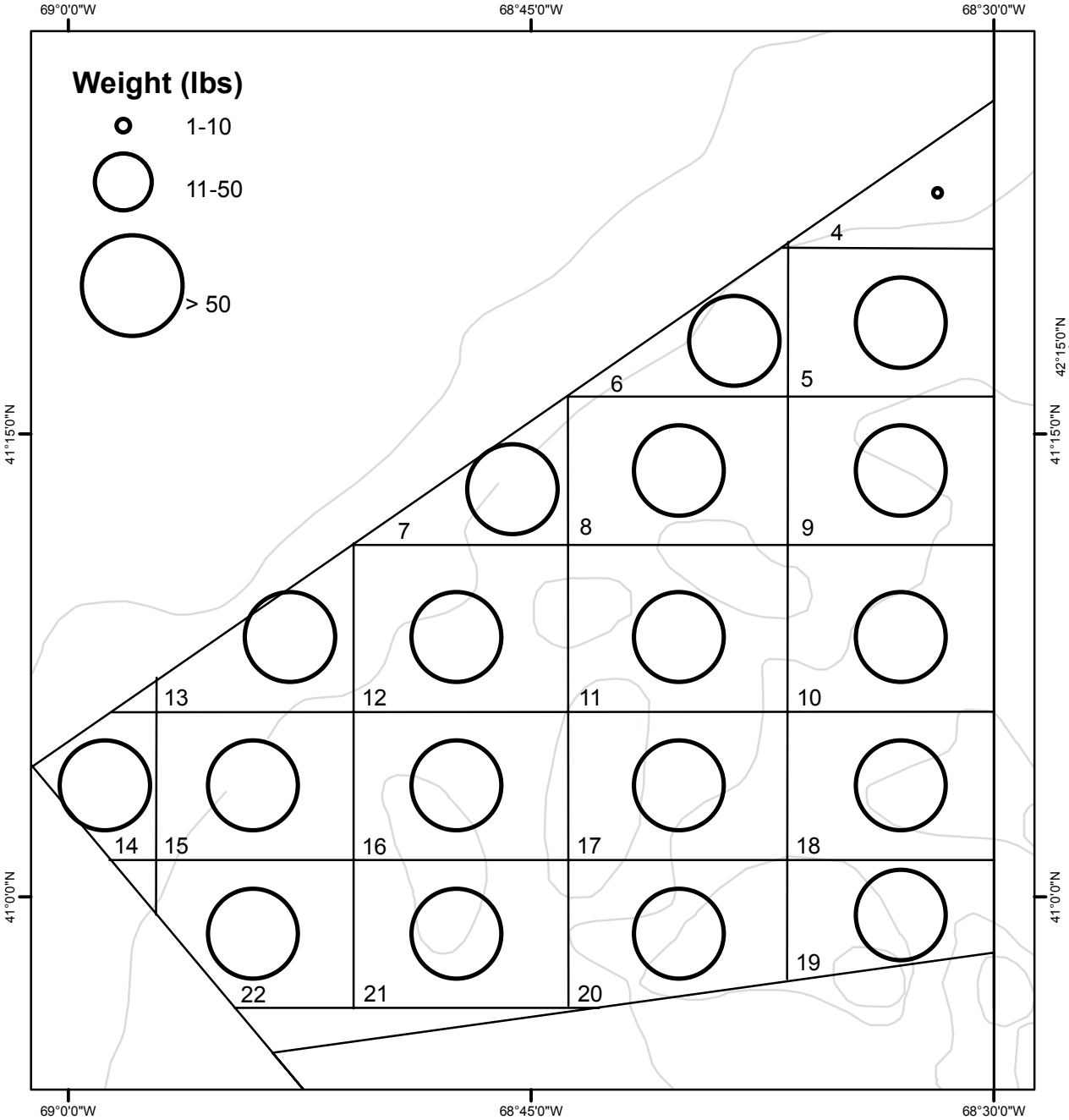


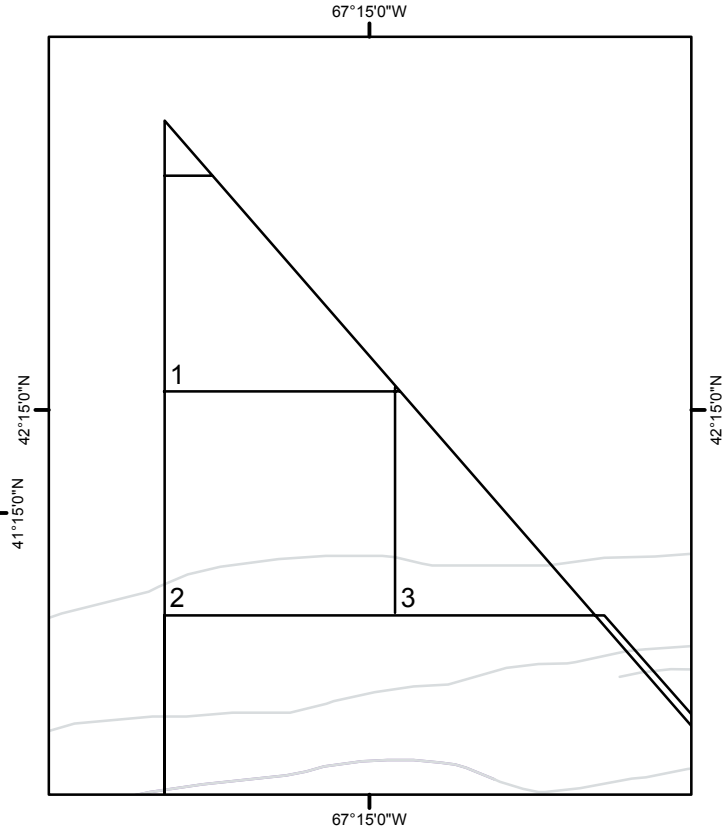


Barndoor Skate Distribution

January 2006

Figure 55



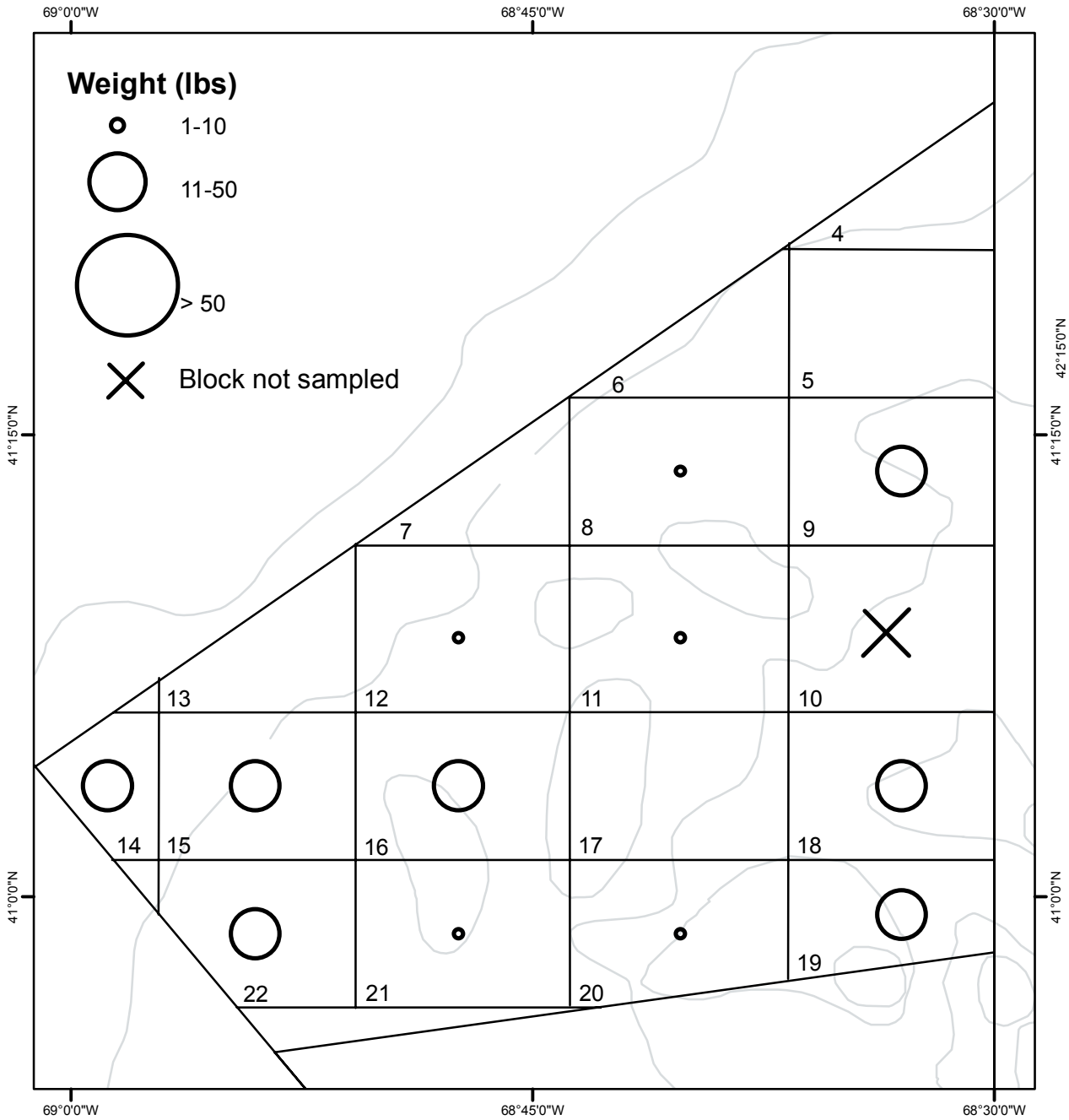


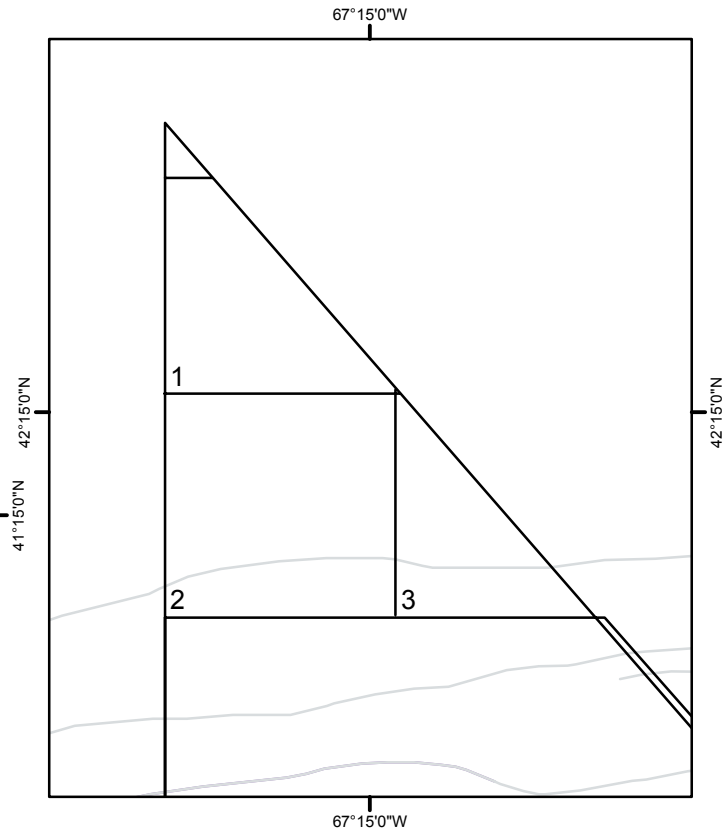
Winter Flounder Distribution

TOTAL

June 2005 - May 2006

Figure 56

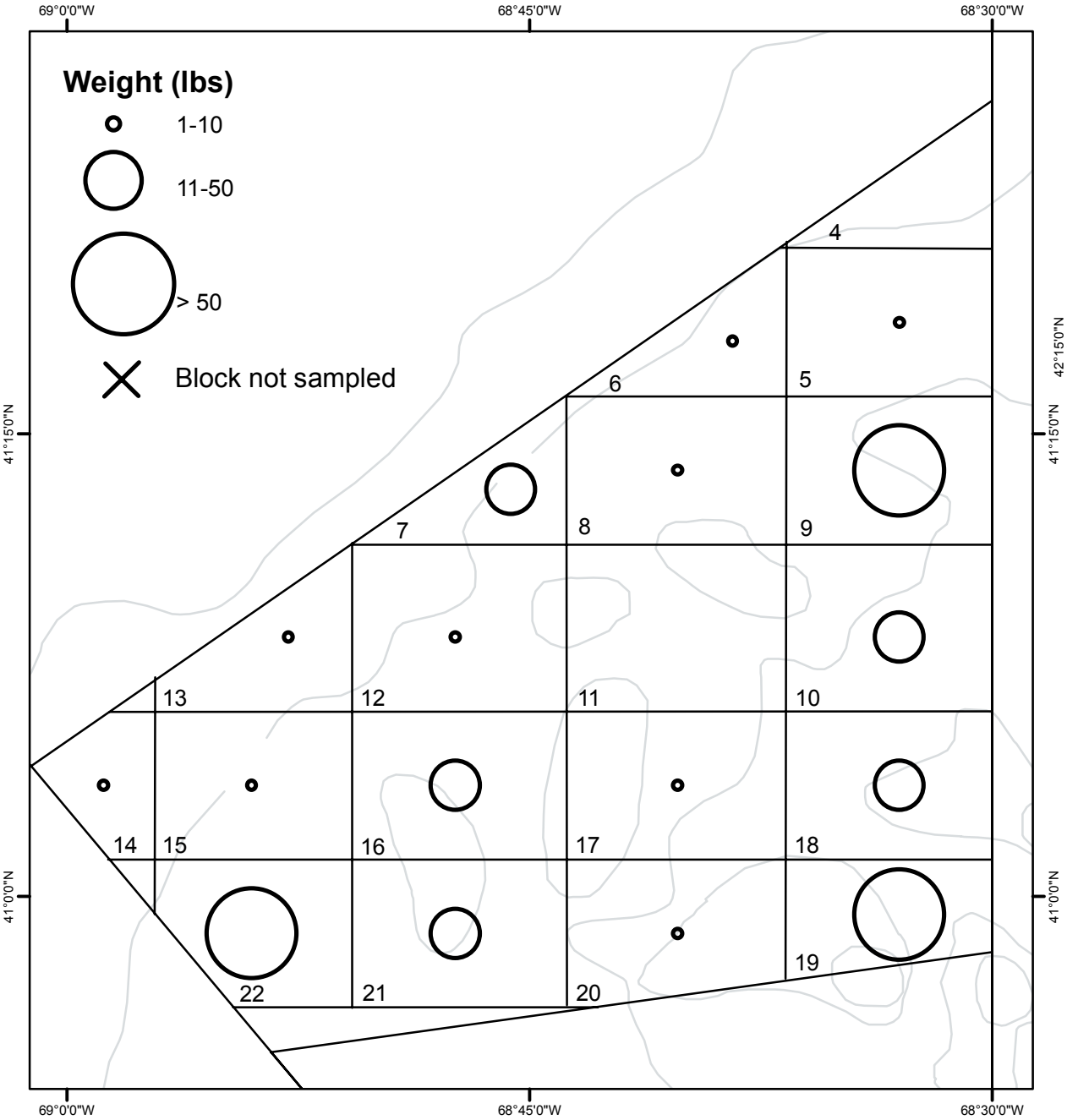


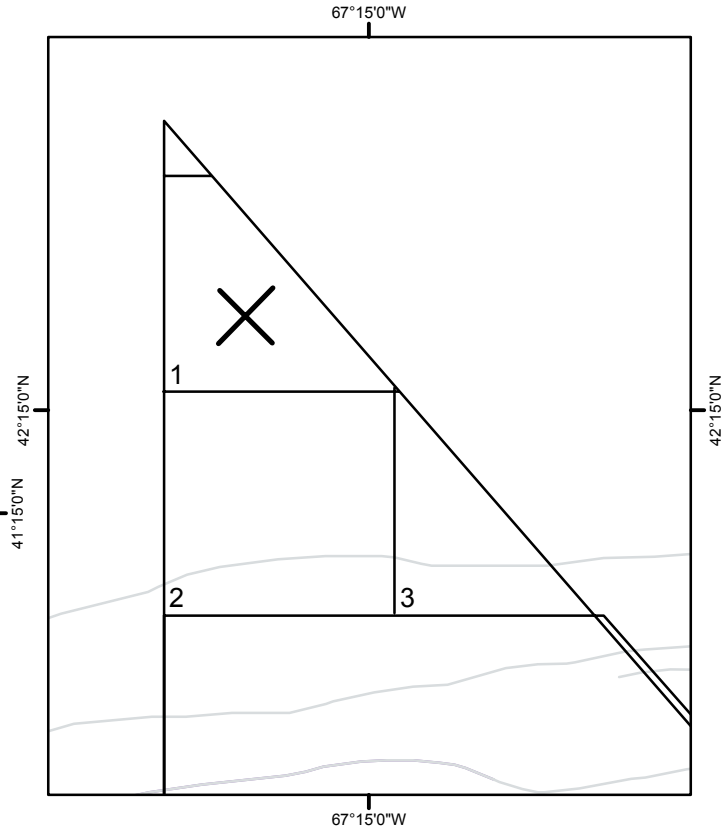


Winter Flounder Distribution

May 2006

Figure 57

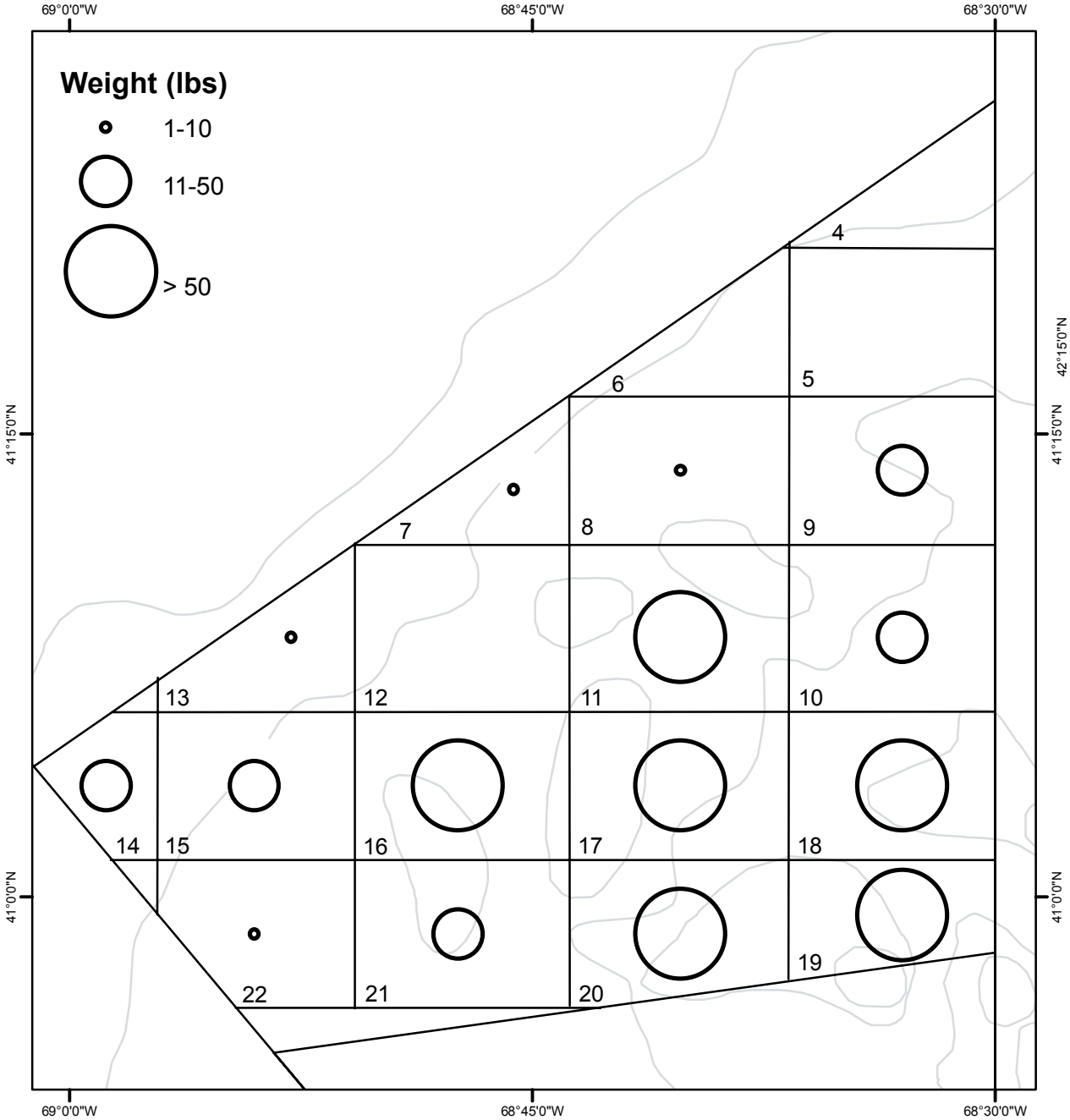


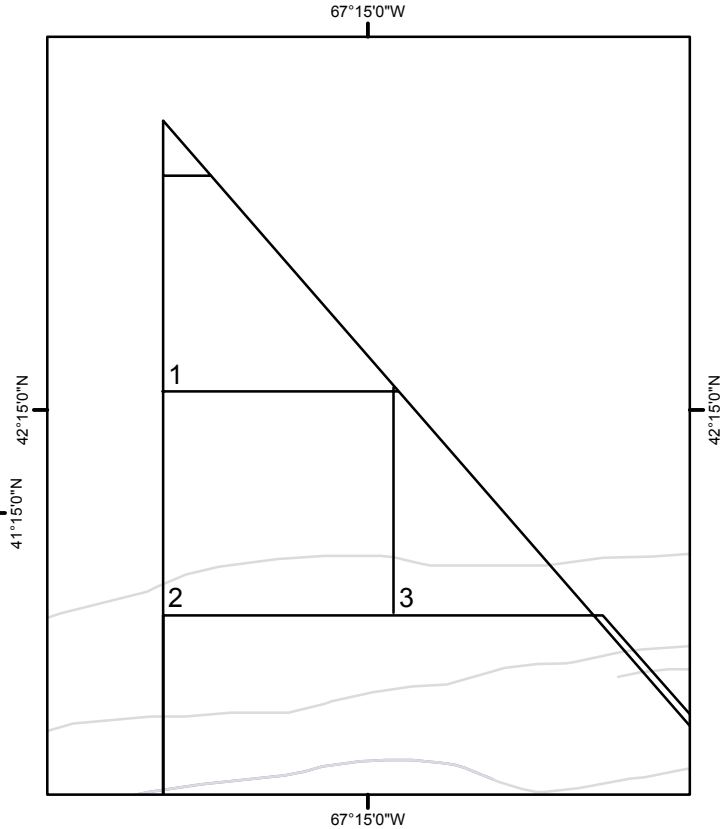


Winter Flounder Distribution

June 2005

Figure 58

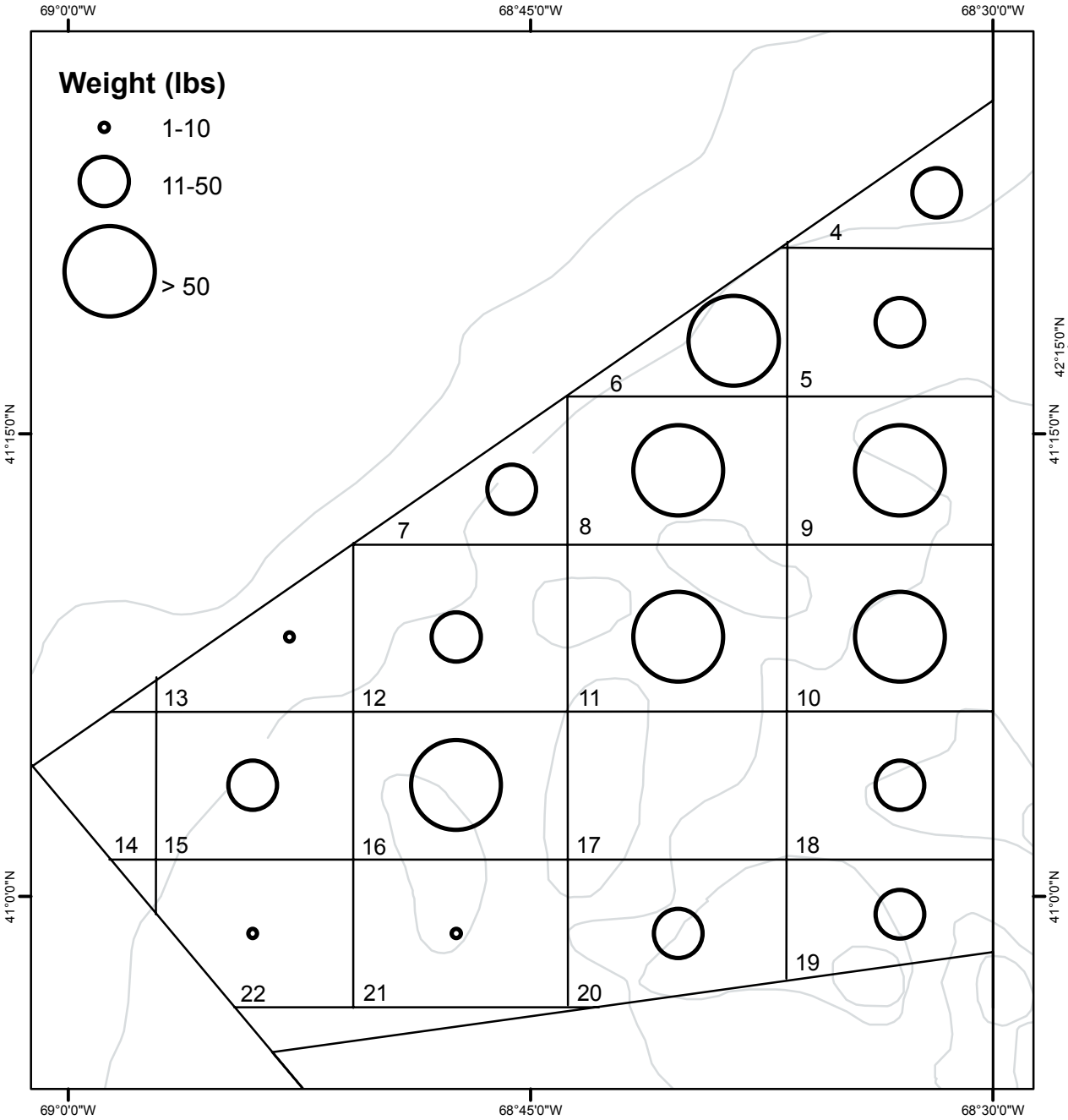


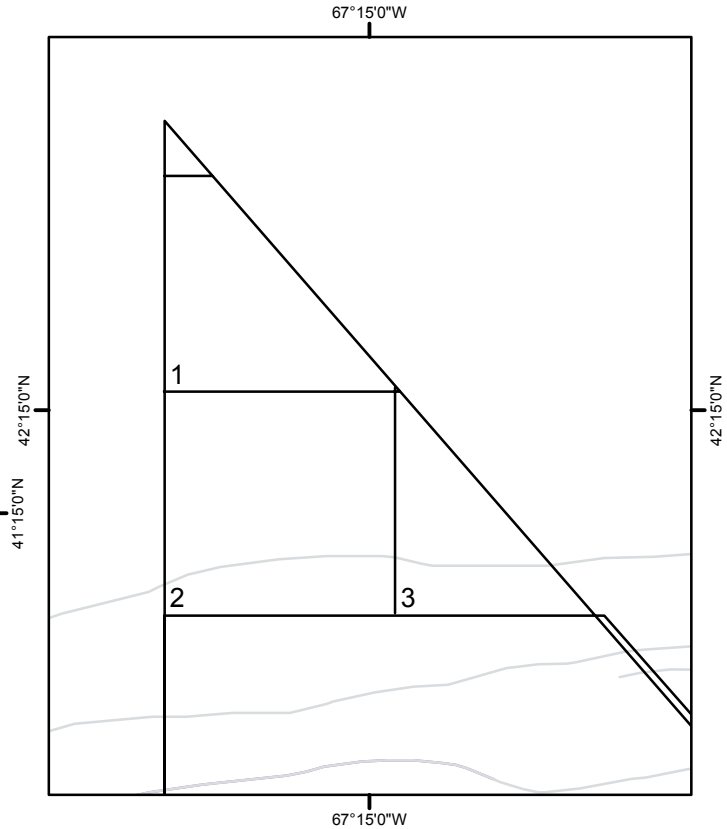


Winter Flounder Distribution

July 2005

Figure 59

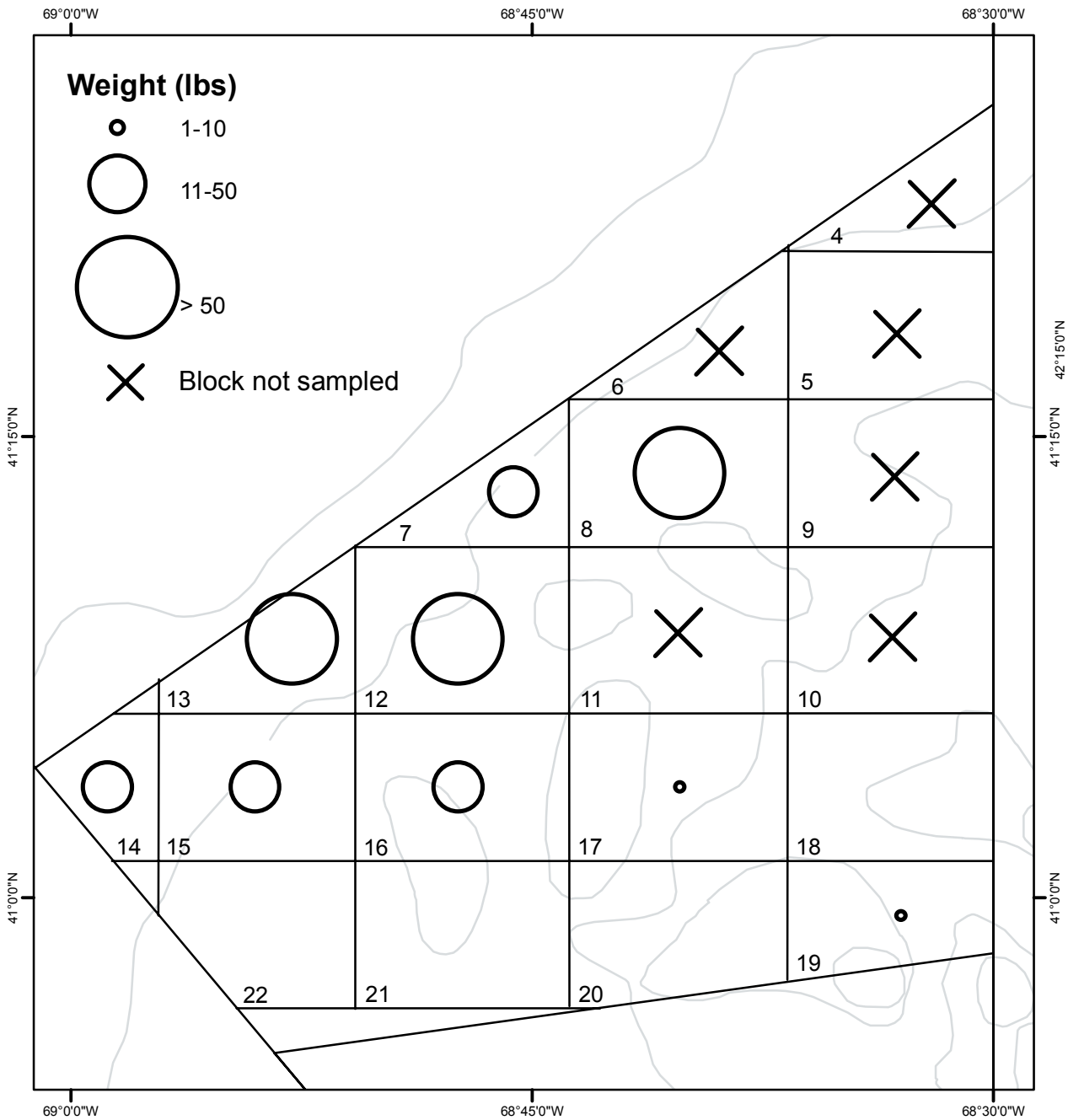


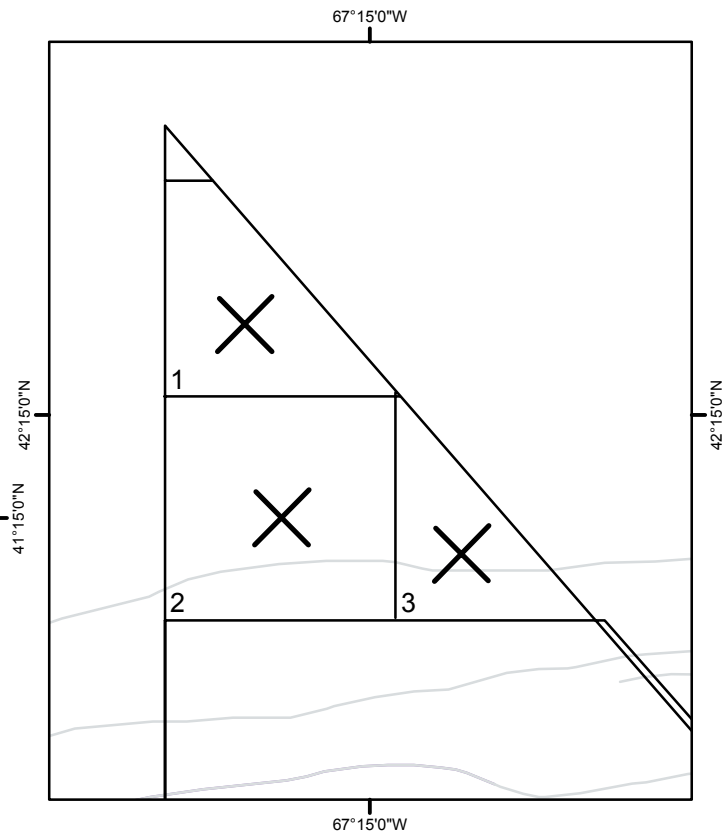


Winter Flounder Distribution

August 2005

Figure 60

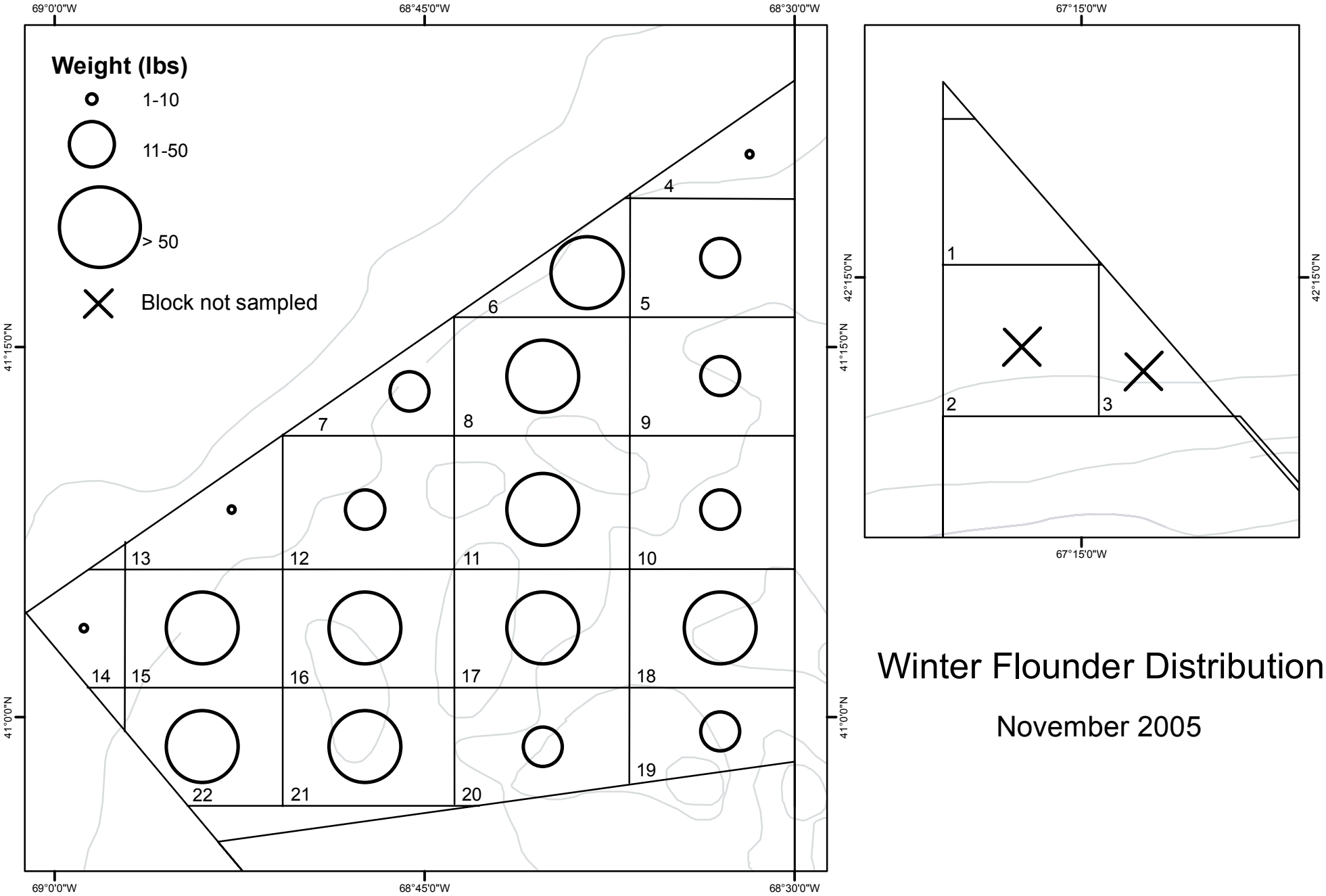




Winter Flounder Distribution

October 2005

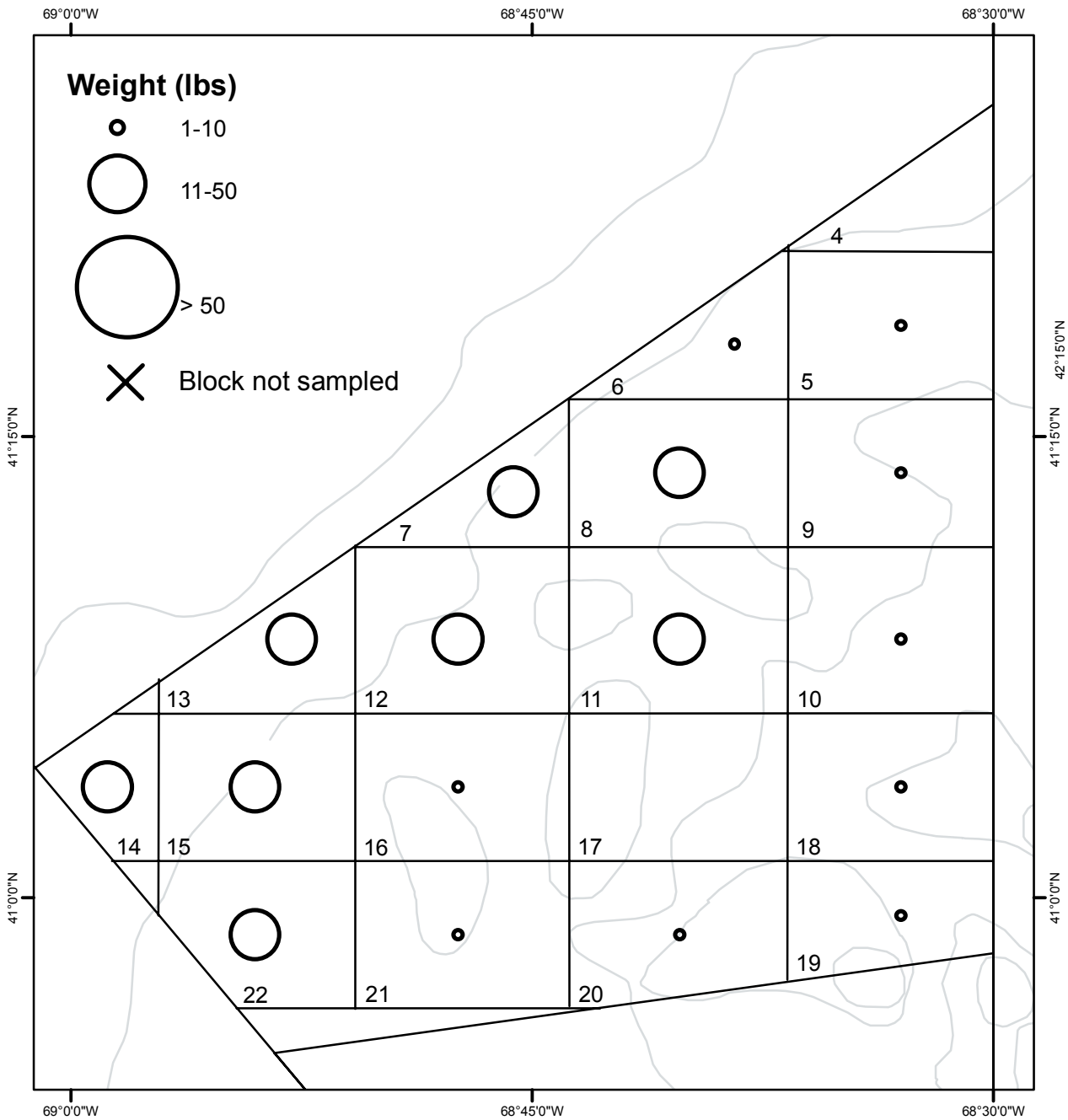
Figure 61

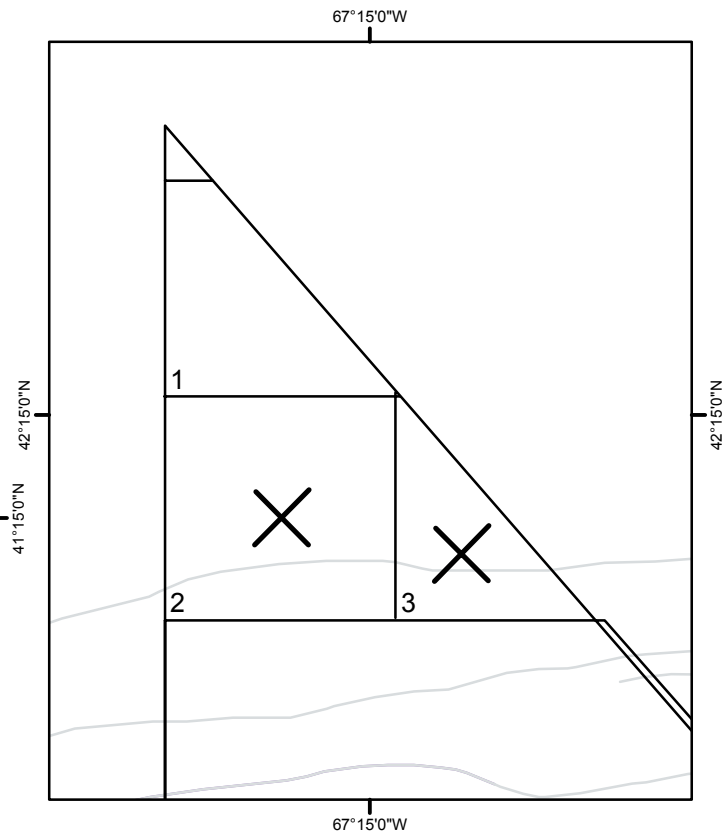


Winter Flounder Distribution

November 2005

Figure 62

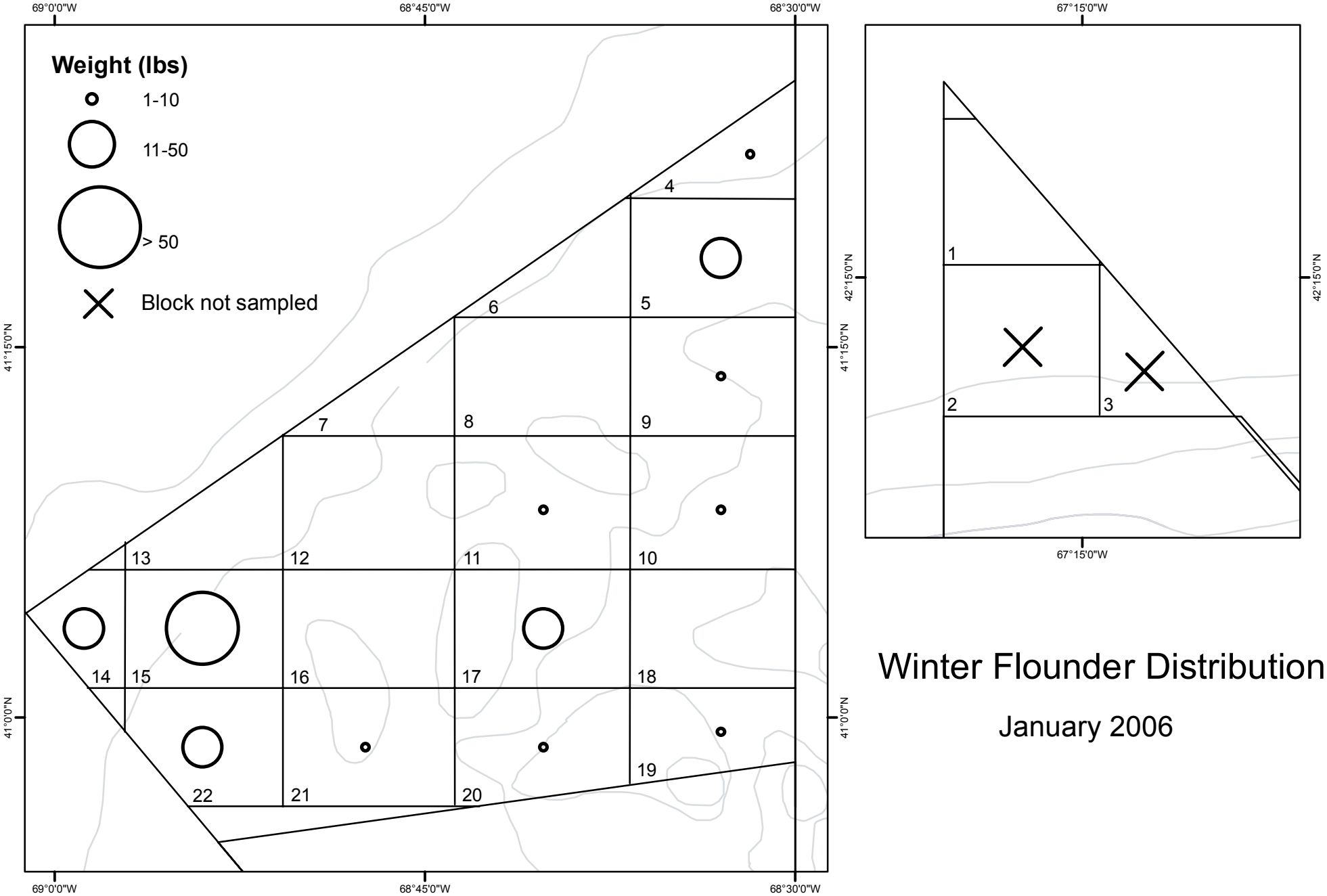




Winter Flounder Distribution

December 2005

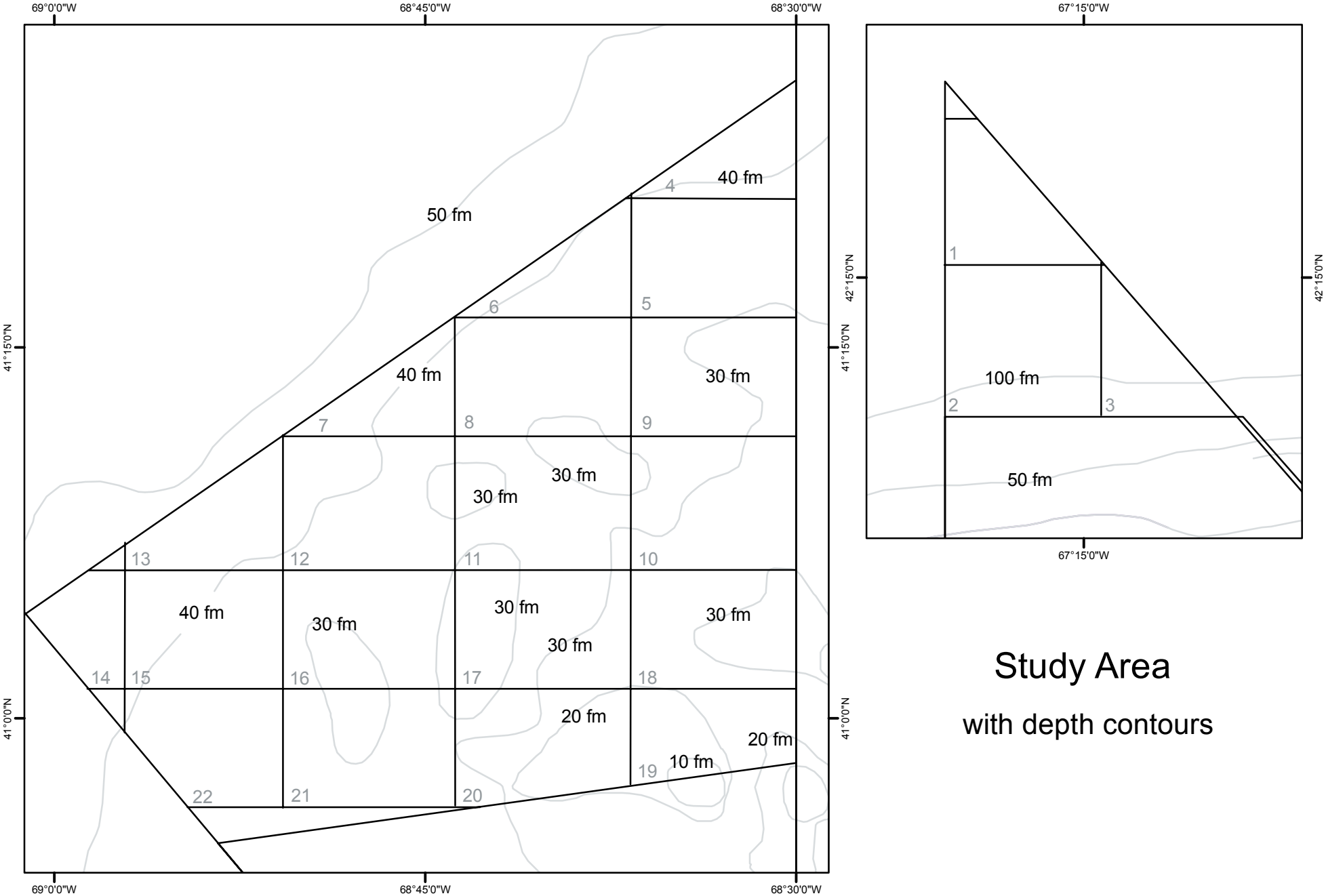
Figure 63



Winter Flounder Distribution

January 2006

Figure 64



Study Area

with depth contours

Figure 65

Appendix I: Gear Data Log

01/01/01
OBOTG

STANDARD GEAR CHARACTERISTICS

NMFS FISHERIES OBSERVER PROGRAM
TRAWL GEAR CHARACTERISTICS LOG

OBS/TRIP ID	—
DATE LANDED mm/yy	—

GEAR NUMBER(S): 1

GEAR CODE: 050

DOORS USED? +
NO 0 ___ YES 1 X

WEIGHT OF ONE DOOR: 900 kg

CONSTRUCTION MATERIAL

TYPE		NET BODY	CODEND
Unknown	00		
Nylon	01		
Poly	02	X	X
Kevlar®	03		
Spectra®	04		
Tenex®	05		
Nomex®	06		
Combination	98		
Other	99		

LENGTH MEASUREMENTS

Headrope	118 ft
Footrope/Sweep	147 ft
Ground Cable	240 ft

FISHING CIRCLE

# MESHES	416
MESH SIZE	6.0 in

CODEND

HUNG
Unknown 0 ___
Diamond 1 X
Square 2 ___
Square, Wrapped 3 ___
Combination 8 ___

TWINE TYPE
Single 1 ___
Double 2 X

TOP MESH SIZE mm	BOTTOM
161	160
165	164
161	167
167	159
164	163
163	166

LINER USED?
NO 0 X
YES 1 ___

MESH SIZE ___ mm

USED?

STRENGTHENER
NO 0 X YES 1 ___

CHAFFING GEAR
NO 0 ___ YES 1 X
→ BOTTOM CODEND ONLY

GEAR MOUNTED ELECTRONICS

USED ?
NO 0 X
YES 1 ___

NUMBER OF TRANSDUCERS ___

TYPE
Unknown 0 ___
Wired 1 ___
Wireless 2 ___

BRAND
Unknown 0 ___
Furuno® 1 ___
Simrad® 2 ___
Other 9 ___

LOCATION
Unknown 0 ___
Headrope 1 ___
Wings 2 ___
Footrope 3 ___
Headrope & Footrope 4 ___
Other Combo 8 ___
Other 9 ___

OF RECEIVERS ___

EXCLUDER/SEPARATOR DEVICE

USED? NO 0 ___ YES 1 X

TYPE
Unknown 0 ___
Nordmore Grate 1 ___
T.E.D. 2 ___
Separator Panel * 3 X
Guiding Device 4 ___
Raised Footrope 5 ___
Combination 8 ___
Other 9 ___

FISH OUTLET
USED? NO 0 X YES 1 ___

LENGTH ___ in

WIDTH ___ in

SHAPE
Unknown 00 ___
Rectangular 01 ___
Square 06 ___
Diamond 07 ___
Triangular 08 ___
Other 99 ___

LOCATION
Unknown 0 ___
Top 1 ___
Bottom 2 ___
Side 3 ___
Combination 8 ___
Other 9 ___

COMMENTS

+ NETS 4m
TRAWL DOORS

HADDOCK
SEPARATOR
TRAWL

* SEPARATOR PANEL:
LEADING EDGE ATTACHED TO FOOTROPE
WITH 2 60" LENGTHS OF CHAIN
ON EITHER SIDE + 1 60" LENGTH
OF CHAIN IN CENTER

GROUND GEAR

TYPE		40FM GROUND CABLE	20FM BRIDLE/ LEG	FOOTROPE
Unknown	0			
Chain	1			
Cable / Wire	2	X	X	
Wrapped Cable	3			
Rock Hopper	4			X
Roller	5			
Rubber Cookie	6			
Bobbin	7			
None	8			
Other	9			

FLOATS
Number 120
Diameter 8 & 10 in

Appendix II: Project Operational Protocols

Georges Bank Closed Area I & II Haddock Separator Trawl Project Protocols

5- day total trip maximum

Scientists will phone in to NMFS reporting hotline to report start and end of each trip and to report landings (as EFP requires)

One 20 minute tow (brake lock to brake release) in each grid block

Tows performed between 6am to 8pm (daylight), if possible

Vessel shall complete hauls specified and complete as many hauls as possible per day, order of grid pattern shall be left to the captain's cooperative discretion

Catches from each codend need to be kept and sorted separately

Actual weights will be taken on all species

Length Frequency:

Lengths shall be taken on all commercially important species:

- cod & haddock are highest priority species (at least 100 length target)
- all undersized fish shall be measured and returned to the sea

Subsampling if necessary will be taken from fish that have been sorted by legal/sublegal sizes)

Crew will help sort the catch, scientists shall concentrate on measuring and transcribing data (at end of each haul transcribe data to sheets before beginning next haul)

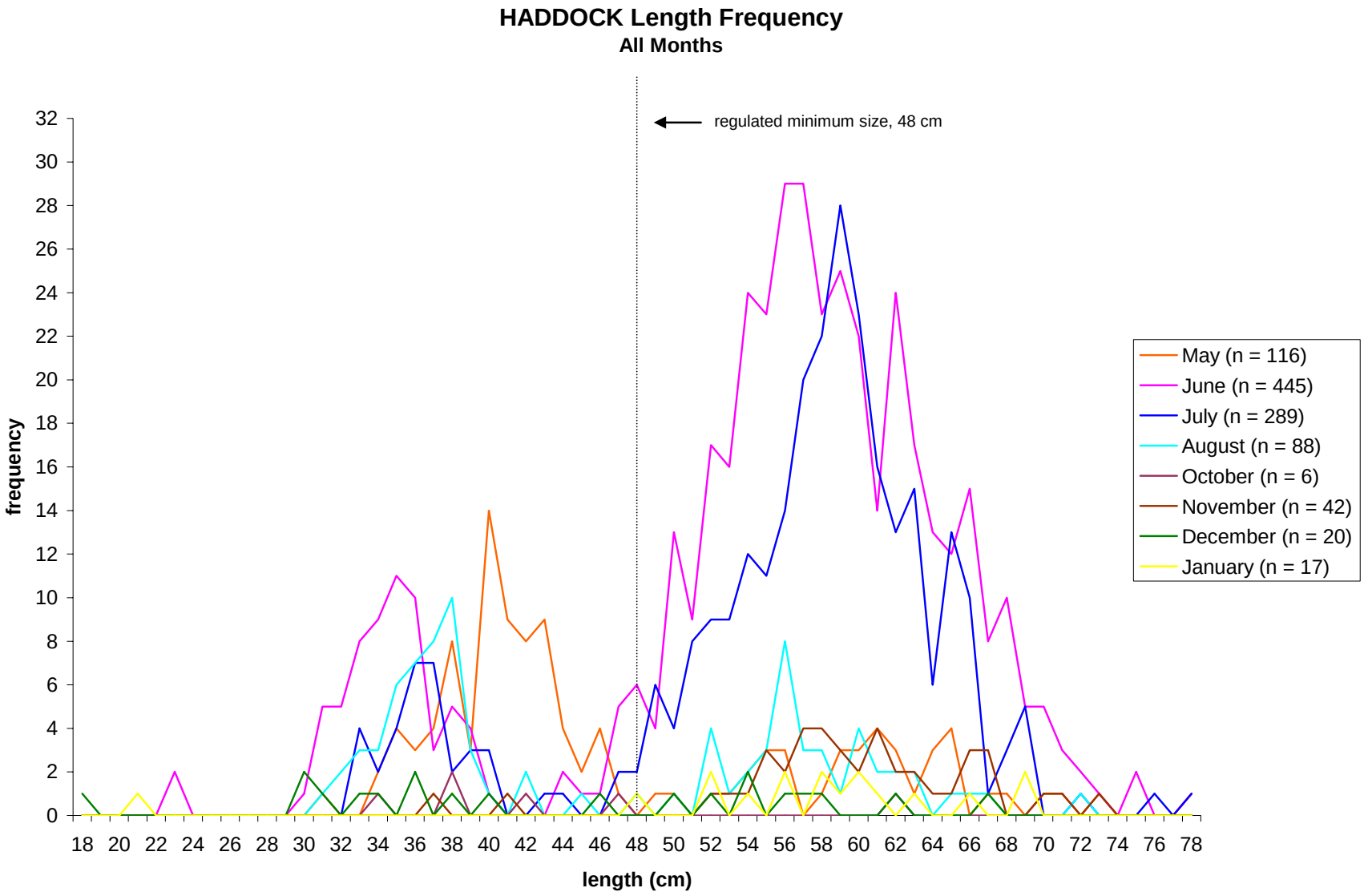
Gear set up, deployment and retrieval methods, and tow speed should be kept the same within a given trip and for the project as a whole to the extent possible

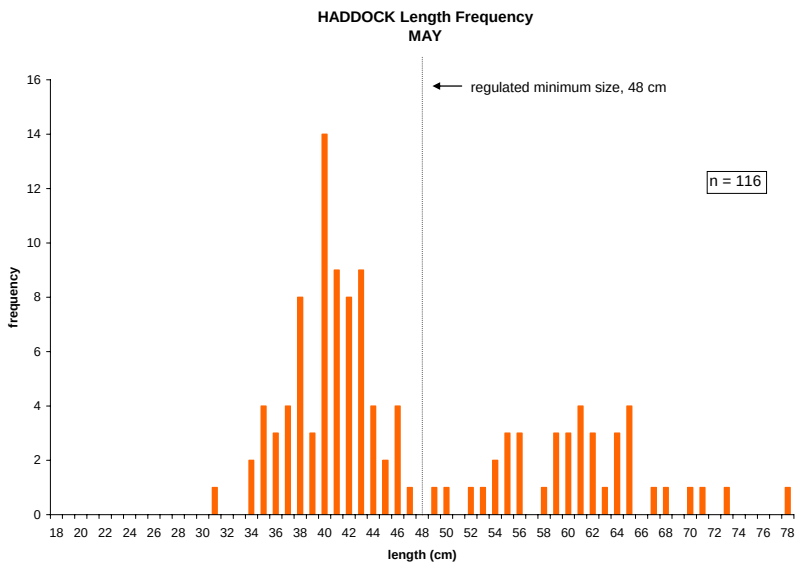
APPENDIX III

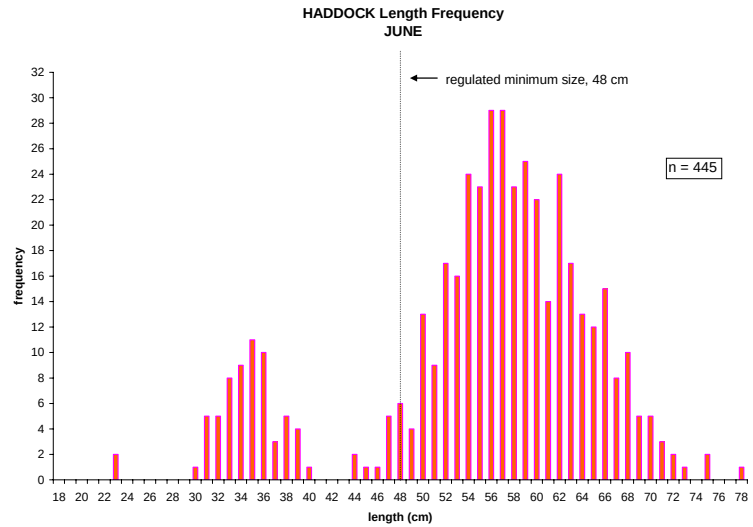
Length Frequencies for Selected Species

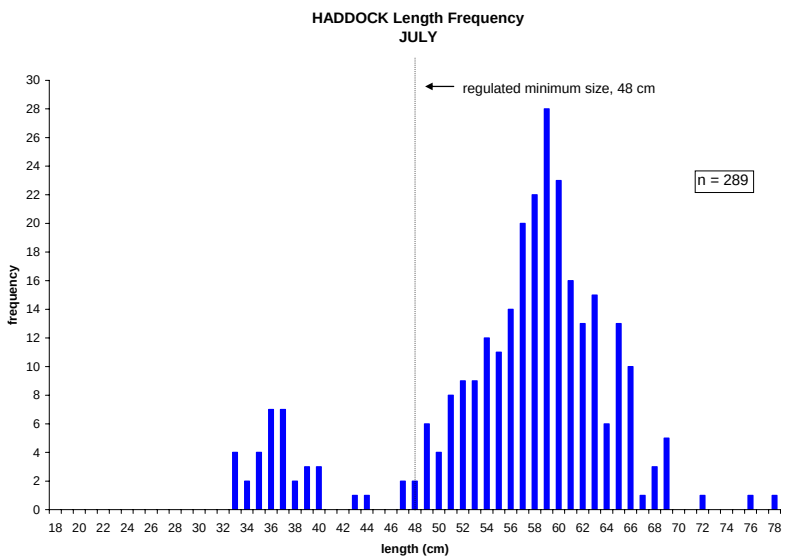
Haddock Length Frequencies

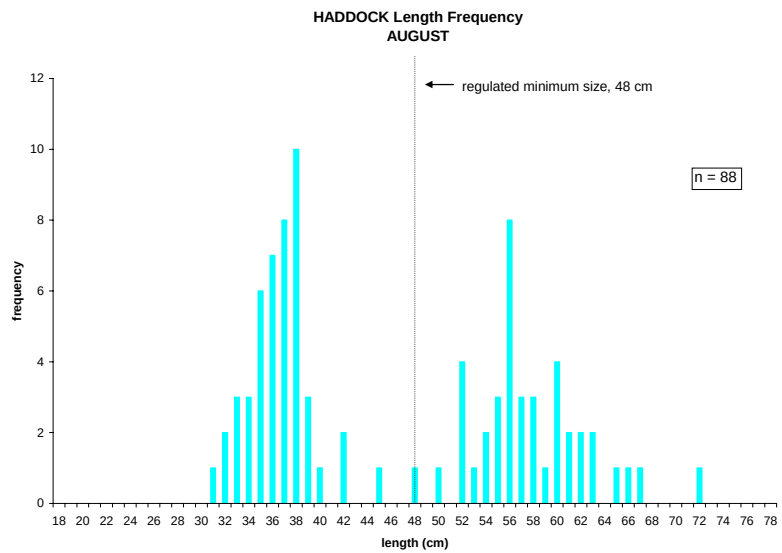
- All months combined
- By individual month

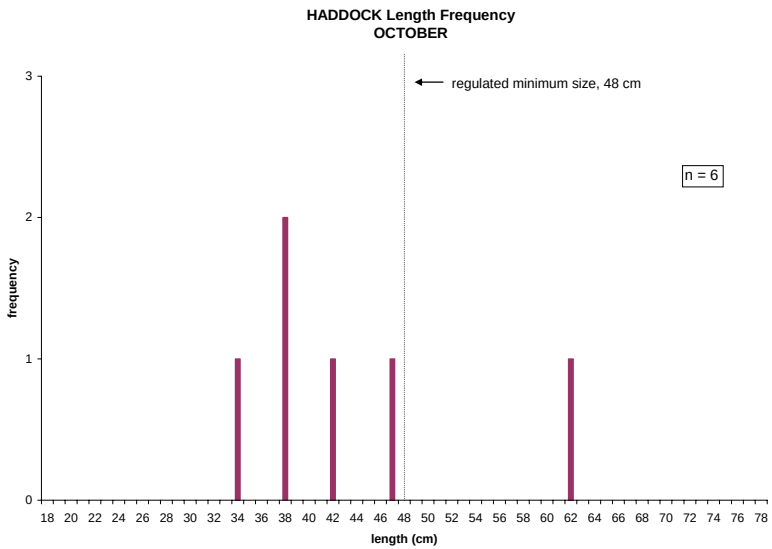

HADDOCK Length Frequency
All Months
regulated minimum size, 48 cm
frequency
length (cm)
May (n = 116)
June (n = 445)
July (n = 289)
August (n = 88)
October (n = 6)
November (n = 42)
December (n = 20)
January (n = 17)

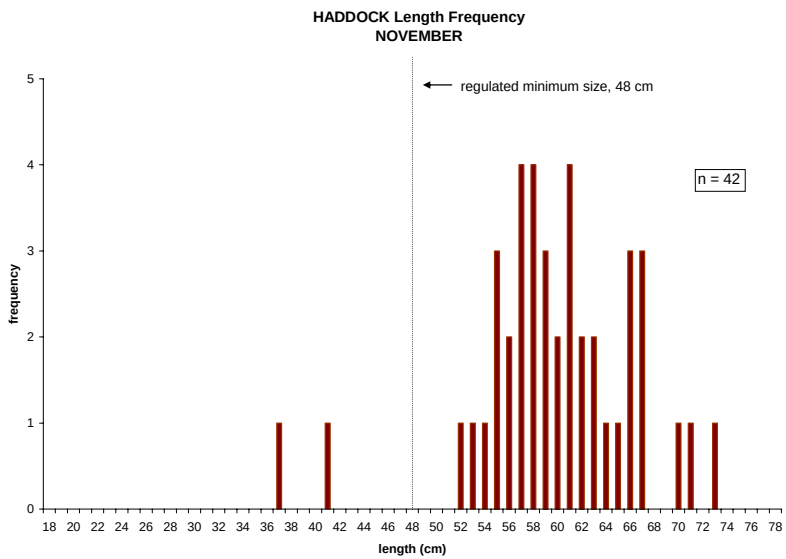

HADDOCK Length Frequency
MAY
regulated minimum size, 48 cm
n = 116
frequency
length (cm)

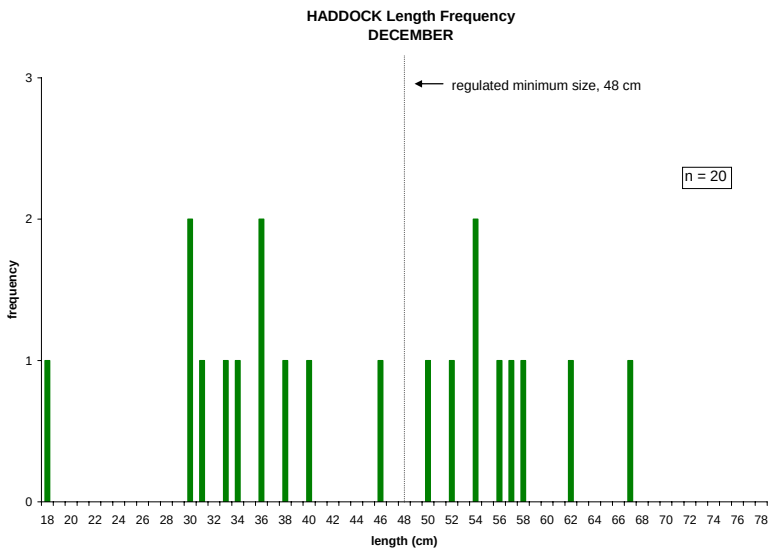

HADDOCK Length Frequency
JUNE
regulated minimum size, 48 cm
n = 445
frequency
length (cm)

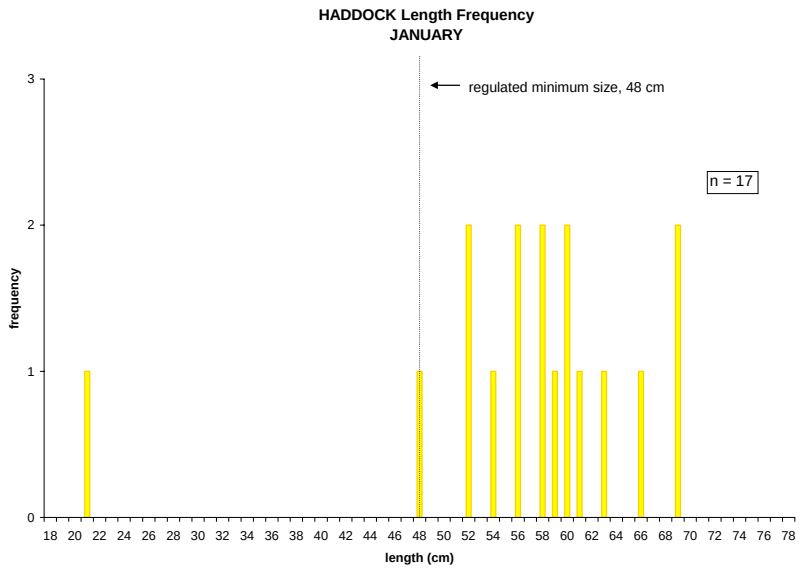

HADDOCK Length Frequency
JULY
regulated minimum size, 48 cm
n = 289
frequency
length (cm)


HADDOCK Length Frequency
AUGUST
regulated minimum size, 48 cm
n = 88
frequency
length (cm)


HADDOCK Length Frequency
OCTOBER
regulated minimum size, 48 cm
n = 6
frequency
length (cm)

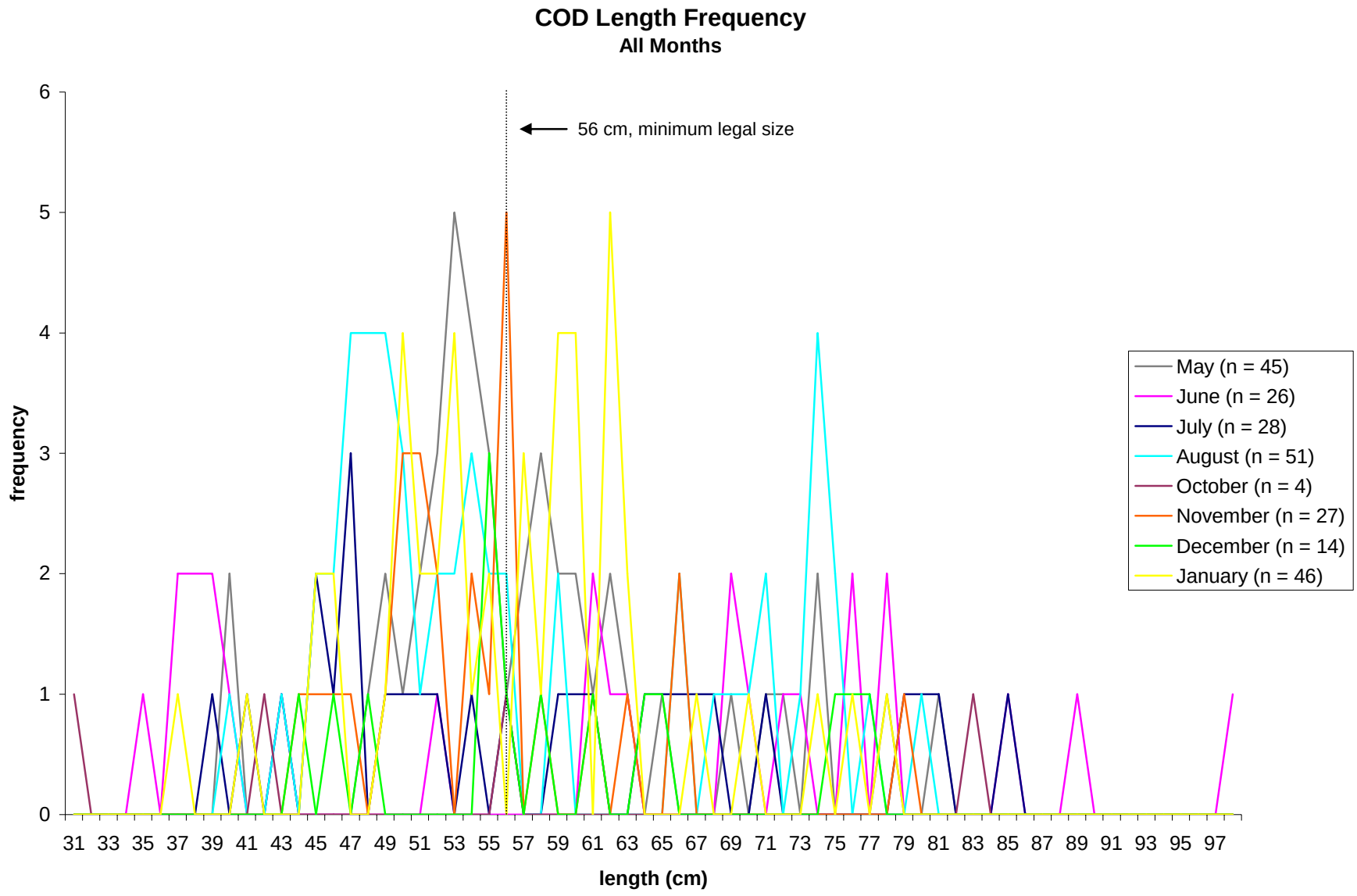

HADDOCK Length Frequency
NOVEMBER
regulated minimum size, 48 cm
n = 42
frequency
length (cm)

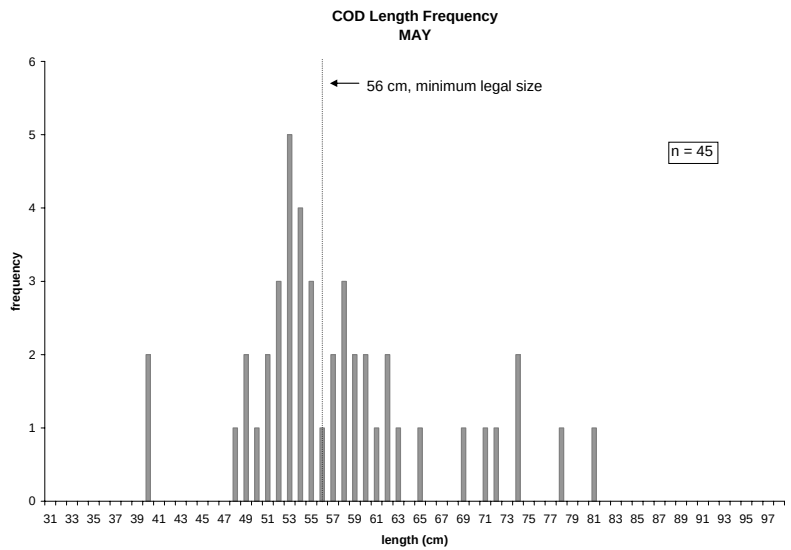

HADDOCK Length Frequency
DECEMBER
regulated minimum size, 48 cm
n = 20
frequency
length (cm)

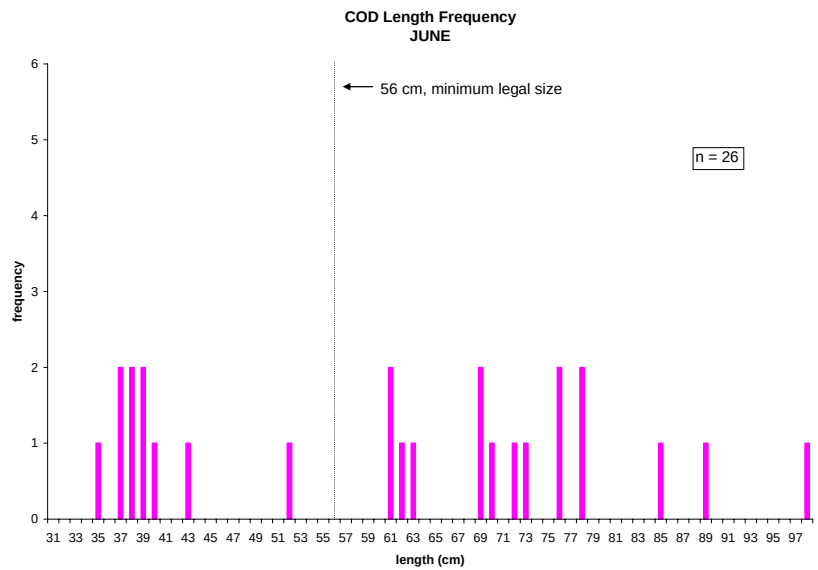

HADDOCK Length Frequency
JANUARY
regulated minimum size, 48 cm
n = 17
frequency
length (cm)

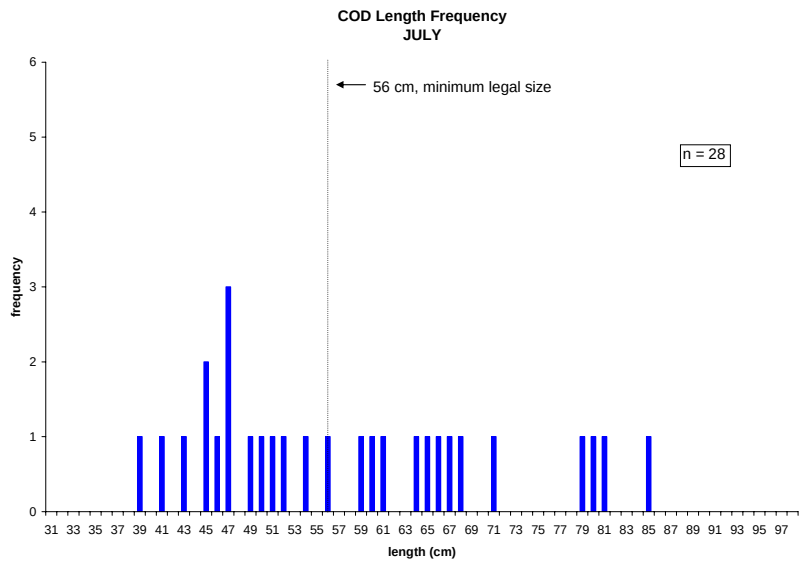
Atlantic Cod Length Frequencies

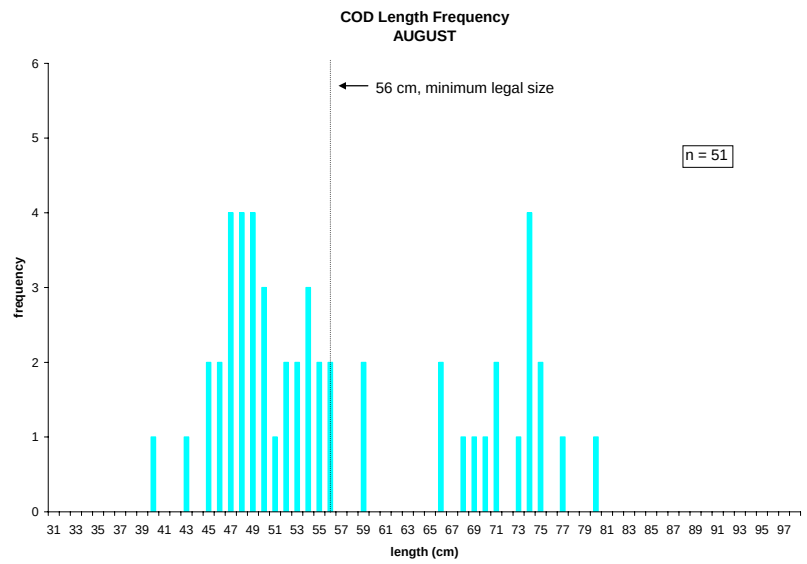
- All months combined
- By individual month
- By codend

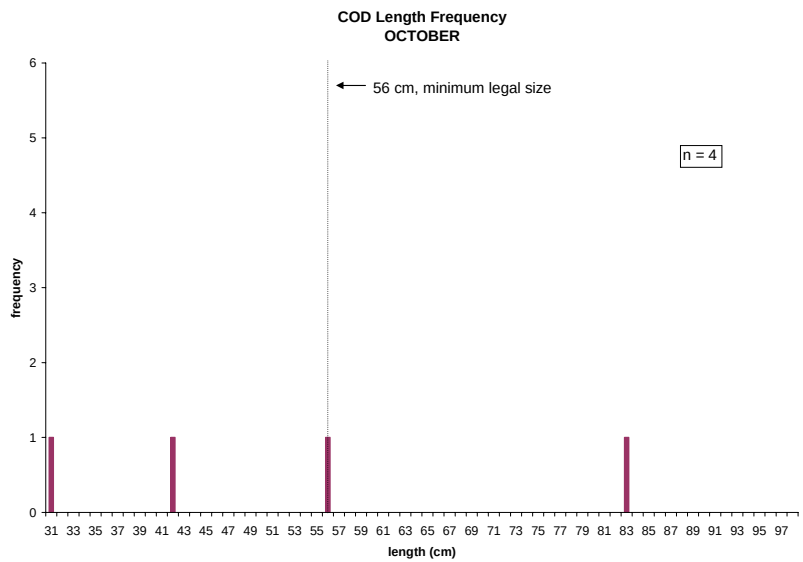

COD Length Frequency
All Months
56 cm, minimum legal size
frequency
length (cm)
0
1
2
3
4
5
6
31 33 35 37 39 41 43 45 47 49 51 53 55 57 59 61 63 65 67 69 71 73 75 77 79 81 83 85 87 89 91 93 95 97
May (n = 45)
June (n = 26)
July (n = 28)
August (n = 51)
October (n = 4)
November (n = 27)
December (n = 14)
January (n = 46)

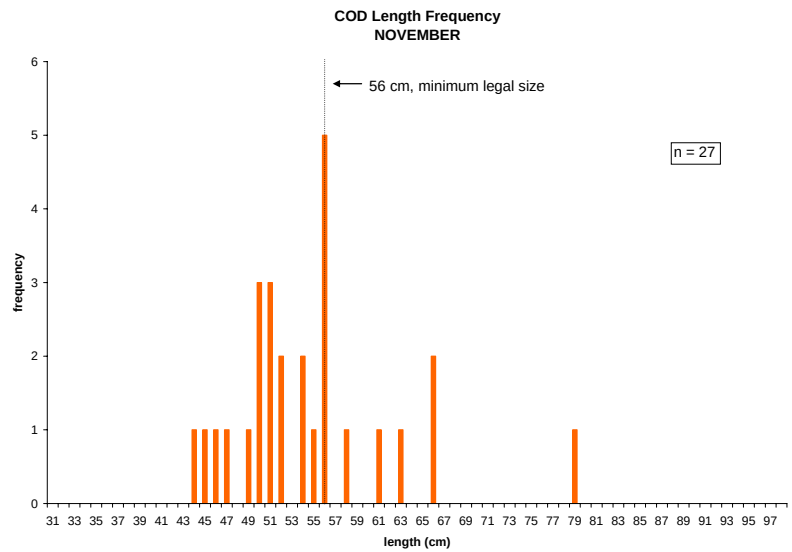

COD Length Frequency
MAY
56 cm, minimum legal size
n = 45
frequency
length (cm)

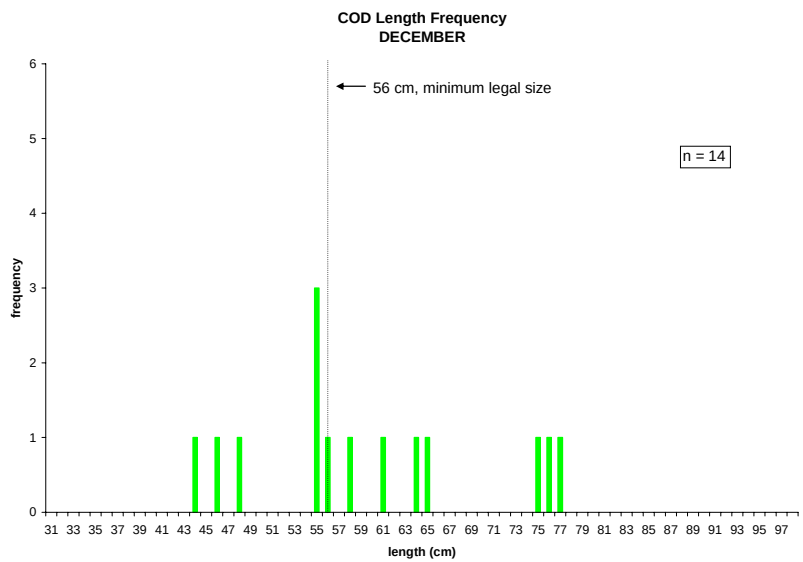

COD Length Frequency
JUNE
56 cm, minimum legal size
n = 26
frequency
length (cm)

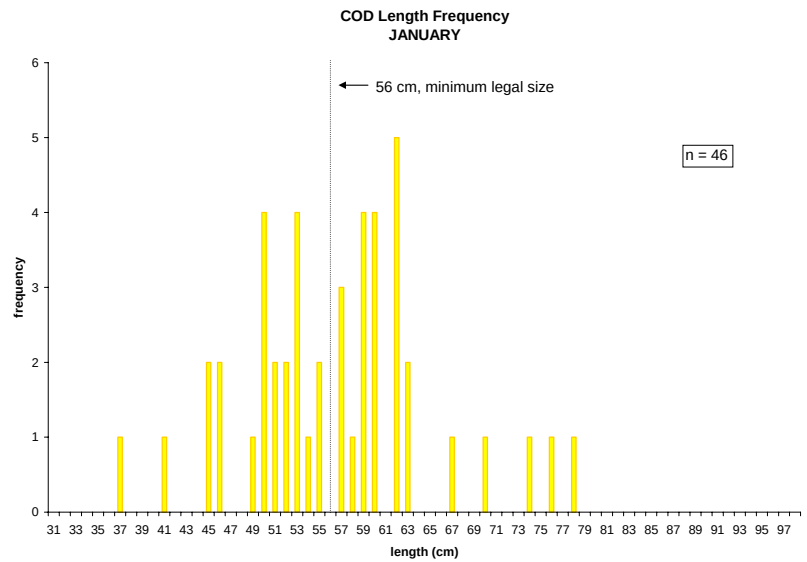

COD Length Frequency
JULY
56 cm, minimum legal size
n = 28
frequency
length (cm)

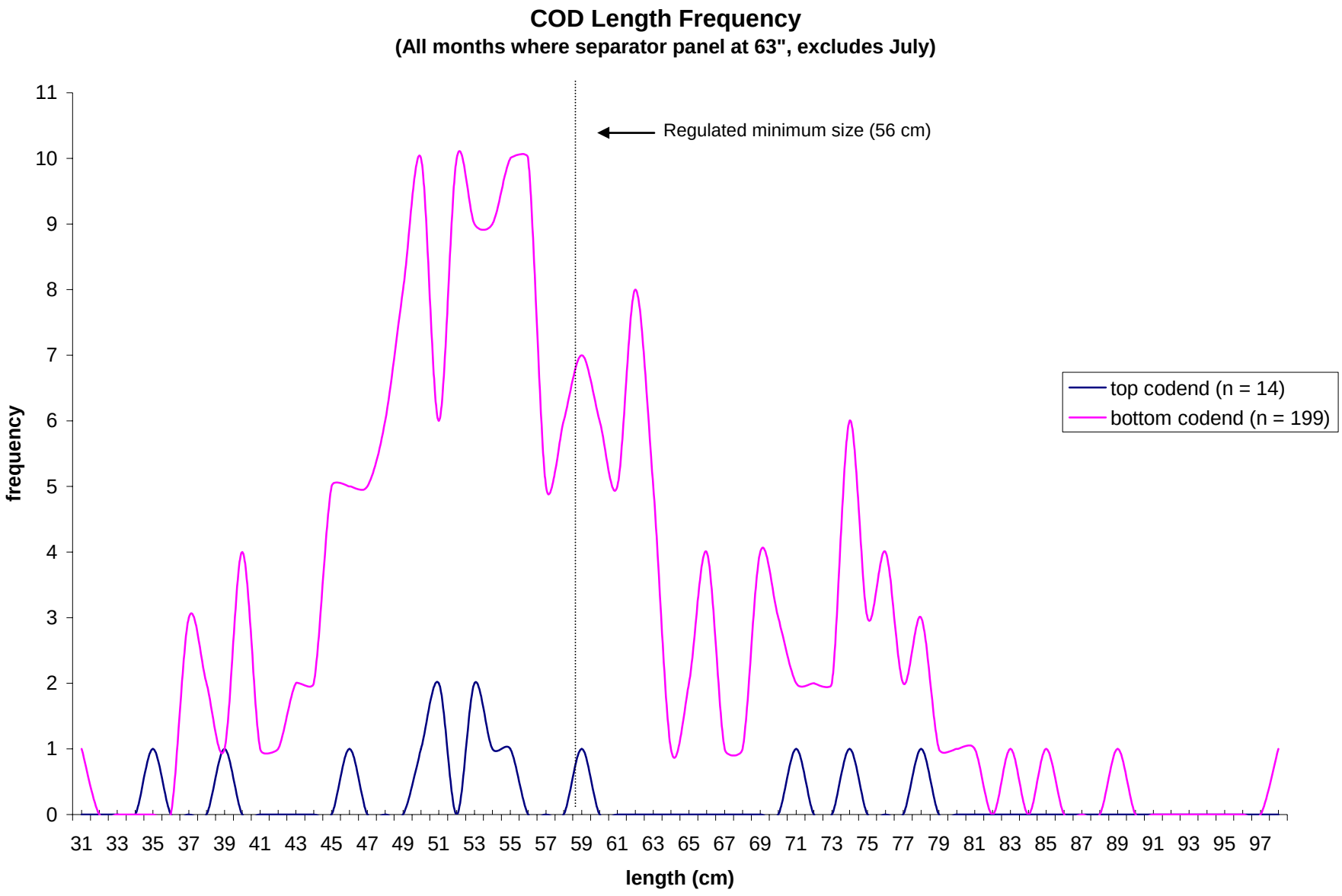

COD Length Frequency
AUGUST
56 cm, minimum legal size
n = 51
frequency
length (cm)


COD Length Frequency
OCTOBER
56 cm, minimum legal size
n = 4
frequency
length (cm)


COD Length Frequency
NOVEMBER
56 cm, minimum legal size
n = 27
frequency
length (cm)

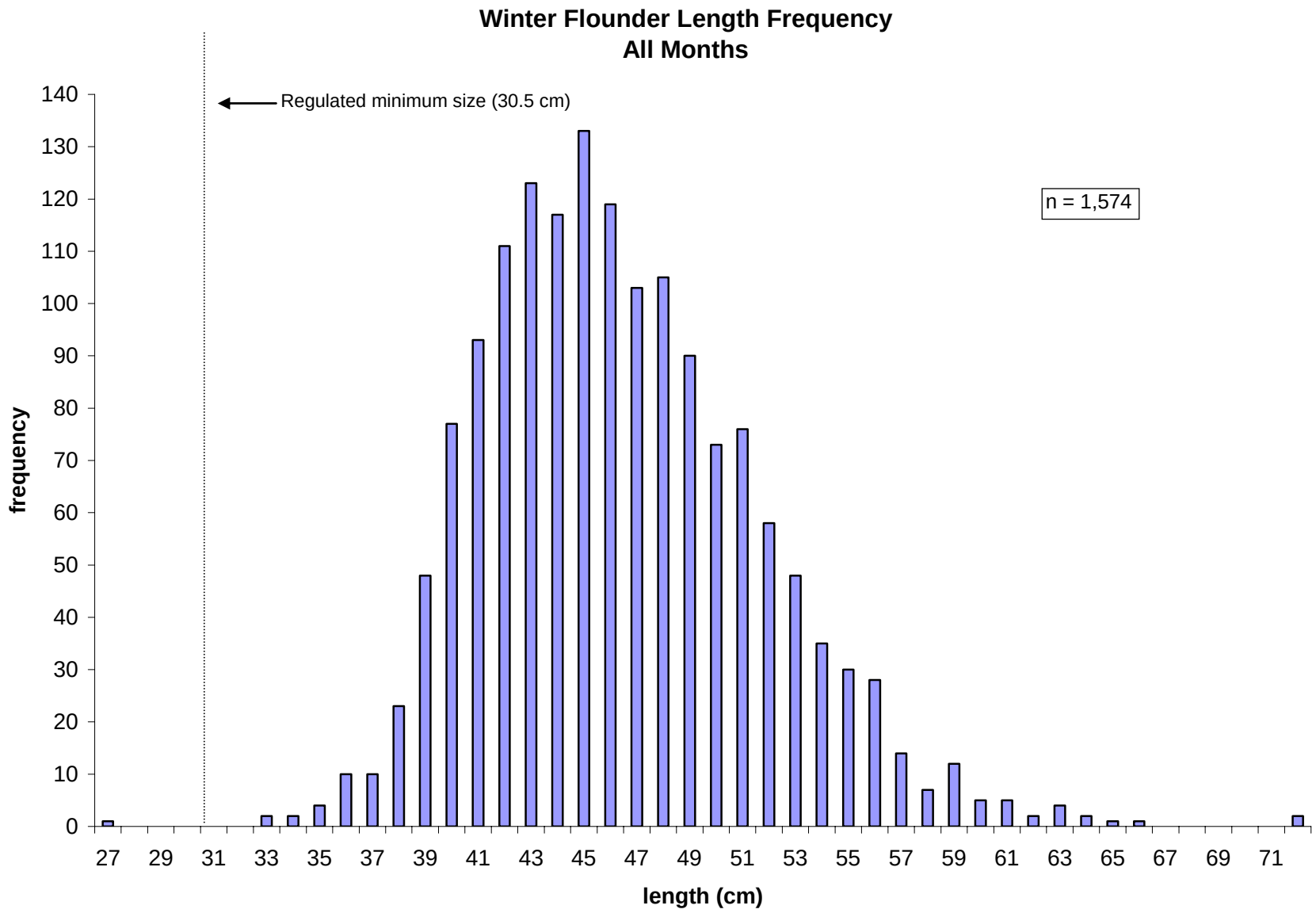

COD Length Frequency
DECEMBER
56 cm, minimum legal size
n = 14
frequency
length (cm)

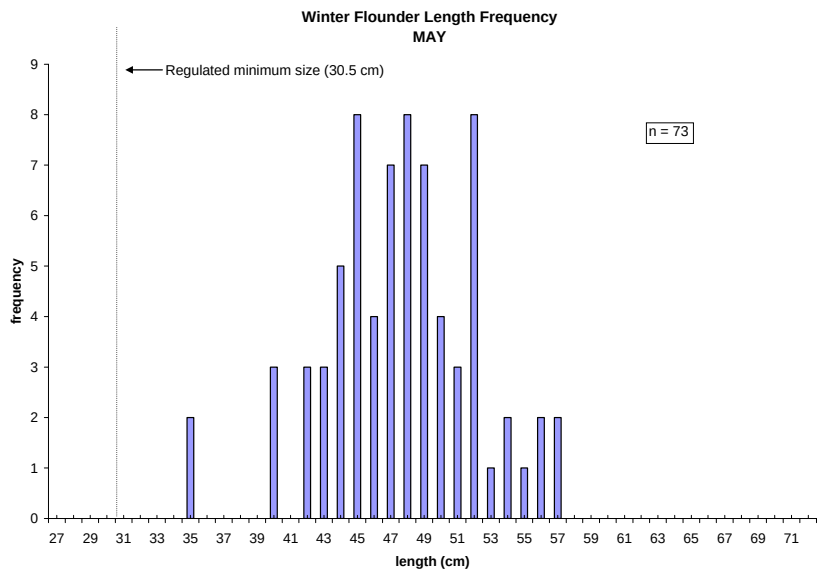

COD Length Frequency
JANUARY
56 cm, minimum legal size
n = 46
frequency
length (cm)

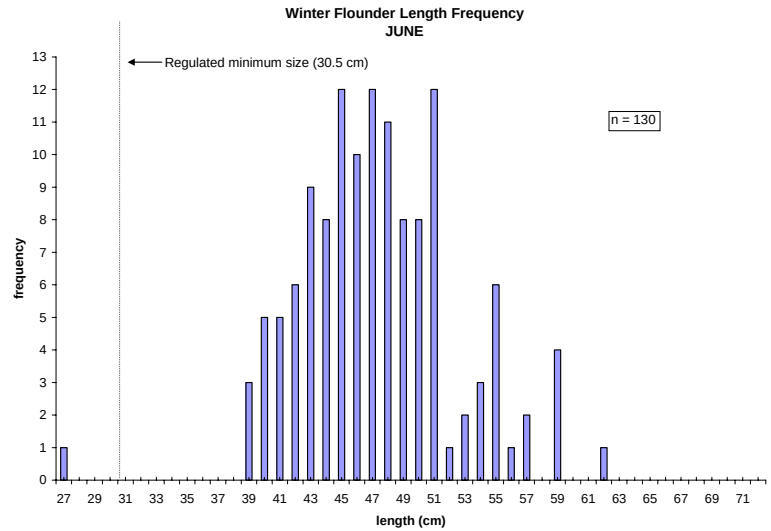

COD Length Frequency
(All months where separator panel at 63", excludes July)
Regulated minimum size (56 cm)
top codend (n = 14)
bottom codend (n = 199)
frequency
length (cm)
0
1
2
3
4
5
6
7
8
9
10
11
31 33 35 37 39 41 43 45 47 49 51 53 55 57 59 61 63 65 67 69 71 73 75 77 79 81 83 85 87 89 91 93 95 97

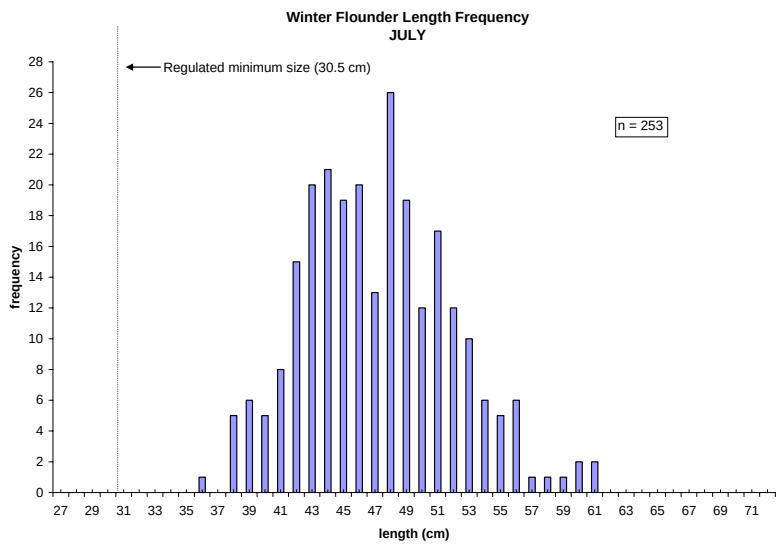
Winter Flounder Length Frequencies

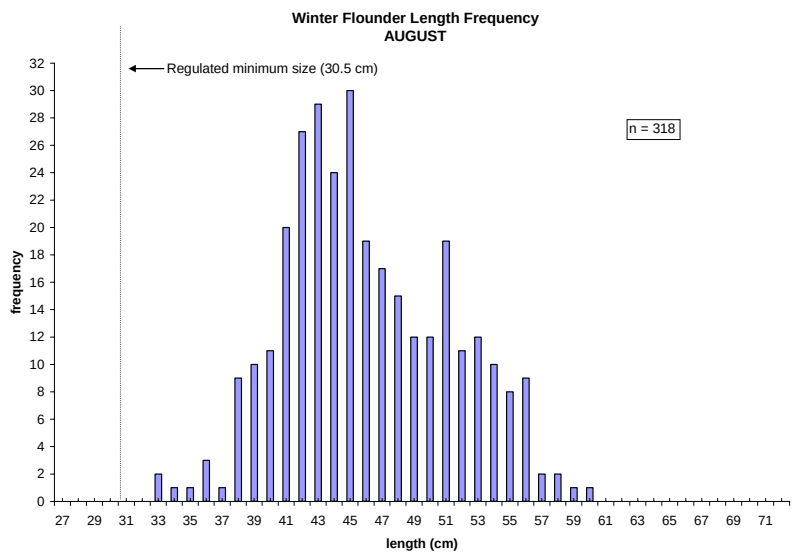
- All months combined
- By individual month

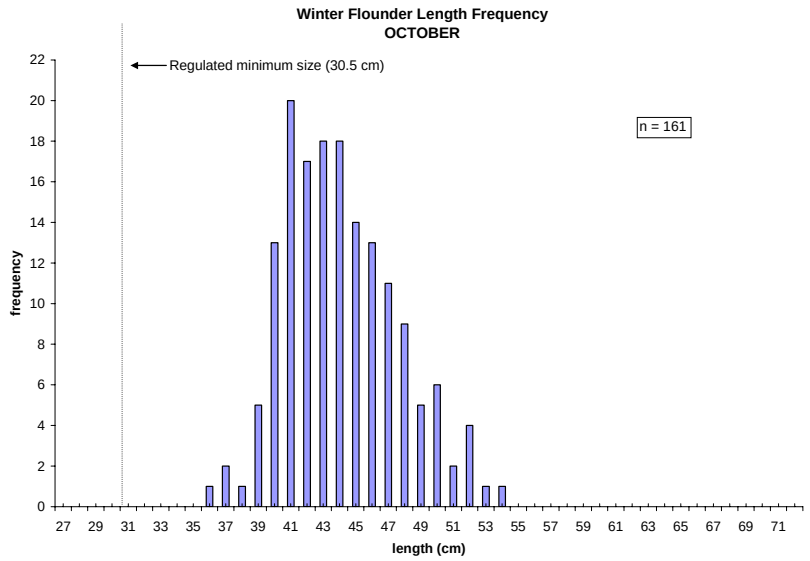

Winter Flounder Length Frequency
All Months
Regulated minimum size (30.5 cm)
n = 1,574
frequency
length (cm)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
27
29
31
33
35
37
39
41
43
45
47
49
51
53
55
57
59
61
63
65
67
69
71

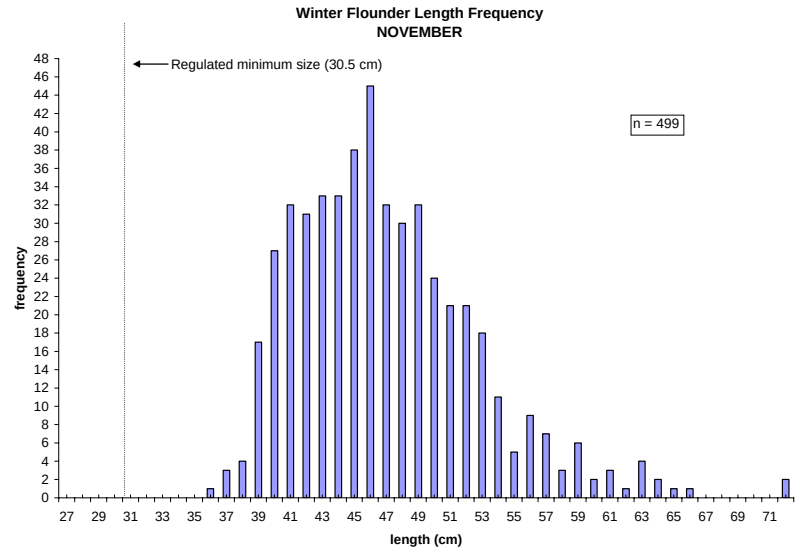

Winter Flounder Length Frequency
MAY
Regulated minimum size (30.5 cm)
n = 73
frequency
length (cm)

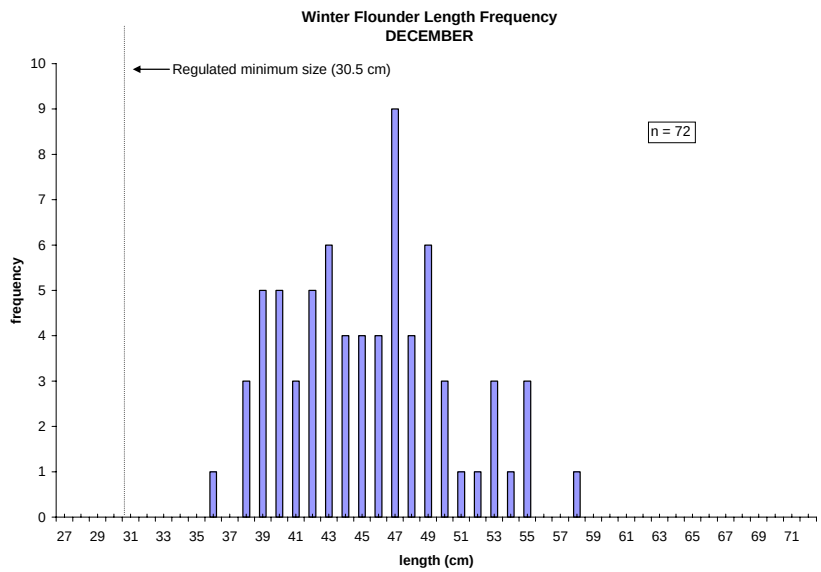

Winter Flounder Length Frequency
JUNE
Regulated minimum size (30.5 cm)
n = 130
frequency
length (cm)

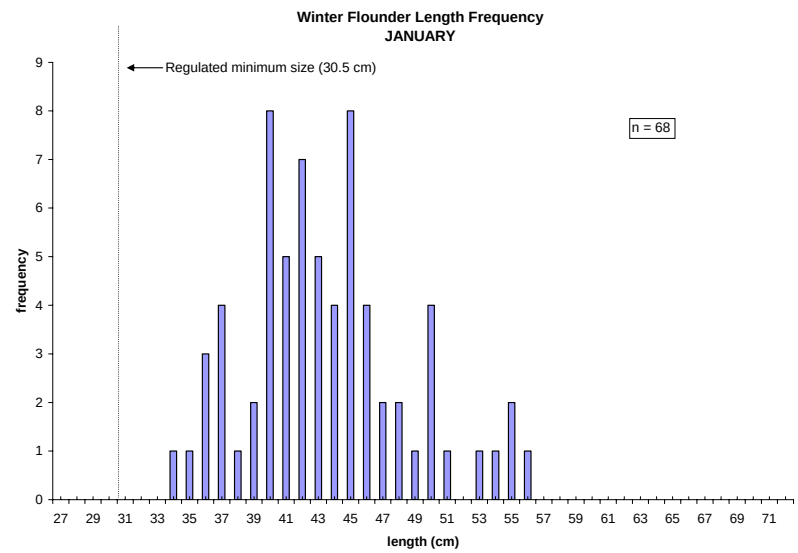

Winter Flounder Length Frequency
JULY
Regulated minimum size (30.5 cm)
n = 253
frequency
length (cm)


Winter Flounder Length Frequency
AUGUST
Regulated minimum size (30.5 cm)
n = 318
frequency
length (cm)


Winter Flounder Length Frequency
OCTOBER
Regulated minimum size (30.5 cm)
n = 161
frequency
length (cm)

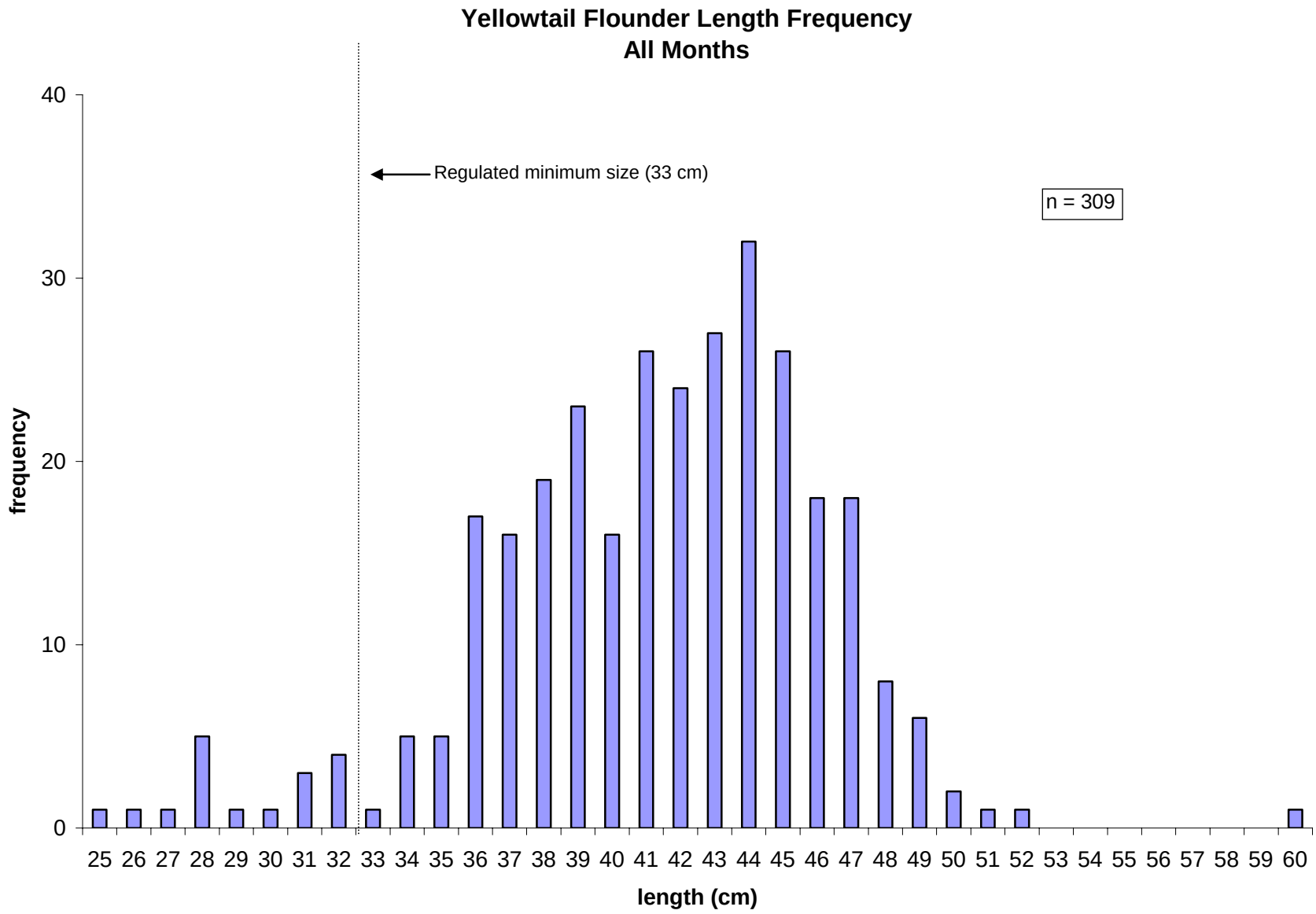

Winter Flounder Length Frequency
NOVEMBER
Regulated minimum size (30.5 cm)
n = 499
frequency
length (cm)

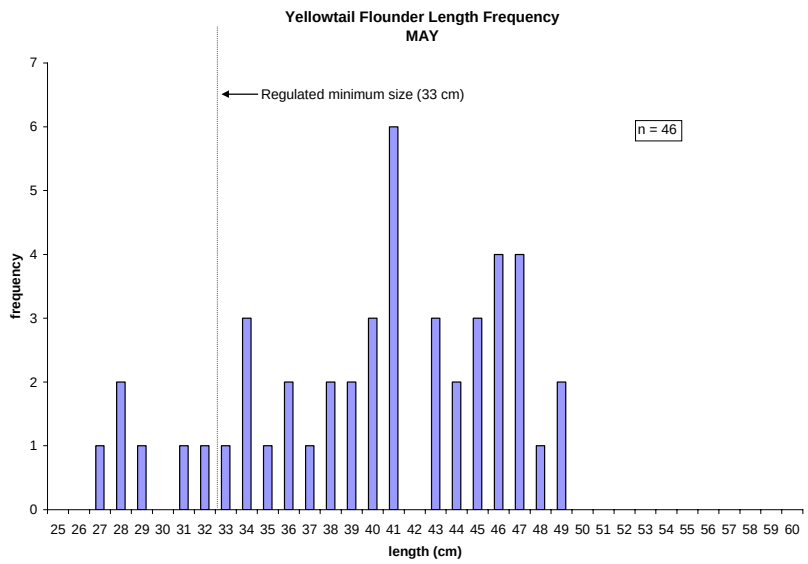

Winter Flounder Length Frequency
DECEMBER
Regulated minimum size (30.5 cm)
n = 72
frequency
length (cm)

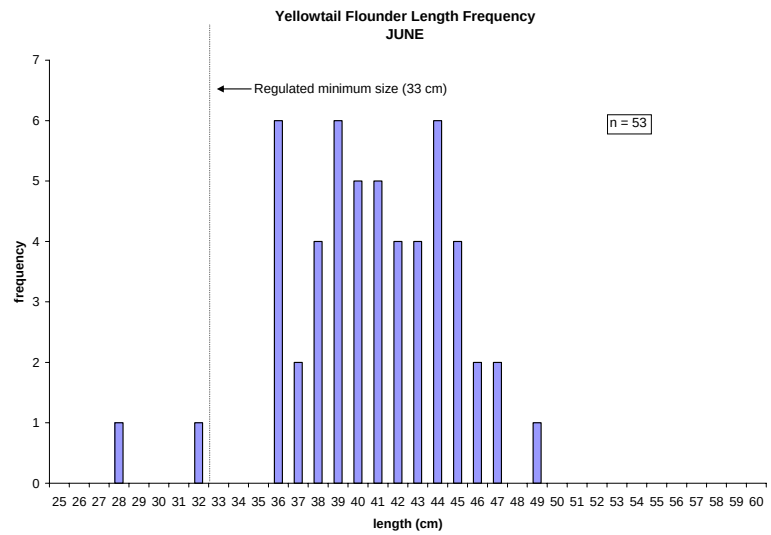

Winter Flounder Length Frequency
JANUARY
Regulated minimum size (30.5 cm)
n = 68
frequency
length (cm)

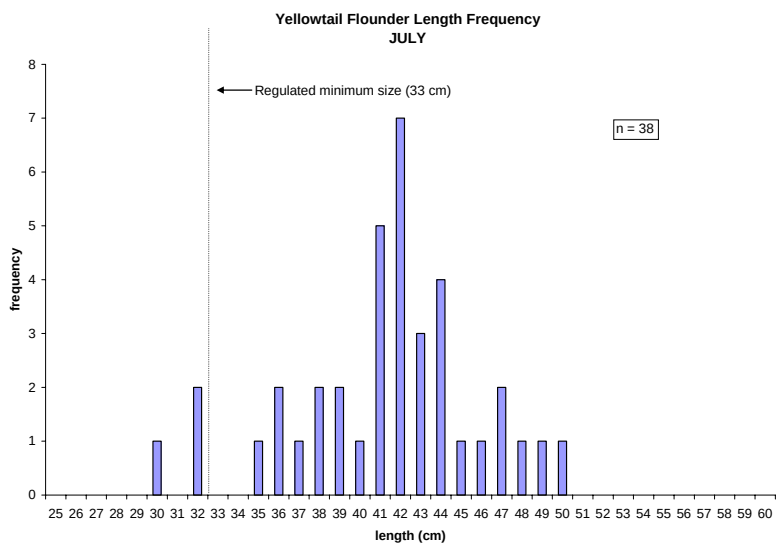
Yellowtail Flounder Length Frequencies

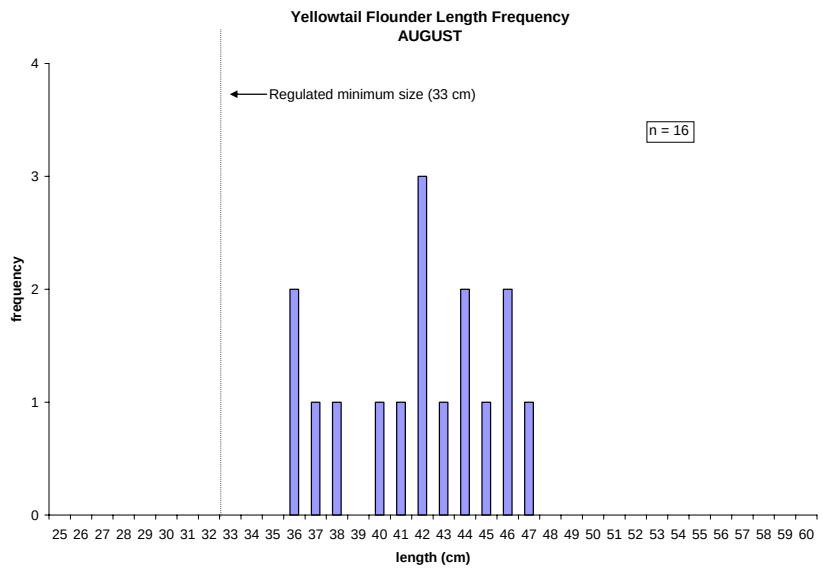
- All months combined
- By individual month

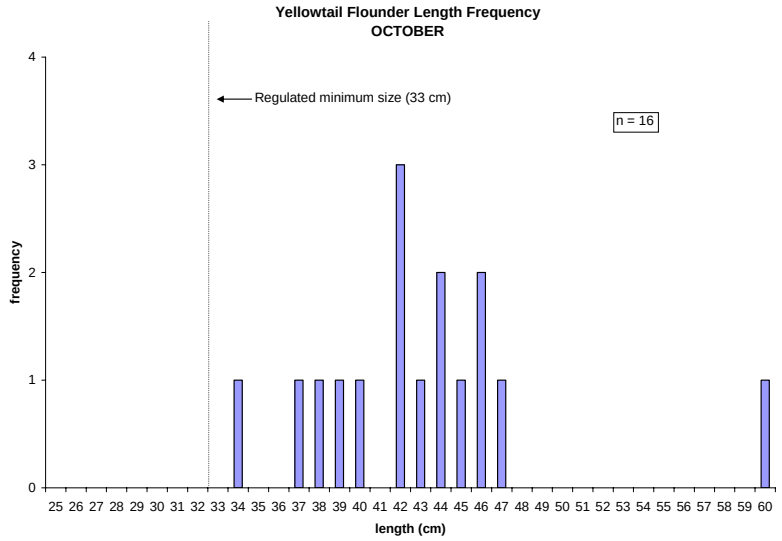

Yellowtail Flounder Length Frequency
All Months
Regulated minimum size (33 cm)
n = 309
frequency
length (cm)
0
10
20
30
40
25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60

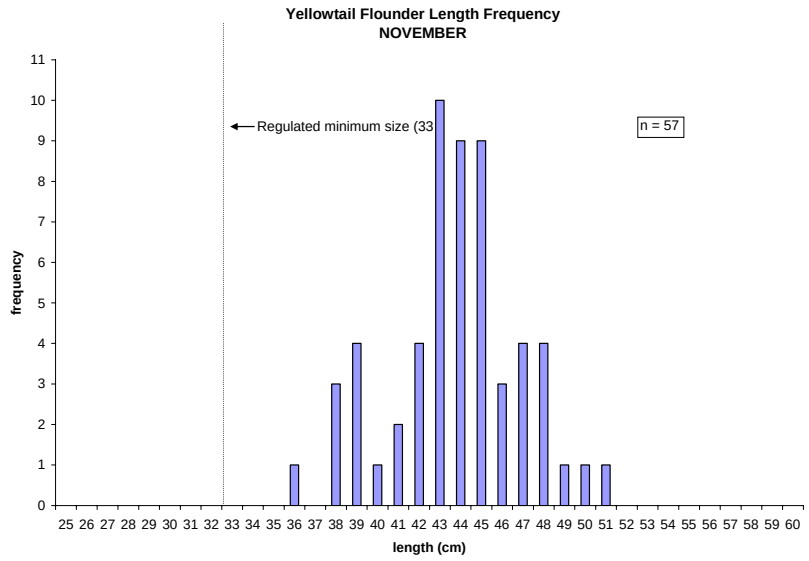

Yellowtail Flounder Length Frequency
MAY
Regulated minimum size (33 cm)
n = 46
frequency
length (cm)

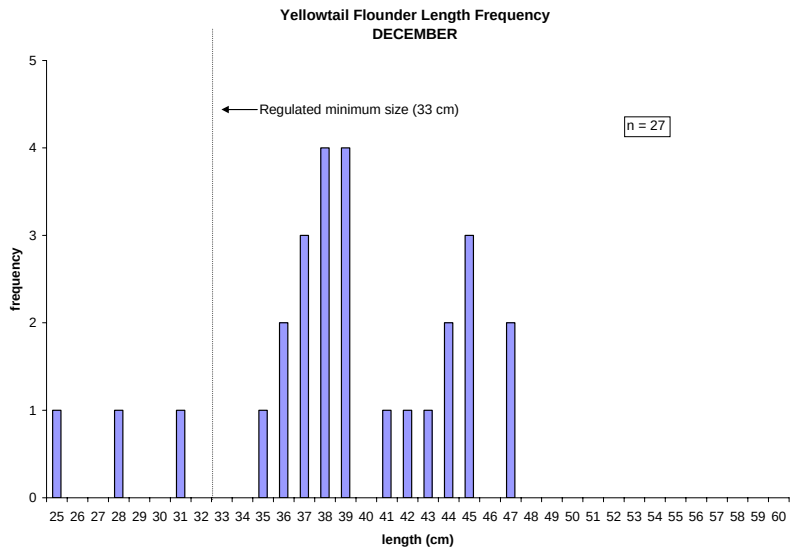

Yellowtail Flounder Length Frequency
JUNE
Regulated minimum size (33 cm)
n = 53
frequency
length (cm)

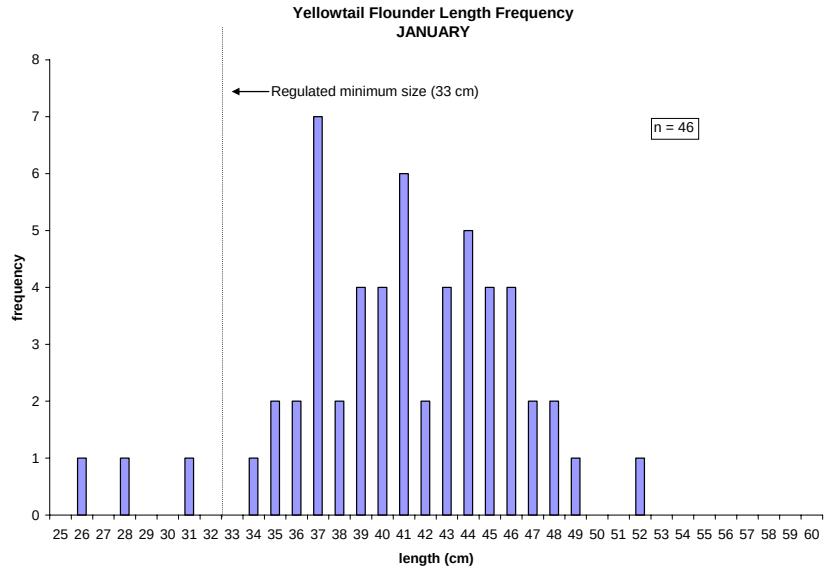

Yellowtail Flounder Length Frequency
JULY
Regulated minimum size (33 cm)
n = 38
frequency
length (cm)


Yellowtail Flounder Length Frequency
AUGUST
Regulated minimum size (33 cm)
n = 16
frequency
length (cm)


Yellowtail Flounder Length Frequency
OCTOBER
Regulated minimum size (33 cm)
n = 16
frequency
length (cm)

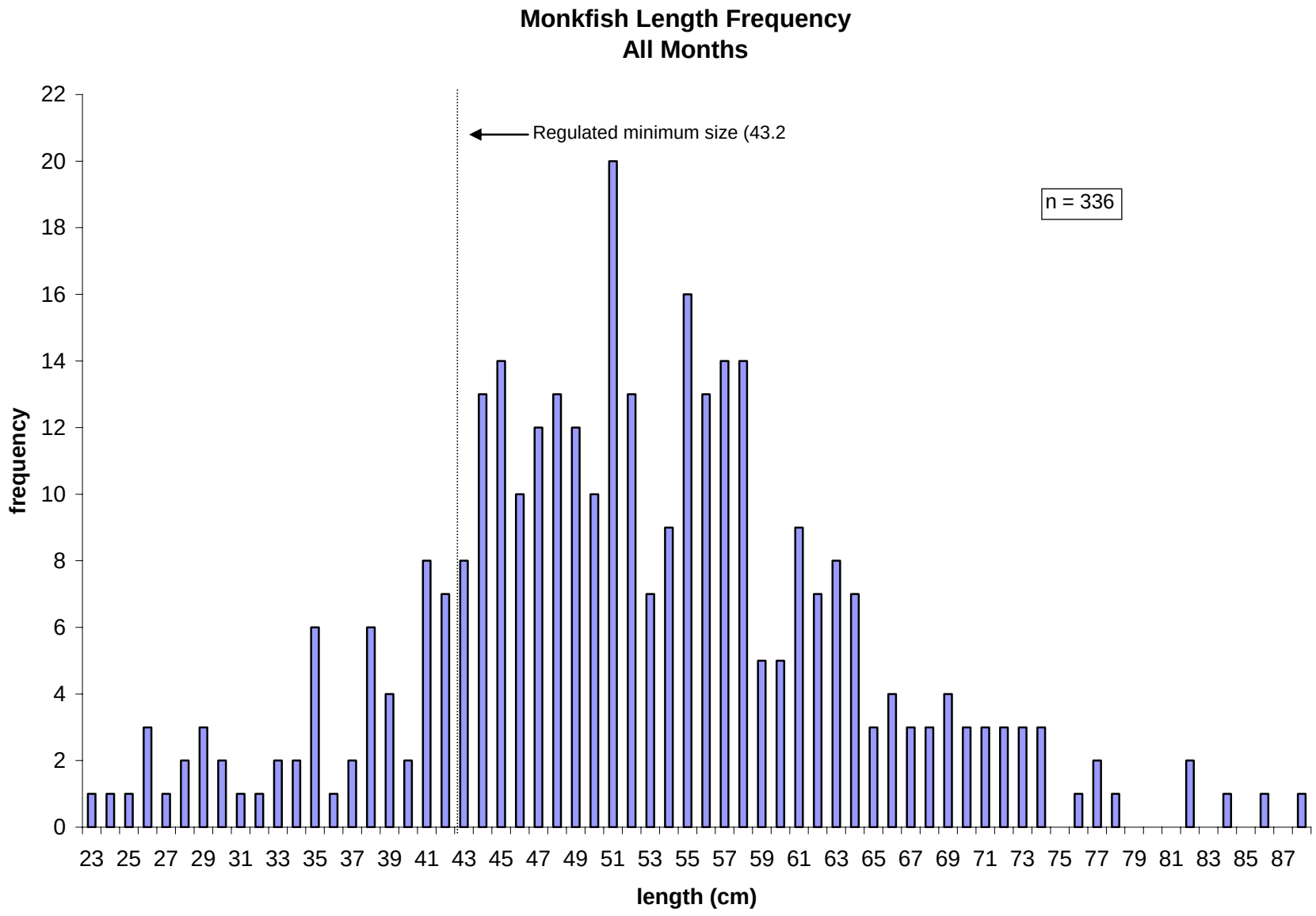

Yellowtail Flounder Length Frequency
NOVEMBER
Regulated minimum size (33
n = 57
frequency
length (cm)

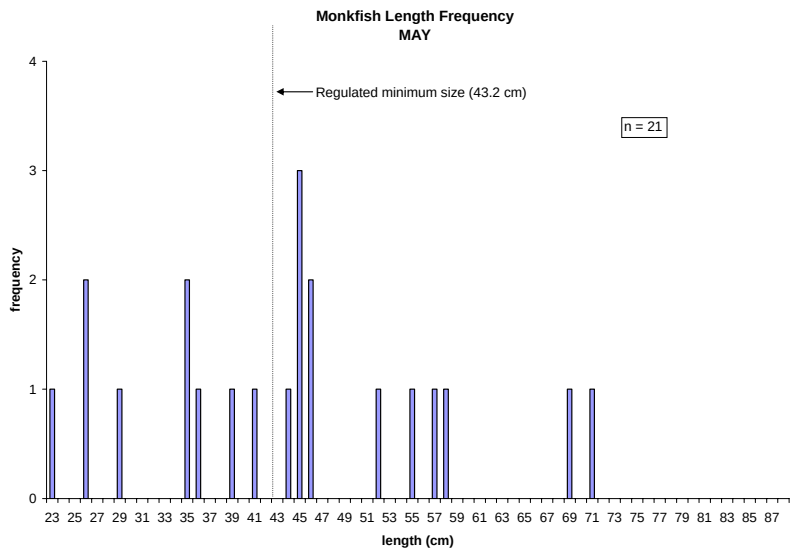

Yellowtail Flounder Length Frequency
DECEMBER
Regulated minimum size (33 cm)
n = 27
frequency
length (cm)

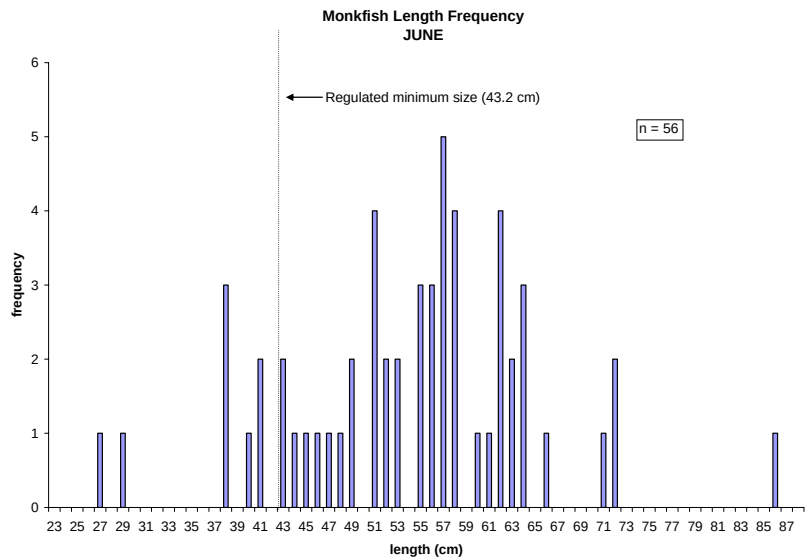

Yellowtail Flounder Length Frequency
JANUARY
Regulated minimum size (33 cm)
n = 46
frequency
length (cm)

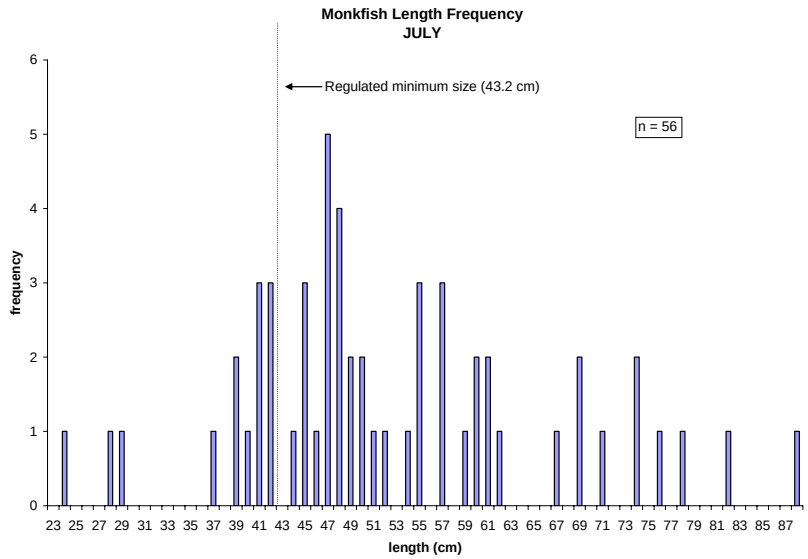
Monkfish Length Frequencies

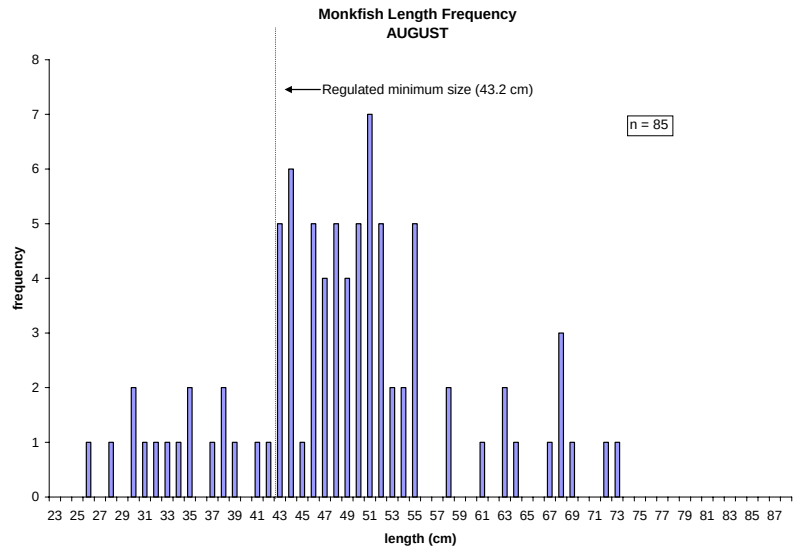
- All months combined
- By individual month

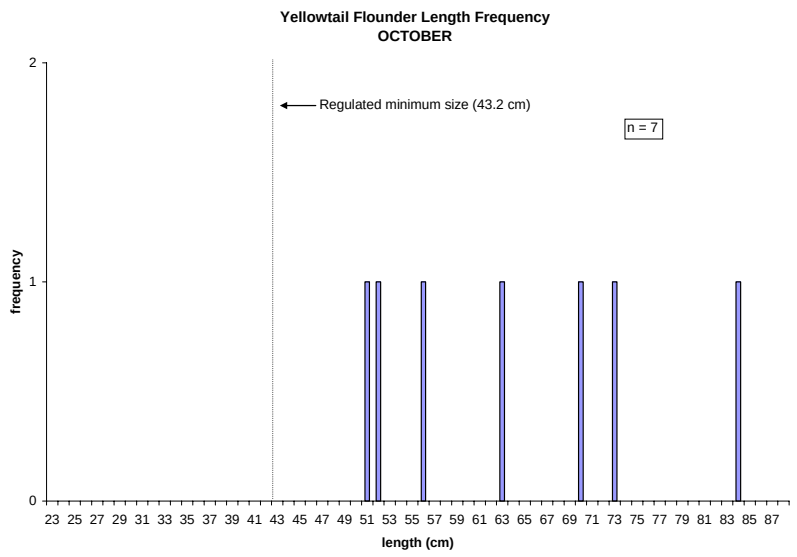

Monkfish Length Frequency
All Months
Regulated minimum size (43.2
n = 336
frequency
length (cm)
0
2
4
6
8
10
12
14
16
18
20
22
23 25 27 29 31 33 35 37 39 41 43 45 47 49 51 53 55 57 59 61 63 65 67 69 71 73 75 77 79 81 83 85 87

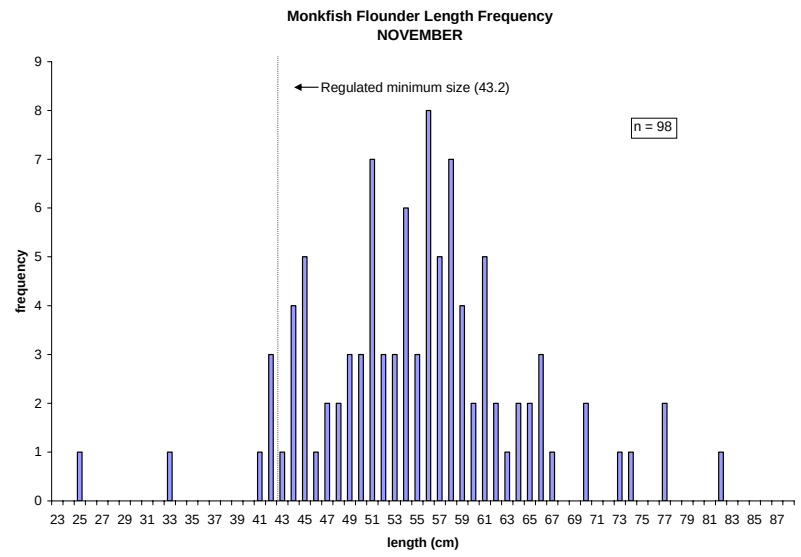

Monkfish Length Frequency
MAY
Regulated minimum size (43.2 cm)
n = 21
frequency
length (cm)

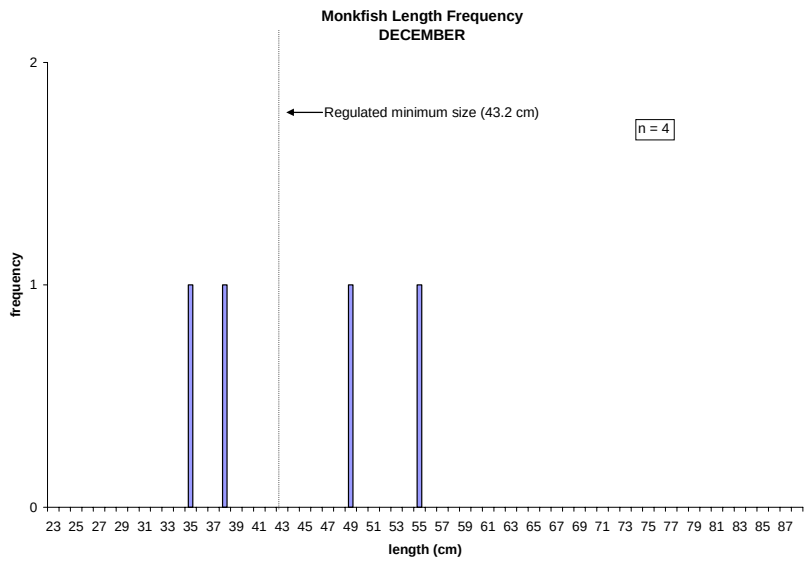

Monkfish Length Frequency
JUNE
Regulated minimum size (43.2 cm)
n = 56
frequency
length (cm)

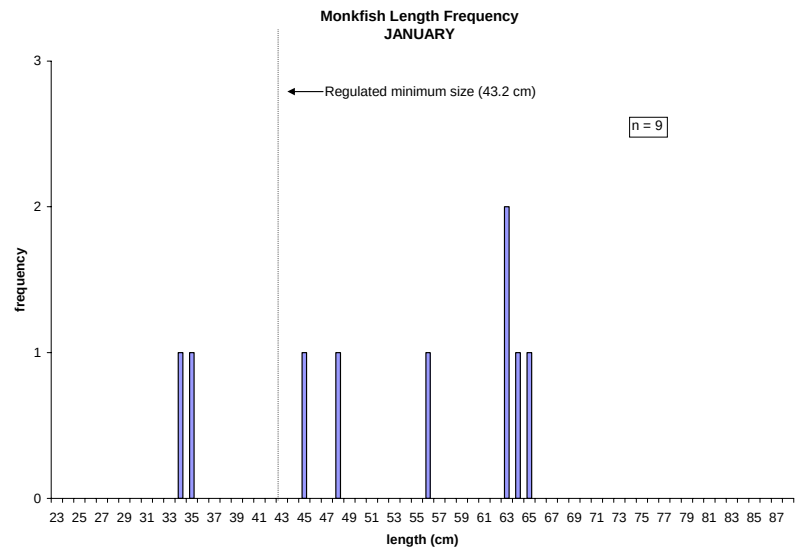

Monkfish Length Frequency
JULY
Regulated minimum size (43.2 cm)
n = 56
frequency
length (cm)


Monkfish Length Frequency
AUGUST
Regulated minimum size (43.2 cm)
n = 85
frequency
length (cm)


Yellowtail Flounder Length Frequency
OCTOBER
Regulated minimum size (43.2 cm)
n = 7
frequency
length (cm)


Monkfish Flounder Length Frequency
NOVEMBER
Regulated minimum size (43.2)
n = 98
frequency
length (cm)

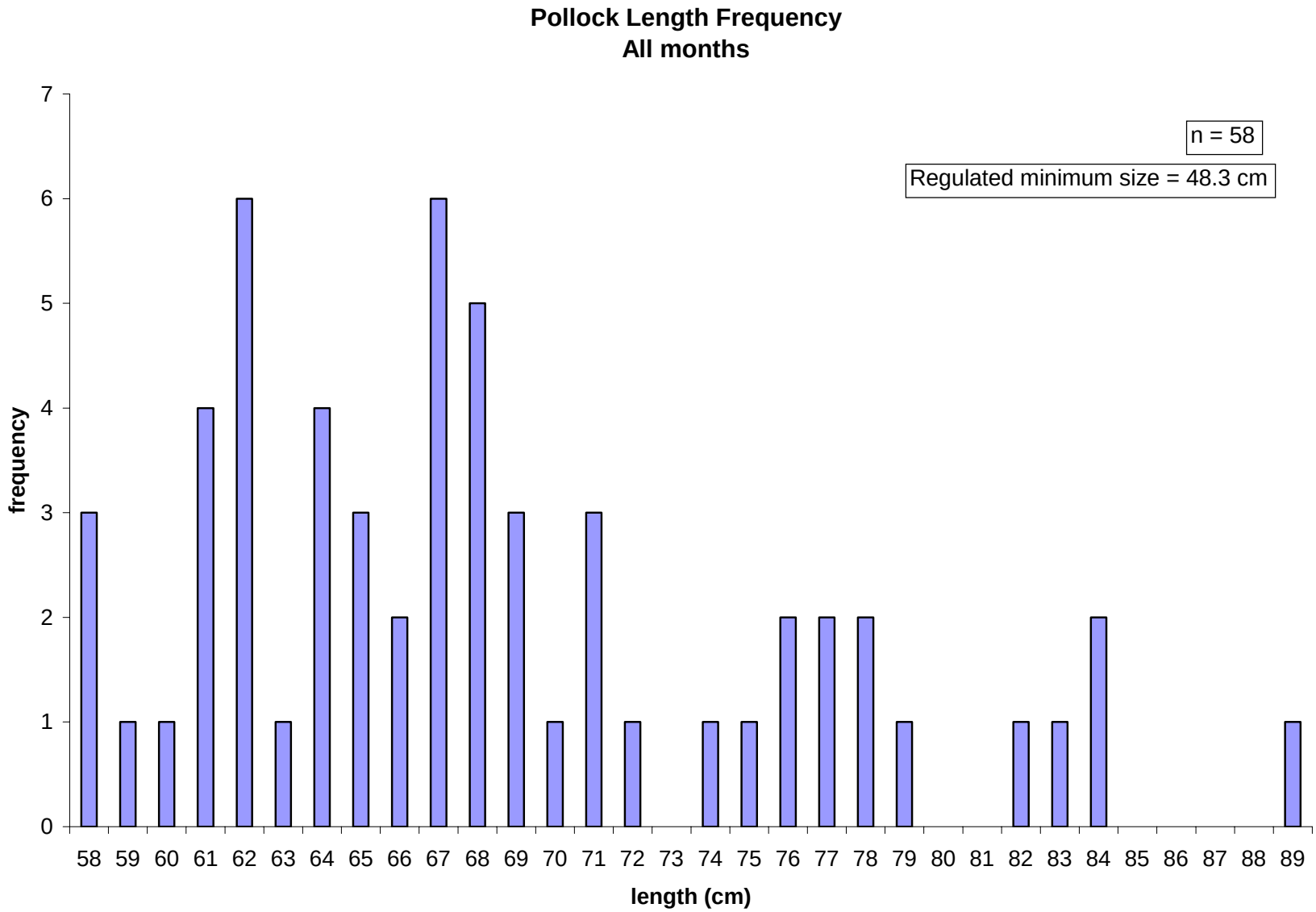

Monkfish Length Frequency
DECEMBER
Regulated minimum size (43.2 cm)
n = 4
frequency
length (cm)

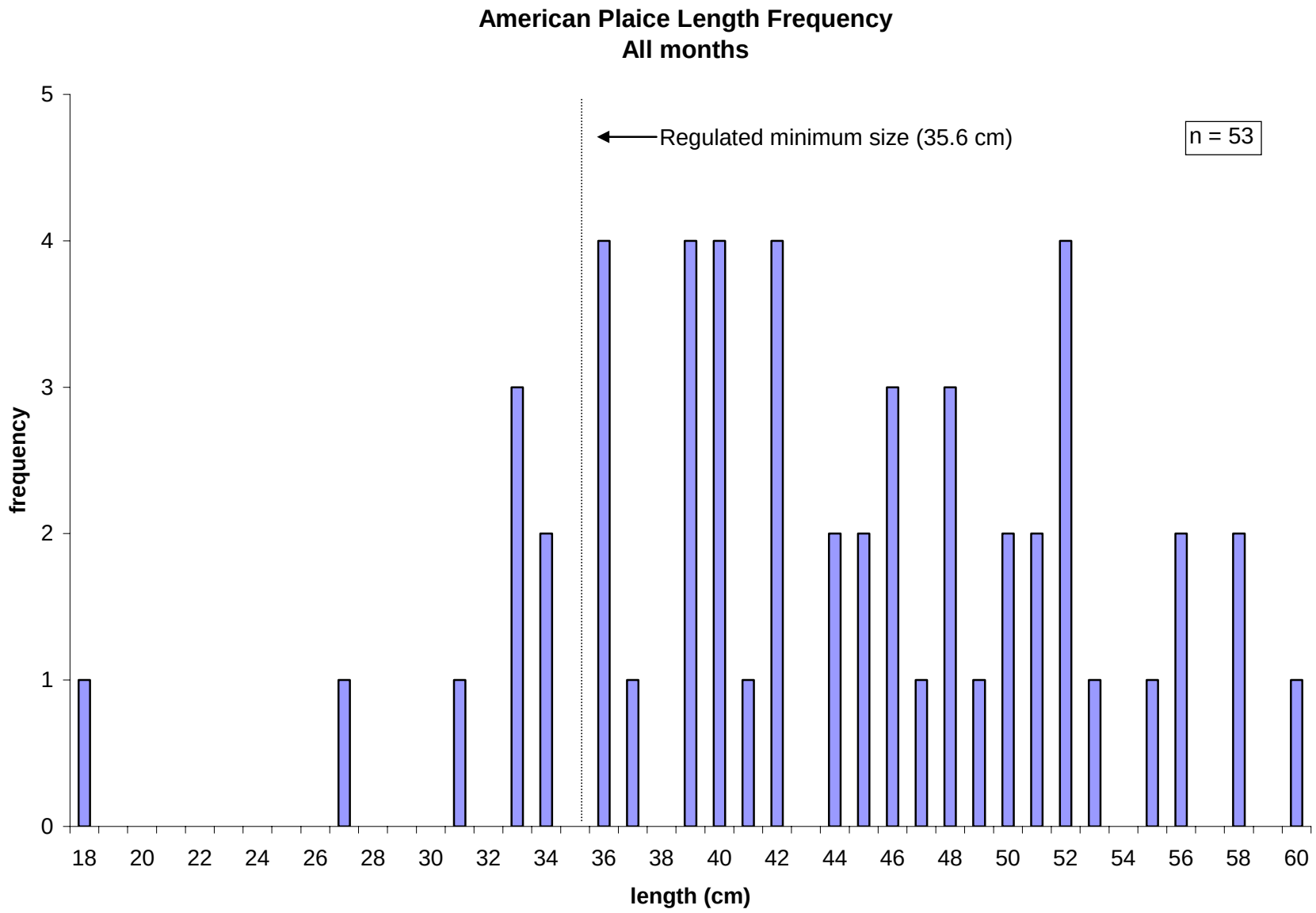

Monkfish Length Frequency
JANUARY
Regulated minimum size (43.2 cm)
n = 9
frequency
length (cm)

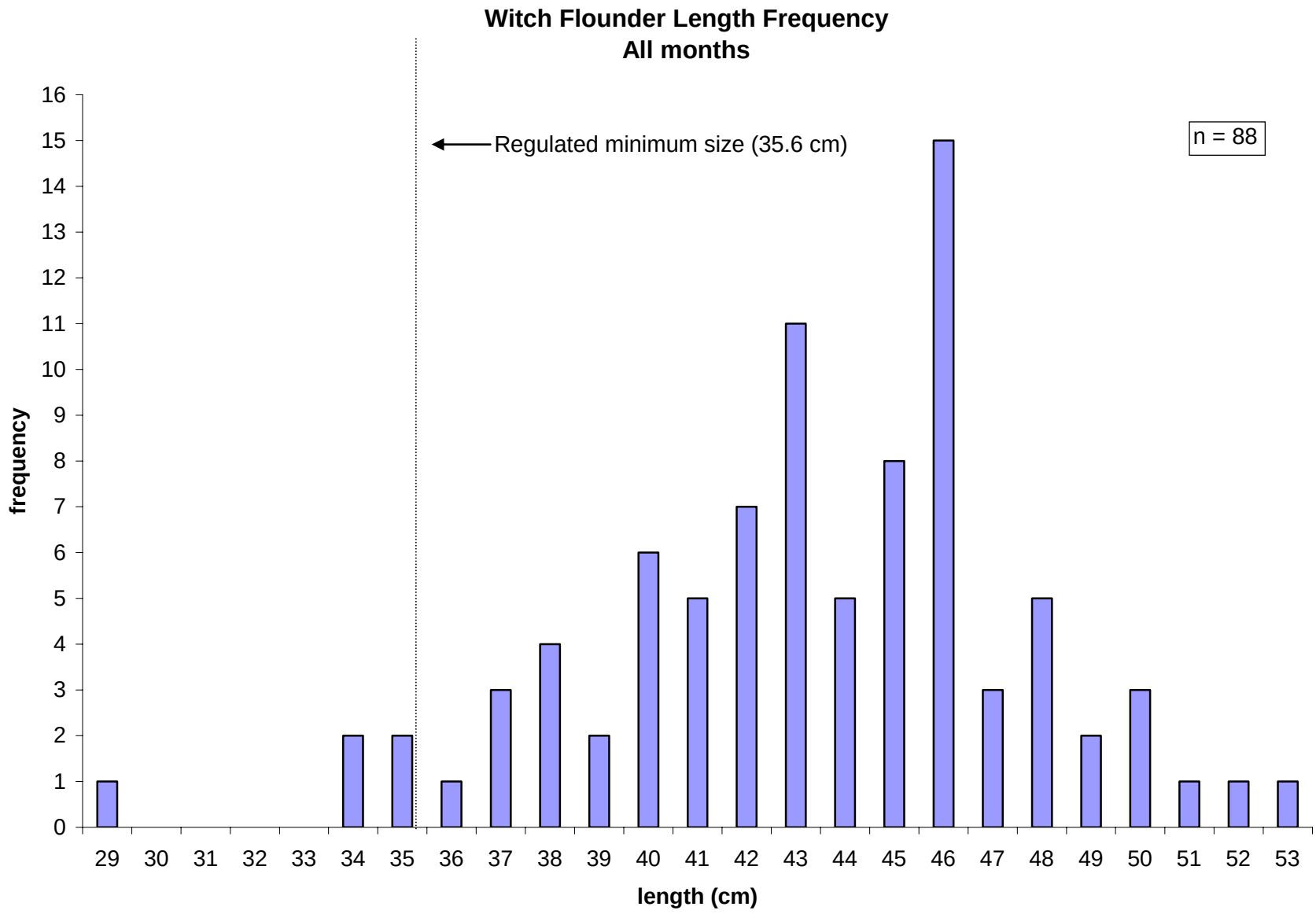
Length Frequencies

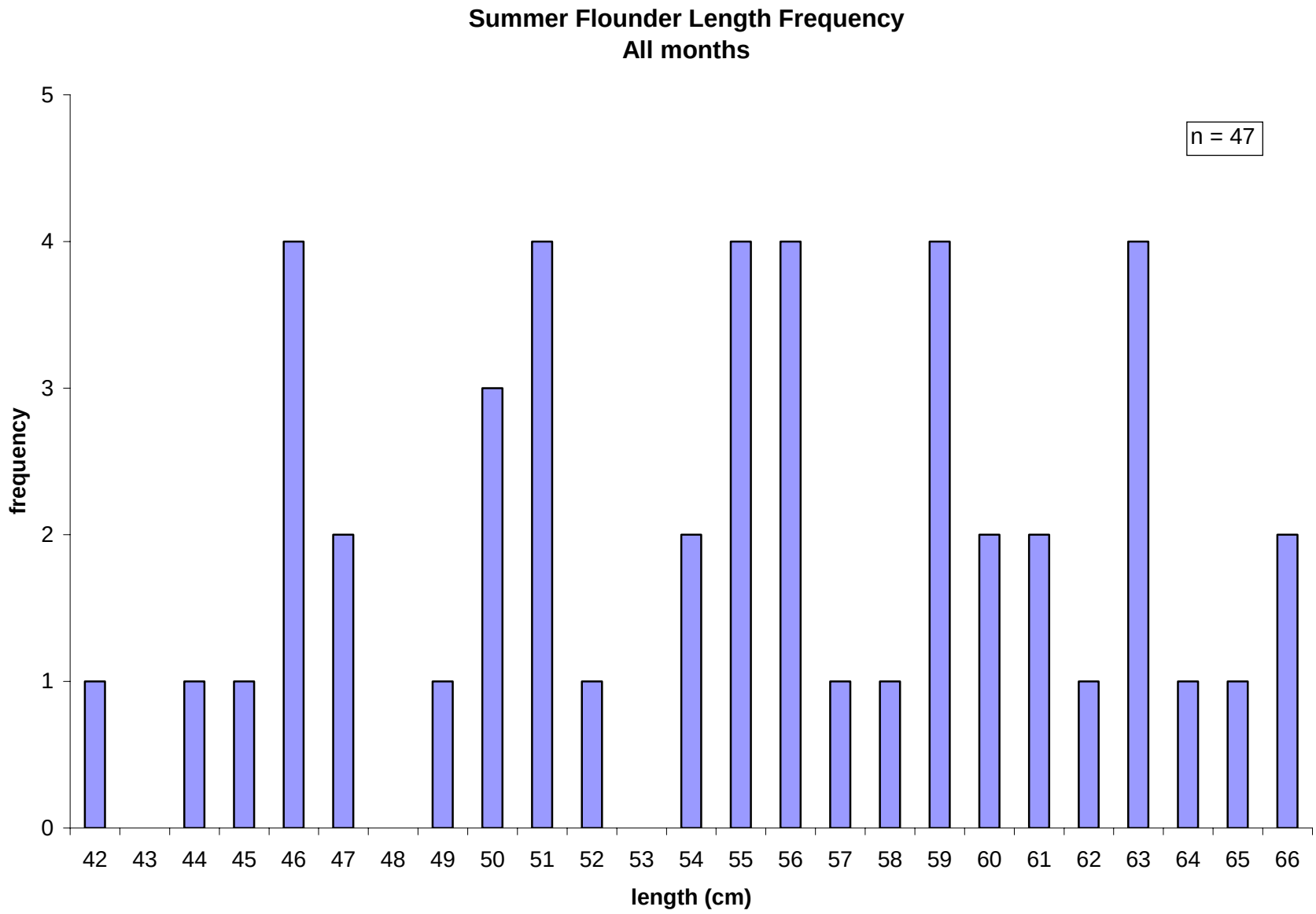
All months combined for:

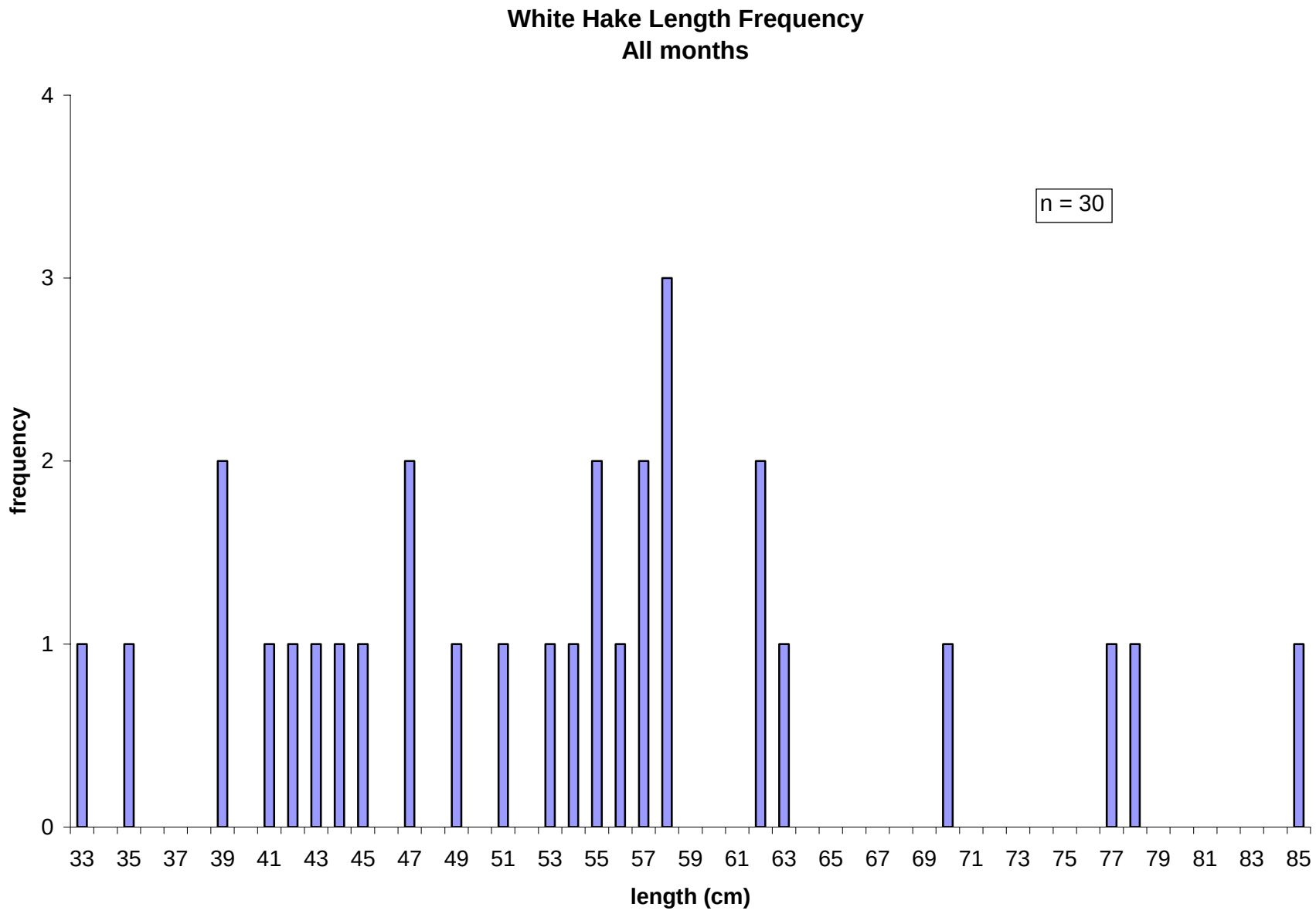
- Pollock
- American Plaice
- Witch Flounder
- Summer Flounder
- White Hake


Pollock Length Frequency
All months
n = 58
Regulated minimum size = 48.3 cm
frequency
length (cm)
0
1
2
3
4
5
6
7
58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89


American Plaice Length Frequency
All months
Regulated minimum size (35.6 cm)
n = 53
frequency
length (cm)
0
1
2
3
4
5
18
20
22
24
26
28
30
32
34
36
38
40
42
44
46
48
50
52
54
56
58
60


Witch Flounder Length Frequency
All months
Regulated minimum size (35.6 cm)
n = 88
frequency
length (cm)
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53


Summer Flounder Length Frequency
All months
n = 47
frequency
length (cm)
0
1
2
3
4
5
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60
61
62
63
64
65
66


White Hake Length Frequency
All months
n = 30
frequency
length (cm)
0
1
2
3
4
33 35 37 39 41 43 45 47 49 51 53 55 57 59 61 63 65 67 69 71 73 75 77 79 81 83 85

Appendix IV: List of Property Purchased under Contract # EA133F-04-CN-0041.

Item Description	Vendor Name	Cost per Item	Number of Items	Total Cost	Invoice Date	Item Location	Item Condition	Comments
Immersion Suit	Hamilton Marine	$293.99	1	$293.99	12-Apr-05	GMRI	good	
Pentax digital camera	Zipzoomfly.com	$295.00	1	$295.00	4-Aug-05	Stolen, Aug 2006	-	
Hydrophone sensor[1]	Northstar Technical	$2,500.00	1	$2,500.00	2-Nov-05	MA DMF	good	Sent for repair

[1] NCRPP property dedicated to MA DMF Industry-based Survey for Gulf of Maine Cod, loaned to GMRI for use under this contract.

Appendix V: List of Presentations made for Contract # EA133F-04-CN-0041.

Venue	Date	Title	Format
Maine Fisherman's Forum, Rockport, ME	March 2005	Evaluating the Efficacy of the Haddock Separator Trawl in Eliminating Cod Bycatch on Georges Bank	Poster
Maine Fisherman's Forum, Rockport, ME	March 2006	Evaluating the Performance of a Haddock Separator Trawl in Reducing Cod Bycatch in Selected Areas on Georges Bank	Oral
ICES 2006, Fishing Technology in the 21st Century, Boston, MA	October 2006	Evaluating the Performance of a Haddock Separator Trawl in Reducing Cod Bycatch	Poster (Invited)

Gulf of Maine
Research Institute

350 Commercial Street, Portland, Maine 04101 · Ph. 207-772-2321 · Fx. 207-772-6855 · www.gmri.org