Optimizing the Georges Bank Scallop Fishery by Maximizing Meat Yield and Minimizing Bycatch

Final Report

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Executive Summary:

Fourteen trips were made to Georges Bank CAI and CAII scallop access areas from October 2010 through April 2012. On each trip approximately 80 stations were surveyed using two scallop dredges following standardized procedures. Yellowtail flounder bycatch rates were found to be highest during the August through October period. Scallop meat growth is highest in the April through June period. Yellowtail flounder suffer high rates of discard mortality (85%); discard mortality of winter flounder is much lower (36%). Results indicate that peak spawning for yellowtail flounder on Georges Bank is around May/June; for winter flounder it is February/March. Evidence supports past experience that the CFarm turtle deflector dredge (CFTDD) frame increases the catch of scallops and decreases the bycatch of flatfish. Additionally, lower twine top ratios and shorter aprons also reduce the bycatch rate of flatfish.

Trips analyzed in this report:

F/V Celtic	Oct. 12 – 18, 2010
F/V Arcturus	March 9 – 15, 2011
F/V Celtic	April 14 – 20, 2011
F/V Westport	May 11 – 17, 2011
F/V Liberty	June 1 – 7, 2011
F/V Endeavor	July 6 – 12, 2011
F/V Regulus	Aug 15 – 21, 2011
F/V Resolution	Sept 10 – 16, 2011
F/V Ranger	Oct. 4 – 10, 2011
F/V Horizon	Nov 29 - Dec 5, 2011
F/V Wisdom	Jan 4 – 10, 2012
F/V Venture	Feb 16 – 22, 2012
F/V Regulus	March 10 – 16, 2012
F/V Endeavor	April 10 – 16, 2012

Introduction

The sea scallop is one of the most economically valuable commercial species in the northeast United States and supports the most valuable wild scallop fishery in the world (Hart and Chute, 2004). The stock has been rebuilt and no overfishing is occurring. However, the harvest of this important resource is currently restricted due to bycatch of yellowtail flounder on Georges Bank and in Southern New England. Management measures to constrain the harvest of sea scallops have resulted in the loss of millions of dollars to the communities of the Northeast and Mid-Atlantic regions of the United States.

Under Amendment 10 to the Sea Scallop Fishery Management Plan (FMP) (NEFMC, 2004a) the scallop resource is harvested through rotational area-based management to allow for identification and protection of juvenile scallops. Despite the success of this program for scallop harvest, the spatial and temporal influences on bycatch of groundfish species has not been quantified. Currently, there are large aggregations of harvestable scallops in the three Closed Areas of Georges Bank that contain populations of yellowtail flounder. Restrictions on the timing of scallop harvest in these areas may result in high bycatch ratios of yellowtail flounder and reduced meat yield of scallops.

Framework 16/39 to the Scallop and Groundfish FMPs defined the access season for scallop vessels from June 15 to January 31 (NEFMC, 2004b). According to the rationale in the joint Framework, the Council made this decision based on unknown but potential risks to spawning groundfish and unknown but potential higher bycatch rates during the spring "when bycatch could not be predicted based on existing data". The document pointed out as part of the rationale that data may become available from future research. The scallop industry, according to the document, supported year round access to reduce the effect of concentrating landings in a shorter season, improve meat yields by avoiding harvest during scallop spawning in the fall, and address safety and weather concerns during the fall and winter seasons.

A report was prepared for the NEFMC (January 27, 2004) by the Ad Hoc Working Group examining ways to limit incidental catches of yellowtail flounder in scallop access programs. The Working Group noted that "neither the Groundfish Oversight Committee nor the Scallop Oversight Committee had recommended restricting the seasons of access" to the three groundfish closures on Georges Bank. Furthermore, the report indicated that "all the available data on bycatch in scallop dredges in those areas came from the period mid-June to January." The report made the Council aware that "bycatch rates in the late winter and through the spring could be very different from the available estimates based on summer and fall data."

The reauthorized Magnuson-Stevens Act (U.S. DOC, 2007) established new requirements to end and prevent overfishing through the implementation of ACLs and Accountability Measures (Section 303(a)(15)) for all stocks and stock areas. For the US sea scallop fishery, these requirements apply to the target stock, Atlantic sea scallops, as well as to non-target species, including three yellowtail flounder stocks (Georges Bank, Cape Cod/Gulf of Maine and Southern New England/Mid Atlantic).

There is currently limited information pertaining to groundfish bycatch and scallop meat yield in the Georges Bank closed areas from February through mid-June due to the absence of fishing during this time period. Furthermore, minimal information exists on the optimization of scallop catch and yellowtail bycatch reduction in open areas. Spatial and temporal variation in scallop meat yield has been observed on Georges Bank in relation to depth, flow velocity and water temperature (Sarro and Stokesbury, 2009). Also, variations in yellowtail flounder bycatch rates have been noted in the open and closed areas of Georges Bank through observer data (Bachman, 2009). The lack of spatially and temporally specific data on meat yield and bycatch rates needed to be addressed and that was the major focus of this project.

As the project developed the opportunity for additional sampling was recognized and incorporated into the program; one effort was examining discard mortality. Discard survival rates are currently assumed for several stock assessments in the Northeast United States including the Southern New England Mid-Atlantic (SNEMA) winter flounder (*Pseudopleuronectes americanus*) and southern summer flounder (*Paralichthys dentatus*) stock assessments (NEFSC, 2011; NEFSC, 2008). Including information on discard mortality allows for a more accurate estimate of the stock abundance as well as more representative Biological Reference Points (BRPs), which may change the overfished and overfishing status of these stocks (Barkley et al., 2010).

Estimated rates of discard mortality range widely. In stock assessments, discard mortality rates are often assumed to be 100% as a conservative approach, while mark-recapture studies typically assume low discard mortality rates (e.g. Alade, 2008). The 2008 stock assessment for SNEMA yellowtail flounder assumed a 100% discard mortality rate (Alade et al., 2008), while a recent yellowtail flounder tagging study performed in the SNEMA estimated a negligible capture mortality rate (Alade, 2008) from short research trawls and field protocols that were designed to minimize mortality. Assumed discard mortality rates of 0% and 100% are unlikely in a complex fishery that spans multiple gear types and differing catch sorting methods. Robinson and Carr (1993) reported that discarded yellowtail flounder exhibited high survival rates with survival estimated to be 67% or greater. Similarly, Carr et al. (1995) showed that yellowtail flounder had the greatest survival rates of the three fish species studied: yellowtail flounder, American plaice (*Hippoglossoides platessoides*), and Atlantic cod (*Gadus morhua*), with survival rates of 66% and higher.

Reflex Action Mortality Predictors (RAMP) provides a tool to address the estimation of discard mortality using direct observations aboard fishing vessels. The RAMP approach is based on behavioral reflexes, involuntary actions or responses to a stimulus (Berube et al., 2001). Davis and Ottmar (2006) and Davis (2007) identified behavioral reflexes that are observed in unstressed fish, but absent in near-dead fish. In all of their experiments, reflex impairment (RAMP scores) increased with mortality (Davis, 2007). Reflex impairment of yellowtail flounder was examined by Barkley and Cadrin (2012), who also found a significant positive relationship between reflex impairment and mortality using a suite of seven reflexes (Table 1).

A study of the seasonal effects on sea scallop reproduction and energetics was supported by this project. Georges Bank supports the largest wild scallop fishery in the world (Caddy, 1989), yet little is known about spawning patterns in this region. Generally Georges Bank scallops are considered fall spawners. However, there have been several reports of semiannual spawning in this area (DiBacco et al., 1995; Almeida et al., 1994). Semiannual spawning would be an important distinction as current management is based on annual spawning (DiBacco et al., 1995) and semiannual spawning could alter yield per recruit estimates.

Scallops have a sequential skeletal deposition which provides a good medium for archiving environmental and physiological changes in growth. Oxygen isotopes are thermodynamically sensitive and the fractionation of $^{18}O/^{16}O$ ($\delta^{18}O$) is mediated by the reaction temperature (Tan et al., 1988; Krantz et al., 1984). Numerous studies have shown that the sequential $\delta^{18}O$ signature in bivalve shell carbonate fluctuates with water temperature (Goewert and Surge, 2008; Owen et al., 2002; Jones and Quitmyer, 1996; Tan et al., 1988; Krantz et al., 1984). In the summer, at warmer sea water temperatures fewer of the heavier ^{18}O isotopes are incorporated into the shell carbonate resulting in a “lighter or depleted” isotope value. In the winter, the opposite is true and more of the heavier isotope is deposited in the shell producing a “heavier or enriched” isotope signature. Thus, the $\delta^{18}O$ signature in scallop shells can provide an estimate of seasonal growth and age (Jones and Quitmyer, 1996; Krantz et al., 1984). As the carbonate $\delta^{18}O$ signature reflects the water temperature when the shell was deposited, the $\delta^{18}O$ value from the umbo can indicate if a scallop originated from a spring or fall spawning event.

Studies suggest that scallop meat weight fluctuates annually (Sarro and Stokesbury, 2009; Penney and McKenzie, 1996). Seasonal changes in meat weight and gonad weight are inversely related (Sarro and Stokesbury 2009), with energy reserves in the form of glycogen and lipids reallocated from the adductor muscle to the gonad during gametogenesis (Gould et al., 1988; MacDonald and Thompson, 1986; Robinson et al., 1981). The timing and the extent of this energy transfer is important for scallop growth and recruitment. Thus, seasonal glycogen levels may be an indicator of scallop condition and reproductive potential.

Sea scallop shell height and meat weight data were collected on all cruises during the course of the study. The purpose of these collections was to estimate area and time specific relationships in an effort to document the annual variation in scallop meat weight. These estimates will provide a relative measure of scallop yield and when comparing these findings to the relative abundance of major bycatch species, forms a baseline for an optimized harvest strategy.

Methods

The project consisted of fourteen research trips aboard commercial scallop vessels; each trip was approximately seven days in duration. Initially, the strategy was to cover 80 stations per trip; 40 in and around CAI (Figure 1) and 40 in and around CAII (Figure 2). As the project progressed we dropped stations that had no yellowtail or scallops, where the dredges loaded up with sand dollars, or where the bottom was too hard to tow successfully (rocks). We added stations that had scallops and yellowtail and thus more stations were fished in and around CAII as the project progressed. The bycatch data was analyzed in two groupings. The first data set was only stations that were successfully occupied on all 14 trips and were located inside the existing boundaries of CAI and CAII. This is referred to as the standardized selected stations in this report. The second grouping was all the data from all stations successfully occupied. In addition, when possible, we added data from the May 2012 and the June 2012 trips to certain tables and figures.

Each vessel was outfitted with a 15-foot wide Cfarm turtle deflector dredge (CFTDD) rigged with a standardized bag that was held constant throughout the project. The second dredge was provided by the vessel and was a New Bedford dredge rigged the way the vessel desired to fish the gear. The vessels were told to tow at 4.6-4.8 knots using 3:1 wire scope. The tows were 30 minutes in duration and the captain was instructed to pass through the center point of the station sometime during the tow. All tow parameters were recorded including start and end positions, depth, and sea conditions. Only the data from the standard Cfarm dredge was used in the bycatch rate analysis between trips. On each trip a relative comparison was made between the two gear types for catch and bycatch.

For each paired tow, the catch from each dredge was separated by species and individually counted. The entire scallop catch was recorded as bushels (bu=35.2 liters). A one bushel subsample of scallops from each dredge was picked at random from each tow. These subsamples were measured in 5 mm incremental groups to estimate the length frequency of the entire catch. This method allows for the determination of the size frequency of the entire catch by expanding the catch at each shell height by the fraction of total number of baskets sampled. All of the commercially important finfish species and barndoor skates were measured to the nearest centimeter and counts were taken of winter and little skates.

RAMP Discard Mortality

Reflex Action Mortality Predictors (RAMP) were tested as described in Barkley and Cadrin (2012) on every tow that yellowtail or winter flounder were captured, on a monthly basis for 11 months.

As the dredge came aboard the vessel, the catch was dumped on deck and sorted as would be done during a standard commercial trip. All yellowtail flounder that were tested were handpicked from the pile and placed in a tub of seawater. After the deck was sorted reflex testing began. Each fish was placed in a fish tote partially filled with seawater to minimize handling effects, followed by being tested for the seven reflexes (Barkley and Cadrin 2012; Table 1). Each reflex was determined to be either present, or absent and recorded as a 0 or 1, respectively, which combined creates the RAMP score (four of seven reflexes absent is expressed as 4/7 or a RAMP score of 0.57). Each mean RAMP score was then applied to the lab-based reflex impairment-mortality relationship to calculate an estimate of discard mortality, as well as lower and upper confidence intervals at ±1 standard deviation (Barkley and Cadrin 2012).

Maturity

Maturity data was collected monthly on all valid tows. All fish (if less than 10 fish) or a sub-sample of 10 fish per species were sampled using the NEFSC 6-stage maturity (Burnett et al., 1989). Sampling began in March 2011; this report is based on data through April 2012. The level of training on maturity staging of each scientific crew varied which may have led to some differences in staging over the months.

Seasonal Effects on Sea Scallop Reproduction and Energetics

Monthly samples were collected to examine seasonal effects on sea scallop reproduction and energetics on Georges Bank. Live scallops (n=30-50) in good condition and approximately 130 mm in shell height (SH) were collected from CA126 (backup station: CA133) and CA222 (backup station: CA223) during March 2011-March 2012 survey cruises and immediately frozen whole. A subset (n=10) of these samples was removed for glycogen analysis.

The remaining samples were thawed, shell height measured using digital calipers, and the gonad separated from the somatic tissue using a scalpel. The crystalline style, intestinal contents and foot were removed from the gonads prior to drying and included with viscera weight. Gonads were oven-dried for approximately 72 hours until reaching constant weight and dry gonad weight was recorded. Gonosomatic index (GSI) was calculated (GSI = [Gonad Weight/Total Tissue Weight]*100, Barber and Blake 2006). Spawning events will be identified by a significant decrease in GSI between months.

Samples collected for glycogen content are currently being processed. The shell height and reproductive condition is recorded and then the semi-frozen tissues are separated into adductor muscle, gonad, mantle gills and digestive gland. These tissues are freeze dried to a constant weight to obtain dry tissue weights. Adductor muscle and gonad tissues are then assayed for glycogen using the BioVision Glycogen Assay Kit and colorimetric (absorbance 570 nm) methods to evaluate seasonal energy partitioning. The results from these samples will be available in June 2012.

Gonad tissue samples (n = 15, 10 females + 5 males) were collected at each station and preserved in formalin for histological analysis from June 2011 – April 2012. Following the criteria of Naidu (1970), the slides are examined and the oocyte diameter measured in order to determine the reproductive stage. A significant difference in oocyte diameter between months will provide additional evidence of spawning.

Two temperature loggers (Minilog V3.09, Vemco) were deployed in steel sheaths welded to the dredges to measure depth and water temperature at the time of sample collection. Measurements were compared with Finite-Volume Coastal Ocean Model FVCOM (Chen et al., 2006) data to provide annual profiles of the bottom water temperature at these two stations. Harmonic regression will be performed to smooth the curves and a two-dimensional Kolmogorov-Smirnov statistical test will determine whether there is significant difference in bottom temperature between areas.

The top shell from the samples for energetic analysis and a subset of top shells from the meat weight component of the bycatch survey were processed for isotope analysis. These shells were scrubbed clean of any exterior organic debris, rinsed with distilled water and then air dried. Shell carbonate powder was collected using a Dremel® diamond head drill with a flexible arm attachment. The outer shell layer was micro drilled every 0.5-1.0 mm along and parallel to the axis of maximum growth from umbo to shell margin. A minimum of 100 micrograms were collected from each sample site on the shell. The carbonate powder was transferred to a micro centrifuge tube and the samples have been submitted to a laboratory for ^{18}O isotope analysis. The samples will be analyzed using Finnigan MAT 251 triple-collector gas source mass spectrometer coupled to a Finnigan Kiel automated preparation device. The isotope values will be reported in the conventional delta δ notation as the enrichment or depletion of ^{18}O (parts per thousand ‰) relative to the Peedee belemnite (PDB) carbonate standard (Peterson and Fry, 1987). The results are expected from the laboratory in June-July 2012.

The predicted water temperature during shell formation will be determined using the paleotemperature equation by Epstein et al. (1953) and modified by Craig (1965):

Equation 1:

$$\delta^{18}\mathrm{O}_{(\mathrm{calcite})} = \delta^{18}\mathrm{O}_{(\mathrm{water})} + \frac{4.2 - \sqrt{17.64 - 0.52(16.9 - T)}}{0.26}$$

where T= ambient temperature (°C).

This value will be correlated with the actual temperature from the FVCOM model providing an estimated date of shell formation for each calcite sample site.

Flounder Disease Study

Yellowtail Flounder collected from various locations in the sampling grid were noted to contain variable sized nodules in the liver parenchyma and on the serosal surfaces during the first sampling trip of the year. Therefore, samples of affected livers were collected in the following trips. Samples were placed in 10% neutral buffered formalin and processed in paraffin, using standard methods, when the boats returned.

Scallop shell height/meat weight relationship

A subset of roughly 30 stations (15 per area) within the study areas were randomly selected prior to the second survey cruise in March 2011. At each of these stations 12 scallops comprising a representative range of observed shell sizes were selected for analysis. The top shell of each animal was measured to the nearest millimeter and the animal was then carefully shucked. The meat was blotted dry, placed in a pint ZipLoc bag and then individually frozen. For each animal, station number, shell size, sex and reproductive stage was recorded. Upon return to port, each animal was weighed to the nearest 0.1 gram. In addition to the animal specific information recorded for each sample, associated tow specific information was linked to each sample. This information included depth, closed area and date of collection. For each cruise, the same stations were occupied on each survey cruise.

Sea scallop meat weight was predicted using a generalized linear mixed model (gamma distribution, log link). Scallop shell height, depth, sampling area (either CAI or CAII) and sampling time (month year) were used as explanatory variables. The mixed modeling approach used a true likelihood based estimation that has multiple advantages. Traditionally, data of this type have been analyzed by least squares regression of the linearized data (i.e. lnMW*lnSH). Some advantages of the mixed modeling approach are the ability to define the underlying distribution of the data. The distribution that was used in this analysis was the gamma distribution and is generally considered a more appropriate distribution for data of this type. This modeling approach also avoids the bias involved with back-transformations from log-linear models. In addition, random variation in the data can occur as a result of temporal and fine scale spatial variability in the process. Incorporating a random effect in the model accounts for this variability by evaluating the data at the station level and allows the intercept to be estimated for every time and station grouping. The station grouping variable consists of a unique code that included the year, month (temporal component) and station number (spatial component) from which the sample originated. This approach tends to capture and account for this variability more effectively relative to a model with only fixed effects. Akaike Information Criteria (AIC) was used to select the best model configuration. Statistical analyses were completed using PROC GLIMMIX on the SAS v. 9.2 System.

Gear Comparisons

The objective of these experiments was to determine if the two different scallop dredges performed differently and how those differences might affect catch rates and size selection of both scallops and the major finfish bycatch species. To examine the comparative data, we used a Generalized Linear Mixed Model (GLMM) to analyze the paired catch data and test for differences in both the pooled length catch data as well as test for differences in the length composition of the catch. Within this modeling framework, the random effects acknowledge the potential for differences that may have occurred at both the trip and individual tow levels. The GLMM groups all the data and gives an overall perspective on how the two gears compare over the entire experiment. Then, a Student t-test was used to compare the separate dredges on each individual trip.

The paired tow experiments were conducted within the context of a bycatch survey of the Georges Bank Closed Areas I and II covering a wide range of fishery conditions. This approach has the advantage of mirroring the actual biotic and abiotic conditions under which the dredge will operate. Multiple vessels and slight variations in gear handling and design were included in the experimental design and, while this variability exists, the GLMM modeling approach detailed in the next section accounts for the variability and allows for a more broad inference (relative to vessels) to be made. In contrast, the Student t-test approach is trip specific and therefore is not an appropriate methodology for comparing data from two or more different trips.

Statistical Models – GLMM

Scallop catch data from the paired tows provided the information to estimate differences in the fishing power of each vessel/gear combination tested and is based on the analytical approach in Cadigan et al. (2006). Assume that each vessel/gear combination tested in this experiment has a unique catchability. Let q_r equal the catchability of the CFTDD and q_f equal the catchability of the standard dredge used in the study. The efficiency of the CFTDD relative to the standard dredge will be equivalent to the ratio of the two catchabilities:

$$\rho_l = \frac{q_r}{q_f} \qquad (1)$$

The catchabilities of each gear are not measured directly. However, within the context of the paired design, assuming that spatial heterogeneity in scallop and fish density is minimized, observed differences in scallop catch for each vessel will reflect differences in the catchabilities of the vessel/gear combinations tested. Our analysis of the efficiency of the CFTDD relative to the standard dredge consisted of two levels of examination. The first analysis examined potential differences in the total catch per tow. Subsequent analyses investigated whether size (i.e. length) was a significant factor affecting relative efficiency. Each analysis assumes a hierarchy of random variation and nests tow by tow variation within trip level variation.

Let C_{iv} represent the scallop catch at station i by dredge v, where $v=r$ denotes the CFTDD and $v=f$ denotes the standard New Bedford style dredge. Let λ_{ir} represent the scallop/fish density for the i^{th} station by the CFTDD and λ_{if} the scallop/fish density encountered by the standard dredge. We assume that due to random, small scale variability in animal density as well as the vagaries of gear performance at tow i, the densities encountered by the two gears may vary as a result of small-scale spatial heterogeneity as reflected by the relationship between scallop patch size and coverage by a paired tow. The probability that a scallop is captured during a standardized tow is given as q_r and q_f. These probabilities can be different for each vessel, but are expected to be constant across stations. Assuming that capture is a Poisson process with mean equal to variance, then the expected catch by the CFTDD is given by:

$$E(C_{if}) = q_f \lambda_{if} = \mu_i \qquad (2)$$

The catch by the standard dredge is also a Poisson random variable with:

$$E(C_{ir}) = q_r \lambda_{ir} = \rho \mu_i \exp(\delta_i) \qquad (3)$$

where δ_i =log ($\lambda_{ir}/ \lambda_{if}$). For each station, if the standardized density of scallops encountered by both vessels is the same, then δ_i=0.

If the dredges encounter the same scallop density for a given tow, (i.e. $\lambda_{ir}= \lambda_{if}$), then ρ can be estimated via a Poisson generalized linear model (GLM). This approach, however, can be complicated especially if there are large numbers of stations and scallop lengths (Cadigan et al., 2006). The preferred approach is to use the conditional distribution of the catch by the CFTDD at station i, given the total non-zero catch of both vessels at that station. Let c_i represent the observed value of the total catch. The conditional distribution of C_{ir} given $C_i=c_i$ is binomial with:

$$\Pr\left(C_{ic} = x \middle| C_i = c_i\right) = \binom{c_i}{x} p^x (1-p)^{r_i - x} \qquad (4)$$

where $p=\rho/(1+\rho)$ is the probability that a scallop taken in the survey is captured by the CFTDD. In this approach, the only unknown parameter is ρ and the requirement to estimate μ for each station is eliminated as would be required in the direct GLM approach (equations 2 & 3). For the binomial distribution $E(C_{ir})=c_i p$ and $Var(C_i r)=c_i p/(1-p)$. Therefore:

$$\log\left(\frac{p}{1-p}\right) = \log(\rho) = \beta \qquad (5)$$

The model in equation 5, however, does not account for spatial heterogeneity in the densities encountered by the two gears for a given tow. If such heterogeneity does exist then the model becomes:

$$\log\left(\frac{p}{1-p}\right) = \beta + \delta_i \qquad (6)$$

where δ_i is a random effect assumed to be normally distributed with a mean=0 and variance=σ^2. This model is the formulation used to estimate the gear effect $exp(\beta_0)$ when scallop catch per tow is pooled over lengths.

Often, modifications can result in changes to the length based relative efficiency of the two gears. In those instances, the potential exists for the catchability of scallops at length (l) to vary. Models to describe length effects are extensions of the models in the previous section to describe the total scallop catch per tow. Again, assuming that between-pair differences in standardized scallop density exist, a binomial logistic regression GLMM for a range of length groups would be:

$$\log\left(\frac{p_i}{1-p_i}\right) = \beta_0 + \delta_i + \beta_1 l, \delta_i \sim N(0,\sigma^2), i = 1,\ldots,n. \qquad (7)$$

In this model, the intercept (β_0) is allowed to vary randomly with respect to cruise/station. The potential exists, however, that there will be variability in both the number as well as the length distributions of scallops encountered within a tow pair. In this situation, a random effects model that again allows the intercept to vary randomly between tows is appropriate (Cadigan and Dowden 2009). This model is given below:

$$\log\left(\frac{p_i}{1-p_i}\right) = \beta_0 + \delta_{i0} + \beta_1 * l, \delta_{ij} \sim N(0,\sigma_j^2), i = 1,\ldots,n,\ j = 0,1. \qquad (8)$$

Adjustments for sub-sampling of the catch

Additional adjustments to the models were required to account for sub-sampling of the catch. In most instances, due to high volume, catches for particular tows were sub-sampled. This is accomplished by randomly selecting a one bushel sample for length frequency analysis. One approach to accounting for this practice is to use the expanded catches. For example, if half of the total catch was measured for length frequency, multiplying the observed catch by two would result in an estimate of the total catch at length for the tow. This approach would overinflate the sample size resulting in an underestimate of the variance, increasing the chances of spurious statistical inference (Holst and Revill, 2009; Millar et al., 2004). In our experiment, the proportion sub-sampled was not consistent between tows as only a one bushel sub-sample was taken regardless of catch size. This difference must be accounted for in the analysis to ensure that common units of effort are compared.

Let q_{ir} equal the sub-sampling fraction at station *i* for the vessel *r*. This adjustment results in a modification to the logistic regression model:

$$\log\left(\frac{p_i}{1+p_i}\right) = \beta_0 + \delta_{i0} + (\beta_1 + \delta_{i1})l_i + \log\left(\frac{q_{ir}}{q_{if}}\right), \delta_{ij} \sim N(0, \sigma_j^2), i = 1,...,n, \; j = 0,1. \quad (9)$$

The last term in the model represents an offset in the logistic regression (Littell et al., 2006). We used SAS/STAT® PROC GLIMMIX to fit the generalized linear mixed effects models.

Statistical approach – Student T-Test

Paired student t-tests were used for trip by trip comparisons to test for significance between the experimental and control dredges in terms of catch of scallops and ten other species. Significance was evaluated as a difference from zero. The methodology of towing two dredges simultaneously provided for the assumptions necessary to analyze the data using a paired t-test. Zar (1984) states, "the paired-sample t-test does not have the normality and equality of variances assumptions of the two sample t-test, but assumes only that the differences (d(t)) come from a normally distributed population of differences.... Whenever the paired-sample t-test is applicable, the Wilcoxon paired-sample test is also applicable. If, however, the d(t) values are from a normal distribution, then the latter (Wilcoxon) has only a 95% of detecting differences as the former (paired t-test)." Although Zar seems to suggest the paired student t-test as the better test, there is not universal agreement on this issue. Because of this, we also evaluated comparisons using the non-parametric Wilcoxon matched pairs test and found that the results were consistent with those provided by the paired Student t-tests. Catch ratios for each dredge were calculated in order to compare the total count of each bycatch species per sampled scallop bushel.

Results

RAMP discard mortality

Yellowtail flounder

The monthly estimates of RAMP score for the scallop fleet indicate that the estimated discard mortality rates range from 64% to 90%. There were three months that varied from relatively stable estimates of discard mortality, which were June 2011, July 2011, and January 2012. These months were excluded from the analyses because limited or no training of the scientific crew took place prior to the beginning of the trips. The remaining trips had a scientific crew that was trained prior to leaving on the trip or had previously performed RAMP sampling. The time series of discard mortality estimates and confidence intervals excluding January, June and July shows a fairly stable estimate of discard mortality near 85% (Table 2).

Winter Flounder

During the scallop dredge field trials, reflex actions were tested on 586 fish, with an average RAMP score of 0.47. The months that were eliminated from the yellowtail flounder results were also removed for winter flounder, due to limited RAMP training of the crew prior to departing on the trip. Excluding those three months (June 2011, July 2011, and January 2012) the mean RAMP score was 0.57 which correlated to a discard mortality estimate of 36%, with lower and upper confidence intervals of 16% and 60% (Table 3).

Maturity

Yellowtail Flounder

In total, 4738 yellowtail flounder were measured and staged for maturity with 3326 females and 1412 males. The mean size of all females sampled was 38.4cm and 34.4cm for male yellowtail flounder (Table 4). The maturity of yellowtail indicated a spawning event in the spring peaking around May/June 2011, followed by yellowtail flounder resting until around January when they began to develop for the next spawning season (Figures 3-15).

Winter Flounder

The winter flounder sample size was 1349 fish measured and staged for maturity split between 857 females and 492 males. The mean size of all females sampled was 43.2cm and 39.4cm for male winter flounder (Table 5). Winter flounder peak spawning seemed to be around February and March, with most fish visibly spent or resting beginning in August and then starting to develop in November and December (Tables 6-9).

Seasonal Effects on Sea Scallop Reproduction and Energetics

Semiannual spawning occurred both at Station 126 and Station 222 on Georges Bank in 2011, since there were both spring and autumn spawning events (Figure 16). At both stations, scallops were ripe in April 2011 and spring spawning occurred in late April and May, reaching minimum GSI in June (Figure 16). There was a significant difference ($p < 0.05$) when GSI was tested with Welsh's two-sample t-test between April-May and May-June in both areas.

Gonads recovered in late June-July, reaching maximum ripeness in August at 126, and in September at 222 (Figure 16). Fall spawning took place from September through November (Figure 16). There was a significant difference ($p < 0.05$) in monthly GSI from August through November at 126, representing a protracted spawning period. In 222 there was a significant difference in monthly GSI from September through November, suggesting delayed spawning initiation compared with 126. In November, GSI was lowest for both areas during the reproductive resting period (Figure 16). GSI increased from January-March 2012, potentially indicating preparation for spring spawning in 2012 (Figure 16).

Examination of June slides confirms that spring spawning occurred in 2011. Vacancies in the center of follicles indicate gamete release (Figure 17).

Results from the temperature loggers suggest that bottom temperature patterns are different between areas from July-October (Figure 18). Different bottom temperature patterns at Station 126 and Station 222 represent differing physical oceanographical conditions, which could explain the disparity in fecundity between areas. Depth at 126 and 222 only differs by approximately 15 m, however varying oceanographical dynamics could result in much lower food availability at 222 than at 126.

Flounder Disease Study

Yellowtail Flounder collected from various locations in the sampling grid were noted to contain variable sized nodules in the liver parenchyma and on the serosal surfaces. Grossly, small, white/tan nodules of 3-5 mm in diameter were noted in the formalin fixed samples of liver tissue. Histological sections (6µm thick) were stained with hematoxylin and eosin and were evaluated by Dr. Smolowitz. Histologically, the nodules seen grossly consisted primarily of granulomas containing *Ichthyophonus* sp. organisms, most likely *I. irregularis* (Rand et al., 2000). Most organisms appeared to be contained within the granulomas, however, occasionally the infected organisms showed early extension from the granulomas into the surrounding hepatic parenchyma. In addition to *Ichthyophonus* sp. organisms, some of the hepatic serosal granulomas contained ascarids consistent with *Anasarcis* sp. nematodes.

Scallop shell height/meat weight relationship

Over 13 cruises from March 2011 through April 2012, a total of 4,359 scallops were sampled at 374 unique stations. Scallop shell heights ranged from 82 mm to 176 mm and meat weights varied from 5 g to 121 g. For CAI depths ranged from 43.9 m to 91.4 m with a mean depth of 65.1 m. Depths in CAII ranged from 54.9 m to 95.1 m with a mean depth of 73.0 m. Log transformed shell height and meat weight data is shown in Figure 19.

Candidate models were evaluated and the model that produced the lowest AIC value was chosen as the model that best fit the data. Combinations of explanatory variables that were evaluated and resulting AIC values are shown in Table 10. The selected model is shown below:

$$MW = e^{(\beta_0+\delta+\beta_1 \ln(SH)+\beta_2 \ln(D)+\beta_3 (A)+\beta_4 (MY)+\beta_5 \ln(SH)*\ln(D)+\epsilon)}$$

Where δ is the random effect term (intercept), MW is scallop meat weight in grams, SH is shell height in millimeters, D is depth in meters, A is area (CAI or CAII) and MY is the month and year when the sample was taken and an interaction term between shell height and depth. Based on an examination of residuals and QQ plot (Figure 20) model fit appears to be reasonable. A few outliers appear that consist of both heavier and lighter than expected meats. These observations could represent natural anomalies such as a diseased or senescent animal or simply an extraordinarily robust animal. While every effort was made to verify the quality of the data, some measurement error could exist in the data set. Regardless, the outliers were few and had minimal impact on parameter estimates.

Parameter estimates, shown in Table 11 were reasonably precise and predicted increasing meat weight as a function of increased shell height and decreasing depth. Parameter estimates by area and month are shown in Table 12-13 with a comparison to estimates for Georges Bank in general and the specific closed area. Meat weights were always higher in Closed Area I relative to Closed Area II and the temporal trend indicated that meat weights were elevated through their peak from May – July and decreased to a trough from August – February. Temporal trends of a modeled 125 mm scallop for the two areas are shown in Figure 21. Comparisons with the estimated meats weights from the subarea specific NEFSC (2010) document are shown in Figures 22-23. The data for the NEFSC estimates generally comes from the June and July time frame, so that is an appropriate time to compare results.

Spatially and temporally explicit fishery independent length weight information tends to be difficult to obtain on the scale that was collected by this study. These results document trends between the two areas on a monthly basis, demonstrating the differences between the two areas and can be used in combination with the bycatch data included in this study to formulate a strategy to optimize the harvest of sea scallops in the Georges Bank Closed Areas.

Bycatch Rates

The bycatch rate was determined for each month (trip) by dividing the weight (lbs) of the bycatch species by the meat weight of the scallop catch from the Cfarm turtle deflector dredge tows. The fish weight was derived from tables (NOAA, 2003) using 3cm increments and the scallop meat weight was from the actual sampling by trip using 5 mm increments (Tables 14 &

15; Figs. 24 & 25). All bycatch rates shown are for the 41 selected stations that were sampled on all trips inside of the CAI and CAII scallop access area boundary lines.

Yellowtail flounder was found in higher abundance in CAII than in CAI. In CAII the largest numbers and pounds of yellowtail were found in the August thru October period (Tables 16 &17; Figs. 26 & 27). The highest bycatch rate in CAII was in October 2011 (Fig. 28).

Windowpane flounder abundance differs between the two study areas. In CAI there was a high catch in October 2010 and again in January 2012 (122 and 114 fish respectively). In CAII the highest numbers of windowpane occur in February-April and all but vanish during the summer months. However, in CAI there is a presence throughout the summer but lower numbers in the February through May period (Table 18; Figs. 29-31).

Winter flounder were most abundant in CAI. The two months with the highest abundance in CAI were July 2011 (71 fish) and December 2011 (70 fish). Winter flounder seemed to be present most of the year in CAI with the exception of the February through April period. The two highest months in CAII were August 2011 (10 fish) and October 2011 (16 fish) (Figs. 32 & 33). The highest bycatch rates in CAI were in December (0.1221), and in October in CAII (0.0228) (Table 19; Fig. 34).

Monkfish were more abundant in CAII (548 fish) than in CAI (243 fish) (Table 20). CAI catches were lowest in the February thru April period and highest during June and July. The bycatch rate peaked in December (0.13856). In CAII the lowest catch rates were also in the February through April period and high catch rates ran from July until October; the highest bycatch rate being October 2011 (0.28653) (Figs. 35-37).

Summer flounder were caught in limited numbers in CAI (62 fish) and CAII (111 fish) (Table 21). In CAI they were present from May to October and in CAII the best catches were October thru February (Figs. 38 & 39). The highest bycatch rates in CAI was September (0.0334) and CAII in January (0.0621). The lowest bycatch rates in both areas were in the February thru April period (Fig. 40).

Little and winter skate seem to be in both areas in high numbers. There is some evidence that the skate catch may be less over the winter months in CAI (Figs. 41 & 42).

Distribution

The bycatch rates presented above reflect the average for each trip by area. The data was further analyzed for yellowtail flounder to determine the distribution of the bycatch rates within each area by station (Figures 43-46). This analysis provides the mean bycatch rate for yellowtail flounder for each trip and is also grouped by month. A series of maps of the number of scallops and the number of bycatch by species for each trip is provided in Appendix A.

Scallop distribution over the study period was affected by weather (catchability), scallop growth, and the fishery opening in August 2011. Yellowtail flounder distribution in CAII was scattered over the selected stations but there was a clear increase in bycatch in August 2011 through October 2011; high bycatch also occurred in October 2010 at the start of the study period. Windowpane flounder were abundant and widely distributed in CAII from January through April; then the numbers were very low through the end of the year. In CAII winter flounder catches were low and scattered but seemed to increase at a pair of stations in August and more so in October. Summer flounder distribution shifts throughout the year in each area, with catch low or nonexistent in CAI from January to April, and highest catches in CAI from June to October. The highest catches for both areas combined occurs from October to December, with most of the catch coming from CAII. Monkfish are present throughout the year but the lowest numbers were seen in February to April. In addition, monkfish appear to be in CAI in June to August, then move to CAII from September to January. Barndoor skate catches increased in June to October, with more skates caught in CAI than CAII in October. Winter and little skates are found in both areas consistently throughout the year. All of the figures for the above species can be found in Appendix A.

Gear Observations

We had the opportunity to compare eleven different New Bedford style dredges against a standardized Cfarm turtle deflector dredge (CFTDD) (Table 22). There were many variations between the New Bedford dredges but we attempted to hold towing parameters relatively constant between trips. The catch data for each trip (Table 23) is for all stations occupied during those trips where the tows were considered good. Overall it seems that the CFTDD may catch more scallops and less fish.

The turtle dredge, which was compared to the New Bedford dredge on each trip, had a twine top that was 60 meshes across. To further refine the analysis we grouped the comparisons based on twine top widths: vessel with greater than 60 meshes (Table 24) and vessels with less than 60 meshes (Table 25). The F/V Celtic had a 60 mesh twine top so we dropped that vessel from the comparison. From this analysis on trips with hanging ratios greater than 2:1 (greater than 60 meshes) we found that the CFTDD caught more scallops and less flatfish. On trips where the New Bedford dredge had a hanging ratio less than (2:1) the New Bedford dredge out-performed the CFTDD on flatfish reduction, though the latter still led in scallops.

In examining the bycatch rate of yellowtail (Table 26) on all trips regardless of hanging ratio we did not find a significant difference between dredge types. When the data was grouped by twine top hanging ratio (Table 27) for the selected stations there were lower flatfish bycatch rates with the lower hanging ratios.

Another key aspect of the dredge design that we examined was the height of the apron (Table 28). The vessels that had long aprons (10-13 rings) had much higher bycatch ratios than those with 7-8 ring aprons for selected stations.

GLMM Dredge Performance Comparisons

The performance of the two dredge frame designs (a standardized CFTDD and multiple New Bedford style dredges) were compared via an examination of the overall catch rates and catch at length of sea scallops and finfish bycatch species encountered during the course of the 14 survey cruises. In addition, we examined the effect of area (CAI and CAII) as well as cruise level effects on the relative performance of the two frame types. It is very important for the reader to remember that the bags on the New Bedford dredge frames varied considerably and heavily influence the results presented in this section of the report. We used an iterative model building strategy to identify the most appropriate model for the data. Akaike Information Criteria (AIC) was used to select the model that provided the best fit to the data and for a given species, the parameter estimates for that model fit was reported.

Pooled data

The first level of examination of relative catch rates used the scaled catch data for each species. This data was examined with generalized linear mixed models (GLMM) and can generally be interpreted as analysis to determine whether differences existed in the overall catch rates of the two gears. In addition, covariates specifying area and cruise were added to the model in an effort to better predict the proportion of the total catch attributed to the CFTDD. Interpretation of results which are output from the model on the logit scale can be converted to the probability scale. Exponentiation of parameter estimates to provide a measure of the relative efficiency of the two gears.

Parameter estimates by species for models that best fit the catch data are shown in Tables 29-39. Scatter plots showing the raw catch data as well as the estimated relative efficiency value are shown in figures 47-62. These figure use model output from the intercept only model to portray the estimated relative efficiency model. While not always the best fit to the data, this model provided a means to capture the signal for the entire data set and portray the results for a single species in one graphic. While this model generally performed well in many cases a strong cruise effect was present, probably related to the variations in bag design on the NB dredges. For most cases there was little evidence to support differences in dredge performance as a function of area (i.e. the relative performance of the dredges was the same in the two areas fished). Visual examination of the scatterplots as well as model output indicates that the CFTDD performed differentially with respect to species. For example, the CFTDD was more efficient with respect to scallop catch and yellowtail flounder and less efficient in a relative sense for winter flounder, fourspot flounder, windowpane flounder and barndoor skate. There appeared to be no clear patterns, however with general trends for being more efficient in the capture of the skate complex and less efficient in the capture of flatfish. As shown earlier, some of the NB dredges had lower twine top hanging ratios which can impact these results significantly.

Unpooled data

The second level of examination attempted to analyze the catch at length data to assess whether the two dredge configurations captured animals of similar length frequencies. Parameter estimates by species for models that best fit the catch data are shown in Tables 40-46. Plots that overlaid the observed length frequencies, observed proportion retained in the CFTDD and the predicted proportion from the model output are shown in Figures 63-73. Again these figures used the output from the model that only included animal length to portray differences in the length based composition of the two dredges. In many cases the effect of cruise was significant while area was not. This suggests that the performance of the dredges on individual cruises was different enough to result in statistical significance for some of the species (scallops, barndoor skates and some flatfish).

With the exception of scallops, yellowtail flounder and winter flounder, the two dredges captured animals with statistically similar length frequency distributions. This might be expected as differences in the catches would be manifested as reductions or gains in overall catch rather than changes in the size selectivity of the gear. Dredge bag components and rigging generally dictate the size selectivity characteristics of the gear for scallops and flatfish. However, it is possible that the frame itself may possess an attribute that could reduce the probability of capture for a size class of animal. For example, the CFTDD appears to more efficient overall relative to the standard dredge with respect to sea scallops. The CFTDD was shown to be significantly more efficient on smaller animals and that relative efficiency decreases as a function of increasing scallop size. This trend is similar for all instances where length was a significant factor.

Overall, the analysis of the relative performance of the CFTDD and NB style dredges demonstrated two gears that fished fairly equally, with a couple of important distinctions. First, with respect to scallop catch, the CFTDD captured more scallops; however the length composition of the catch appeared to contain a larger proportion of smaller scallops. Secondly, with respect to flatfish that represents a major consideration for current bycatch reduction efforts. Results for the CFTDD were a bit mixed with some success in the reduction some species but not others. From a conservation engineering standpoint, reducing the scallop fisheries impact on the flatfish complex represents a major focal point for future efforts.

Discussion

RAMP discard mortality

Yellowtail flounder

The results from the scallop vessels exhibit the ability to collect reflex impairment data in the field to obtain discard mortality estimates. The discard mortality estimates varied and there was a lack of training on three of the trips (June 2011, July 2011, and January 2012). We propose that these 3 months be excluded from the analysis. This set of data indicated stable and consistent results and covered all seasons (winter, spring, summer and fall). The estimate of discard mortality from the scallop dredge vessels using all data excluding January, June and July is 85% with lower and upper confidence intervals ranging from 72%-93%. Based on the RAMP results and the possibility for additional sources of mortality not accounted for by the RAMP method, the group agreed to assume a discard mortality of 90% for the southern New England/Mid Atlantic yellowtail flounder stock assessment.

Winter Flounder

Our estimate of discard mortality for winter flounder in the scallop fishery (36%) is lower than the currently assumed 50% for all commercial fishing. The accepted value of 50% falls within our confidence interval range, indicating that the 50% used in the stock assessments may not be an overestimate for the scallop fleet. Although the basis of the 50% discard mortality assumption is not well documented, it appears to be an approximation based on an estimate of discard mortality of yellowtail flounder off Canada (Mark Gibson, *Pers. Comm.).* Our results show that the currently accepted value used in the winter flounder stock assessments may be an accurate representation of the true discard mortality rate for the scallop industry.

Maturity

Yellowtail flounder

The results of the maturity staging for yellowtail flounder on Georges Bank indicate that peak spawning is around May/June, followed by resting until January when they begin to develop for spawning the following spring. This is relatively consistent with the spawning period indicated by Collette and Klein-MacPhee (2002), who indicate peak spawning on Georges Bank and SNEMA occurs during April/May. Our results may indicate that spawning on GB occurs about a month later then Collette and Klein-MacPhee (2002), peaking in May/June as compared to April/May.

Winter Flounder

The maturity staging results suggest that winter flounder spawning on Georges Bank peaks around February and March, with development starting in November. These results are similar to those reported by Collette and Klein-MacPhee (2002), which indicates spawning time differs as you travel north along the coast but still occurs between December and March. The sample sizes of winter flounder from this study are quite low, but were determined based on the total number of winter flounder caught on each tow.

Seasonal Effects on Sea Scallop Reproduction and Energetics

Although Georges Bank scallops are known to spawn in the fall, this research has shown that semiannual spawning does occur in this area. If spring spawning is a Bank-wide event, optimum CPUE would be attained by avoiding spawning events and maximizing fishing effort when meat yield is highest.

When managing a commercial fishery, it is essential to consider both the natural and anthropogenic impacts on the life history of the species. Understanding the effects of temperature on scallop growth and fecundity can help evaluate how seasonal temperature fluctuations and interannual variability may influence the status of the resource. Although temperature differences between CAI and CAII are expected, warmer temperatures and a well-mixed water column at Station 126 may result in greater productivity than at Station 222. Variable food availability may explain the observed differences in GSI between these locations and further investigation is recommended.

Flounder Disease Study

Some yellowtail flounder were found to be infected with granulomas containing *Ichthyophonus* sp. Organisms. *I. irregularis* was identified in 2000 as a species found only in yellowtail flounder from Nova Scotia, Canada using ssu-rDNA sequences in PCR methods. Co-infections with *I. hoferi* were not identified in this study. *I. hoferi* is responsible for significant disease in some species of fish, such a herring, but is quiescent in others that are mostly top of the food chain predators. In species of fish significantly affected by disease due to the *I. hoferi*, the disease usually occurs annually during stressful certain times of year. Disease results when the infectious organisms “escape” from the granulomas and extend fungal-like elements throughout infected tissues and infected organs are destroyed. The rest of the year, *I. hoferi*, remains in quiescent granulomas in the tissues of infected animals. *I. hoferi* does infect multiple host species and can be directly passed from one fish to the next. *I. irregularis*, however, is thought to be specific for yellowtail flounder. The ability of *I. irregularis* or *I. hoferi* to cause disease in wild yellowtail flounder is not known. For the 2012 RSA Bycatch Survey, we will sample yellowtail flounder for the disease to determine the area of incidence as well as the effects on the population.

Scallop and Bycatch species distribution

The data collected during the 14 trips included in this project analysis showed that the highest number of yellowtail flounder are caught on Georges Bank (primarily in CAII) during August through October, with the highest bycatch rate occurring in October. Since the GB scallop fishery is affected by yellowtail flounder bycatch amounts, understanding the changes in distribution of this species as well as other potentially important commercial species can inform managers to implement closures that are appropriate for both the harvested species as well as commercial fishers. This data is being considered in changes to Framework 24 to increase scallop meat yield while decreasing bycatch.

Because of the large scope of this project, there is additional funding to continue the survey in 2012, with some modifications implemented to increase sampling standardization and decrease inconsistencies from trip to trip.

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Tables and Figures

Table 1. Reflexes monitored for yellowtail flounder.

Reflex	Description
Resistance	Resistance to being restrained
Mouth	Resistance to the forced opening of the mouth
Operculum	Resistance to the forced opening of the operculum
Gag	Response to insertion of probe into the throat
Fin control	Response to a brushing stimulus on the fins
Natural righting	Attempts to dorso-ventrally right itself within 5 seconds
Evade	Attempts to actively swim away after reflex testing

Table 2. Mean RAMP score and discard mortality estimates for yellowtail flounder including upper and lower confidence intervals for the scallop dredge fleet. Lower and Upper CI indicate confidence intervals and Exc. Total is excluding January, June and July.

Month	n	RAMP	Mortality	Lower CI	Upper CI
January	170	0.43	66%	50%	78%
February	130	0.62	85%	72%	92%
March	149	0.69	90%	77%	96%
April	154	0.65	88%	75%	94%
May	168	0.57	82%	68%	91%
June	160	0.45	68%	52%	80%
July	188	0.42	64%	48%	77%
August	163	0.65	88%	75%	94%
September	192	0.61	85%	72%	92%
October	188	0.54	78%	64%	88%
Nov./Dec.	116	0.64	87%	74%	94%
Total	1778	0.53	81%	67%	89%
Exc. Total	1260	0.62	85%	72%	93%

Table 3. Mean RAMP score and discard mortality estimates for winter flounder including upper and lower confidence intervals for the scallop dredge fleet. Lower and Upper CI indicate confidence intervals and Exc. Total is excluding January, June and July.

Winter Flounder Discard Mortality Estimates					
Month	n	Average RAMP	Discard Mortality	Lower CI	Upper CI
1	42	0.27	2%	0%	15%
2	20	0.44	12%	4%	34%
3	25	0.61	48%	26%	69%
4	22	0.60	45%	24%	66%
5	37	0.47	17%	7%	39%
6	47	0.40	9%	2%	28%
7	92	0.30	3%	1%	16%
8	73	0.59	42%	22%	65%
9	72	0.53	29%	14%	51%
10	77	0.49	22%	10%	44%
12	79	0.57	36%	17%	60%
Total	586	0.47	17%	7%	39%
Exc. Total	405	0.57	36%	17%	60%

Table 4. Maturity results for yellowtail flounder including sample size and mean size for each month of the survey and totals for sample size and grand mean for each sex.

Yellowtail Flounder					
	Month	Female n	Female Mean	Male n	Male Mean
2011	3	205	38.6	101	33.7
	4	253	38.7	94	33.9
	5	209	37.6	153	35.5
	6	203	37.3	139	36.1
	7	309	37.6	77	33.6
	8	282	38.3	118	33.7
	9	294	38.5	122	34.1
	10	346	38.8	85	33.9
	11	30	38.9	5	33.4
	12	232	39.0	95	34.7
2012	1	263	38.6	114	34.5
	2	164	39.0	77	34.9
	3	175	38.6	120	34.4
	4	361	38.4	112	33.8
	Total	3326	38.4	1412	34.4

Table 5. Maturity results for winter flounder including sample size and mean size for each month of the survey and totals for sample size and grand mean for each sex.

Winter Flounder					
	Month	Female n	Female Mean	Male n	Male Mean
2011	3	28	40.8	18	38.9
	4	34	40.8	15	38.5
	5	3	46.3	73	40.0
	6	48	41.6	40	42.1
	7	113	43.9	65	40.0
	8	118	43.2	53	37.6
	9	110	44.1	49	39.5
	10	120	43.7	47	38.0
	11	87	43.7	17	37.8
	12	68	46.6	29	41.6
2012	1	71	40.0	45	38.6
	2	12	43.9	15	38.4
	3	18	41.8	22	38.3
	4	27	41.1	4	38.8
	Total	857	43.2	492	39.4

Table 6. Maturity staging results for female winter flounder in closed area I including sample size and number at each stage for each month of the survey and totals for sample size. D- denotes developing, I-immature, R-ripe, S- spent, T-resting, U-ripe and running.

Closed Area I		Stages						
	Month	D	I	R	S	T	U	Total
2011	3	17	0	0	0	0	0	17
	4	7	2	2	0	12	0	23
	5	2	0	1	0	0	0	3
	6	41	0	0	5	0	1	47
	7	5	0	0	68	40	0	113
	8	0	0	0	33	67	0	100
	9	0	0	0	30	63	0	93
	10	0	0	0	0	96	0	96
	11	87	0	0	0	0	0	87
	12	56	0	0	0	0	0	56
2012	1	47	7	7	0	0	0	61
	2	5	0	3	0	0	0	8
	3	1	2	11	1	0	0	15
	4	0	0	1	13	0	1	15
	Totals	268	11	25	150	278	2	734

Table 7. Maturity staging results for male winter flounder in closed area I including sample size and number at each stage for each month of the survey and totals for sample size. D- denotes developing, I-immature, R-ripe, S- spent, T-resting, U-ripe and running.

Closed Area I		Stages						
	Month	D	I	R	S	T	U	Total
2011	3	3	0	6	0	0	0	9
	4	0	1	0	0	4	3	8
	5	23	0	3	42	0	0	68
	6	20	0	1	16	0	0	37
	7	0	2	0	33	29	0	64
	8	0	1	0	42	0	0	43
	9	0	0	0	0	41	0	41
	10	0	0	0	1	39	0	40
	11	8	1	0	0	8	0	17
	12	20	0	1	0	0	0	21
2012	1	10	1	23	0	0	2	36
	2	0	0	13	0	0	0	13
	3	0	1	4	0	0	12	17
	4	0	0	0	0	0	3	3
Totals		84	7	51	134	121	20	417

Table 8. Maturity staging results for female winter flounder in closed area II including sample size and number at each stage for each month of the survey and totals for sample size. D- denotes developing, I-immature, R-ripe, S- spent, T-resting, U-ripe and running.

Closed Area II		Stages						
	Month	D	I	R	S	T	U	Total
2011	3	11	0	0	0	0	0	11
	4	2	0	0	0	9	0	11
	5	0	0	0	0	0	0	0
	6	0	0	1	0	0	0	1
	7	0	0	0	0	0	0	0
	8	0	0	0	5	13	0	18
	9	0	0	0	3	14	0	17
	10	0	0	0	0	24	0	24
	11	0	0	0	0	0	0	0
	12	12	0	0	0	0	0	12
2012	1	5	0	5	0	0	0	10
	2	2	0	2	0	0	0	4
	3	0	0	3	0	0	0	3
	4	0	0	0	11	0	1	12
	Totals	32	0	11	19	60	1	123

Table 9. Maturity staging results for male winter flounder in closed area II including sample size and number at each stage for each month of the survey and totals for sample size. D- denotes developing, I-immature, R-ripe, S- spent, T-resting, U-ripe and running.

Closed Area II		Stages						
	Month	D	I	R	S	T	U	Total
2011	3	1	0	8	0	0	0	9
	4	0	0	1	0	0	6	7
	5	1	0	1	3	0	0	5
	6	1	0	0	2	0	0	3
	7	0	1	0	0	0	0	1
	8	0	0	0	9	1	0	10
	9	0	0	0	0	8	0	8
	10	0	0	0	1	6	0	7
	11	0	0	0	0	0	0	0
	12	8	0	0	0	0	0	8
2012	1	0	0	8	0	0	1	9
	2	0	0	2	0	0	0	2
	3	0	0	1	0	0	4	5
	4	0	0	0	0	0	1	1
	Totals	11	1	21	15	15	12	75

Table 10: Results from iterative model building. Model with the minimum AIC value is shown in bold. Fixed effects are shown to the right of the ~ symbol. This symbol separates the response (Meat Weight) from the predictor variables used in the analysis. Interaction terms are denoted with the factor1*factor2 nomenclature. For the models that included a random effect, this effect was always evaluated at the station level. The best model was also evaluated without a random effect to assess the impact of including a random effect in the model.

Fixed Effects	**Random Effect**	**AIC**	**BIC**	**-2 Log Likelihood**
Meat Weight~Shell Height, Depth, Area, Month_Year, Shell Height*Depth	***Intercept***	***28750***	***28836***	***-28712***
Meat Weight~Shell Height, Depth, Area, Month_Year	Intercept	28768	28849	-28732
Meat Weight~Shell Height, Month_Year	Intercept	28847	28919	-28815
Meat Weight~Shell Height, Depth, Area, Shell Height*Depth	Intercept	28994	29025	-28980
Meat Weight~Shell Height, Depth, Shell Height*Depth	Intercept	29005	29032	-28993
Meat Weight~Shell Height, Depth, Area	Intercept	29028	29056	-29016
Meat Weight~Shell Height, Area	Intercept	29041	29064	-29031
Meat Weight~Shell Height, Depth	Intercept	29042	29065	-29032
Meat Weight~Shell Height	Intercept	29068	29086	-29060
Meat Weight~Shell Height, Depth, Area, Month_Year, Shell Height*Depth	None	29485	29600	-29449
Meat Weight~Depth, Area, Month_Year	Intercept	33583	33660	-33549
Meat Weight~Depth, Month_Year	Intercept	33588	33661	-33556
Meat Weight~Area, Month_Year	Intercept	33593	33665	-33561
Meat Weight~Month_Year	Intercept	33606	33674	-33576
Meat Weight~Depth, Area	Intercept	33637	33660	-33627
Meat Weight~Depth	Intercept	33641	33659	-33633
Meat Weight~Area	Intercept	33647	33665	-33639

Table 11: Parameter estimates for the best model as described by minimum AIC value. For the categorical variables (Area, Month Year), differences within that category are relative to the value with a 0 parameter estimate (i.e. CAII and September 2011). Similarly, p-values within a category are relative to that standard and not for the whole model. All included fixed effects were highly significant overall.

Effect	**Month_Year**	**Area**	**Estimate**	**Standard Error**	**DF**	**t-statistic**	**p-value**
Intercept			34.9204	3.1857	360	10.96177	0.0000
Shell Height			-6.2263	0.6455	3982	-9.64494	0.0000
Depth			-10.2388	0.7491	3982	-13.6677	0.0000
Area		CAI	0.0819	0.0131	3982	6.234638	0.0000
Area		CAII	0	-	-	-	-
Month_Year	March 2011		0.0436	0.0311	3982	1.4027	0.1608
Month_Year	April 2011		0.1174	0.0315	3982	3.7271	0.0002
Month_Year	May 2011		0.2198	0.0325	3982	6.7609	0.0000
Month_Year	June 2011		0.4302	0.0310	3982	13.8783	0.0000
Month_Year	July 2011		0.2767	0.0317	3982	8.7329	0.0000
Month_Year	August 2011		0.1201	0.0310	3982	3.8722	0.0001
Month_Year	September 2011		0	-	-	-	-
Month_Year	October 2011		0.0375	0.0310	3982	1.2103	0.2262
Month_Year	November 2011		0.0054	0.0310	3982	0.1752	0.8609
Month_Year	January 2012		0.0068	0.0342	3982	0.1992	0.8422
Month_Year	February 2012		0.0533	0.0310	3982	1.7190	0.0857
Month_Year	March 2012		0.1467	0.0309	3982	4.7397	0.0000
Month_Year	April 2012		0.2408	0.0307	3982	7.8386	0.0000
Shell Height*Depth			2.0415	0.1519	3982	13.4420	0.0000

Table 12: Closed Area I parameter estimates for all months. The parameters estimated are: the intercept (β_0), shell height coefficient (β_1), depth coefficient (β_2) , area coefficient (β_3), month year coefficient (β_4) and the coefficient for the interaction between shell height and depth (β_5). Parameter estimates for length weight relationships for the Georges Bank in general and Closed Area I specifically from NEFSC (2010) are shown for comparison.

	β_0	β_1	β_2	β_3	β_4	β_5
March_2011	34.9204	-6.2263	-10.2388	0.0819	0.0436	2.0415
April_2011	34.9204	-6.2263	-10.2388	0.0819	0.1174	2.0415
May_2011	34.9204	-6.2263	-10.2388	0.0819	0.2198	2.0415
June_2011	34.9204	-6.2263	-10.2388	0.0819	0.4302	2.0415
July_2011	34.9204	-6.2263	-10.2388	0.0819	0.2767	2.0415
August_2011	34.9204	-6.2263	-10.2388	0.0819	0.1201	2.0415
September_2011	34.9204	-6.2263	-10.2388	0.0819	0.0000	2.0415
October_2011	34.9204	-6.2263	-10.2388	0.0819	0.0375	2.0415
November_2011	34.9204	-6.2263	-10.2388	0.0819	0.0054	2.0415
January_2012	34.9204	-6.2263	-10.2388	0.0819	0.0068	2.0415
February_2012	34.9204	-6.2263	-10.2388	0.0819	0.0533	2.0415
March_2012	34.9204	-6.2263	-10.2388	0.0819	0.1467	2.0415
April_2012	34.9204	-6.2263	-10.2388	0.0819	0.2408	2.0415
SARC 2011 GB	-8.0500	2.8400	-0.5100	-	-	-
SARC 2010 CAI	-6.3757	2.7999	-0.8405	-	-	-

Table 13: Closed Area II parameter estimates for all months. The parameters estimated are: the intercept (β_0), shell height coefficient (β_1), depth coefficient (β_2) , area coefficient (β_3), month year coefficient (β_4) and the coefficient for the interaction between shell height and depth (β_5). Parameter estimates for length weight relationships for the Georges Bank in general and Closed Area II specifically from NEFSC (2010) are shown for comparison.

	β_0	β_1	β_2	β_3	β_4	β_5
March_2011	34.9204	-6.2263	-10.2388	0.0000	0.0436	2.0415
April_2011	34.9204	-6.2263	-10.2388	0.0000	0.1174	2.0415
May_2011	34.9204	-6.2263	-10.2388	0.0000	0.2198	2.0415
June_2011	34.9204	-6.2263	-10.2388	0.0000	0.4302	2.0415
July_2011	34.9204	-6.2263	-10.2388	0.0000	0.2767	2.0415
August_2011	34.9204	-6.2263	-10.2388	0.0000	0.1201	2.0415
September_2011	34.9204	-6.2263	-10.2388	0.0000	0.0000	2.0415
October_2011	34.9204	-6.2263	-10.2388	0.0000	0.0375	2.0415
November_2011	34.9204	-6.2263	-10.2388	0.0000	0.0054	2.0415
January_2012	34.9204	-6.2263	-10.2388	0.0000	0.0068	2.0415
February_2012	34.9204	-6.2263	-10.2388	0.0000	0.0533	2.0415
March_2012	34.9204	-6.2263	-10.2388	0.0000	0.1467	2.0415
April_2012	34.9204	-6.2263	-10.2388	0.0000	0.2408	2.0415
SARC 2011 GB	-8.0500	2.8400	-0.5100	-	-	-
SARC 2010 CAII	-8.7026	2.8338	-0.3354	-	-	-

Table 14: Totals of scallop meat weights in pounds from the selected standardized stations inside CAI and CAII (Turtle CFTDD dredge only).

	CAI	CAII	Total
Oct 10	2290.76	2220.05	4510.81
Mar 11	2530.92	2058.03	4588.95
Apr 11	2353.29	1638.51	3991.81
May 11	3800.49	3214.34	7014.84
Jun 11	4527.96	4150.00	8677.96
Jul 11	2877.04	2652.85	5529.89
Aug 11	2033.12	1704.40	3737.51
Sep 11	1554.05	1526.99	3081.04
Oct 11	1808.48	1670.68	3479.16
Dec 11	1328.73	1482.48	2811.21
Jan 12	1514.82	1391.33	2906.15
Feb 12	928.88	1385.16	2314.05
Mar 12	1185.19	1340.22	2525.41
Apr 12	1340.33	1565.82	2906.15

Table 15: Scallop meat weights in pounds from all surveyed stations inside and outside of CAI and CAII (Turtle CFTDD dredge only).

	CAI	CAII	Total
Oct 10	5025.02	2549.96	7574.98
Mar 11	4656.53	2703.66	7360.18
Apr 11	5002.18	2075.75	7077.93
May 11	5872.19	3925.89	9798.07
Jun 11	10369.32	5147.39	15516.70
Jul 11	6592.65	3243.50	9836.16
Aug 11	3930.66	2248.40	6179.06
Sep 11	3250.21	2206.21	5456.42
Oct 11	3857.86	2227.44	6085.30
Dec 11	2273.25	2227.92	4501.18
Jan 12	2458.35	2158.32	4616.66
Feb 12	2353.53	1934.14	4287.67
Mar 12	2398.26	1641.42	4039.67
Apr 12	2694.86	2510.47	5205.33

Table 16: The yellowtail flounder catch from the CFTDD from all successful stations in and around the two access areas (CAI and CAII). The Station (#) column is the number of stations occupied and the catch is the combined catch from those stations in pounds.

Vessel	Date	Stations (#)		Total Weights in Lbs		
		CAI	CAII	CAI	CAII	Total
Celtic	Oct '10	31	40	2	617	619
Arcturus	Mar '11	38	39	19	230	249
Celtic	Apr '11	37	37	19	205	224
Westport	May '11	25	42	39	143	182
Liberty	Jun '11	32	45	58	173	231
Endeavour	Jul '11	36	47	45	176	222
Regulus	Aug '11	29	40	17	527	544
Resolution	Sep '11	33	44	30	606	637
Ranger	Oct '11	34	42	34	729	763
Horizon	Dec '11	30	48	61	384	445
Wisdom	Jan '12	33	47	41	293	334
Venture	Feb '12	37	42	8	324	332
Regulus	Mar '12	34	43	8	296	304
Endeavour	Apr '12	31	47	40	406	446

Table 17: The yellowtail flounder catch from the CFTDD from only the selected standardized stations (12 stations in CAI and 29 stations inside CAII). The bycatch rate is pounds of yellowtail divided by pounds of scallop meats. The scallop meat weight was determined monthly by area during the project period. The yellowtail weights were from the NEFSC.

	CAI		CAII		Bycatch Rate	
Date	**#**	**lbs**	**#**	**lbs**	**CAI**	**CAII**
Oct 10	0	0	537	574.4	0.00000	0.25873
Mar 11	3	3.15	186	201.2	0.00124	0.09776
Apr 11	8	6.2	172	172.7	0.00263	0.10540
May 11	17	15.6	116	109.1	0.00410	0.03394
Jun 11	23	18.1	123	123.3	0.00400	0.02971
Jul 11	17	13.5	108	104.4	0.00469	0.03935
Aug 11	8	7.55	450	431.7	0.00371	0.25329
Sep 11	1	1.35	445	457.2	0.00087	0.29941
Oct 11	16	16.75	527	560	0.00926	0.33519
Dec 11	24	27.1	201	222.65	0.02040	0.15019
Jan 12	9	9.3	188	209.1	0.00614	0.15029
Feb 12	2	1.8	169	192.1	0.00194	0.13868
Mar 12	2	1.3	197	213	0.00110	0.15893
Apr 12	5	5.8	253	258.45	0.00433	0.16506

Table 18: The windowpane flounder catch from the CFTDD from only the selected standardized stations (12 stations in CAI and 29 stations inside CAII). The bycatch rate is pounds of windowpane divided by pounds of scallop meats. The scallop meat weight was determined monthly by area during the project period. The windowpane weights were from the NEFSC.

	CAI		CAII	Bycatch Rate		
Date	**#**	**lbs**	**#**	**lbs**	**CAI**	**CAII**
Oct 10	122	60.25	7	3.50	0.0263	0.0016
Mar 11	32	16.6	599	340.13	0.0066	0.1653
Apr 11	27	13.2	365	190.25	0.0056	0.1161
May 11	12	6.3	86	44.60	0.0017	0.0139
Jun 11	16	8.6	3	2.60	0.0019	0.0006
Jul 11	46	25.55	8	4.60	0.0089	0.0017
Aug 11	81	37.85	1	0.55	0.0186	0.0003
Sep 11	81	40.65	0	0.00	0.0262	0.0000
Oct 11	55	26.35	64	34.10	0.0146	0.0204
Dec 11	86	52.05	160	83.95	0.0392	0.0566
Jan 12	114	61.55	483	266.62	0.0406	0.1916
Feb 12	27	12.45	809	448.35	0.0134	0.3237
Mar 12	30	16.85	576	323.81	0.0142	0.2416
Apr 12	35	17.55	900	490.80	0.0131	0.3134
Totals	764	395.8	4061	2233.86		

Table 19: The winter flounder catch from the CFTDD from only the selected standardized stations (12 stations in CAI and 29 stations inside CAII). The bycatch rate is pounds of winter flounder divided by pounds of scallop meats. The scallop meat weight was determined monthly by area during the project period. The winter flounder weights were from the NEFSC.

	CAI		CAII		Bycatch Rate	
Date	**#**	**lbs**	**#**	**lbs**	**CAI**	**CAII**
Oct 10	40	73.1	8	22.95	0.0319	0.0103
Mar 11	2	3.2	5	10.65	0.0013	0.0052
Apr 11	6	7.65	5	9.05	0.0033	0.0055
May 11	30	47.65	4	8.85	0.0125	0.0028
Jun 11	31	61.4	2	3.2	0.0136	0.0008
Jul 11	71	128.6	0	0	0.0447	0.0000
Aug 11	28	39.6	10	21.9	0.0195	0.0128
Sep 11	22	34.5	5	10.35	0.0222	0.0068
Oct 11	42	92.35	16	38.1	0.0511	0.0228
Dec 11	70	162.3	4	9.7	0.1221	0.0065
Jan 12	18	35.45	1	3.75	0.0234	0.0027
Feb 12	6	10.2	3	6.6	0.0110	0.0048
Mar 12	2	4.25	1	3.75	0.0036	0.0028
Apr 12	4	4.3	4	8.4	0.0032	0.0054
Totals	372	704.55	68	157.25		

Table 20: The monkfish catch from the CFTDD from only the selected standardized stations (12 stations in CAI and 29 stations inside CAII). The bycatch rate is pounds of monkfish divided by pounds of scallop meats. The scallop meat weight was determined monthly by area during the project period. The monkfish weights were from the NEFSC.

	CAI		CAII		Bycatch Rate	
Date	**#**	**lbs**	**#**	**lbs**	**CAI**	**CAII**
Oct 10	10	80.95	56	365.4	0.03534	0.16459
Mar 11	0	0	3	22.2	0.00000	0.01079
Apr 11	2	1.65	6	45.8	0.00070	0.02795
May 11	9	33.05	35	204.85	0.00870	0.06373
Jun 11	53	214.8	40	247.05	0.04744	0.05953
Jul 11	62	211.45	71	399.3	0.07350	0.15052
Aug 11	27	141.3	63	462.1	0.06950	0.27112
Sep 11	17	115.75	66	418.65	0.07448	0.27417
Oct 11	17	102.45	70	478.7	0.05665	0.28653
Dec 11	30	183.45	36	253.5	0.13806	0.17100
Jan 12	11	52.95	41	171.4	0.03495	0.12319
Feb 12	0	0	12	56.4	0.00000	0.04072
Mar 12	2	1.9	13	19.1	0.00160	0.01425
Apr 12	3	4.9	36	162	0.00366	0.10346
Totals	243	1144.6	548	3306.45		

Table 21: The summer flounder catch from the CFTDD dredge from only the selected standardized stations (12 stations in CAI and 29 stations inside CAII). The bycatch rate is pounds of summer flounder divided by pounds of scallop meats. The scallop meat weight was determined monthly by area during the project period. The summer flounder weights were from the NEFSC.

	CAI		CAII		Bycatch Rate	
Date	**#**	**lbs**	**#**	**lbs**	**CAI**	**CAII**
Oct 10	5	24	8	28.55	0.0105	0.0129
Mar 11	0	0	1	1.9	0.0000	0.0009
Apr 11	0	0	0	0	0.0000	0.0000
May 11	6	9.95	3	6.55	0.0026	0.0020
Jun 11	20	76.75	3	6.25	0.0170	0.0015
Jul 11	5	22.75	0	0	0.0079	0.0000
Aug 11	4	23.55	3	28.9	0.0116	0.0170
Sep 11	12	51.95	7	23.7	0.0334	0.0155
Oct 11	7	31.35	13	59.7	0.0173	0.0357
Dec 11	3	17.1	21	68	0.0129	0.0459
Jan 12	0	0	33	86.45	0.0000	0.0621
Feb 12	0	0	12	22.3	0.0000	0.0161
Mar 12	0	0	3	10.65	0.0000	0.0079
Apr 12	0	0	4	7.45	0.0000	0.0048
Totals	62	257.4	111	350.4		

Table 22: Gear specifications for the New Bedford style dredges used on the research cruises.

		Celtic	Westport	Arcturus	Turtle	Liberty	Endeavour	Regulus	Resolution	Ranger	Horizon	Wisdom	Venture
Dredge Width (ft)		15	15	15	15	13	15	15	15	15	15	15	13
Pressure Plate Width (inches)		8	8	8	8	8	8	9.5	8	9	1.5	1	8.5
Wheel Diameter (inches)		16	none	18	16	17	20	17	23	22	18	8	16
Dredge Builder		Quinn	unknown	Dockside	Dockside	Blue Fleet	Blue Fleet	Blue Fleet	Dockside	Dockside	Dockside	Dockside	Blue Fleet
Turtle Chains	# up/downs					11	13	13	13	14	19	11	18 (trawlex)
	# ticklers					6	8	10	9	10	9	7	9
	Chain Link size					3/8	3/8	3/8*	1/2	2.25 in	3/8		5/8
Bag (Belly)		10 x 40	9 x 40	9 x 40	10 x 40	9 x 38	7 x 40	7 x 38	10 x 42	8 x 38	9 x 44	10 x 38	9 x 36
Apron		8 x 40	13 x 40	10 x 40	8 x 40	7 x 38	8 x 40	8 x 38	8 x 42	7 x 38	8 x 44	10 x 38	7 x 36
Side Piece		6 x 17	5 x 16	5 x 17	6 x 17	6 x 18	5 x 19	5 x 25	4 x 20	5 x 20	4 x 44	5 x 18	5 x 19
Diamond # rings/side		14	14	13	14	13	14	13	14	14	15	13	13
Skirt		3 x 38	2 x 36	dog chains	3 x 38		3			3 links	4 x 18		2 links
Sweep	# of links	125	121 long	141	125	127	113	105	147	139	149	154	117
	Link size					5/8	5/8	5/8	5/8	3 inches	5/8	long	5/8
	Dog chains							1/4		None; shackles	22 link, 5/8 inch	1 inch	None; shackles
Standard Twine Top		7.5 x 60	8.5 x 80	8.5 x 90	8.5 x 60	8.5 x 90	8.5 x 80	7.5 x 43	10.5 x 36	9 x 33	8 x 96	11 x 90	7.5 x 80
Twine top mesh size (inches)		11.5	11.5	11.5	11.5	11	10.5	11	11	10.5	12		10

Table 23: Species comparisons between the CFTDD and New Bedford style dredges.

	Scallops (bu)	Yellowtail flounder	Winter Flounder	Summer Flounder	Little Skate	Winter Skate	Monkfish	Barndoor Skate	Fourspot	Window pane	American Plaice
Celtic 2010-1											
Standard	946.55	491	106	16	3414	236	110	74	88	448	0
Turtle	1048	577	118	28	4208	272	114	85	106	463	0
# diff	101	86	12	12	794	36	4	11	18	15	0
% diff	110.7%	117.5%	111.3%	175.0%	123.3%	115.3%	103.6%	114.9%	120.5%	103.3%	#DIV/0!
Arcturus 2011-1											
Standard	1384.9	431	46	2	6778	324	5	5	0	1533	73
Turtle	1253.9	229	11	1	4888	301	3	6	0	751	31
# diff	-131	-202	-35	-1	-1890	-23	-2	1	0	-782	-42
% diff	90.5%	53.1%	23.9%	50.0%	72.1%	92.9%	60.0%	120.0%		49.0%	42.5%
Celtic 2011-1											
Standard	1191.05	307	35	1	5421	437	13	11	0	636	54
Turtle	1112.55	225	17	0	4943	541	11	8	0	554	38
# diff	-79	-82	-18	-1	-478	104	-2	-3	0	-82	-16
% diff	93.4%	73.3%	48.6%	0.0%	91.2%	123.8%	84.6%	72.7%		87.1%	70.4%
Westport 2011-1											
Standard	1344.5	294	80	13	5258	331	65	71	72	236	45
Turtle	1502.75	218	41	13	4751	363	69	37	79	214	40
# diff	158	-76	-39	0	-507	32	4	-34	7	-22	-5
% diff	111.8%	74.1%	51.3%	100.0%	90.4%	109.7%	106.2%	52.1%	109.7%	90.7%	88.9%
Liberty 2011-1											
Standard	1358.54	213	54	38	5428	233	157	76	94	42	21
Turtle	1753.45	236	63	34	5622	388	180	79	115	51	43
# diff	395	23	9	-4	194	155	23	3	21	9	22
% diff	129.1%	110.8%	116.7%	89.5%	103.6%	166.5%	114.6%	103.9%	122.3%	121.4%	204.8%

Table 23 (con't): Species comparisons between the CFTDD and New Bedford style dredges.

	Scallops (bu)	Yellowtail flounder	Winter Flounder	Summer Flounder	Little Skate	Winter Skate	Monkfish	Barndoor Skate	Fourspot	Window pane	American Plaice
Endeavour 2011-1											
Standard	1130.81	264	133	35	6914	0	310	132	228	274	28
Turtle	1190.36	230	123	29	7765	0	318	141	232	141	30
# diff	60	-34	-10	-6	851	0	8	9	4	-133	2
% diff	105.3%	87.1%	92.5%	82.9%	112.3%		102.6%	106.8%	101.8%	51.5%	107.1%
Regulus 2011-1											
Standard	881.3	511	150	21	5070	307	269	117	178	163	14
Turtle	956.4	565	119	12	5239	467	247	147	176	115	21
# diff	75	54	-31	-9	169	160	-22	30	-2	-48	7
% diff	108.5%	110.6%	79.3%	57.1%	103.3%	152.1%	91.8%	125.6%	98.9%	70.6%	150.0%
Resolution 2011-1											
Standard	947.54	377	104	32	4910	341	281	117	120	108	1
Turtle	932.91	633	161	31	6436	323	270	123	166	163	1
# diff	-15	256	57	-1	1526	-18	-11	6	46	55	0
% diff	98.5%	167.9%	154.8%	96.9%	131.1%	94.7%	96.1%	105.1%	138.3%	150.9%	100.0%
Ranger 2011-1											
Standard	910.62	340	108	40	4582	326	301	99	99	176	1
Turtle	1063.56	721	143	38	6777	523	236	146	167	298	1
# diff	153	381	35	-2	2195	197	-65	47	68	122	0
% diff	116.8%	212.1%	132.4%	95.0%	147.9%	160.4%	78.4%	147.5%	168.7%	169.3%	100.0%
Horizon 2011-1											
Standard	725.98	290	179	33	5161	377	171	56	52	565	1
Turtle	809.39	399	135	42	6336	430	177	77	96	410	2
# diff	83	109	-44	9	1175	53	6	21	44	-155	1
% diff	111.5%	137.6%	75.4%	127.3%	122.8%	114.1%	103.5%	137.5%	184.6%	72.6%	200.0%

Table 23 (con't): Species comparisons between the CFTDD and New Bedford style dredges.

	Scallops (bu)	Yellowtail flounder	Winter Flounder	Summer Flounder	Little Skate	Winter Skate	Monkfish	Barndoor Skate	Fourspot	Window pane	American Plaice
Wisdom 2011-1											
Standard	799.9	408	96	72	6282	245	136	43	69	1189	9
Turtle	801.95	309	37	49	5357	255	131	44	26	799	7
# diff	2	-99	-59	-23	-925	10	-5	1	-43	-390	-2
% diff	100.3%	75.7%	38.5%	68.1%	85.3%	104.1%	96.3%	102.3%	37.7%	67.2%	77.8%
Venture 2011-1											
Standard	522.05	177	14	12	2500	77	21	2	12	832	28
Turtle	689.9	300	15	18	3931	231	33	16	41	1128	29
# diff	168	123	1	6	1431	154	12	14	29	296	1
% diff	132.2%	169.5%	107.1%	150.0%	157.2%	300.0%	157.1%	800.0%	341.7%	135.6%	103.6%
Regulus 2012-1											
Standard	646.15	332	26	10	5211	307	46	18	19	1538	57
Turtle	673.25	290	12	10	4722	213	44	25	23	1014	37
# diff	27	-42	-14	0	-489	-94	-2	7	4	-524	-20
% diff	104.2%	87.3%	46.2%	100.0%	90.6%	69.4%	95.7%	138.9%	121.1%	65.9%	64.9%
Endeavour 2012-1											
Standard	708.86	367	17	18	7010	282	96	43	59	1554	69
Turtle	746.74	443	17	17	6093	266	108	58	35	1278	65
# diff	38	76	0	-1	-917	-16	12	15	-24	-276	-4
% diff	105.3%	120.7%	100.0%	94.4%	86.9%	94.3%	112.5%	134.9%	59.3%	82.2%	94.2%
All 14 Trips Combined											
Standard	13498.8	4802.0	1148.0	343.0	73939.0	3823.0	1981.0	864.0	1090.0	9294.0	401.0
Turtle	14535.1	5375.0	1012.0	322.0	77068.0	4573.0	1941.0	992.0	1262.0	7379.0	345.0
# diff	1036	573	-136	-21	3129	750	-40	128	172	-1915	-56
% diff	107.7%	111.9%	88.2%	93.9%	104.2%	119.6%	98.0%	114.8%	115.8%	79.4%	86.0%

Table 24: All trips that had twine tops with a hanging ratio greater than 2:1.

	Scallops (bu)	Yellowtail flounder	Winter Flounder	Summer Flounder	Little Skate	Winter Skate	Monkfish	Barndoor Skate	Fourspot	Window pane	American Plaice
Arcturus 2011-1											
Standard	1384.9	431	46	2	6778	324	5	5	0	1533	73
Turtle	1253.9	229	11	1	4888	301	3	6	0	751	31
# diff	-131	-202	-35	-1	-1890	-23	-2	1	0	-782	-42
% diff	90.5%	53.1%	23.9%	50.0%	72.1%	92.9%	60.0%	120.0%		49.0%	42.5%
Westport 2011-1											
Standard	1344.5	294	80	13	5258	331	65	71	72	236	45
Turtle	1502.75	218	41	13	4751	363	69	37	79	214	40
# diff	158	-76	-39	0	-507	32	4	-34	7	-22	-5
% diff	111.8%	74.1%	51.3%	100.0%	90.4%	109.7%	106.2%	52.1%	109.7%	90.7%	88.9%
Liberty 2011-1											
Standard	1358.54	213	54	38	5428	233	157	76	94	42	21
Turtle	1753.45	236	63	34	5622	388	180	79	115	51	43
# diff	395	23	9	-4	194	155	23	3	21	9	22
% diff	129.1%	110.8%	116.7%	89.5%	103.6%	166.5%	114.6%	103.9%	122.3%	121.4%	204.8%
Endeavour 2011-1											
Standard	1130.81	264	133	35	6914	0	310	132	228	274	28
Turtle	1190.36	230	123	29	7765	0	318	141	232	141	30
# diff	60	-34	-10	-6	851	0	8	9	4	-133	2
% diff	105.3%	87.1%	92.5%	82.9%	112.3%		102.6%	106.8%	101.8%	51.5%	107.1%
Horizon 2011-1											
Standard	725.98	290	179	33	5161	377	171	56	52	565	1
Turtle	809.39	399	135	42	6336	430	177	77	96	410	2
# diff	83	109	-44	9	1175	53	6	21	44	-155	1
% diff	111.5%	137.6%	75.4%	127.3%	122.8%	114.1%	103.5%	137.5%	184.6%	72.6%	200.0%
Wisdom 2011-1											
Standard	799.9	408	96	72	6282	245	136	43	69	1189	9
Turtle	801.95	309	37	49	5357	255	131	44	26	799	7
# diff	2	-99	-59	-23	-925	10	-5	1	-43	-390	-2
% diff	100.3%	75.7%	38.5%	68.1%	85.3%	104.1%	96.3%	102.3%	37.7%	67.2%	77.8%
Venture 2011-1											
Standard	522.05	177	14	12	2500	77	21	2	12	832	28
Turtle	689.9	300	15	18	3931	231	33	16	41	1128	29
# diff	168	123	1	6	1431	154	12	14	29	296	1
% diff	132.2%	169.5%	107.1%	150.0%	157.2%	300.0%	157.1%	800.0%	341.7%	135.6%	103.6%
Endeavour 2012-1											
Standard	708.86	367	17	18	7010	282	96	43	59	1554	69
Turtle	746.74	443	17	17	6093	266	108	58	35	1278	65
# diff	38	76	0	-1	-917	-16	12	15	-24	-276	-4
% diff	105.3%	120.7%	100.0%	94.4%	86.9%	94.3%	112.5%	134.9%	59.3%	82.2%	94.2%
Trips with twine tops greater than 60 meshes wide											
Standard	7975.54	2444	619	223	45331	1869	961	428	586	6225	274
Turtle	8748.44	2364	442	203	44743	2234	1019	458	624	4772	247
# diff	773	-80	-177	-20	-588	365	58	30	38	-1453	-27
% diff	109.7%	96.7%	71.4%	91.0%	98.7%	119.5%	106.0%	107.0%	106.5%	76.7%	90.1%

Table 25: All trips with hanging ratios less than 2:1.

	Scallops (bu)	Yellowtail flounder	Winter Flounder	Summer Flounder	Little Skate	Winter Skate	Monkfish	Barndoor Skate	Fourspot	Window pane	American Plaice
Regulus 2011-1											
Standard	881.3	511	150	21	5070	307	269	117	178	163	14
Turtle	956.4	565	119	12	5239	467	247	147	176	115	21
# diff	75	54	-31	-9	169	160	-22	30	-2	-48	7
% diff	108.5%	110.6%	79.3%	57.1%	103.3%	152.1%	91.8%	125.6%	98.9%	70.6%	150.0%
Resolution 2011-1											
Standard	947.54	377	104	32	4910	341	281	117	120	108	1
Turtle	932.91	633	161	31	6436	323	270	123	166	163	1
# diff	-15	256	57	-1	1526	-18	-11	6	46	55	0
% diff	98.5%	167.9%	154.8%	96.9%	131.1%	94.7%	96.1%	105.1%	138.3%	150.9%	100.0%
Regulus 2012-1											
Standard	646.15	332	26	10	5211	307	46	18	19	1538	57
Turtle	673.25	290	12	10	4722	213	44	25	23	1014	37
# diff	27	-42	-14	0	-489	-94	-2	7	4	-524	-20
% diff	104.2%	87.3%	46.2%	100.0%	90.6%	69.4%	95.7%	138.9%	121.1%	65.9%	64.9%
Ranger 2011-1											
Standard	910.62	340	108	40	4582	326	301	99	99	176	1
Turtle	1063.56	721	143	38	6777	523	236	146	167	298	1
# diff	153	381	35	-2	2195	197	-65	47	68	122	0
% diff	116.8%	212.1%	132.4%	95.0%	147.9%	160.4%	78.4%	147.5%	168.7%	169.3%	100.0%
Trips with twine tops less than 60 meshes wide											
Standard	3385.61	1560	388	103	19773	1281	897	351	416	1985	73
Turtle	3626.12	2209	435	91	23174	1526	797	441	532	1590	60
# diff	241	649	47	-12	3401	245	-100	90	116	-395	-13
% diff	107.1%	141.6%	112.1%	88.3%	117.2%	119.1%	88.9%	125.6%	127.9%	80.1%	82.2%

Table 26: Summary of bycatch rates for yellowtail using all trips combined for both CAI and CAII for all stations.

		Yellowtail (lbs)		Scallops (lbs)		Bycatch Rate	
Selected stations	**Twine Top Size**	**Turtle**	**New Bedford**	**Turtle**	**New Bedford**	**Turtle**	**New Bedford**
Celtic 2010 (Oct)	7.5 x 60	574	490	4511	4262	0.127	0.115
Arcturus (Mar)	8.5 x 90	204	367	4589	5296	0.045	0.069
Celtic 2011 (Apr)	7.5 x 60	179	211	3992	4838	0.045	0.044
Westport (May)	8.5 x 80	125	194	7015	6880	0.018	0.028
Liberty (June)	8.5 x 90	141	143	8678	7067	0.016	0.020
Endeavour (July)	8.5 x 80	118	141	5530	5764	0.021	0.024
Regulus (Aug)	7.5 x 43	439	422	3738	3355	0.118	0.126
Resolution (Sept)	10.5 x 36	459	315	3081	3505	0.149	0.090
Ranger (Oct)	9 x 33	577	271	3479	3265	0.166	0.083
Horizon (Dec)	8 x 96	250	193	2811	2747	0.089	0.070
Wisdom (Jan)	11 x 90	218	284	2906	2966	0.075	0.096
Venture (Feb)	7.5 x 80	194	146	2314	1933	0.084	0.075
Regulus (March)	7.5 x 43	214	249	2525	2717	0.085	0.092
Endeavour (April)	8.5 x 80	264	242	2906		0.091	
Totals		3957	3668	58075	54596	**0.068**	**0.067**
All stations							
Celtic 2010 (Oct)	7.5 x 60	619	538	7575	6666	0.082	0.081
Arcturus (Mar)	8.5 x 90	249	477	7360	8495	0.034	0.056
Celtic 2011 (Apr)	7.5 x 60	224	282	7078	7777	0.032	0.036
Westport (May)	8.5 x 80	182	260	9798	9757	0.019	0.027
Liberty (June)	8.5 x 90	231	215	15517	12087	0.015	0.018
Endeavour (July)	8.5 x 80	222	270	9836	9185	0.023	0.029
Regulus (Aug)	7.5 x 43	544	514	6179	5565	0.088	0.092
Resolution (Sept)	10.5 x 36	637	400	5456	5638	0.117	0.071
Ranger (Oct)	9 x 33	763	372	6085	5491	0.125	0.068
Horizon (Dec)	8 x 96	445	336	4501	4338	0.099	0.077
Wisdom (Jan)	11 x 90	334	432	4617	4543	0.072	0.095
Venture (Feb)	7.5 x 80	332	201	4288	3102	0.077	0.065
Regulus (March)	7.5 x 43	304	360	4040	4166	0.075	0.086
Endeavour (April)	8.5 x 80	446	366	5205		0.086	
Totals		5530	5024	97535	86811	**0.057**	**0.058**
Turtle Dredge	8.5 x 60						

Table 27: Bycatch rates for the selected stations inside CAI and CAII combined with the trips grouped by twine top width (greater than 60 meshes versus less than 60 meshes).

		Yellowtail (lbs)		Scallops (lbs)		Bycatch Rate	
Selected stations	Twine Top Size	Turtle	New Bedford	Turtle	New Bedford	Turtle	New Bedford
Arcturus (Mar)	8.5 x 90	204	367	4589	5296	0.045	0.069
Westport (May)	8.5 x 80	125	194	7015	6880	0.018	0.028
Liberty (June)	8.5 x 90	141	143	8678	7067	0.016	0.020
Endeavour (July)	8.5 x 80	118	141	5530	5764	0.021	0.024
Horizon (Dec)	8 x 96	250	193	2811	2747	0.089	0.070
Wisdom (Jan)	11 x 90	218	284	2906	2966	0.075	0.096
Venture (Feb)	7.5 x 80	194	146	2314	1933	0.084	0.075
Endeavour (April)	8.5 x 80	264	242	2906		0.091	
Totals		1515	1710	36749	32653	**0.041**	**0.052**
Regulus (Aug)	7.5 x 43	439	422	3738	3355	0.118	0.126
Resolution (Sept)	10.5 x 36	459	315	3081	3505	0.149	0.090
Ranger (Oct)	9 x 33	577	271	3479	3265	0.166	0.083
Regulus (March)	7.5 x 43	214	249	2525	2717	0.085	0.092
Totals		1689	1258	12823	12843	**0.132**	**0.098**
Turtle Dredge	**8.5 x 60**						

Table 28: Bycatch rates for the selected stations inside CAI and CAII combined with the trips grouped by apron height.

			Yellowtail (lbs)		Scallops (lbs)		Bycatch Rate	
All stations	**Twine Top Size**	**Apron Size**	**Turtle**	**New Bedford**	**Turtle**	**New Bedford**	**Turtle**	**New Bedford**
Arcturus (Mar)	8.5 x 90	10 x 40	249	477	7360	8495	0.034	0.056
Westport (May)	8.5 x 80	13 x 40	182	260	9798	9757	0.019	0.027
Wisdom (Jan)	11 x 90	10 x 38	334	432	4617	4543	0.072	0.095
Total			765	1170	21775	22796	**0.035**	**0.051**
Celtic 2010 (Oct)	7.5 x 60	8 x 40	619	538	7575	6666	0.082	0.081
Celtic 2011 (Apr)	7.5 x 60	8 x 40	224	282	7078	7777	0.032	0.036
Liberty (June)	8.5 x 90	7 x 38	231	215	15517	12087	0.015	0.018
Endeavour (July)	8.5 x 80	8 x 40	222	270	9836	9185	0.023	0.029
Regulus (Aug)	7.5 x 43	8 x 38	544	514	6179	5565	0.088	0.092
Resolution (Sept)	10.5 x 36	8 x 42	637	400	5456	5638	0.117	0.071
Ranger (Oct)	9 x 33	7 x 38	763	372	6085	5491	0.125	0.068
Horizon (Dec)	8 x 96	8 x 44	445	336	4501	4338	0.099	0.077
Venture (Feb)	7.5 x 80	7 x 36	332	201	4288	3102	0.077	0.065
Regulus (March)	7.5 x 43	8 x 38	304	360	4040	4166	0.075	0.086
Endeavour (April)	8.5 x 80	8 x 40	446	366	5205		0.086	
Total			4765	3854	75760	64015	**0.063**	**0.060**
Turtle Dredge	8 x 40							

Table 29: Mixed effects model pooled catch data for all bycatch survey cruises. Results are from species where the intercept only model provided the best fit to the data as supported by model comparison (minimum AIC value). Confidence limits are Wald type confidence intervals. Parameter estimates are on the logit scale.

Species	Effect	Estimate	StdErr	DF	t	P value	Alpha	LCI	UCI
Spiny Dogfish	Intercept Only	**1.972**	0.627	62	3.146	0.003	0.05	0.719	3.225
American Plaice	Intercept Only	-0.141	0.092	279	-1.535	0.126	0.05	-0.322	0.040
Summer Flounder	Intercept Only	-0.143	0.104	255	-1.369	0.172	0.05	-0.349	0.063
Grey Sole	Intercept Only	0.217	0.119	149	1.825	0.070	0.05	-0.018	0.451
Monkfish	Intercept Only	0.020	0.038	663	0.521	0.602	0.05	-0.055	0.095
Haddock	Intercept Only	0.224	0.188	82	1.194	0.236	0.05	-0.149	0.598

Table 30: Mixed effects model with pooled catch data for all bycatch survey cruises. Results are for scallops from the model that provided the best fit (intercept and cruiseid) to the data as supported by model comparison (minimum AIC value). Confidence limits are Wald type confidence intervals. Parameter estimates are on the logit scale.

Species	Effect	CruiseID	Estimate	StdErr	DF	t	P-value	Alpha	LCI	UCI
Sea Scallops	Intercept		0.081	0.039	942	2.093	0.037	0.05	0.005	0.157
Sea Scallops	CRUISEID	ARC-1-11	-0.163	0.056	942	-2.908	0.004	0.05	-0.274	-0.053
Sea Scallops	CRUISEID	CEL-1-11	-0.160	0.057	942	-2.807	0.005	0.05	-0.272	-0.048
Sea Scallops	CRUISEID	CEL-2-10	0.080	0.063	942	1.272	0.204	0.05	-0.043	0.202
Sea Scallops	CRUISEID	END-1-11	-0.063	0.056	942	-1.139	0.255	0.05	-0.173	0.046
Sea Scallops	CRUISEID	END-2-12	-0.105	0.055	942	-1.913	0.056	0.05	-0.213	0.003
Sea Scallops	CRUISEID	HOR-1-11	-0.031	0.055	942	-0.575	0.565	0.05	-0.139	0.076
Sea Scallops	CRUISEID	LIB-1-11	0.149	0.056	942	2.674	0.008	0.05	0.040	0.259
Sea Scallops	CRUISEID	RAN-1-11	0.114	0.055	942	2.063	0.039	0.05	0.006	0.223
Sea Scallops	CRUISEID	REG-1-11	0.052	0.056	942	0.926	0.355	0.05	-0.058	0.161
Sea Scallops	CRUISEID	REG-2-12	-0.099	0.056	942	-1.774	0.076	0.05	-0.208	0.010
Sea Scallops	CRUISEID	RES-1-11	-0.014	0.056	942	-0.259	0.796	0.05	-0.123	0.095
Sea Scallops	CRUISEID	VEN-1-12	0.313	0.055	942	5.708	0.000	0.05	0.205	0.420
Sea Scallops	CRUISEID	WES-1-11	-0.014	0.058	942	-0.245	0.807	0.05	-0.127	0.099
Sea Scallops	CRUISEID	WIS-1-12	0.000							

Table 31: Mixed effects model with pooled catch data for all bycatch survey cruises. Results are unclassified skates from the model that provided the best fit (intercept and cruiseid) to the data as supported by model comparison (minimum AIC value). Confidence limits are Wald type confidence intervals. Parameter estimates are on the logit scale.

Species	Effect	CruiseID	Estimate	StdErr	DF	tValue	Probt	Alpha	LCI	UCI
Uncl. Skate	Intercept		0.265	0.074	134	3.563	0.001	0.05	0.118	0.412
Uncl. Skate	CRUISEID	ARC-1-11	-0.512	0.360	134	-1.421	0.158	0.05	-1.225	0.201
Uncl. Skate	CRUISEID	CEL-1-11	-0.455	0.107	134	-4.249	0.000	0.05	-0.667	-0.243
Uncl. Skate	CRUISEID	END-1-11	0.000							

Table 32: Mixed effects model with pooled catch data for all bycatch survey cruises. Results are for yellowtail flounder from the model that provided the best fit (intercept and cruiseid) to the data as supported by model comparison (minimum AIC value). Confidence limits are Wald type confidence intervals. Parameter estimates are on the logit scale.

Species	Effect	CruiseID	Estimate	StdErr	DF	tValue	Probt	Alpha	LCI	UCI
Yellowtail Flounder	Intercept		-0.259	0.106	707	-2.442	0.015	0.05	-0.468	-0.051
Yellowtail Flounder	CRUISEID	ARC-1-11	-0.304	0.157	707	-1.941	0.053	0.05	-0.612	0.003
Yellowtail Flounder	CRUISEID	CEL-1-11	-0.073	0.160	707	-0.456	0.649	0.05	-0.386	0.241
Yellowtail Flounder	CRUISEID	CEL-2-10	0.420	0.161	707	2.604	0.009	0.05	0.103	0.736
Yellowtail Flounder	CRUISEID	END-1-11	0.255	0.162	707	1.571	0.117	0.05	-0.064	0.574
Yellowtail Flounder	CRUISEID	END-2-12	0.436	0.142	707	3.067	0.002	0.05	0.157	0.715
Yellowtail Flounder	CRUISEID	HOR-1-11	0.508	0.150	707	3.388	0.001	0.05	0.213	0.802
Yellowtail Flounder	CRUISEID	LIB-1-11	0.398	0.166	707	2.404	0.016	0.05	0.073	0.723
Yellowtail Flounder	CRUISEID	RAN-1-11	1.140	0.147	707	7.753	0.000	0.05	0.852	1.429
Yellowtail Flounder	CRUISEID	REG-1-11	0.355	0.144	707	2.465	0.014	0.05	0.072	0.638
Yellowtail Flounder	CRUISEID	REG-2-12	0.119	0.156	707	0.762	0.447	0.05	-0.187	0.424
Yellowtail Flounder	CRUISEID	RES-1-11	0.889	0.147	707	6.067	0.000	0.05	0.601	1.176
Yellowtail Flounder	CRUISEID	VEN-1-12	0.875	0.166	707	5.272	0.000	0.05	0.549	1.202
Yellowtail Flounder	CRUISEID	WES-1-11	-0.023	0.159	707	-0.146	0.884	0.05	-0.336	0.290
Yellowtail Flounder	CRUISEID	WIS-1-12	0.000							

Table 33: Mixed effects model with pooled catch data for all bycatch survey cruises. Results are for winter flounder from the model that provided the best fit (intercept and cruiseid) to the data as supported by model comparison (minimum AIC value). Confidence limits are Wald type confidence intervals. Parameter estimates are on the logit scale.

Species	Effect	CruiseID	Estimate	StdErr	DF	tValue	Probt	Alpha	LCI	UCI
Winter Flounder	Intercept		-1.009	0.236	375	-4.271	0.000	0.05	-1.474	-0.545
Winter Flounder	CRUISEID	ARC-1-11	-0.250	0.431	375	-0.580	0.562	0.05	-1.098	0.598
Winter Flounder	CRUISEID	CEL-1-11	0.135	0.440	375	0.308	0.759	0.05	-0.730	1.001
Winter Flounder	CRUISEID	CEL-2-10	1.045	0.296	375	3.527	0.000	0.05	0.462	1.627
Winter Flounder	CRUISEID	END-1-11	1.103	0.302	375	3.656	0.000	0.05	0.510	1.697
Winter Flounder	CRUISEID	END-2-12	0.929	0.439	375	2.118	0.035	0.05	0.066	1.791
Winter Flounder	CRUISEID	HOR-1-11	0.711	0.282	375	2.518	0.012	0.05	0.156	1.266
Winter Flounder	CRUISEID	LIB-1-11	1.223	0.330	375	3.707	0.000	0.05	0.574	1.872
Winter Flounder	CRUISEID	RAN-1-11	1.302	0.290	375	4.492	0.000	0.05	0.732	1.872
Winter Flounder	CRUISEID	REG-1-11	0.845	0.287	375	2.948	0.003	0.05	0.282	1.409
Winter Flounder	CRUISEID	REG-2-12	0.408	0.463	375	0.881	0.379	0.05	-0.503	1.318
Winter Flounder	CRUISEID	RES-1-11	1.356	0.293	375	4.631	0.000	0.05	0.780	1.931
Winter Flounder	CRUISEID	VEN-1-12	0.025	0.459	375	0.055	0.956	0.05	-0.877	0.928
Winter Flounder	CRUISEID	WES-1-11	0.198	0.335	375	0.590	0.555	0.05	-0.461	0.858
Winter Flounder	CRUISEID	WIS-1-12	0.000							

Table 34: Mixed effects model with pooled catch data for all bycatch survey cruises. Results are for windowpane flounder from the model that provided the best fit (intercept and cruiseid) to the data as supported by model comparison (minimum AIC value). Confidence limits are Wald type confidence intervals. Parameter estimates are on the logit scale.

Species	**Effect**	**CruiseID**	**Estimate**	**StdErr**	**DF**	**tValue**	**Probt**	**Alpha**	**LCI**	**UCI**
Windowpane Flounder	Intercept		-0.452	0.071	652	-6.325	0.000	0.05	-0.592	-0.311
Windowpane Flounder	CRUISEID	ARC-1-11	-0.354	0.101	652	-3.516	0.000	0.05	-0.552	-0.156
Windowpane Flounder	CRUISEID	CEL-1-11	0.301	0.110	652	2.740	0.006	0.05	0.085	0.516
Windowpane Flounder	CRUISEID	CEL-2-10	0.488	0.149	652	3.281	0.001	0.05	0.196	0.780
Windowpane Flounder	CRUISEID	END-1-11	-0.138	0.169	652	-0.820	0.413	0.05	-0.469	0.193
Windowpane Flounder	CRUISEID	END-2-12	0.252	0.093	652	2.699	0.007	0.05	0.069	0.435
Windowpane Flounder	CRUISEID	HOR-1-11	0.117	0.109	652	1.078	0.281	0.05	-0.096	0.331
Windowpane Flounder	CRUISEID	LIB-1-11	0.521	0.291	652	1.789	0.074	0.05	-0.051	1.093
Windowpane Flounder	CRUISEID	RAN-1-11	0.945	0.143	652	6.613	0.000	0.05	0.664	1.226
Windowpane Flounder	CRUISEID	REG-1-11	0.076	0.169	652	0.447	0.655	0.05	-0.256	0.408
Windowpane Flounder	CRUISEID	REG-2-12	0.006	0.096	652	0.057	0.954	0.05	-0.183	0.194
Windowpane Flounder	CRUISEID	RES-1-11	0.835	0.177	652	4.715	0.000	0.05	0.487	1.183
Windowpane Flounder	CRUISEID	VEN-1-12	0.733	0.099	652	7.383	0.000	0.05	0.538	0.928
Windowpane Flounder	CRUISEID	WES-1-11	0.453	0.168	652	2.695	0.007	0.05	0.123	0.783
Windowpane Flounder	CRUISEID	WIS-1-12	0.000							

Table 35: Mixed effects model with pooled catch data for all bycatch survey cruises. Results are for Atlantic cod from the model that provided the best fit (intercept and area) to the data as supported by model comparison (minimum AIC value). Confidence limits are Wald type confidence intervals. Parameter estimates are on the logit scale.

Species	**Effect**	**CruiseID**	**Estimate**	**StdErr**	**DF**	**tValue**	**Probt**	**Alpha**	**LCI**	**UCI**
Atlantic Cod	Intercept		1.706	1.531	41	1.115	0.271	0.05	-1.385	4.798
Atlantic Cod	AREA	CAI	-2.481	2.019	41	-1.229	0.226	0.05	-6.558	1.596
Atlantic Cod	AREA	CAII	0.000							

Table 36: Mixed effects model with pooled catch data for all bycatch survey cruises. Results are for barndoor skate scallops from the model that provided the best fit (intercept, cruiseid and area) to the data as supported by model comparison (minimum AIC value). Confidence limits are Wald type confidence intervals. Parameter estimates are on the logit scale.

Species	Effect	CRUISEID	AREA	Estimate	StdErr	DF	tValue	Probt	Alpha	Lower	Upper
Barndoor Skate	Intercept			0.066	0.239	485	0.279	0.781	0.05	-0.402	0.535
Barndoor Skate	AREA		CAI	-0.325	0.119	485	-2.740	0.006	0.05	-0.559	-0.092
Barndoor Skate	AREA		CAII	0.000							
Barndoor Skate	CRUISEID	ARC-1-11		0.687	0.627	485	1.095	0.274	0.05	-0.545	1.919
Barndoor Skate	CRUISEID	CEL-1-11		-0.484	0.554	485	-0.874	0.382	0.05	-1.572	0.604
Barndoor Skate	CRUISEID	CEL-2-10		0.335	0.316	485	1.063	0.288	0.05	-0.285	0.956
Barndoor Skate	CRUISEID	END-1-11		0.228	0.274	485	0.833	0.405	0.05	-0.310	0.767
Barndoor Skate	CRUISEID	END-2-12		-0.437	1.294	485	-0.338	0.736	0.05	-2.979	2.105
Barndoor Skate	CRUISEID	HOR-1-11		0.343	0.304	485	1.126	0.261	0.05	-0.255	0.941
Barndoor Skate	CRUISEID	LIB-1-11		0.126	0.296	485	0.427	0.670	0.05	-0.455	0.708
Barndoor Skate	CRUISEID	RAN-1-11		0.611	0.283	485	2.160	0.031	0.05	0.055	1.166
Barndoor Skate	CRUISEID	REG-1-11		0.370	0.277	485	1.338	0.182	0.05	-0.174	0.914
Barndoor Skate	CRUISEID	REG-2-12		0.305	0.414	485	0.737	0.461	0.05	-0.508	1.119
Barndoor Skate	CRUISEID	RES-1-11		0.077	0.282	485	0.275	0.783	0.05	-0.476	0.631
Barndoor Skate	CRUISEID	VEN-1-12		1.823	0.816	485	2.234	0.026	0.05	0.219	3.426
Barndoor Skate	CRUISEID	WES-1-11		-0.621	0.328	485	-1.894	0.059	0.05	-1.265	0.023
Barndoor Skate	CRUISEID	WIS-1-12		0.000							

Table 37: Mixed effects model with pooled catch data for all bycatch survey cruises. Results are for winter skate from the model that provided the best fit (intercept, cruiseid and area) to the data as supported by model comparison (minimum AIC value). Confidence limits are Wald type confidence intervals. Parameter estimates are on the logit scale.

Species	Effect	CRUISEID	AREA	Estimate	StdErr	DF	tValue	Probt	Alpha	Lower	Upper
Winter Skate	Intercept			-0.043	0.117	732	-0.368	0.713	0.05	-0.272	0.186
Winter Skate	AREA		CAI	-0.213	0.073	732	-2.913	0.004	0.05	-0.357	-0.069
Winter Skate	AREA		CAII	0.000							
Winter Skate	CRUISEID	ARC-1-11		0.033	0.165	732	0.201	0.841	0.05	-0.291	0.357
Winter Skate	CRUISEID	CEL-1-11		0.262	0.156	732	1.678	0.094	0.05	-0.045	0.568
Winter Skate	CRUISEID	CEL-2-10		0.117	0.176	732	0.663	0.508	0.05	-0.229	0.462
Winter Skate	CRUISEID	END-2-12		0.036	0.156	732	0.229	0.819	0.05	-0.271	0.343
Winter Skate	CRUISEID	HOR-1-11		0.247	0.152	732	1.626	0.104	0.05	-0.051	0.545
Winter Skate	CRUISEID	LIB-1-11		0.454	0.161	732	2.825	0.005	0.05	0.138	0.769
Winter Skate	CRUISEID	RAN-1-11		0.616	0.153	732	4.040	0.000	0.05	0.317	0.916
Winter Skate	CRUISEID	REG-1-11		0.542	0.153	732	3.538	0.000	0.05	0.241	0.844
Winter Skate	CRUISEID	REG-2-12		-0.338	0.161	732	-2.099	0.036	0.05	-0.654	-0.022
Winter Skate	CRUISEID	RES-1-11		0.059	0.155	732	0.380	0.704	0.05	-0.245	0.363
Winter Skate	CRUISEID	VEN-1-12		1.167	0.196	732	5.958	0.000	0.05	0.782	1.552
Winter Skate	CRUISEID	WES-1-11		0.282	0.164	732	1.723	0.085	0.05	-0.039	0.603
Winter Skate	CRUISEID	WIS-1-12		0.000							

Table 38: Mixed effects model with pooled catch data for all bycatch survey cruises. Results are for little skate from the model that provided the best fit (intercept, cruiseid and area) to the data as supported by model comparison (minimum AIC value). Confidence limits are Wald type confidence intervals. Parameter estimates are on the logit scale.

Species	Effect	CRUISEID	AREA	Estimate	StdErr	DF	tValue	Probt	Alpha	Lower	Upper
Little Skate	Intercept			-0.259	0.061	803	-4.209	0.000	0.05	-0.379	-0.138
Little Skate	AREA		CAI	-0.071	0.036	803	-1.980	0.048	0.05	-0.142	-0.001
Little Skate	AREA		CAII	0.000							
Little Skate	CRUISEID	ARC-1-11		-0.080	0.086	803	-0.933	0.351	0.05	-0.249	0.089
Little Skate	CRUISEID	CEL-1-11		-0.275	0.367	803	-0.747	0.455	0.05	-0.996	0.447
Little Skate	CRUISEID	CEL-2-10		0.527	0.096	803	5.485	0.000	0.05	0.338	0.715
Little Skate	CRUISEID	END-2-12		0.115	0.082	803	1.397	0.163	0.05	-0.047	0.277
Little Skate	CRUISEID	HOR-1-11		0.566	0.084	803	6.740	0.000	0.05	0.401	0.731
Little Skate	CRUISEID	LIB-1-11		0.433	0.087	803	4.969	0.000	0.05	0.262	0.604
Little Skate	CRUISEID	RAN-1-11		0.811	0.085	803	9.524	0.000	0.05	0.644	0.979
Little Skate	CRUISEID	REG-1-11		0.335	0.086	803	3.883	0.000	0.05	0.166	0.505
Little Skate	CRUISEID	REG-2-12		0.227	0.085	803	2.678	0.008	0.05	0.061	0.394
Little Skate	CRUISEID	RES-1-11		0.462	0.085	803	5.422	0.000	0.05	0.295	0.630
Little Skate	CRUISEID	VEN-1-12		0.721	0.085	803	8.516	0.000	0.05	0.555	0.887
Little Skate	CRUISEID	WES-1-11		0.291	0.089	803	3.276	0.001	0.05	0.117	0.466
Little Skate	CRUISEID	WIS-1-12		0.000							

Table 39: Mixed effects model with pooled catch data for all bycatch survey cruises. Results are for fourspot flounder from the model that provided the best fit (intercept, cruiseid and area) to the data as supported by model comparison (minimum AIC value). Confidence limits are Wald type confidence intervals. Parameter estimates are on the logit scale.

Species	Effect	CRUISEID	AREA	Estimate	StdErr	DF	tValue	Probt	Alpha	Lower	Upper
Fourspot Flounder	Intercept			-0.988	0.259	494	-3.811	0.000	0.05	-1.497	-0.479
Fourspot Flounder	AREA		CAI	-0.309	0.134	494	-2.309	0.021	0.05	-0.571	-0.046
Fourspot Flounder	AREA		CAII	0.000							
Fourspot Flounder	CRUISEID	ARC-1-11		-12.822	659.875	494	-0.019	0.985	0.05	-1309.329	1283.685
Fourspot Flounder	CRUISEID	CEL-1-11		0.240	0.958	494	0.251	0.802	0.05	-1.642	2.123
Fourspot Flounder	CRUISEID	CEL-2-10		1.326	0.323	494	4.109	0.000	0.05	0.692	1.960
Fourspot Flounder	CRUISEID	END-1-11		1.005	0.292	494	3.441	0.001	0.05	0.431	1.579
Fourspot Flounder	CRUISEID	END-2-12		0.505	0.362	494	1.397	0.163	0.05	-0.205	1.216
Fourspot Flounder	CRUISEID	HOR-1-11		1.683	0.328	494	5.138	0.000	0.05	1.039	2.327
Fourspot Flounder	CRUISEID	LIB-1-11		1.272	0.315	494	4.032	0.000	0.05	0.652	1.891
Fourspot Flounder	CRUISEID	RAN-1-11		1.748	0.307	494	5.691	0.000	0.05	1.145	2.352
Fourspot Flounder	CRUISEID	REG-1-11		1.025	0.294	494	3.489	0.001	0.05	0.448	1.602
Fourspot Flounder	CRUISEID	REG-2-12		1.157	0.448	494	2.585	0.010	0.05	0.278	2.037
Fourspot Flounder	CRUISEID	RES-1-11		1.460	0.305	494	4.790	0.000	0.05	0.861	2.058
Fourspot Flounder	CRUISEID	VEN-1-12		2.278	0.444	494	5.132	0.000	0.05	1.406	3.150
Fourspot Flounder	CRUISEID	WES-1-11		0.952	0.346	494	2.749	0.006	0.05	0.272	1.633
Fourspot Flounder	CRUISEID	WIS-1-12		0.000							

Table 40: Mixed effects model with the unpooled catch data for all bycatch survey cruises. Results are for from the model that provided the best fit (intercept and length) to the data as supported by model comparison (minimum AIC value). Confidence limits are Wald type confidence intervals. Parameter estimates are on the logit scale.

Species	Effect	Estimate	StdErr	DF	tValue	Probt	Alpha	Lower	Upper
Spiny Dogfish	Intercept	3.860	2.033	61	1.898	0.062	0.05	-0.206	7.925
Spiny Dogfish	Length	-0.027	0.028	47	-0.942	0.351	0.05	-0.084	0.030
Atlantic Cod	Intercept	3.095	2.293	42	1.350	0.184	0.05	-1.532	7.723
Atlantic Cod	Length	-0.061	0.046	7	-1.347	0.220	0.05	-0.169	0.046
American Plaice	Intercept	-0.964	0.651	276	-1.482	0.139	0.05	-2.245	0.316
American Plaice	Length	0.021	0.017	343	1.255	0.210	0.05	-0.012	0.054
Summer Flounder	Intercept	-0.160	0.513	252	-0.312	0.756	0.05	-1.171	0.851
Summer Flounder	Length	0.001	0.010	274	0.090	0.928	0.05	-0.018	0.020
Grey Sole	Intercept	0.675	1.066	146	0.633	0.528	0.05	-1.432	2.782
Grey Sole	Length	-0.012	0.026	151	-0.452	0.652	0.05	-0.063	0.039
Monkfish	Intercept	0.145	0.140	663	1.038	0.300	0.05	-0.129	0.419
Monkfish	Length	-0.003	0.003	2466	-1.074	0.283	0.05	-0.008	0.002

Table 41: Mixed effects model with the unpooled catch data for all bycatch survey cruises. Results are for scallops from the model that provided the best fit (intercept, length and cruiseid) to the data as supported by model comparison (minimum AIC value). Confidence limits are Wald type confidence intervals. Parameter estimates are on the logit scale.

Species	Effect	Cruiseid	Estimate	StdErr	DF	tValue	Probt	Alpha	Lower	Upper
Sea Scallops	Intercept		0.969	0.062	942	15.563	0.000	0.05	0.847	1.091
Sea Scallops	LENGTH		-0.007	0.000	11297	-18.372	0.000	0.05	-0.008	-0.006
Sea Scallops	CRUISEID	ARC-1-11	-0.150	0.057	11297	-2.649	0.008	0.05	-0.262	-0.039
Sea Scallops	CRUISEID	CEL-1-11	-0.151	0.058	11297	-2.622	0.009	0.05	-0.264	-0.038
Sea Scallops	CRUISEID	CEL-2-10	0.092	0.064	11297	1.447	0.148	0.05	-0.033	0.217
Sea Scallops	CRUISEID	END-1-11	-0.056	0.056	11297	-0.987	0.324	0.05	-0.166	0.055
Sea Scallops	CRUISEID	END-2-12	-0.115	0.056	11297	-2.061	0.039	0.05	-0.224	-0.006
Sea Scallops	CRUISEID	HOR-1-11	-0.018	0.055	11297	-0.317	0.751	0.05	-0.126	0.091
Sea Scallops	CRUISEID	LIB-1-11	0.155	0.057	11297	2.742	0.006	0.05	0.044	0.266
Sea Scallops	CRUISEID	RAN-1-11	0.130	0.056	11297	2.320	0.020	0.05	0.020	0.241
Sea Scallops	CRUISEID	REG-1-11	0.053	0.057	11297	0.933	0.351	0.05	-0.058	0.164
Sea Scallops	CRUISEID	REG-2-12	-0.096	0.056	11297	-1.709	0.088	0.05	-0.206	0.014
Sea Scallops	CRUISEID	RES-1-11	0.002	0.056	11297	0.032	0.975	0.05	-0.109	0.112
Sea Scallops	CRUISEID	VEN-1-12	0.316	0.055	11297	5.713	0.000	0.05	0.208	0.424
Sea Scallops	CRUISEID	WES-1-11	-0.011	0.058	11297	-0.194	0.846	0.05	-0.126	0.103
Sea Scallops	CRUISEID	WIS-1-12	0.000							

Table 42: Mixed effects model with the unpooled catch data for all bycatch survey cruises. Results are for yellowtail flounder from the model that provided the best fit (intercept, length and cruiseid) to the data as supported by model comparison (minimum AIC value). Confidence limits are Wald type confidence intervals. Parameter estimates are on the logit scale.

Species	Effect	Cruiseid	Estimate	StdErr	DF	tValue	Probt	Alpha	Lower	Upper
Yellowtail Flounder	Intercept		0.536	0.252	708	2.124	0.034	0.05	0.041	1.031
Yellowtail Flounder	LENGTH		-0.022	0.006	3609	-3.495	0.000	0.05	-0.034	-0.010
Yellowtail Flounder	CRUISEID	ARC-1-11	-0.295	0.147	708	-2.003	0.046	0.05	-0.584	-0.006
Yellowtail Flounder	CRUISEID	CEL-1-11	0.020	0.151	708	0.132	0.895	0.05	-0.277	0.317
Yellowtail Flounder	CRUISEID	CEL-2-10	0.455	0.150	708	3.039	0.002	0.05	0.161	0.749
Yellowtail Flounder	CRUISEID	END-1-11	0.265	0.154	708	1.723	0.085	0.05	-0.037	0.567
Yellowtail Flounder	CRUISEID	END-2-12	0.473	0.135	708	3.498	0.000	0.05	0.208	0.739
Yellowtail Flounder	CRUISEID	HOR-1-11	0.540	0.142	708	3.803	0.000	0.05	0.261	0.819
Yellowtail Flounder	CRUISEID	LIB-1-11	0.403	0.157	708	2.567	0.010	0.05	0.095	0.711
Yellowtail Flounder	CRUISEID	RAN-1-11	1.094	0.139	708	7.892	0.000	0.05	0.821	1.366
Yellowtail Flounder	CRUISEID	REG-1-11	0.357	0.134	708	2.672	0.008	0.05	0.095	0.620
Yellowtail Flounder	CRUISEID	REG-2-12	0.136	0.146	708	0.931	0.352	0.05	-0.151	0.423
Yellowtail Flounder	CRUISEID	RES-1-11	0.876	0.137	708	6.398	0.000	0.05	0.607	1.145
Yellowtail Flounder	CRUISEID	VEN-1-12	0.810	0.157	708	5.146	0.000	0.05	0.501	1.118
Yellowtail Flounder	CRUISEID	WES-1-11	-0.068	0.152	708	-0.448	0.654	0.05	-0.366	0.230
Yellowtail Flounder	CRUISEID	WIS-1-12	0.000							

Table 43: Mixed effects model with the unpooled catch data for all bycatch survey cruises. Results are for windowpane flounder from the model that provided the best fit (intercept, length and cruiseid) to the data as supported by model comparison (minimum AIC value). Confidence limits are Wald type confidence intervals. Parameter estimates are on the logit scale.

Species	Effect	Cruiseid	Estimate	StdErr	DF	tValue	Probt	Alpha	Lower	Upper
Windowpane Flounder	Intercept		-0.451	0.214	644	-2.109	0.035	0.05	-0.871	-0.031
Windowpane Flounder	LENGTH		-0.001	0.007	3345	-0.121	0.904	0.05	-0.015	0.013
Windowpane Flounder	CRUISEID	ARC-1-11	-0.323	0.121	644	-2.679	0.008	0.05	-0.560	-0.086
Windowpane Flounder	CRUISEID	CEL-1-11	0.307	0.128	644	2.399	0.017	0.05	0.056	0.558
Windowpane Flounder	CRUISEID	CEL-2-10	0.531	0.172	644	3.083	0.002	0.05	0.193	0.869
Windowpane Flounder	CRUISEID	END-1-11	-0.171	0.190	644	-0.902	0.368	0.05	-0.543	0.201
Windowpane Flounder	CRUISEID	END-2-12	0.340	0.112	644	3.042	0.002	0.05	0.120	0.559
Windowpane Flounder	CRUISEID	HOR-1-11	0.139	0.126	644	1.107	0.269	0.05	-0.108	0.386
Windowpane Flounder	CRUISEID	LIB-1-11	0.493	0.310	644	1.589	0.112	0.05	-0.116	1.103
Windowpane Flounder	CRUISEID	RAN-1-11	0.965	0.163	644	5.939	0.000	0.05	0.646	1.284
Windowpane Flounder	CRUISEID	REG-1-11	0.101	0.193	644	0.523	0.601	0.05	-0.278	0.480
Windowpane Flounder	CRUISEID	REG-2-12	0.137	0.115	644	1.186	0.236	0.05	-0.090	0.364
Windowpane Flounder	CRUISEID	RES-1-11	0.866	0.202	644	4.297	0.000	0.05	0.470	1.262
Windowpane Flounder	CRUISEID	VEN-1-12	0.598	0.118	644	5.060	0.000	0.05	0.366	0.830
Windowpane Flounder	CRUISEID	WES-1-11	0.515	0.185	644	2.786	0.005	0.05	0.152	0.878
Windowpane Flounder	CRUISEID	WIS-1-12	0.000							

Table 44: Mixed effects model with the unpooled catch data for all bycatch survey cruises. Results are for haddock from the model that provided the best fit (intercept, length and area) to the data as supported by model comparison (minimum AIC value). Confidence limits are Wald type confidence intervals. Parameter estimates are on the logit scale.

Species	Effect	Cruiseid	Estimate	StdErr	DF	tValue	Probt	Alpha	Lower	Upper
Haddock	Intercept		0.188	0.533	79	0.352	0.726	0.05	-0.874	1.249
Haddock	LENGTH		0.014	0.014	44	0.989	0.328	0.05	-0.015	0.043
Haddock	AREA	CAI	-0.696	0.417	79	-1.669	0.099	0.05	-1.527	0.134
Haddock	AREA	CAII	0.000							

Table 45: Mixed effects model with the unpooled catch data for all bycatch survey cruises. Results are for barndoor skate from the model that provided the best fit (intercept, length, area and cruiseid) to the data as supported by model comparison (minimum AIC value). Confidence limits are Wald type confidence intervals. Parameter estimates are on the logit scale.

Species	Effect	Cruiseid	Area	Estimate	StdErr	DF	tValue	Probt	Alpha	Lower	Upper
Barndoor Skate	Intercept			0.006	0.265	512	0.023	0.981	0.05	-0.514	0.527
Barndoor Skate	LENGTH			0.001	0.002	1095	0.510	0.610	0.05	-0.003	0.005
Barndoor Skate	AREA		CAI	-0.322	0.121	512	-2.664	0.008	0.05	-0.559	-0.084
Barndoor Skate	AREA		CAII	0.000							
Barndoor Skate	CRUISEID	ARC-1-11		0.707	0.625	512	1.130	0.259	0.05	-0.522	1.935
Barndoor Skate	CRUISEID	CEL-1-11		-0.361	0.561	512	-0.644	0.520	0.05	-1.463	0.741
Barndoor Skate	CRUISEID	CEL-2-10		0.483	0.315	512	1.534	0.126	0.05	-0.136	1.102
Barndoor Skate	CRUISEID	END-1-11		0.218	0.274	512	0.793	0.428	0.05	-0.321	0.756
Barndoor Skate	CRUISEID	END-2-12		0.295	0.327	512	0.901	0.368	0.05	-0.348	0.938
Barndoor Skate	CRUISEID	HOR-1-11		0.415	0.304	512	1.363	0.173	0.05	-0.183	1.012
Barndoor Skate	CRUISEID	LIB-1-11		0.107	0.295	512	0.363	0.717	0.05	-0.473	0.687
Barndoor Skate	CRUISEID	RAN-1-11		0.512	0.282	512	1.812	0.071	0.05	-0.043	1.066
Barndoor Skate	CRUISEID	REG-1-11		0.464	0.278	512	1.667	0.096	0.05	-0.083	1.011
Barndoor Skate	CRUISEID	REG-2-12		0.329	0.413	512	0.797	0.426	0.05	-0.483	1.141
Barndoor Skate	CRUISEID	RES-1-11		0.150	0.279	512	0.537	0.591	0.05	-0.399	0.699
Barndoor Skate	CRUISEID	VEN-1-12		1.834	0.814	512	2.252	0.025	0.05	0.234	3.433
Barndoor Skate	CRUISEID	WES-1-11		-0.652	0.327	512	-1.992	0.047	0.05	-1.295	-0.009
Barndoor Skate	CRUISEID	WIS-1-12		0.000							

Table 46: Mixed effects model with the unpooled catch data for all bycatch survey cruises. Results are for fourspot flounder from the model that provided the best fit (intercept, length, area and cruiseid) to the data as supported by model comparison (minimum AIC value). Confidence limits are Wald type confidence intervals. Parameter estimates are on the logit scale.

Species	Effect	Cruiseid	Area	Estimate	StdErr	DF	tValue	Probt	Alpha	Lower	Upper
Fourspot Flounder	Intercept			-1.011	0.310	493	-3.260	0.001	0.05	-1.620	-0.402
Fourspot Flounder	LENGTH			0.001	0.000	1171		0.000			
Fourspot Flounder	AREA		CAI	-0.364	0.129	493	-2.811	0.005	0.05	-0.618	-0.110
Fourspot Flounder	AREA		CAII	0.000							
Fourspot Flounder	CRUISEID	ARC-1-11		-11.809	402.003	493	-0.029	0.977	0.05	-801.659	778.040
Fourspot Flounder	CRUISEID	CEL-1-11		0.235	0.940	493	0.250	0.803	0.05	-1.612	2.083
Fourspot Flounder	CRUISEID	CEL-2-10		1.367	0.312	493	4.379	0.000	0.05	0.754	1.981
Fourspot Flounder	CRUISEID	END-1-11		0.999	0.282	493	3.542	0.000	0.05	0.445	1.553
Fourspot Flounder	CRUISEID	END-2-12		0.480	0.350	493	1.371	0.171	0.05	-0.208	1.167
Fourspot Flounder	CRUISEID	HOR-1-11		1.741	0.319	493	5.459	0.000	0.05	1.114	2.367
Fourspot Flounder	CRUISEID	LIB-1-11		1.256	0.305	493	4.119	0.000	0.05	0.657	1.855
Fourspot Flounder	CRUISEID	RAN-1-11		1.699	0.299	493	5.681	0.000	0.05	1.111	2.286
Fourspot Flounder	CRUISEID	REG-1-11		1.038	0.285	493	3.638	0.000	0.05	0.477	1.598
Fourspot Flounder	CRUISEID	REG-2-12		1.136	0.436	493	2.608	0.009	0.05	0.280	1.992
Fourspot Flounder	CRUISEID	RES-1-11		1.434	0.295	493	4.867	0.000	0.05	0.855	2.013
Fourspot Flounder	CRUISEID	VEN-1-12		2.238	0.432	493	5.175	0.000	0.05	1.388	3.087
Fourspot Flounder	CRUISEID	WES-1-11		0.947	0.331	493	2.863	0.004	0.05	0.297	1.596
Fourspot Flounder	CRUISEID	WIS-1-12		0.000							

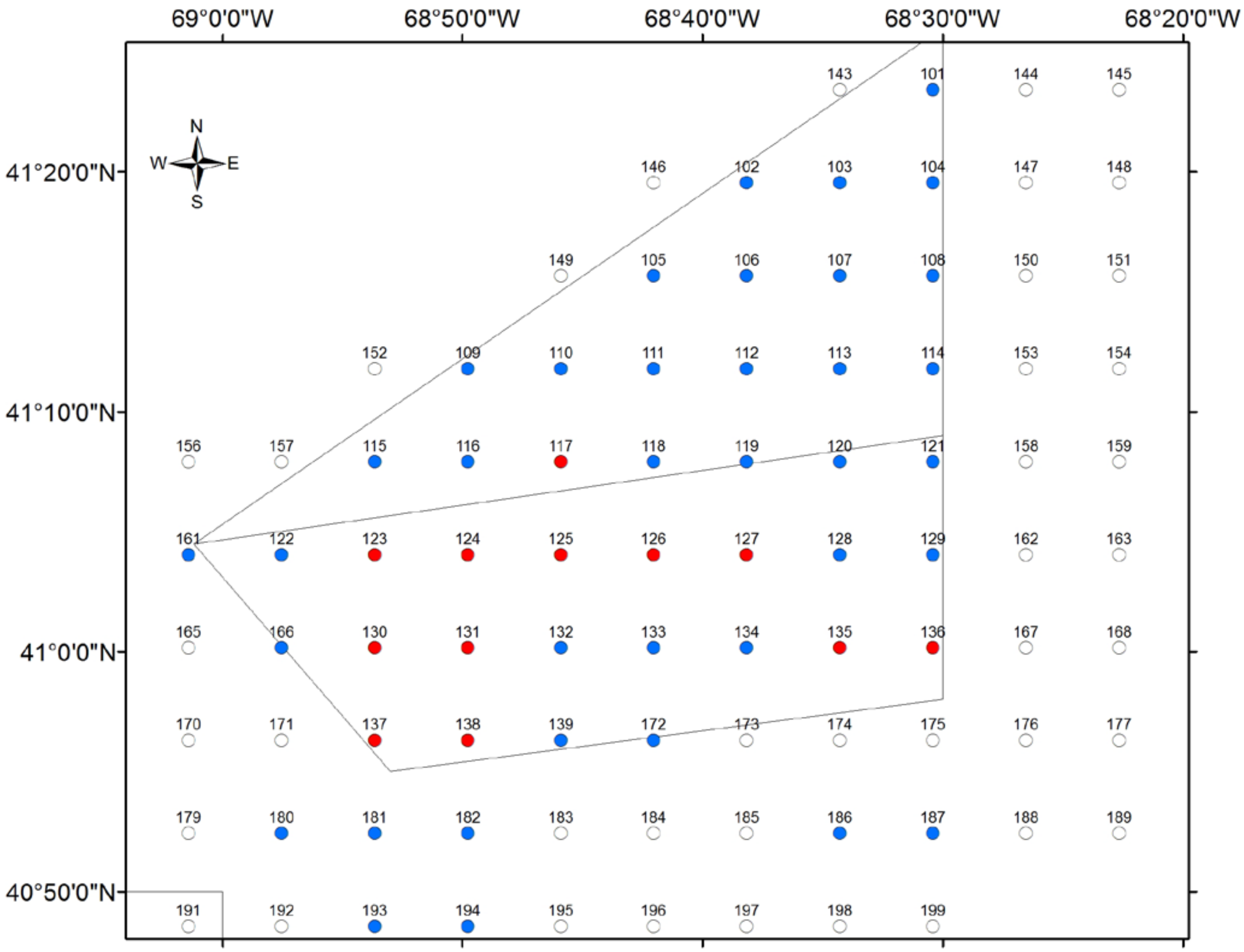


Figure 1: Stations in and around Georges Bank CAI scallop access area. Stations occupied successfully inside CAI on all 14 trips were 117, 123, 124, 125, 126, 127, 130, 131, 135, 136, 137, and 138.

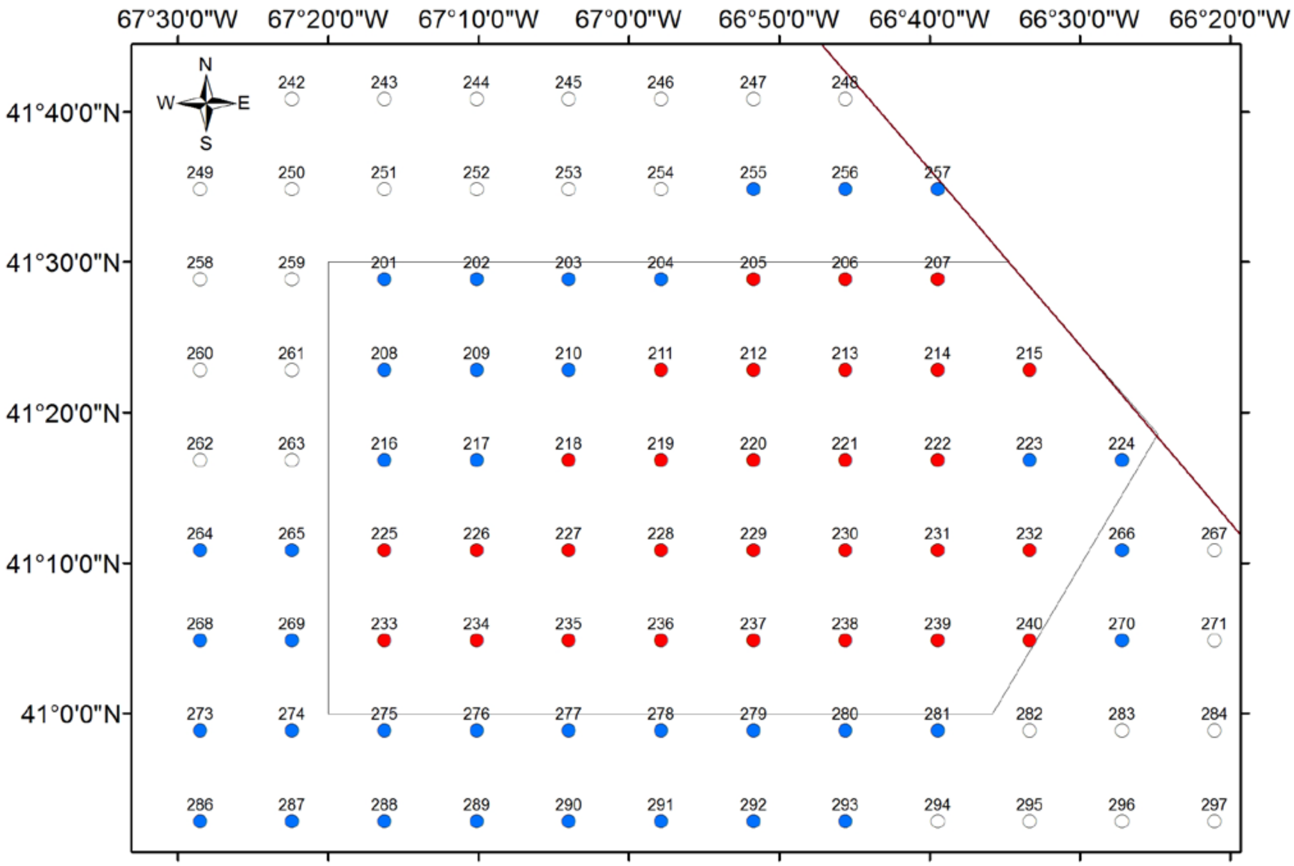


Figure 2: Stations in and around Georges Bank CAII scallop access area. Stations occupied successfully inside CAII on all 14 trips were 205-207, 211-215, 218-222, and 225-240. As the project progressed more stations were occupied south of CAII.

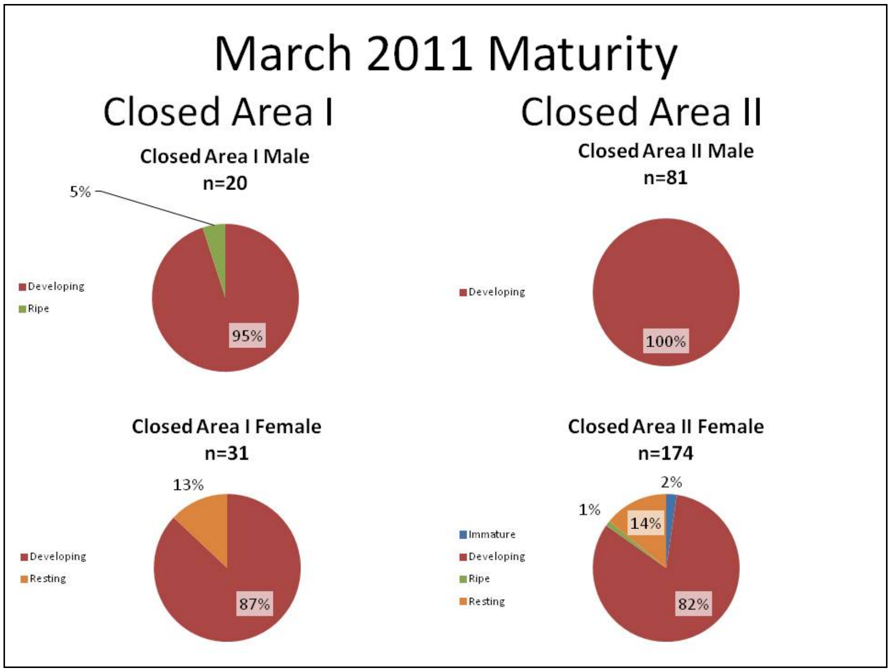


Figure 3: March 2011 Yellowtail flounder Maturity.

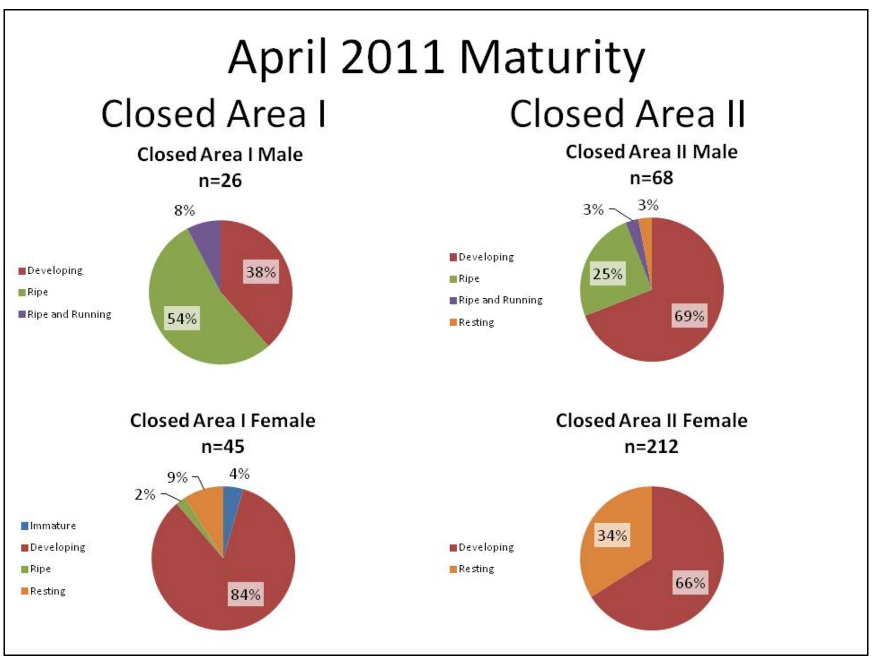


Figure 4: April 2011 Yellowtail Flounder Maturity.

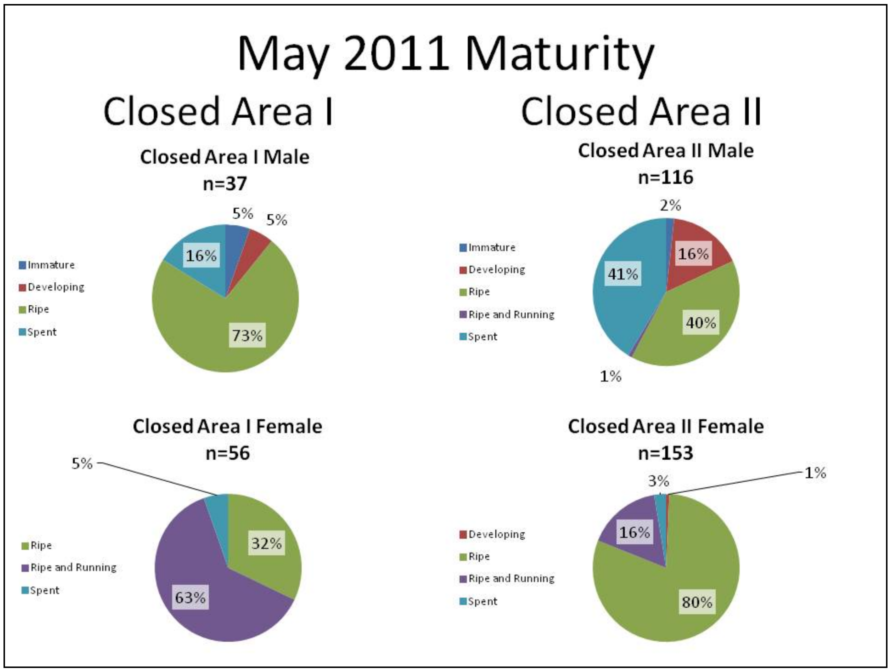


Figure 5: May 2011 Yellowtail Flounder Maturity**.**

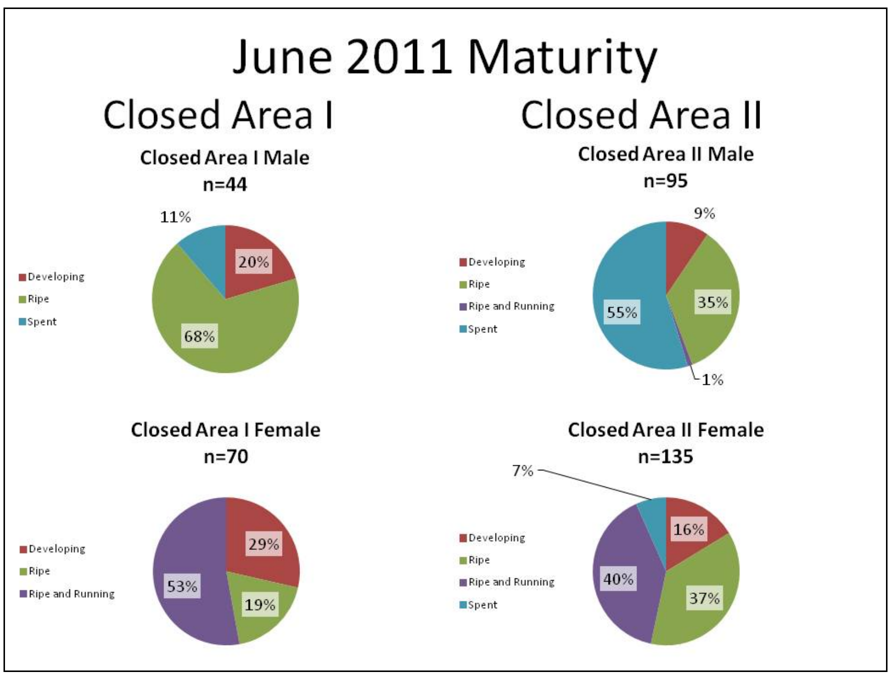


Figure 6: June 2011 Yellowtail Flounder Maturity.

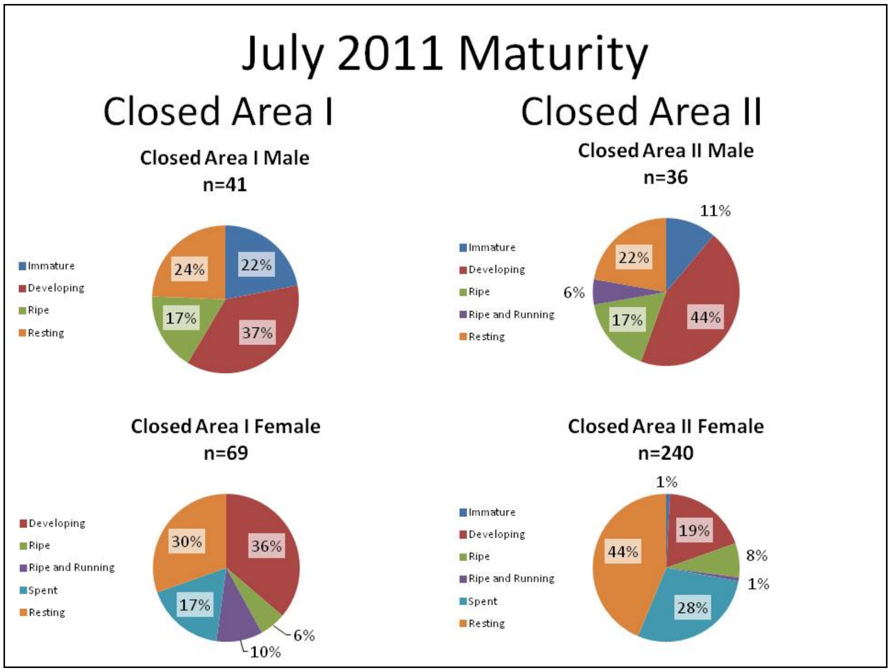


Figure 7. July 2011 Yellowtail Flounder Maturity.

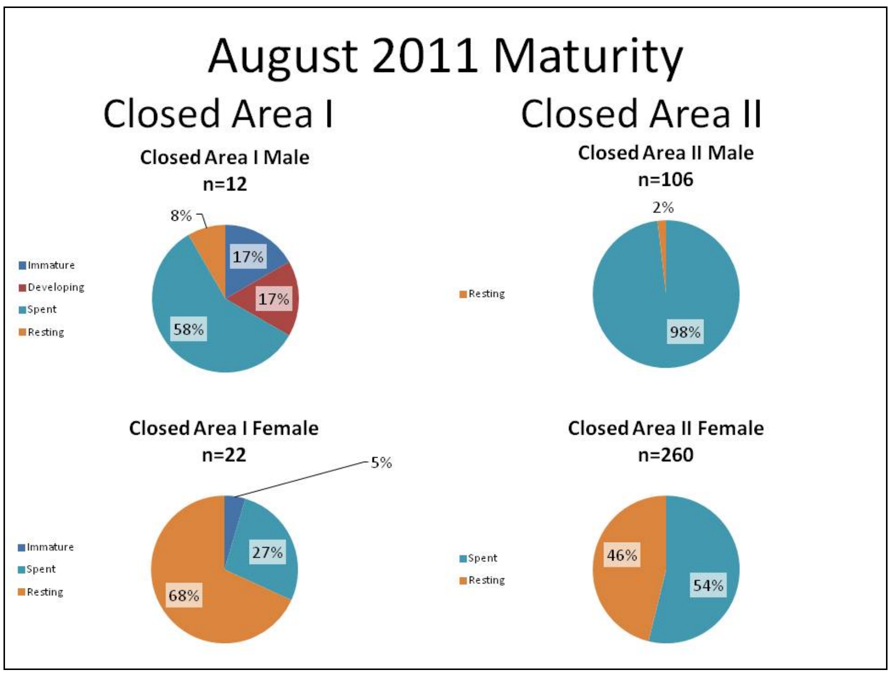


Figure 8. August 2011 Yellowtail Flounder Maturity.

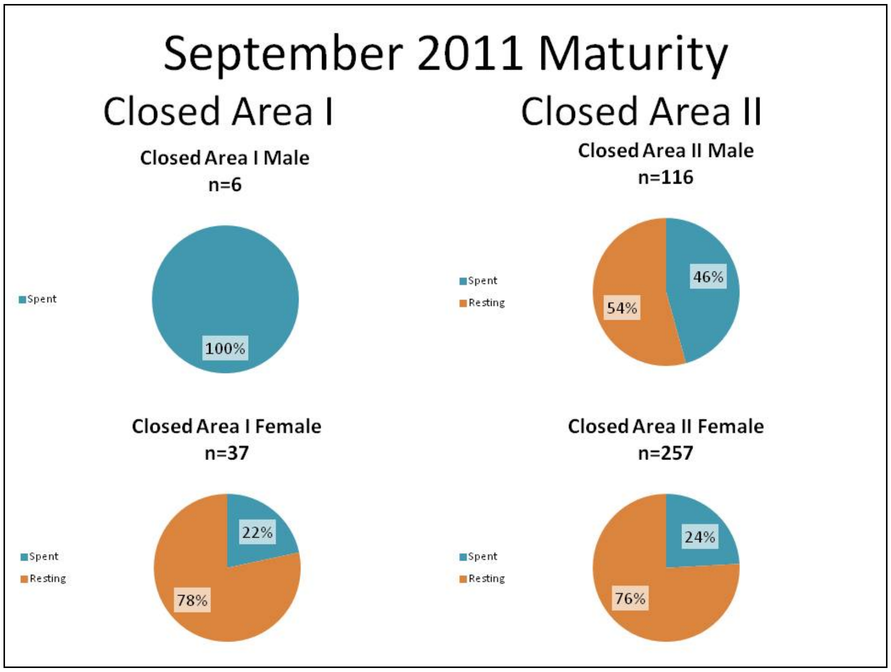


Figure 9: September 2011 Yellowtail Flounder Maturity.

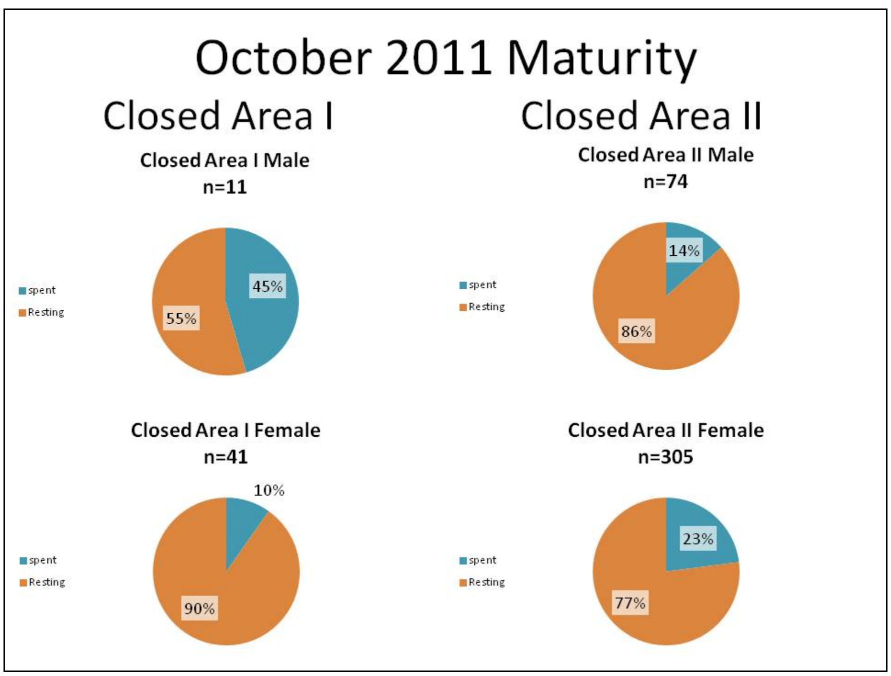


Figure 10: October 2011 Yellowtail Flounder Maturity.

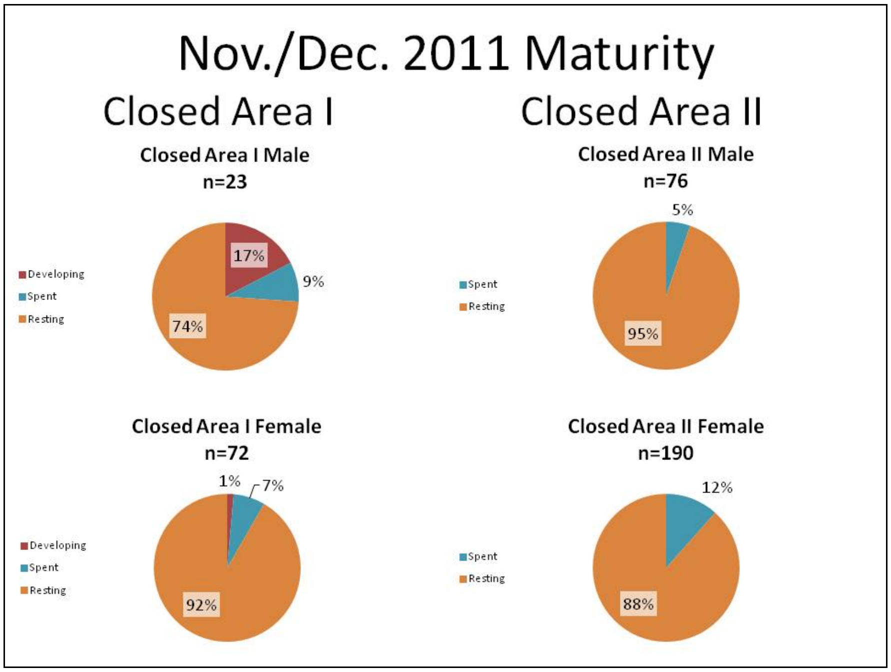


Figure 11: November-December 2011 Yellowtail Flounder Maturity.

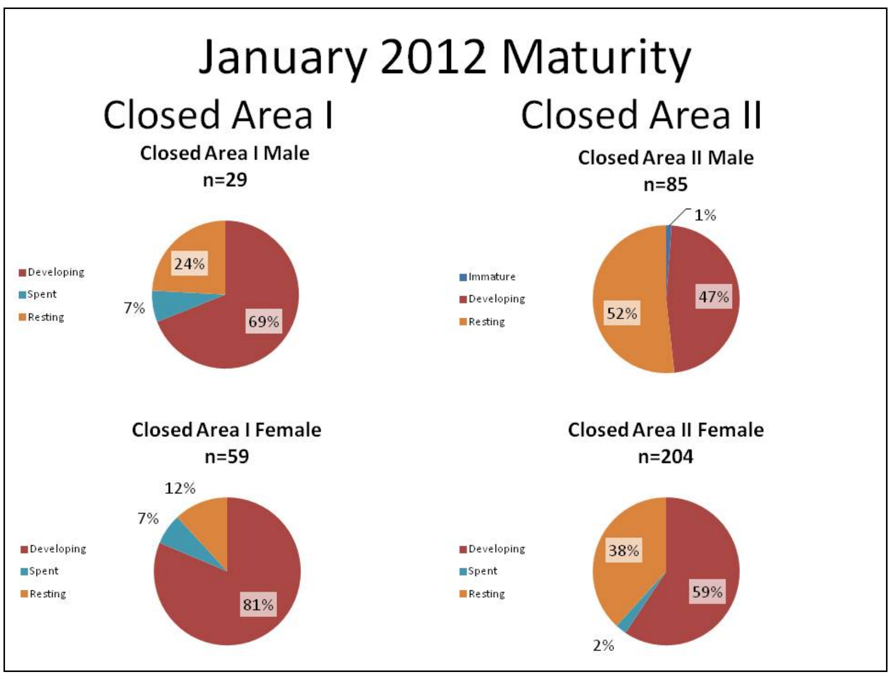


Figure 12: January 2012 Yellowtail Flounder Maturity.

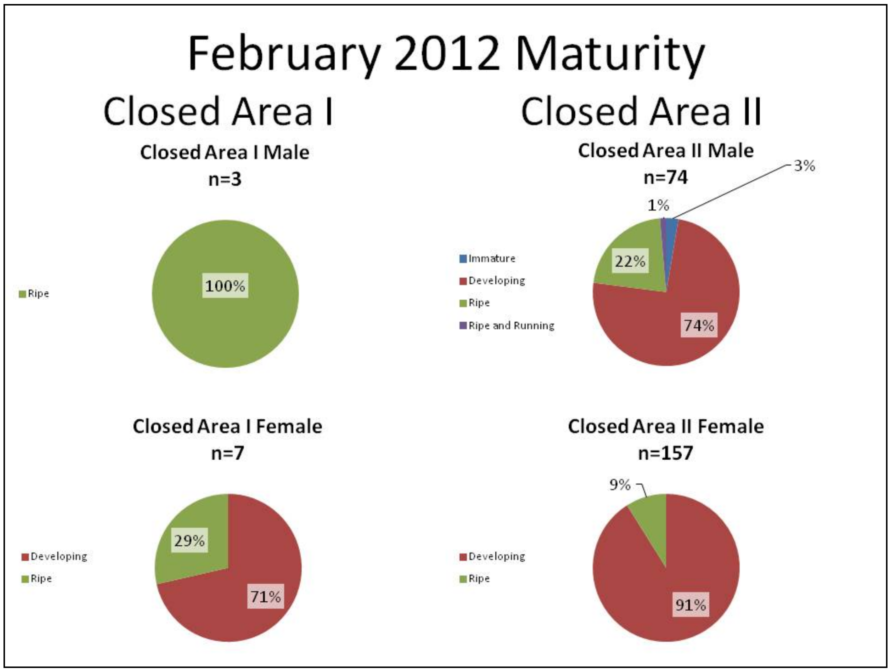


Figure 13: February 2012 Yellowtail Flounder Maturity.

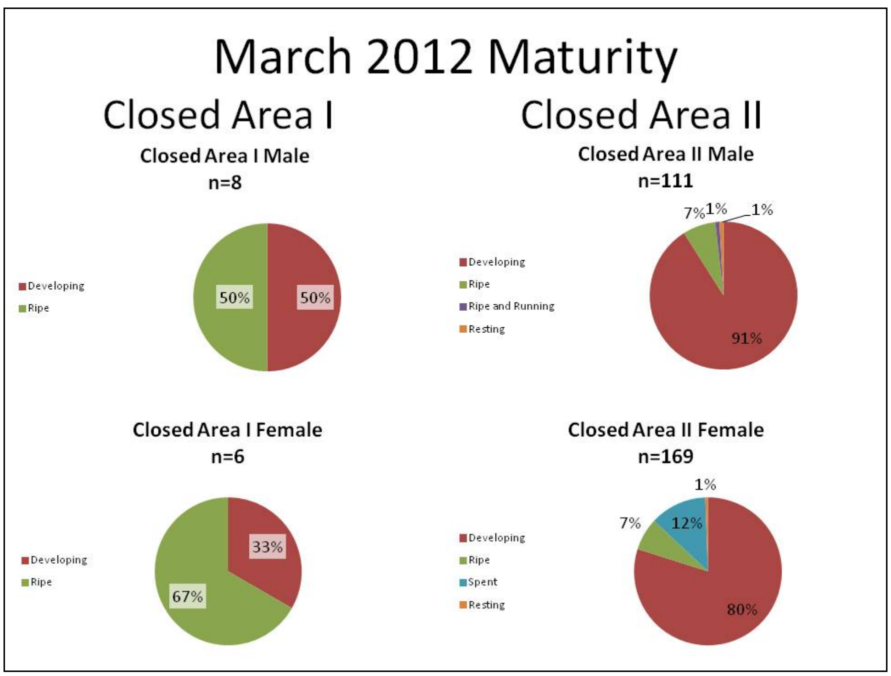


Figure 14: March 2012 Yellowtail Flounder Maturity.

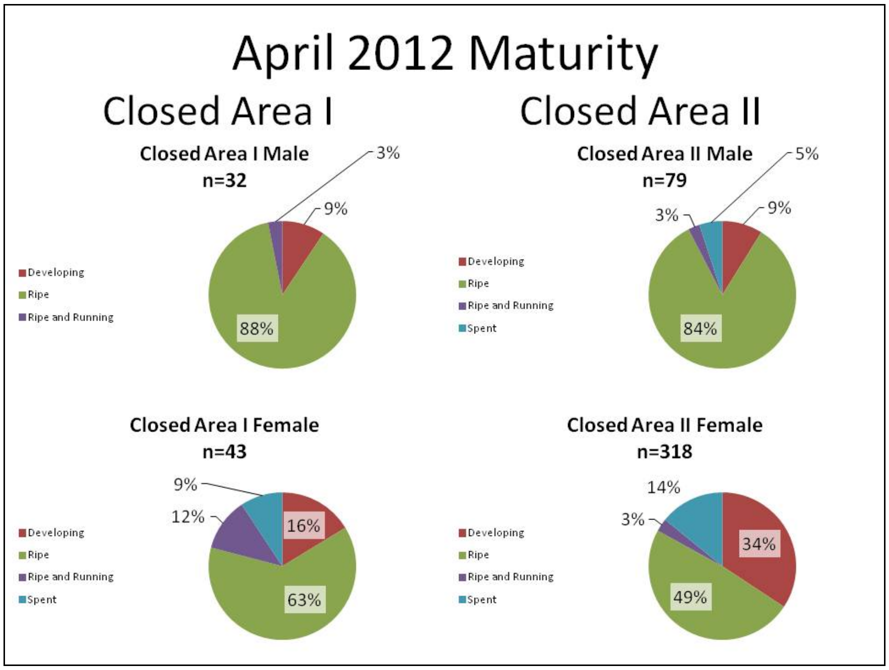


Figure 15: April 2012 Yellowtail Flounder Maturity.

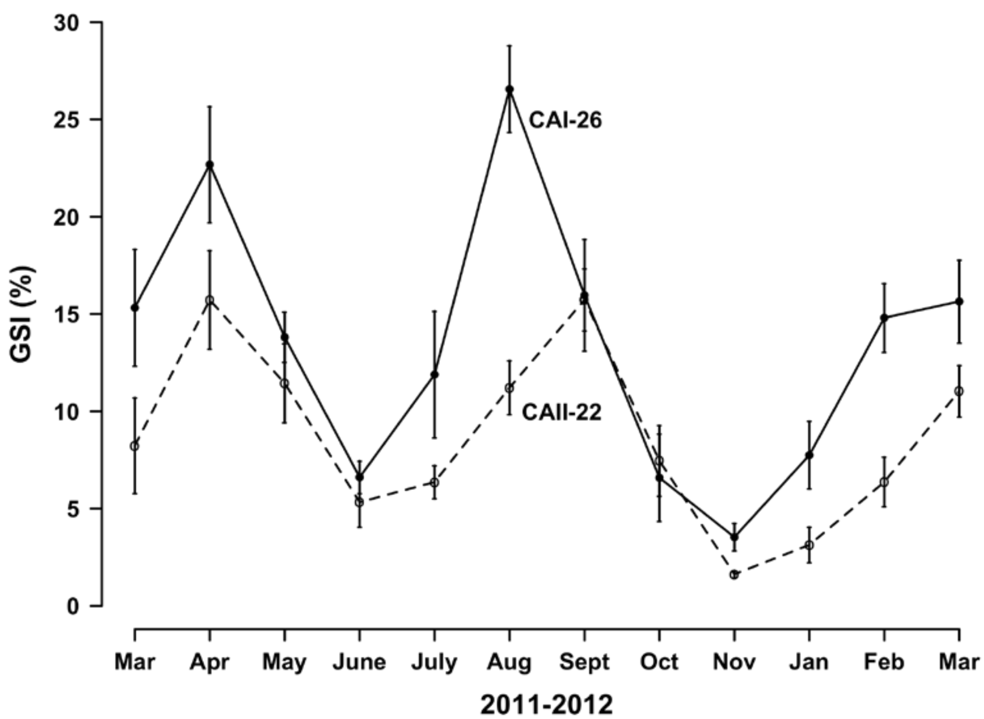


Figure 16: Mean gonosomatic index (GSI) at Station 126 and Station 222 from March 2011-March 2012 with 95% confidence intervals.

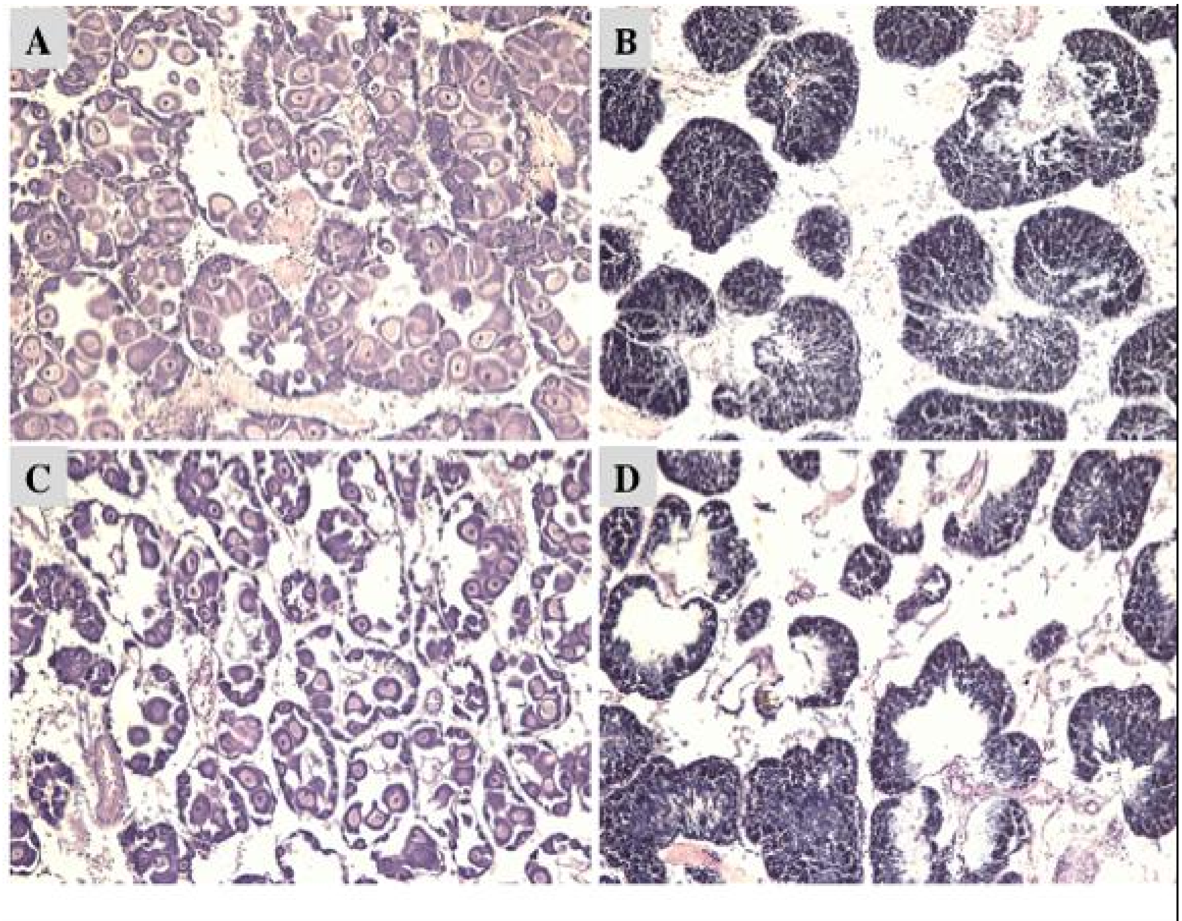


Figure 17: Histological evidence of spring spawning. Station 126: A. 120 mm female (June), B. 125 mm male (June); Station 222: C. 136 mm female (July), D. 155 mm male (June).

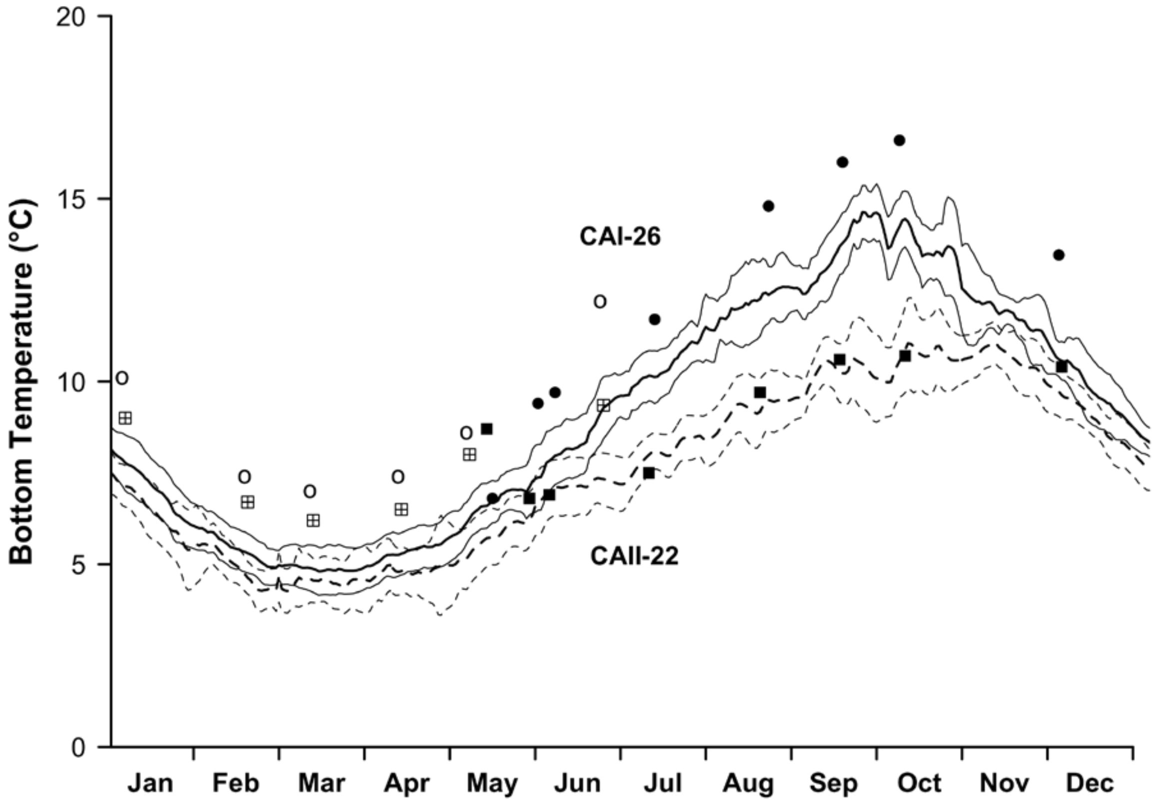
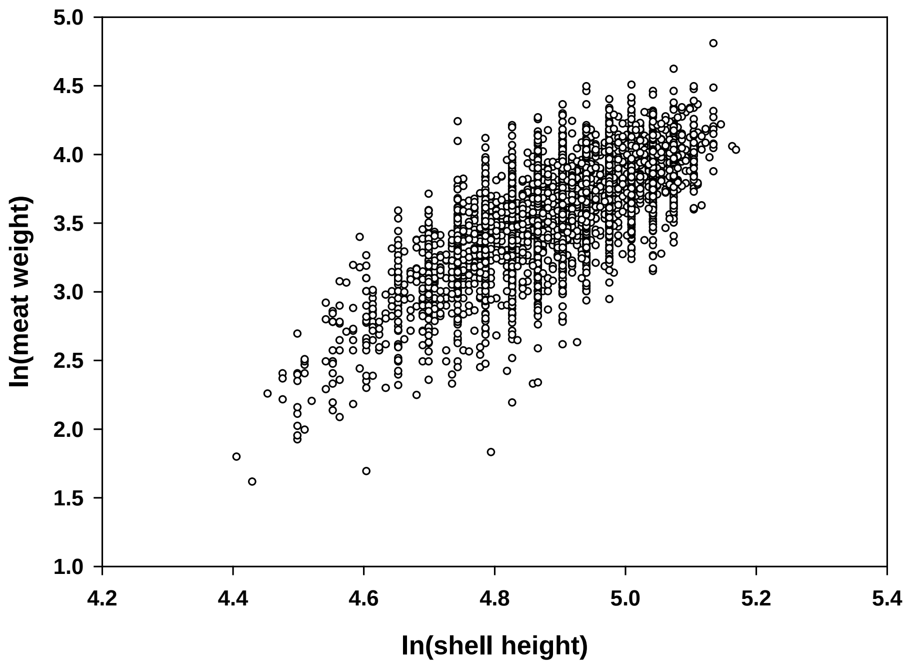


Figure 18: Bottom temperature at Station 126 (solid lines, circles) and Station 222 (hashed lines, squares): FVCOM mean daily estimates 2000-2009 (± 95% CI), measured bottom temperature from May-Dec 2011 (solid points) and Jan-June 2012 (hollow points).



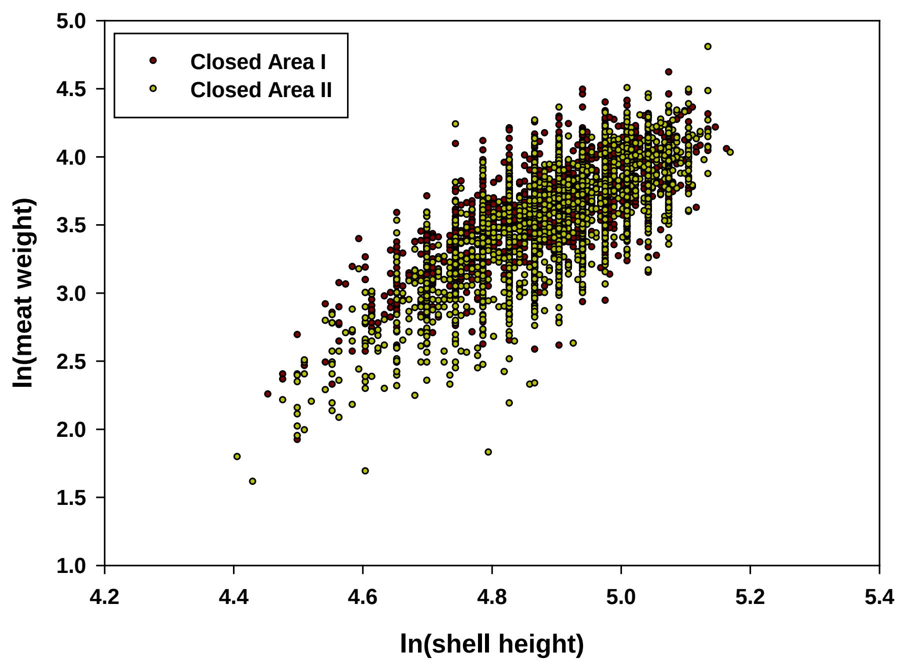


Figure 19: Shell Height: Meat Weight data for both areas combined (top panel) and the two areas plotted separately (bottom panel).

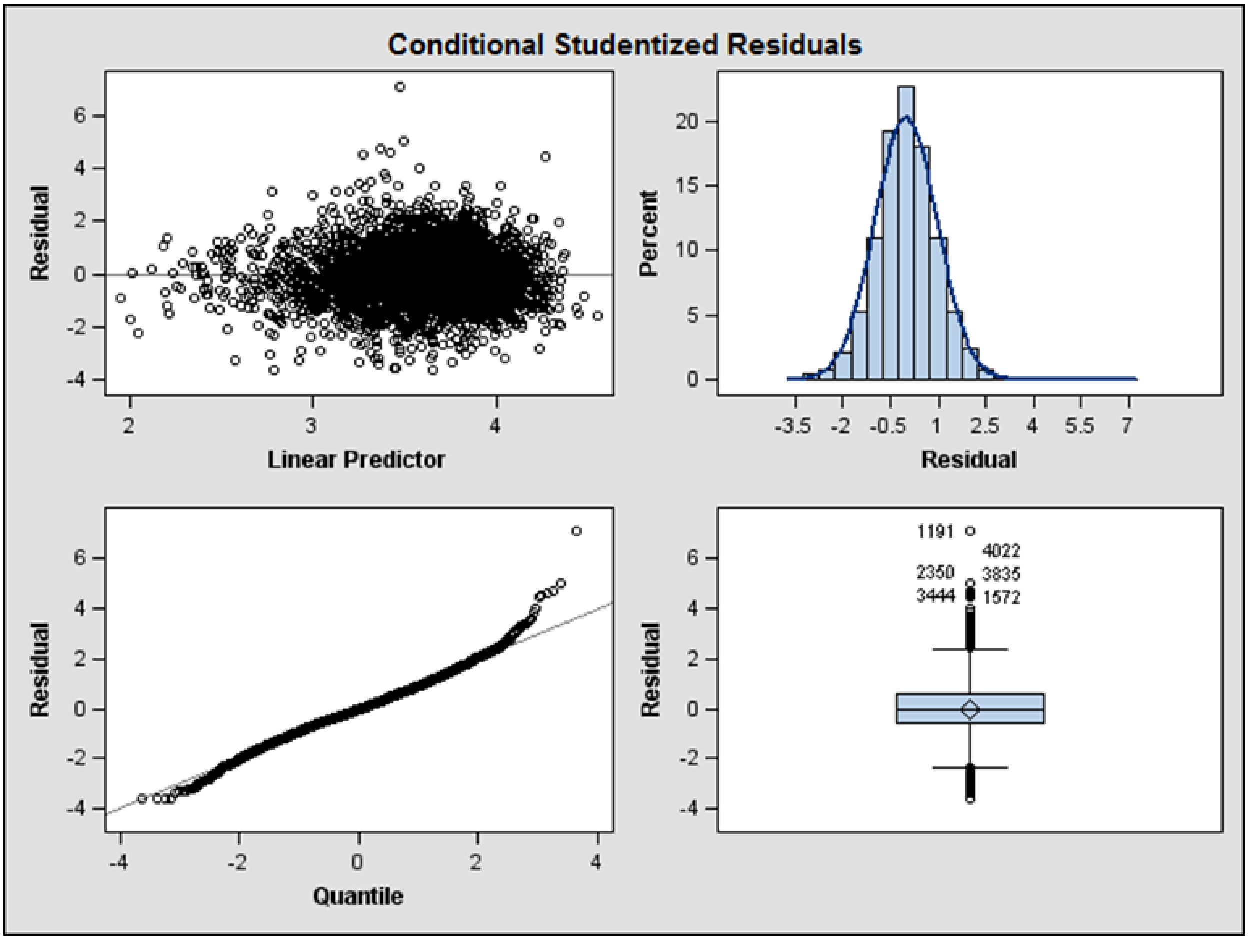


Figure 20: Residuals and QQ plot for the best model fit as determined by minimum AIC value. Residuals show no evidence of pattern, however a number of larger than expected meats were observed as evidenced by a small number of large positively valued residuals.

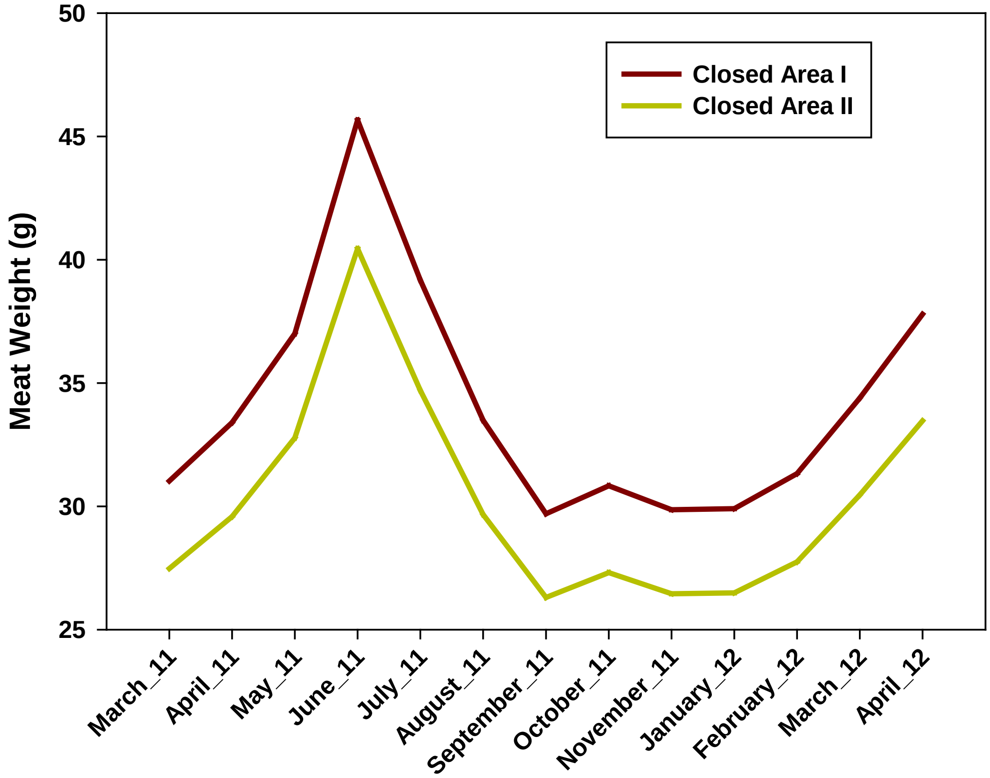


Figure 21: Temporal trends for the predicted meat weight of a 125 mm shell height scallop from the two areas. Depth was calculated as the mean depth of each area (CAI=65.06m, CAII=73.02m).

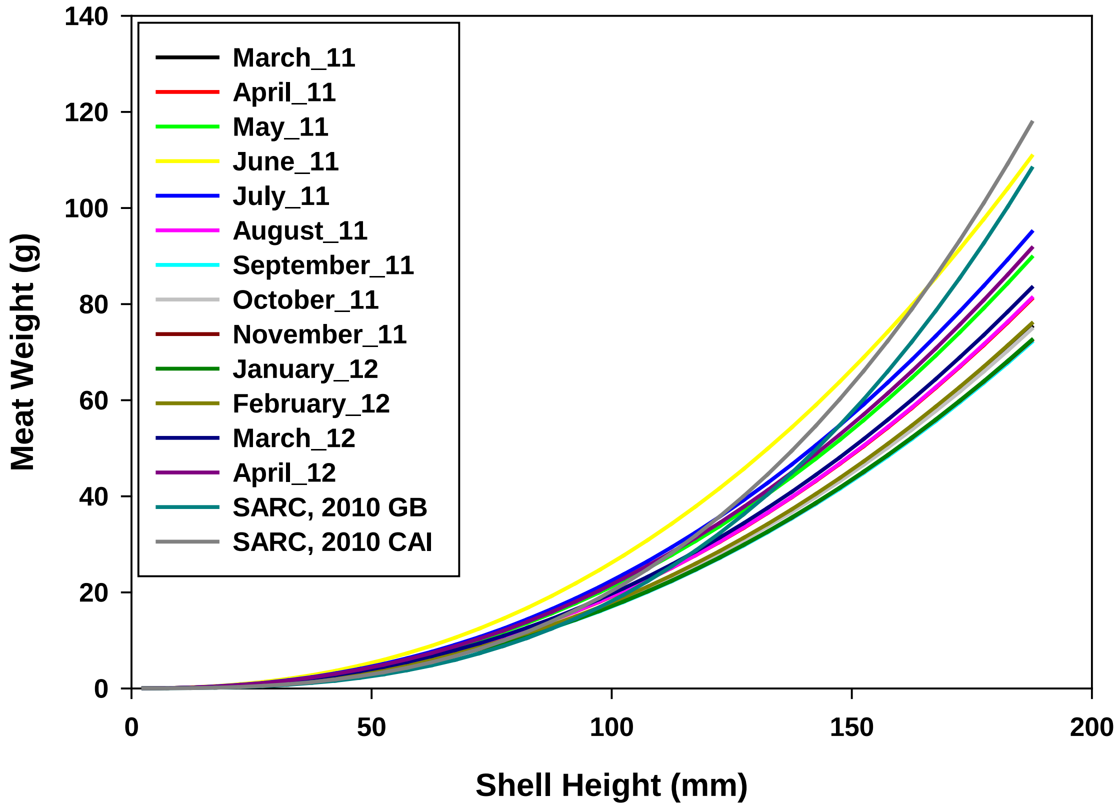


Figure 22: Comparison of estimated curves for each month in Closed Area I. Estimates for length:weight relationships for the Georges Bank in general and Closed Area I specifically from NEFSC (2010) are shown for comparison. Depth was calculated as the mean depth of each area (CAI=65.06m).

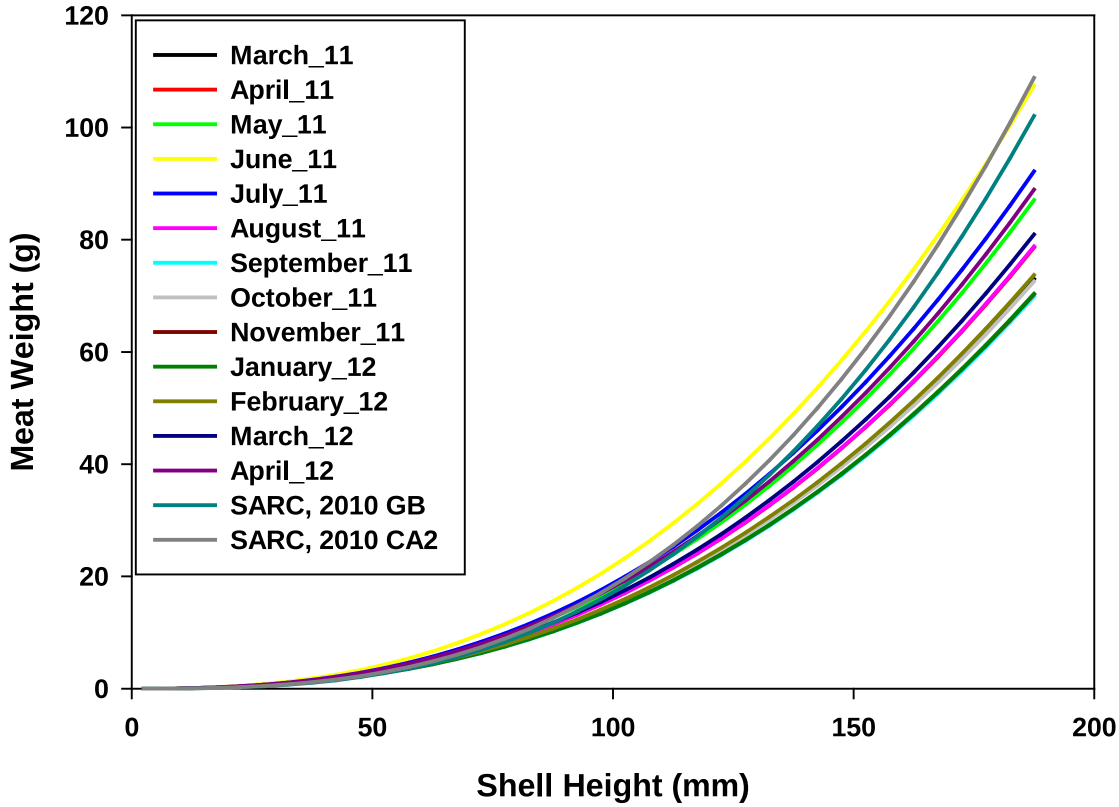
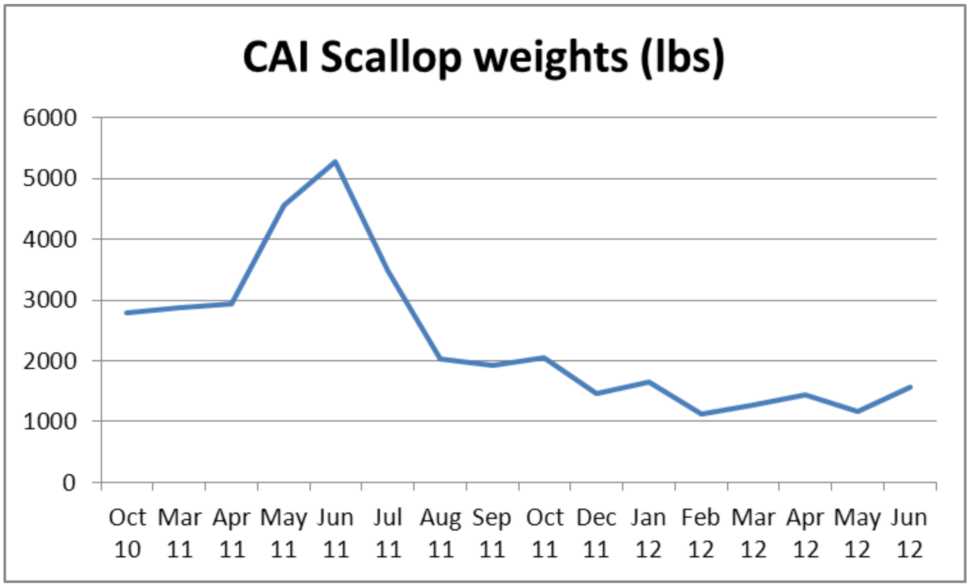


Figure 23: Comparison of estimated curves for each month in Closed Area II. Estimates for length:weight relationships for the Georges Bank in general and Closed Area II specifically from NEFSC (2010) are shown for comparison. Depth was calculated as the mean depth of each area (CAII=73.02m).



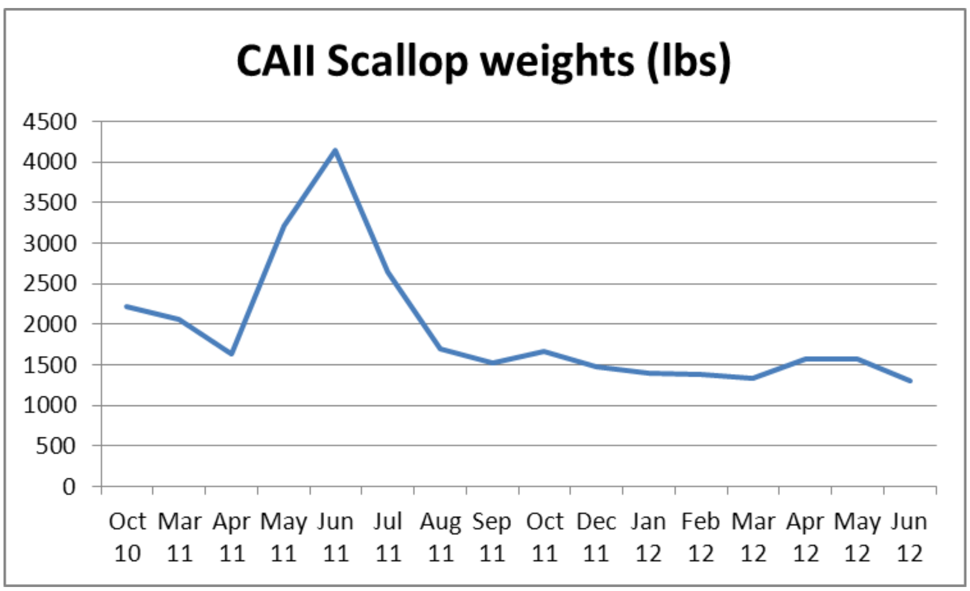
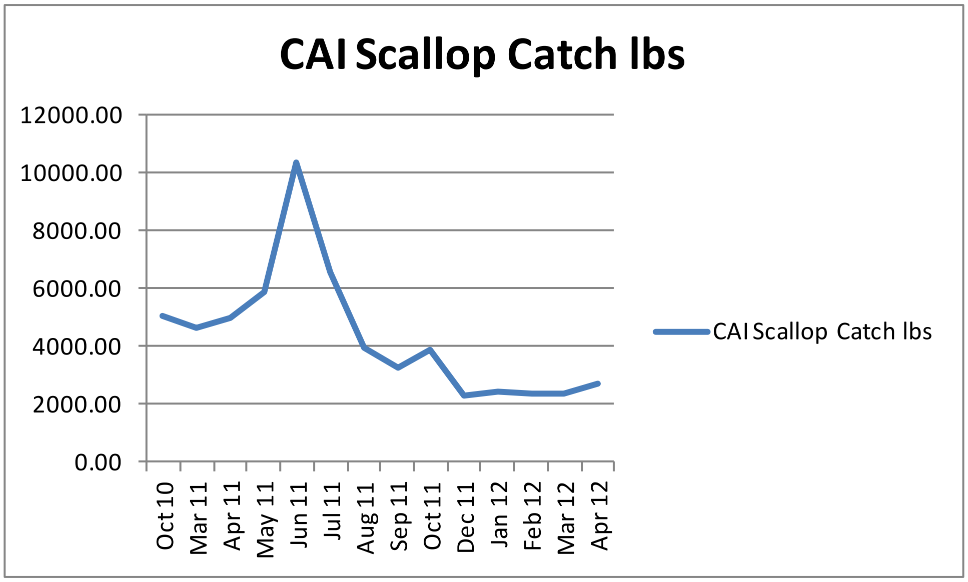


Figure 24: The scallop catch by weight in pounds from the 41 selected stations inside and outside of CAI and CAII. (CFTDD only.)



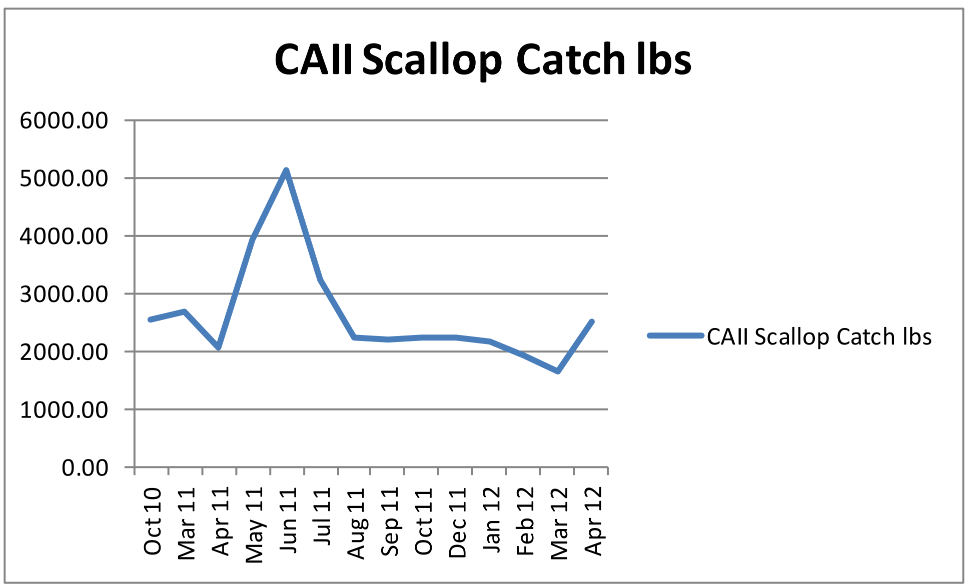
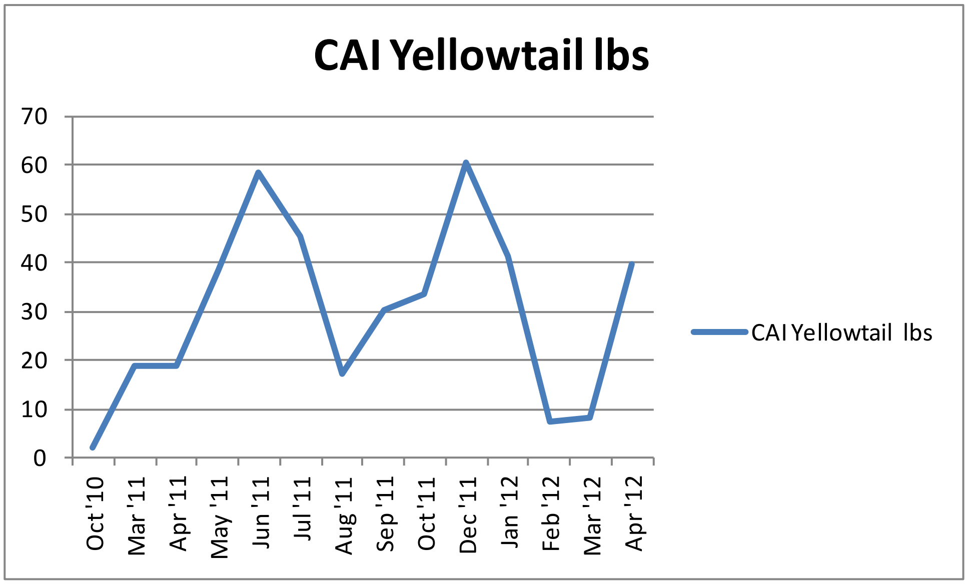


Figure 25: The scallop catch by weight in pounds from all surveyed stations inside and outside of CAI and CAII. (CFTDD only.)



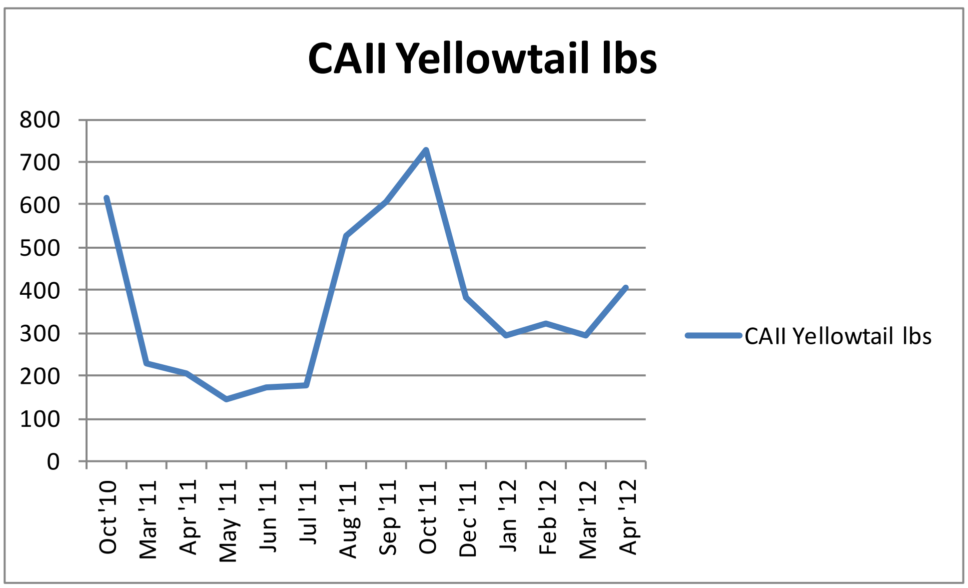
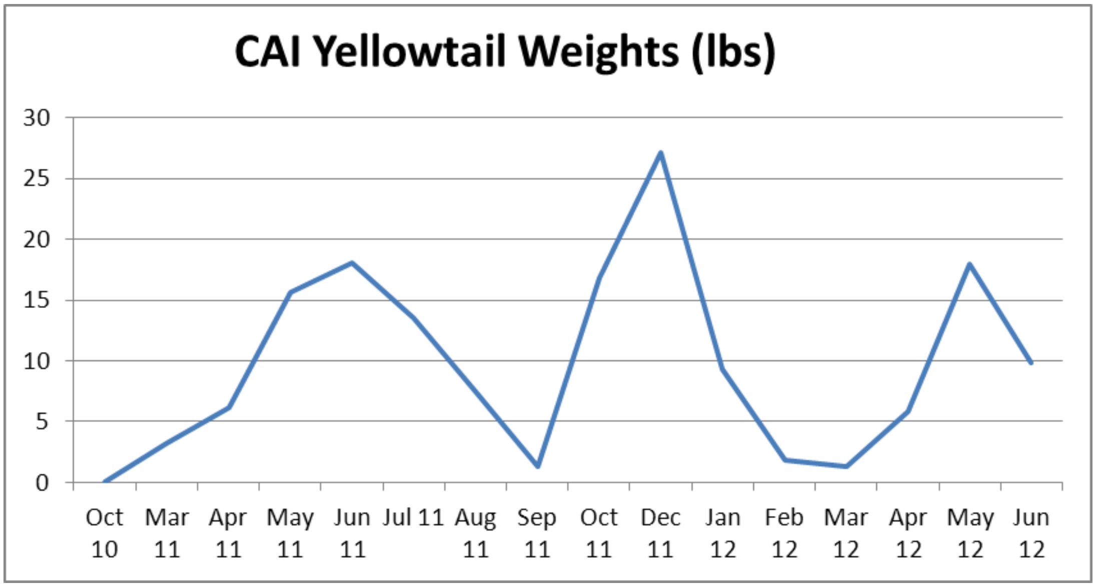


Figure 26: Monthly catch distribution in weight of yellowtail flounder from all surveyed stations inside and outside of CAI and CAII. (CFTDD only.)



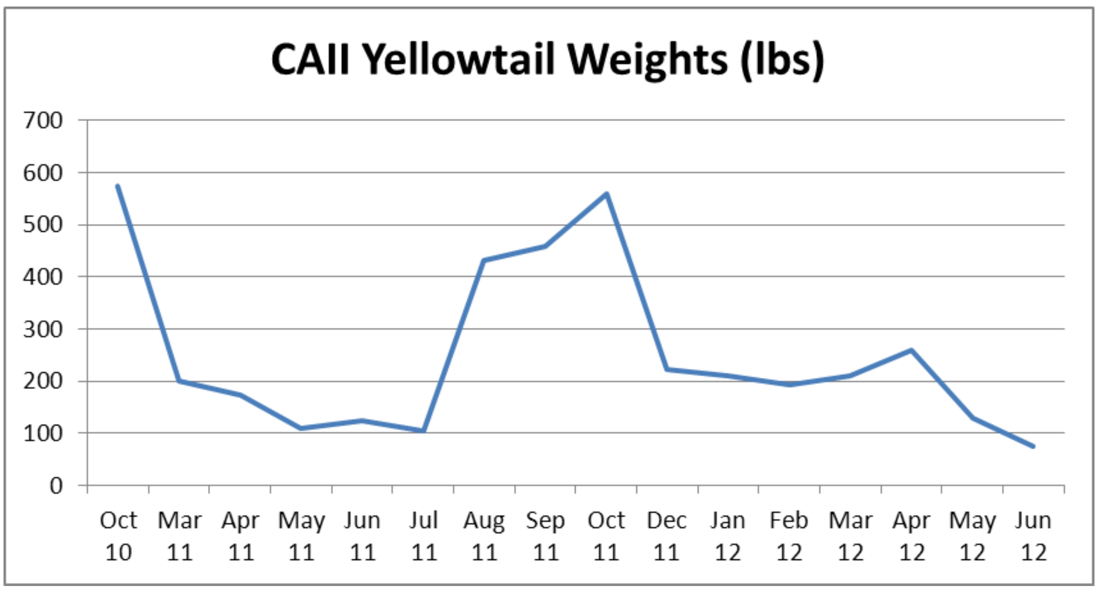
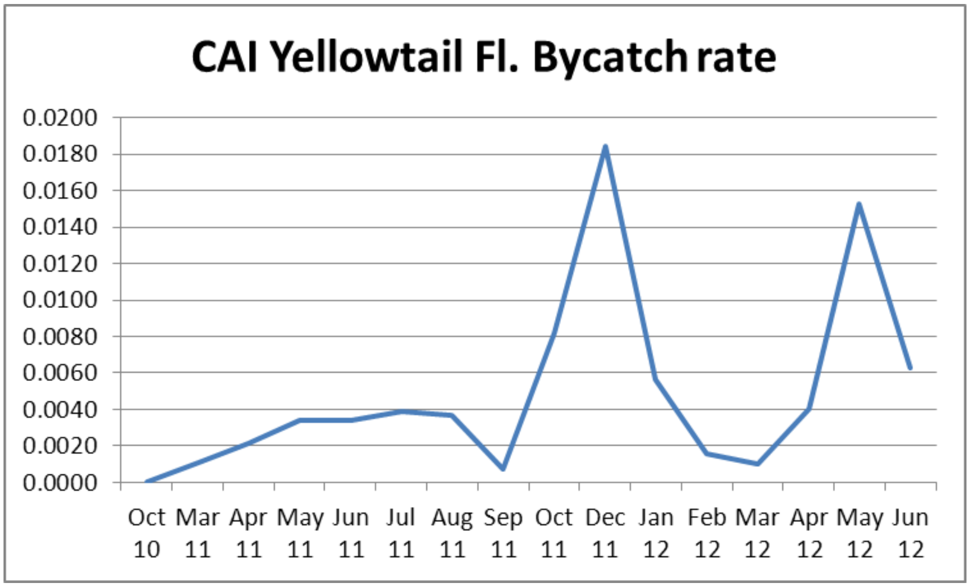


Figure 27: Monthly catch distribution in weight of yellowtail flounder from the 41 selected standardized stations inside of CAI and CAII. (CFTDD only.)



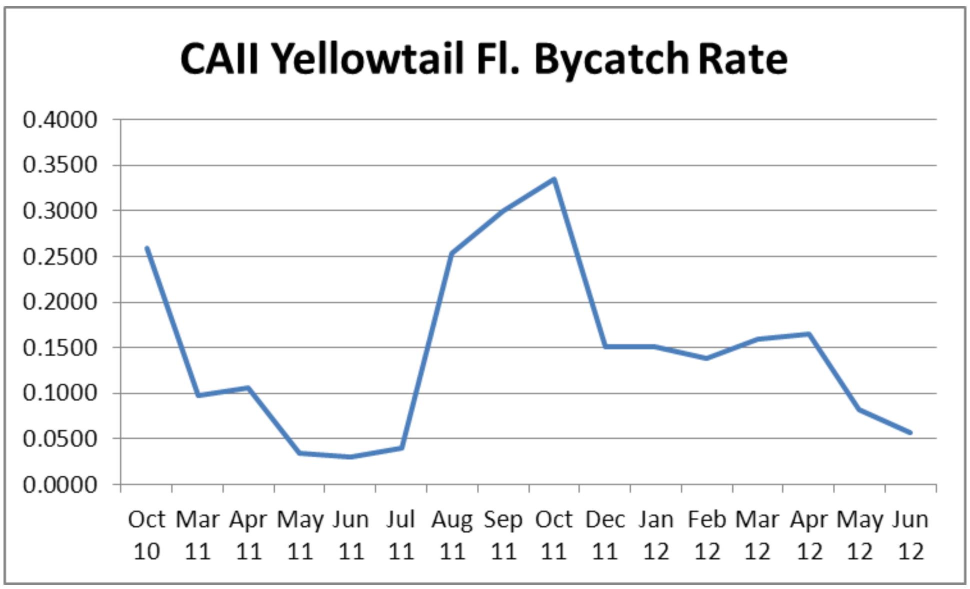


Figure 28: Yellowtail bycatch rates for the 41 selected stations inside CAI and CAII. (CFTDD only.)

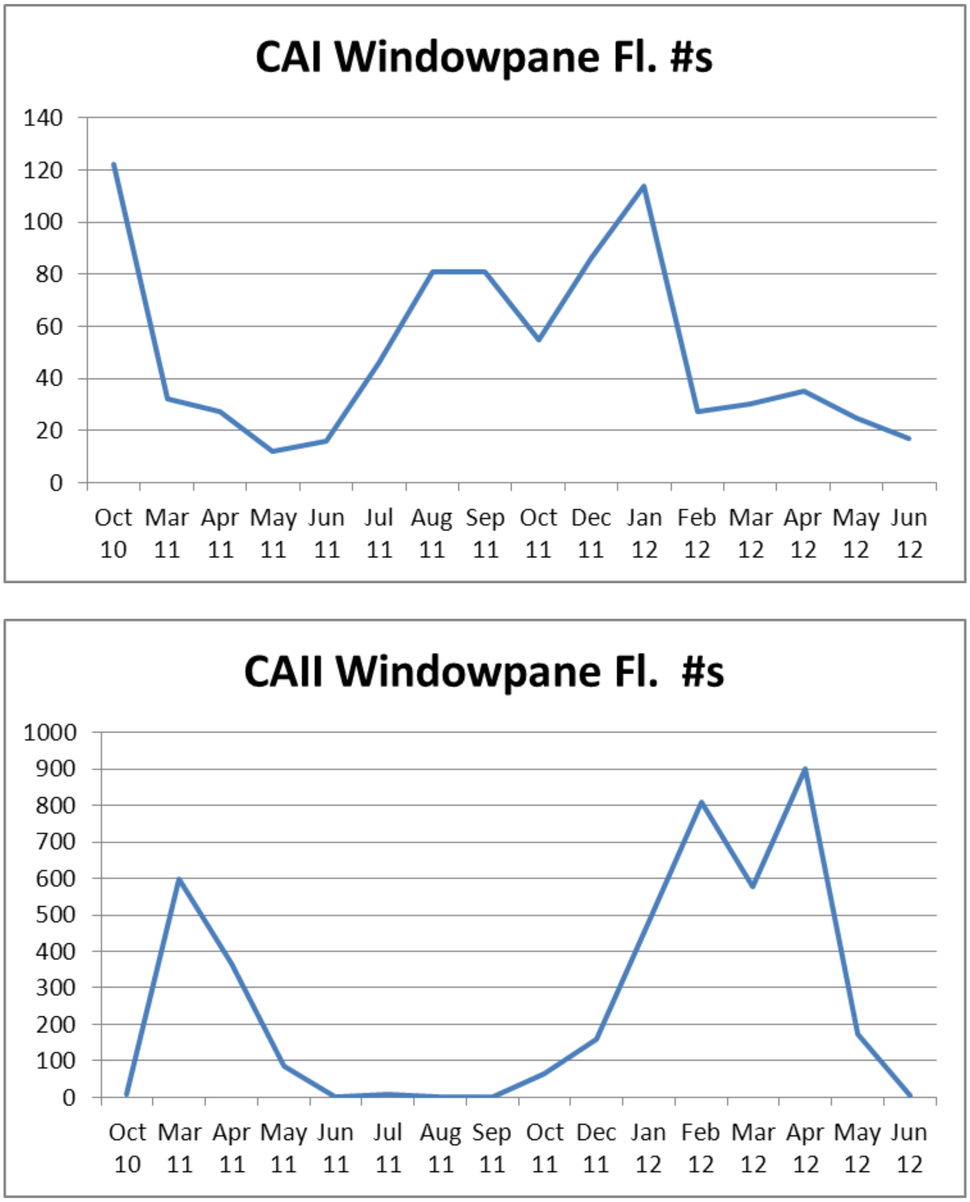
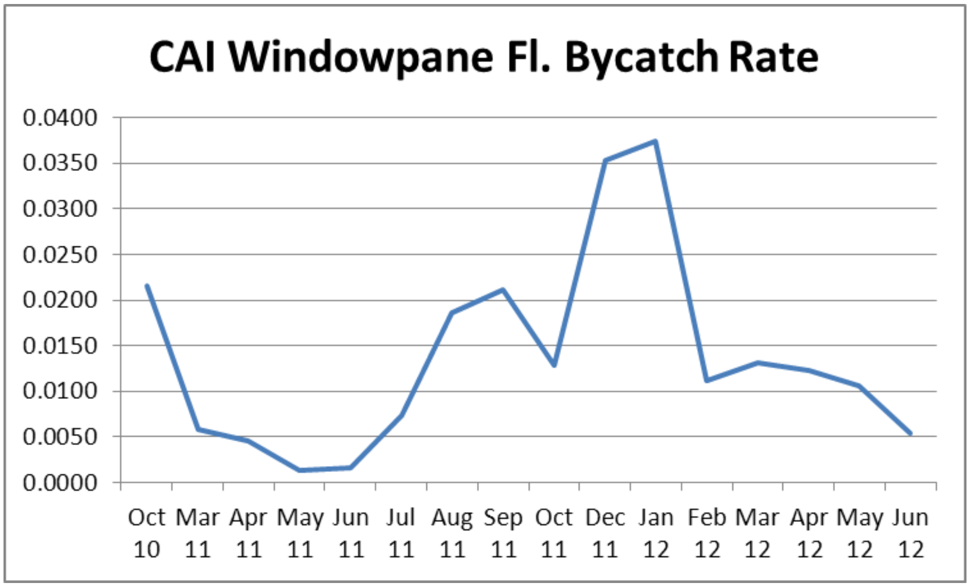


Figure 29: Number of windowpane flounder caught at the 41 selected stations inside CAI and CAII. (CFTDD only.)



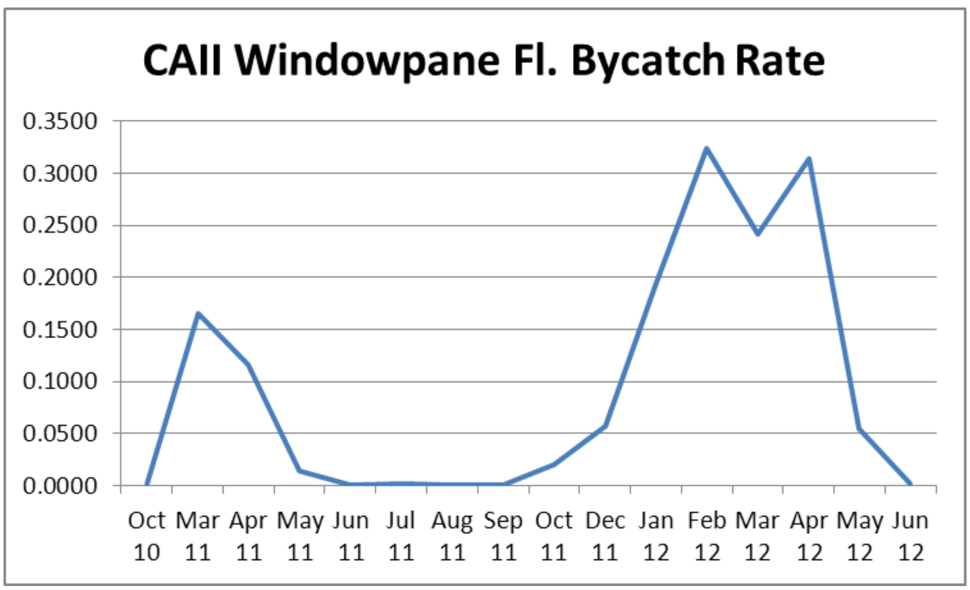
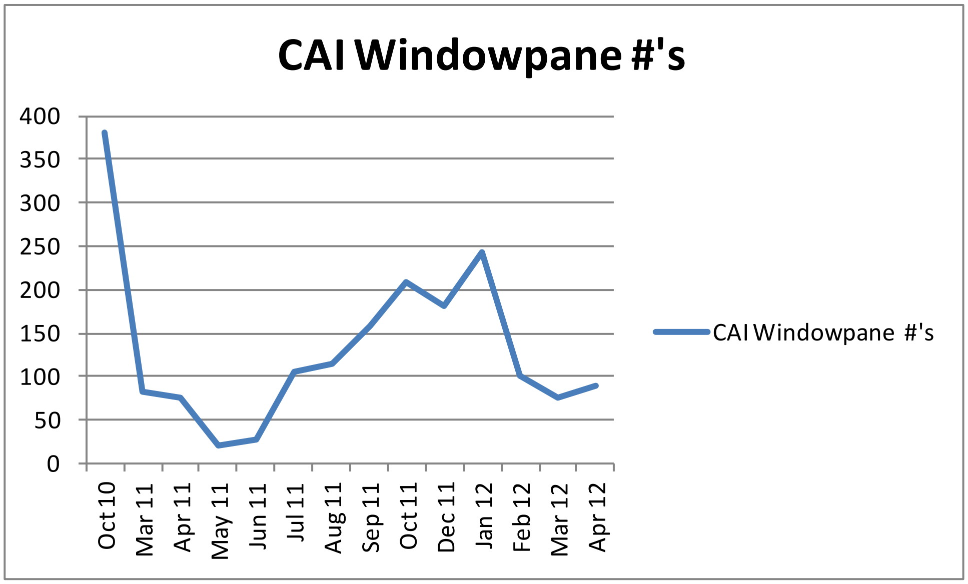


Figure 30: Windowpane flounder bycatch rates for the 41 selected stations inside CAI and CAII. (CFTDD only.)



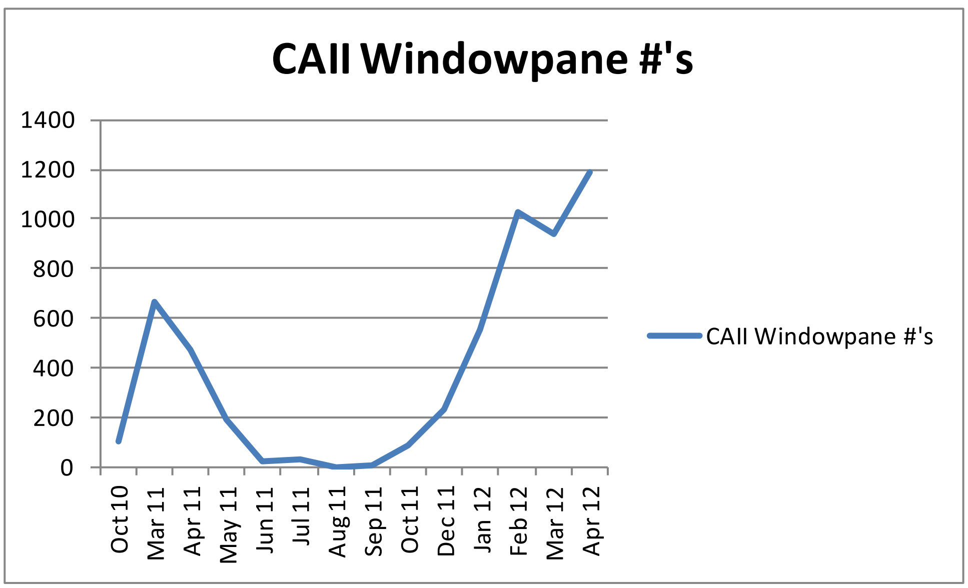
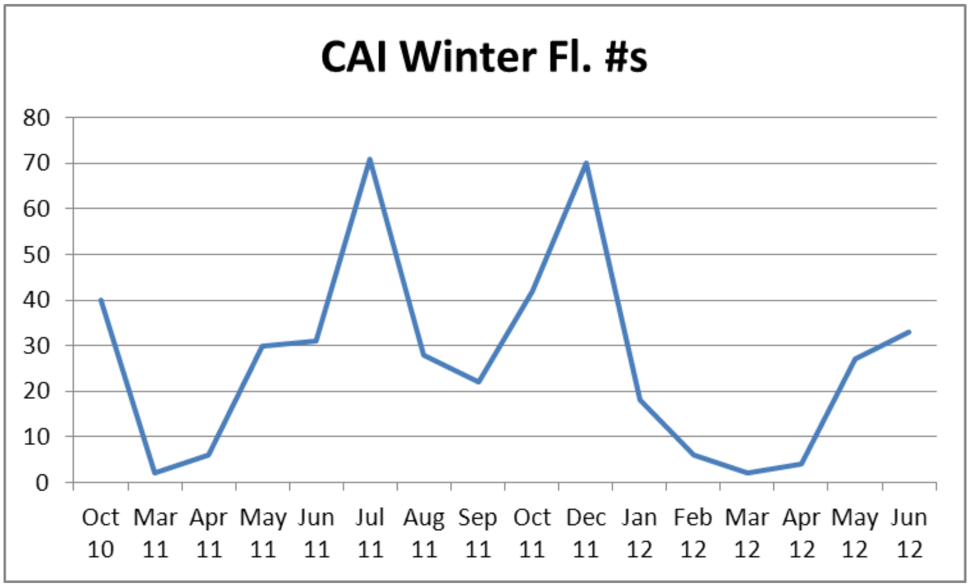


Figure 31: Number of windowpane flounder caught at all surveyed stations inside and outside CAI and CAII. (CFTDD only.)



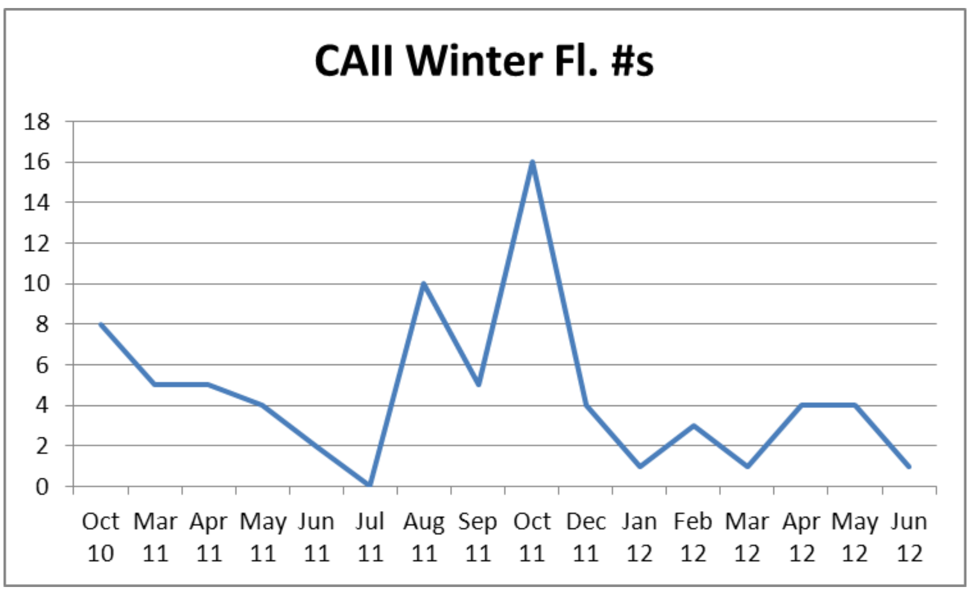
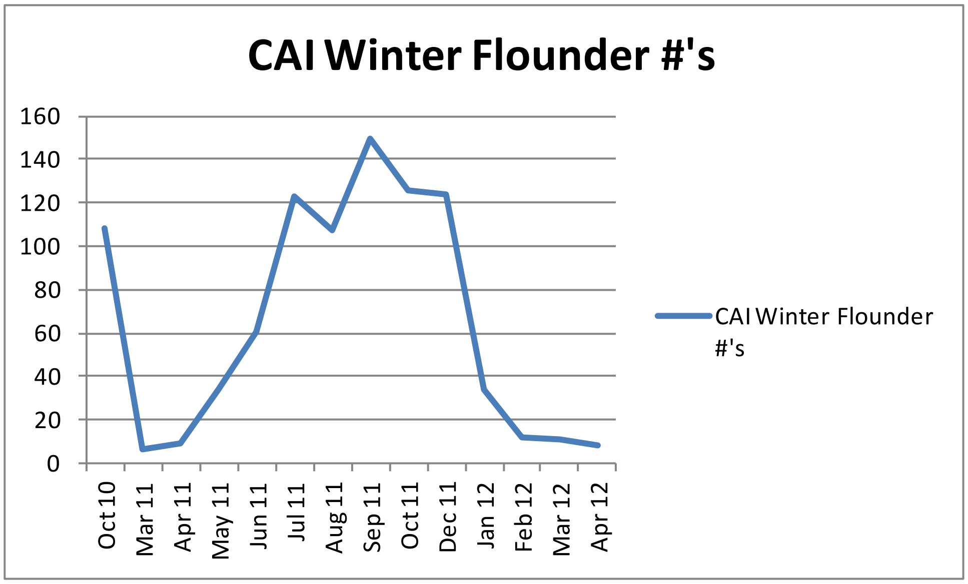


Figure 32: Number of winter flounder caught at the 41 selected stations inside CAI and CAII. (CFTDD only.)



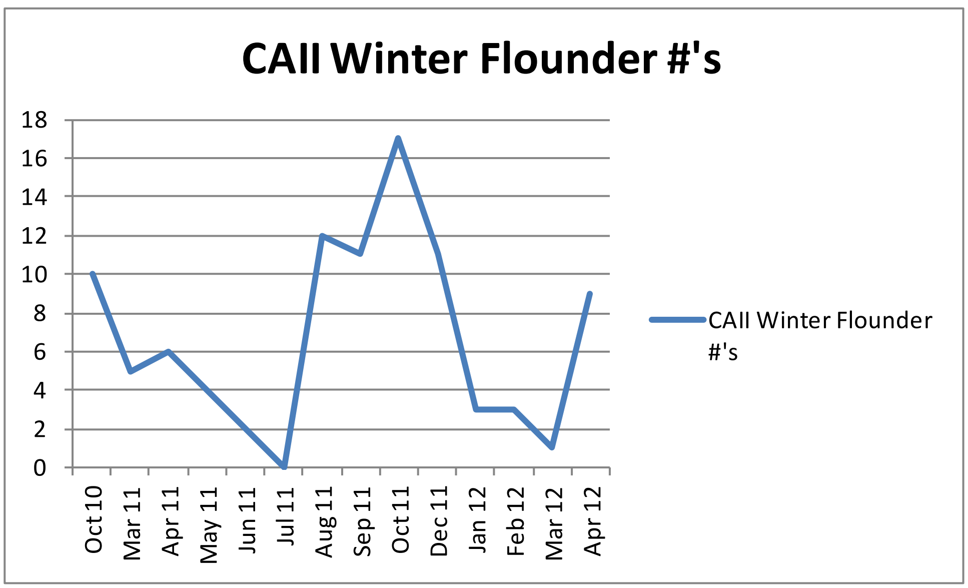
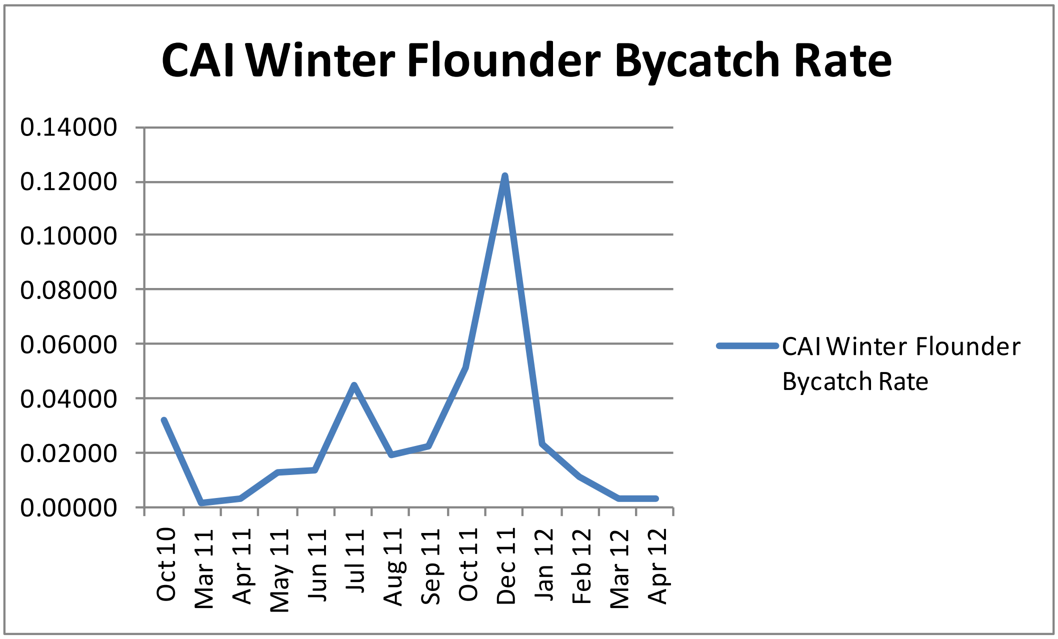


Figure 33: Number of winter flounder caught at all surveyed stations inside and outside CAI and CAII. (CFTDD only.)



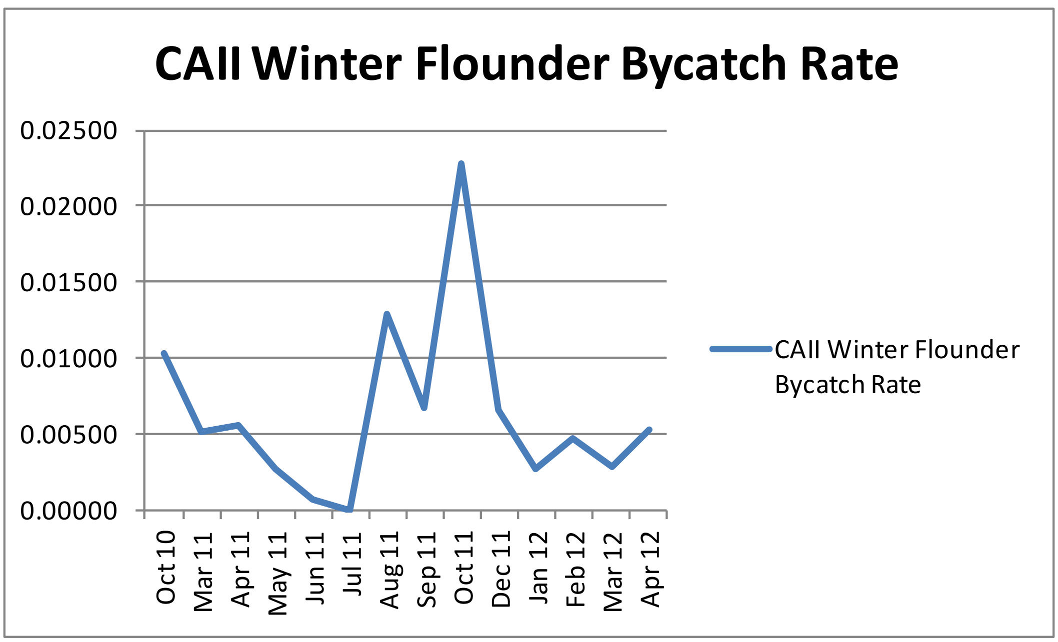
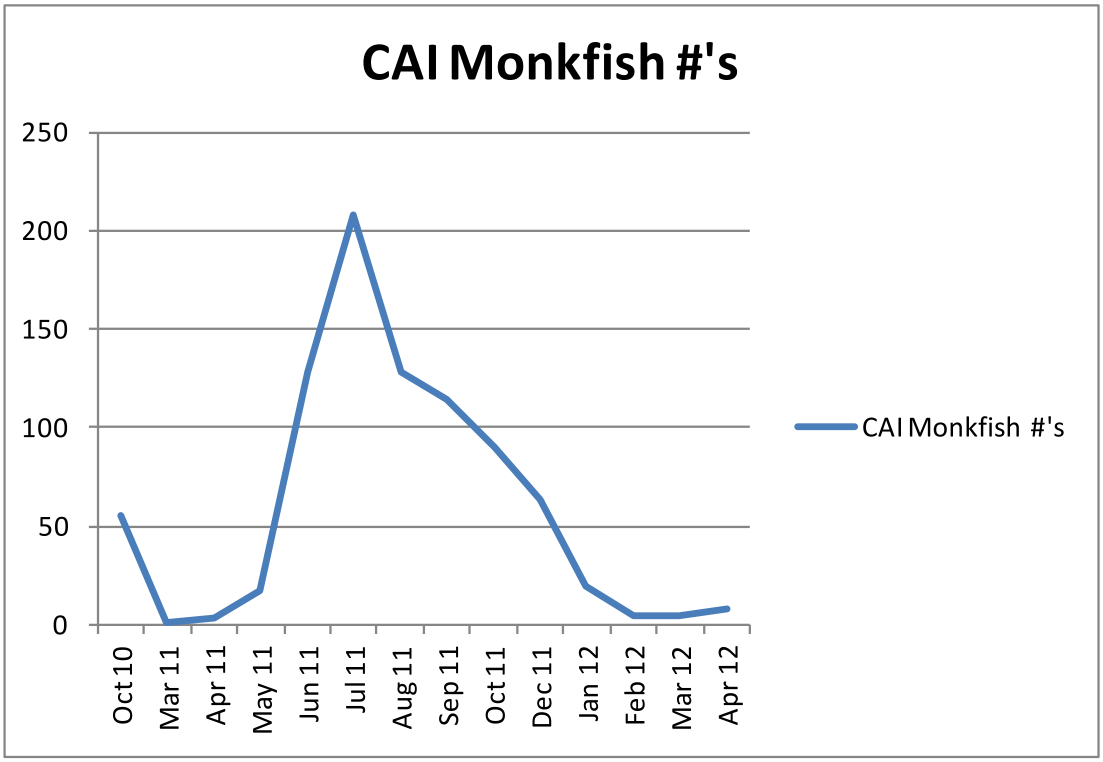


Figure 34: Winter flounder bycatch rates for the 41 selected stations inside CAI and CAII. (CFTDD only.)



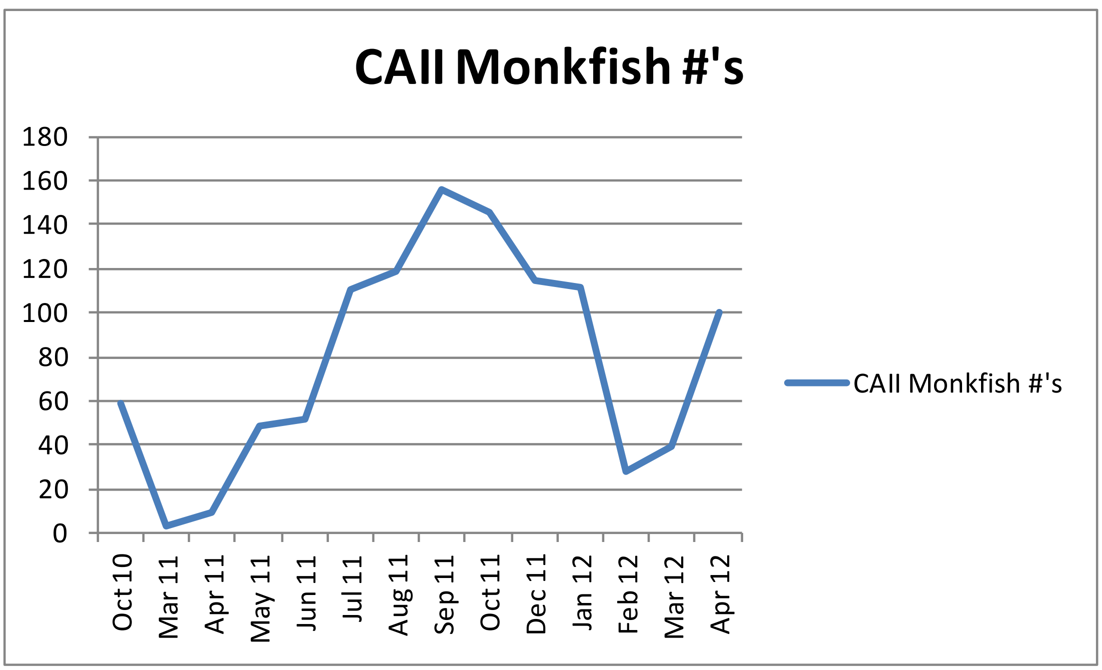
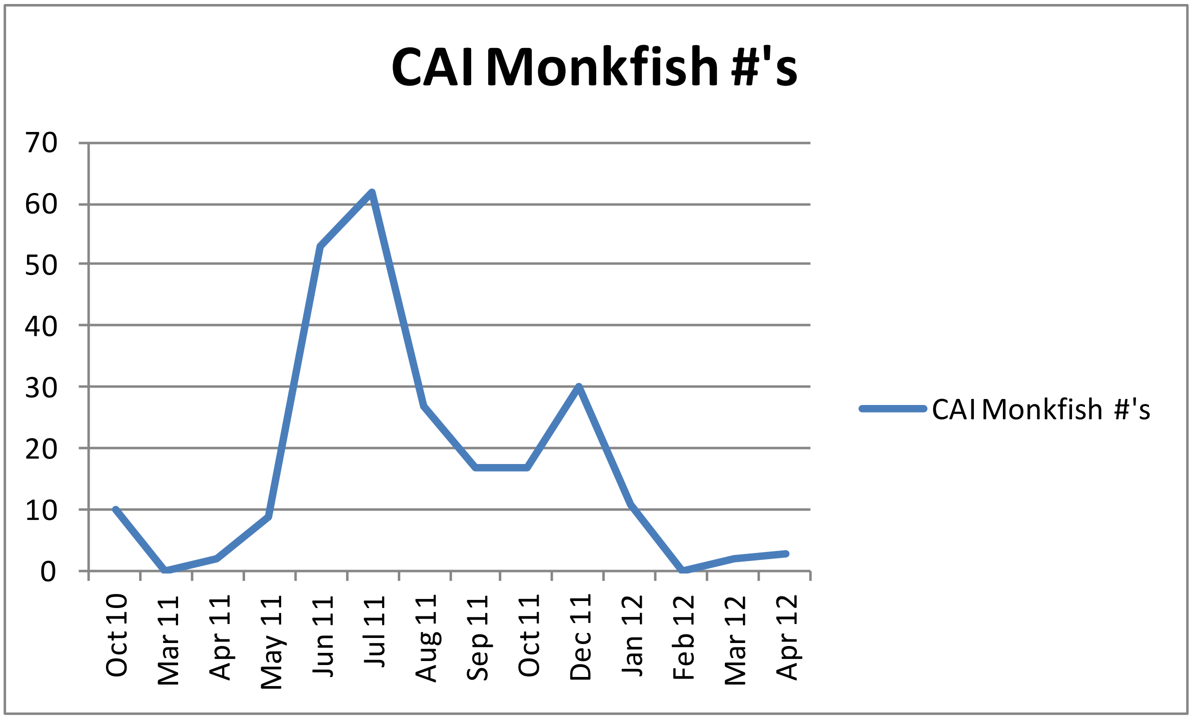


Figure 35: Number of monkfish caught for all surveyed stations inside and outside CAI and CAII. (CFTDD only.)



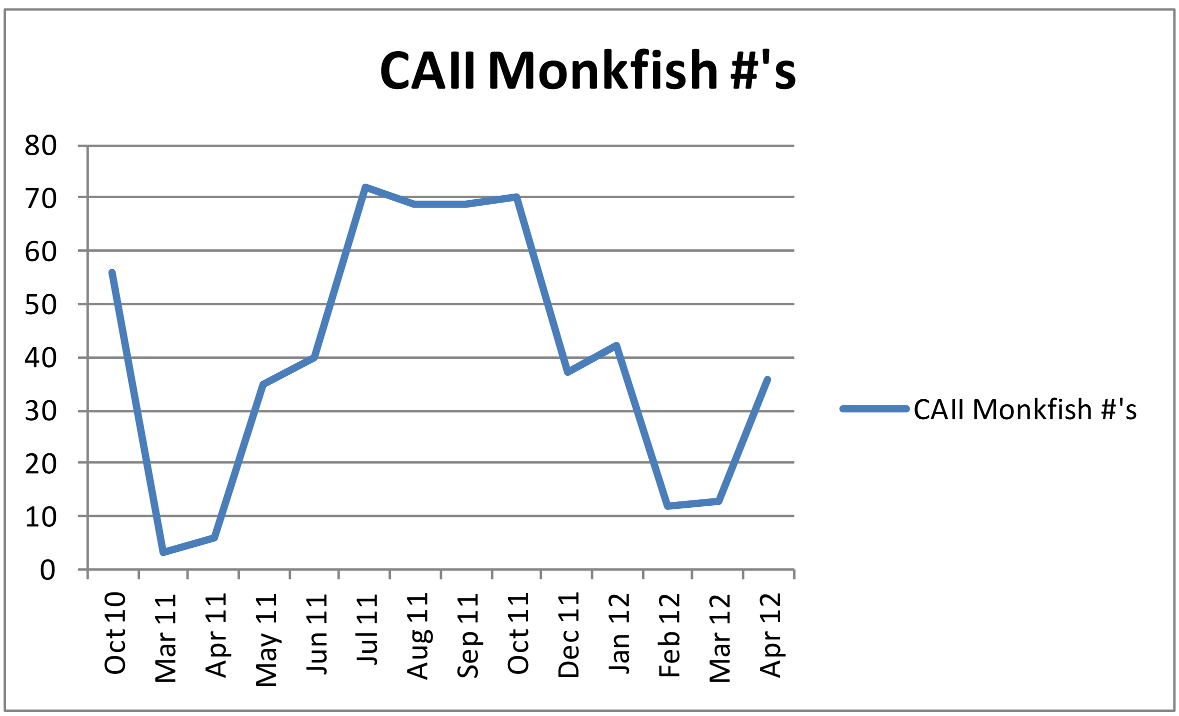
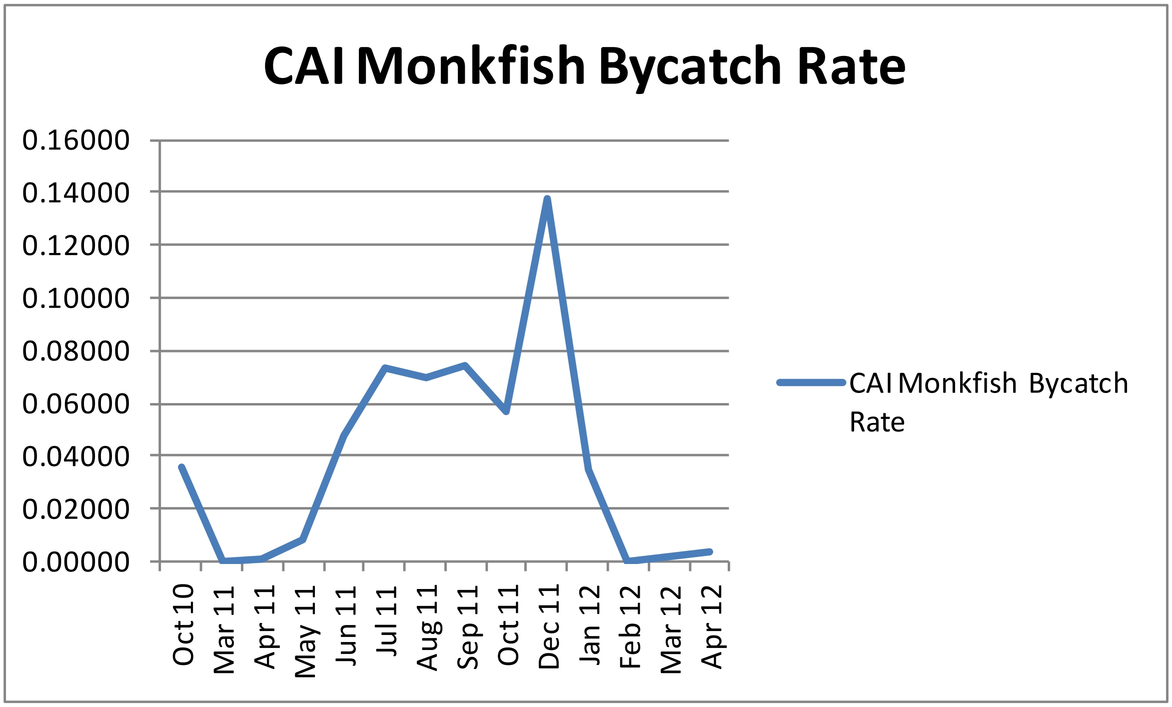


Figure 36: Number of monkfish caught at the 41 selected stations inside CAI and CAII. (CFTDD only.)



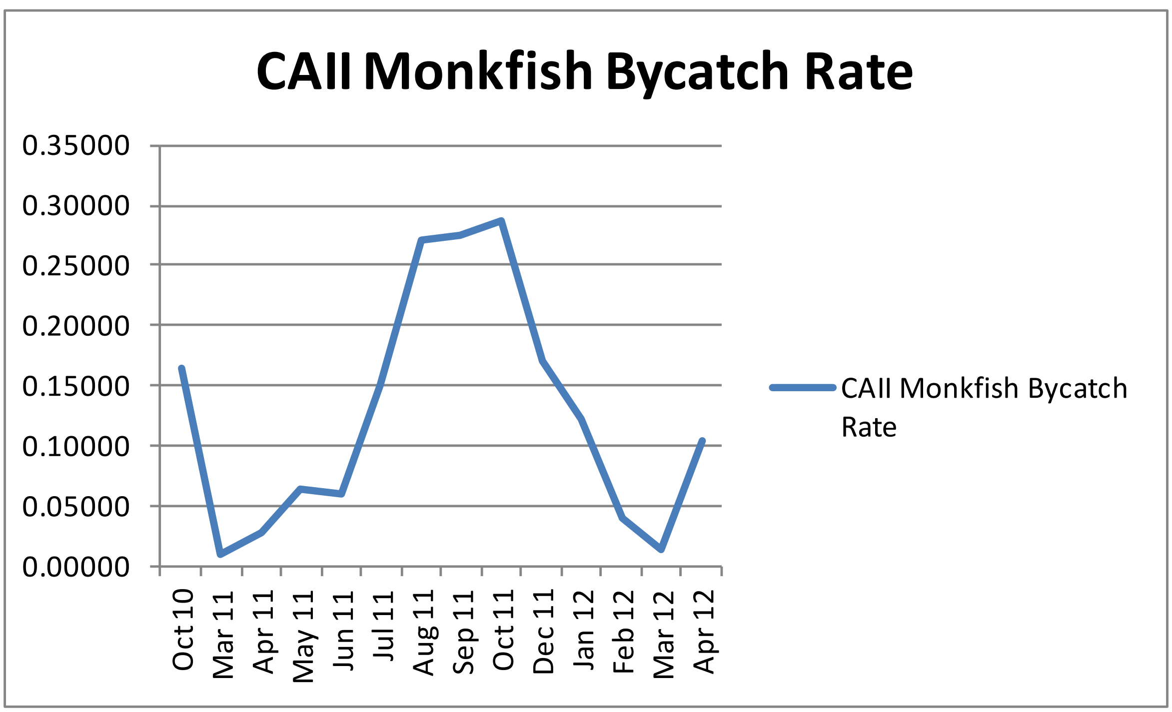
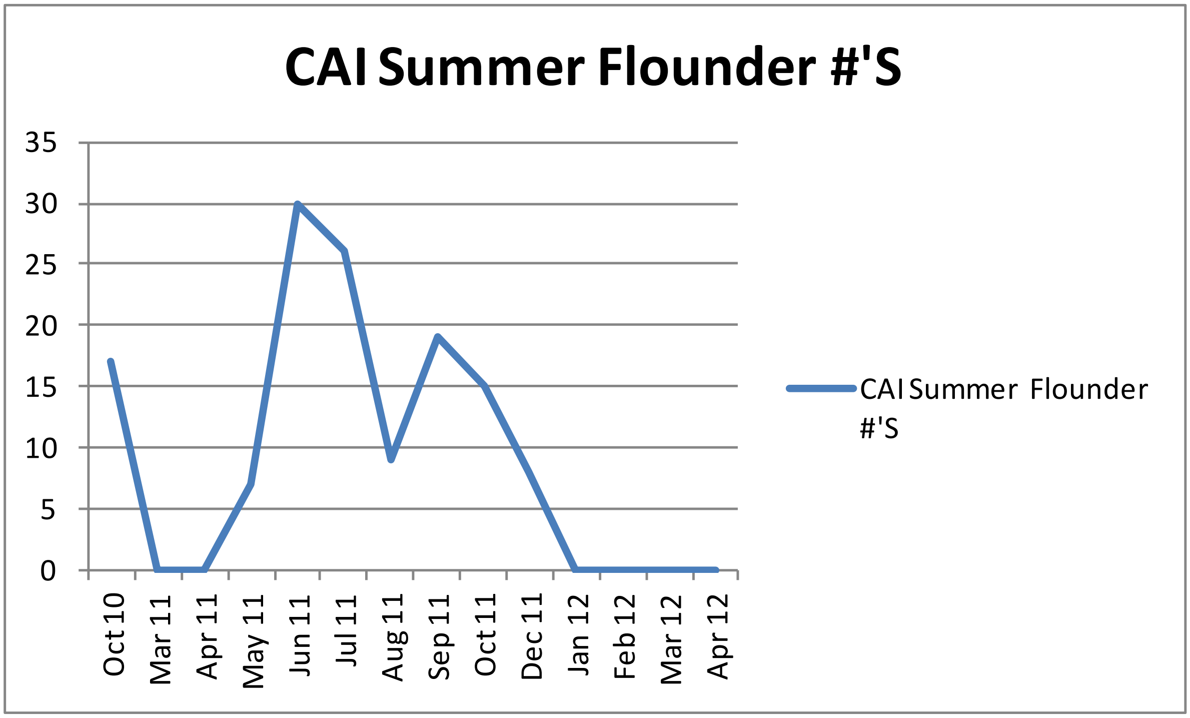


Figure 37: Monkfish bycatch rates for the 41 selected stations inside CAI and CAII. (CFTDD only.)



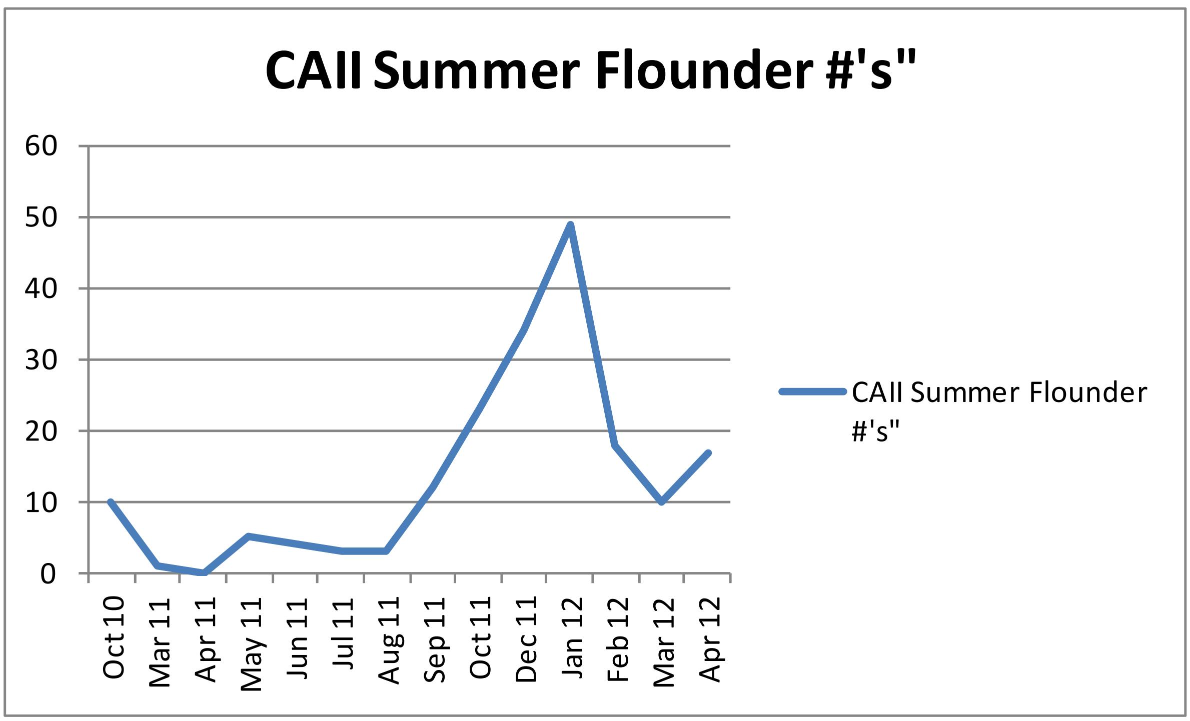


Figure 38: Number of summer flounder caught at all surveyed stations inside and outside CAI and CAII. (CFTDD only.)

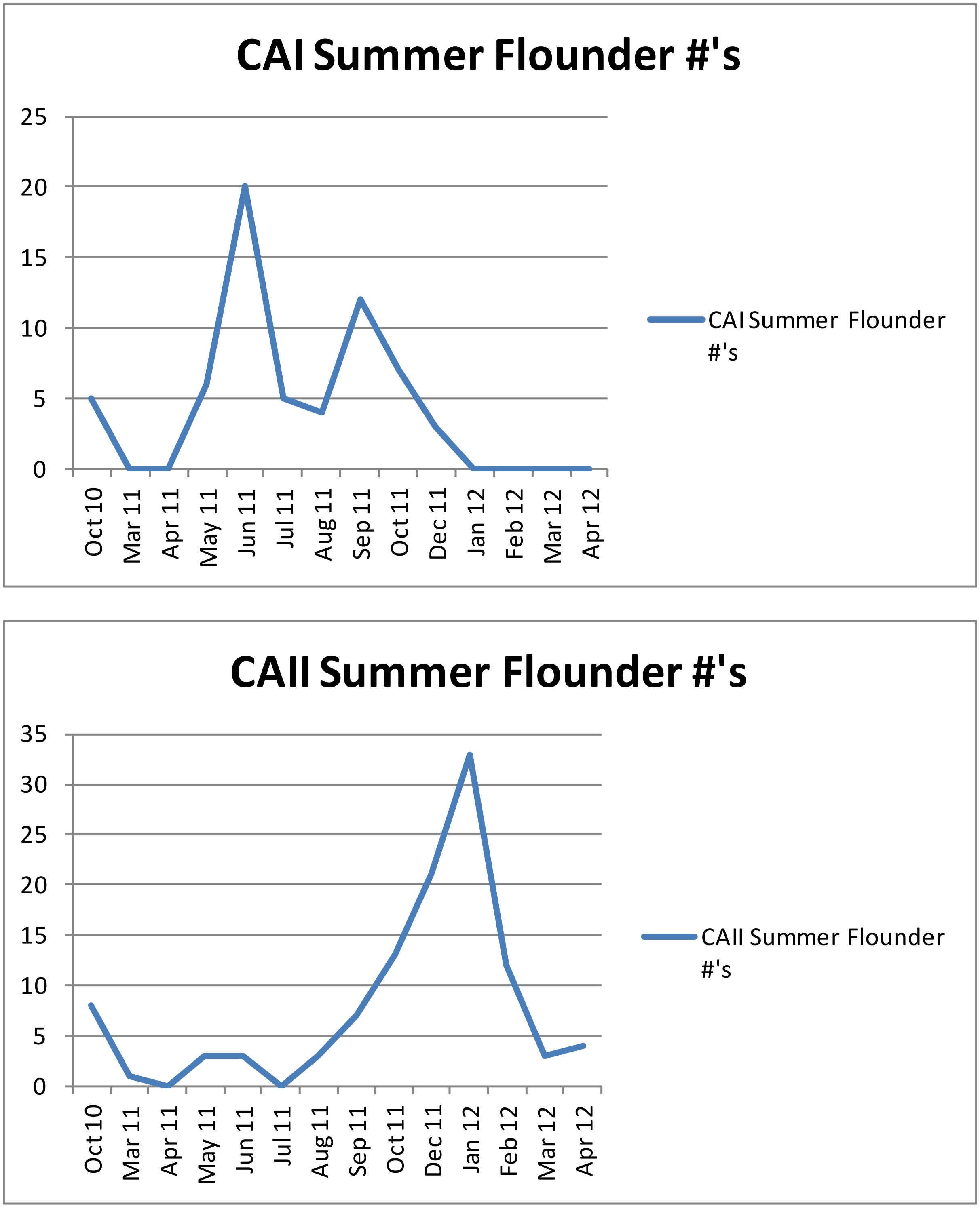


Figure 39: Number of summer flounder caught at the 41 selected stations inside CAI and CAII. (CFTDD only.)

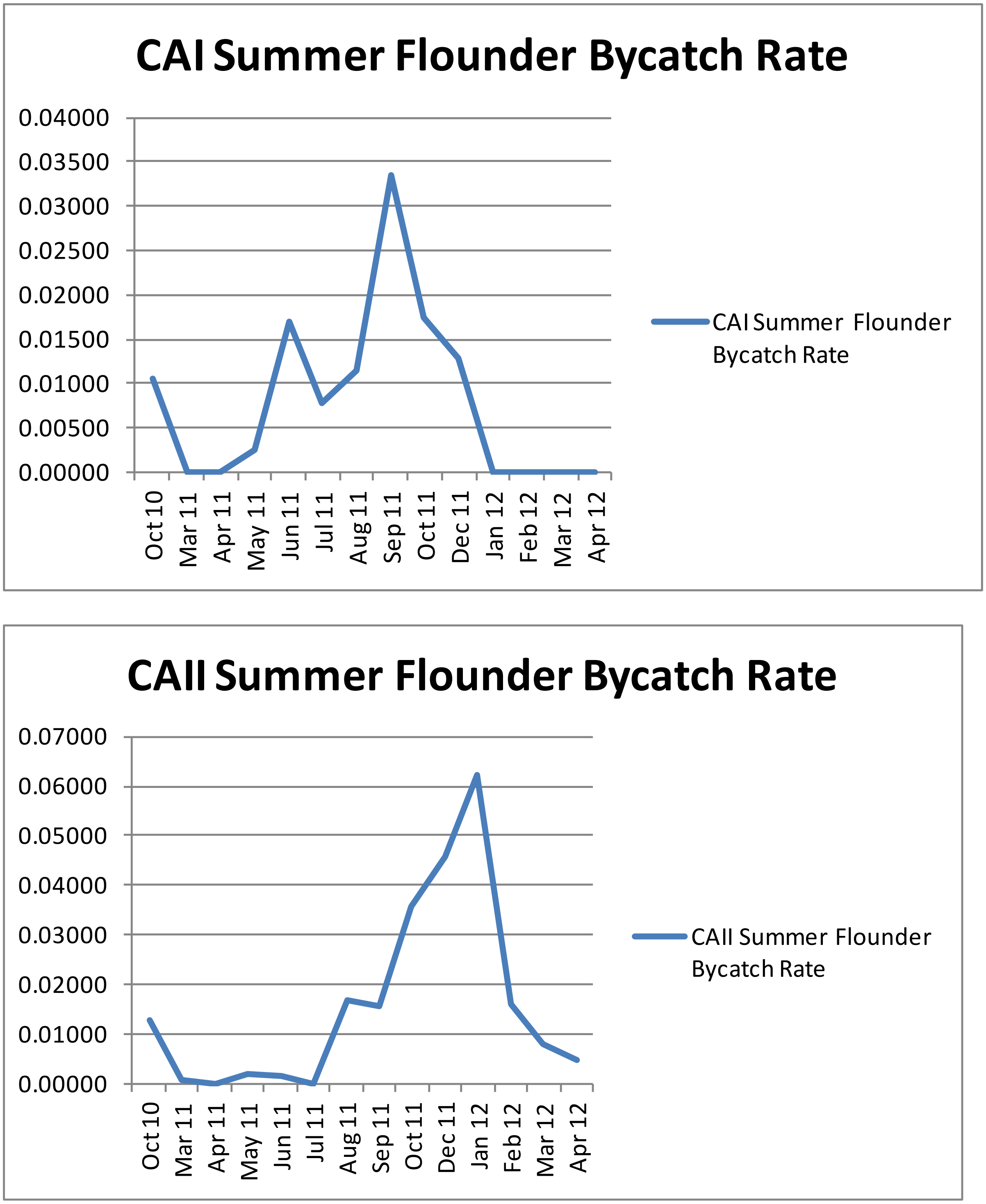
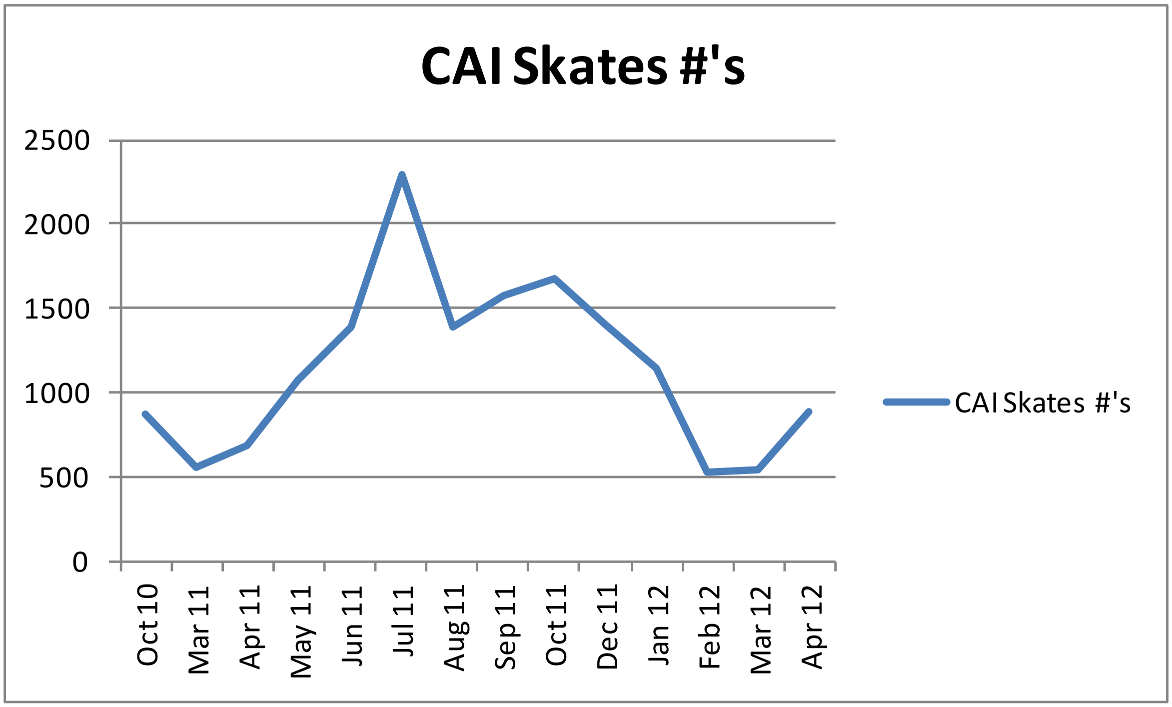


Figure 40: Summer flounder bycatch rates for the 41 selected stations inside CAI and CAII. (CFTDD only.)



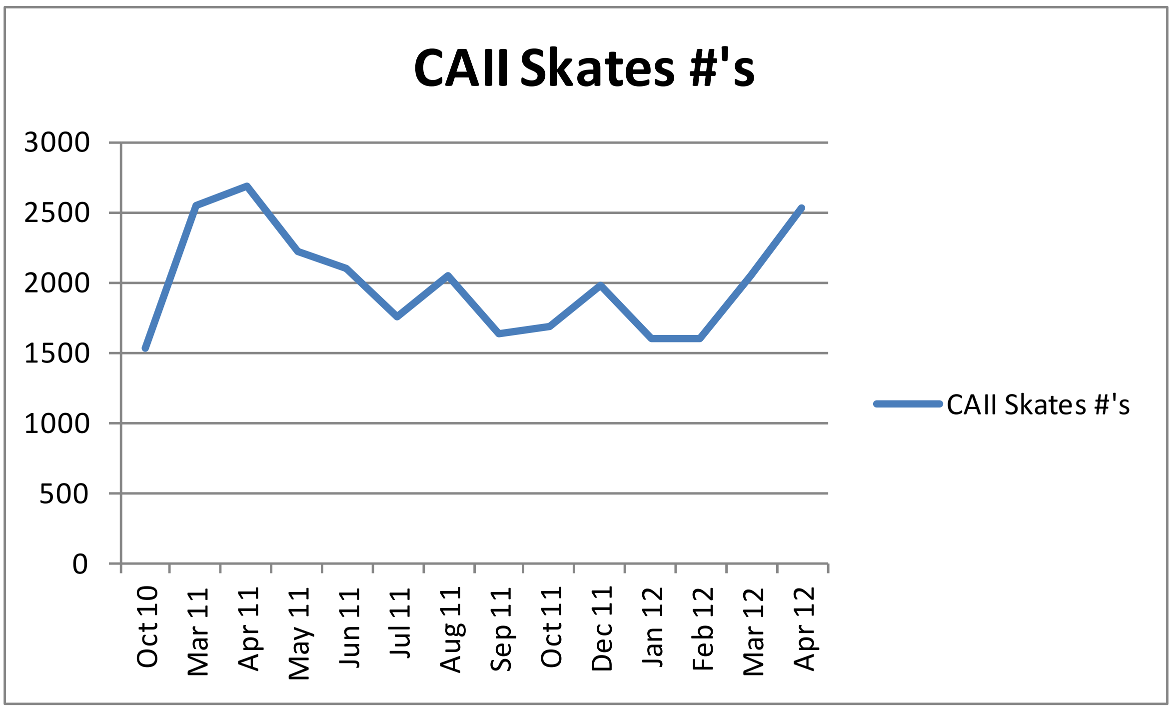
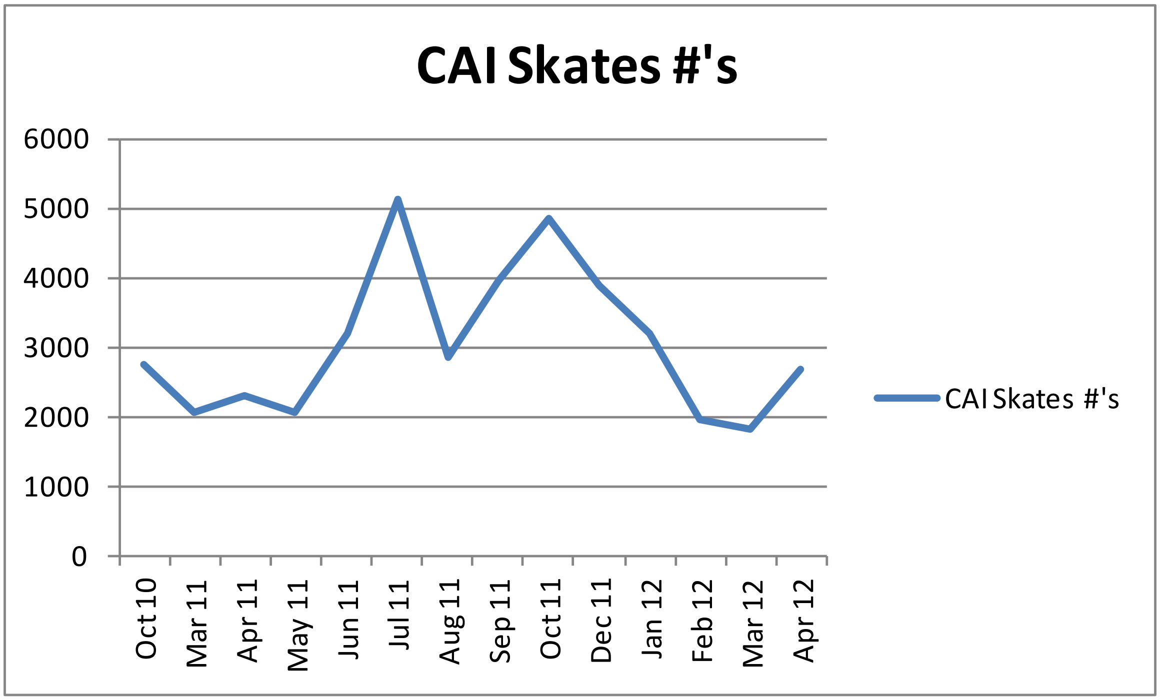


Figure 41: Number of little and winter skates caught at the 41 selected stations inside CAI and CAII. (CFTDD only.)



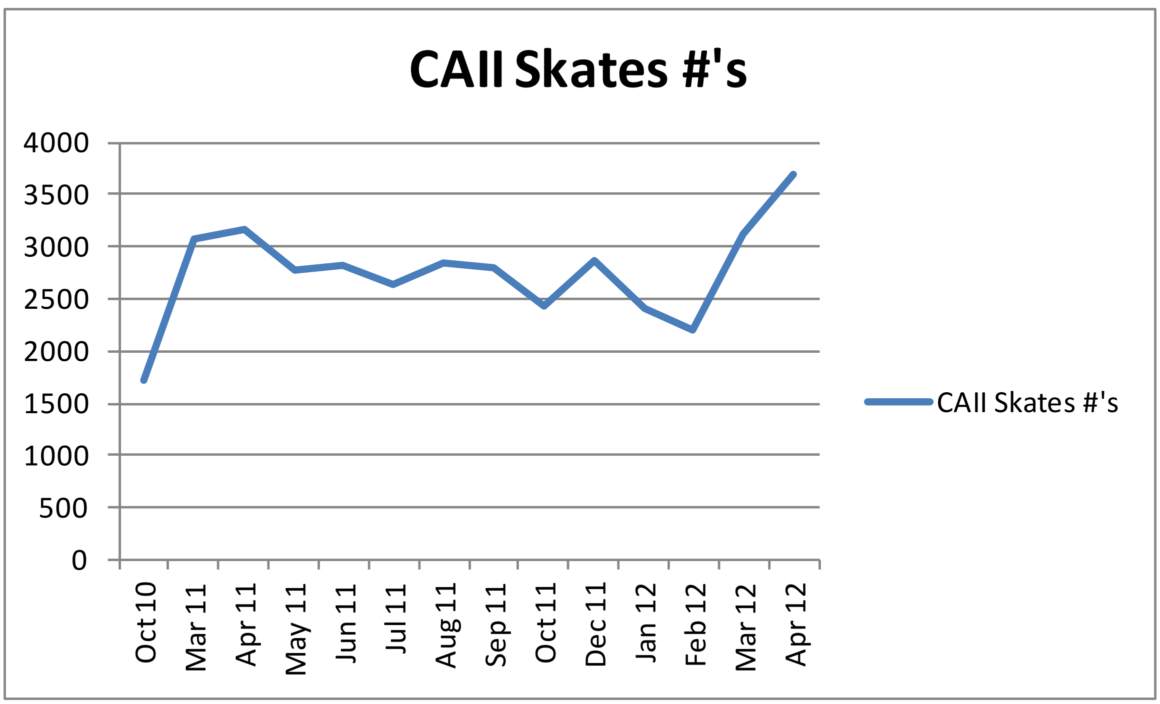


Figure 42: Number of little and winter skates caught at all surveyed stations inside and outside CAI and CAII. (CFTDD only.)

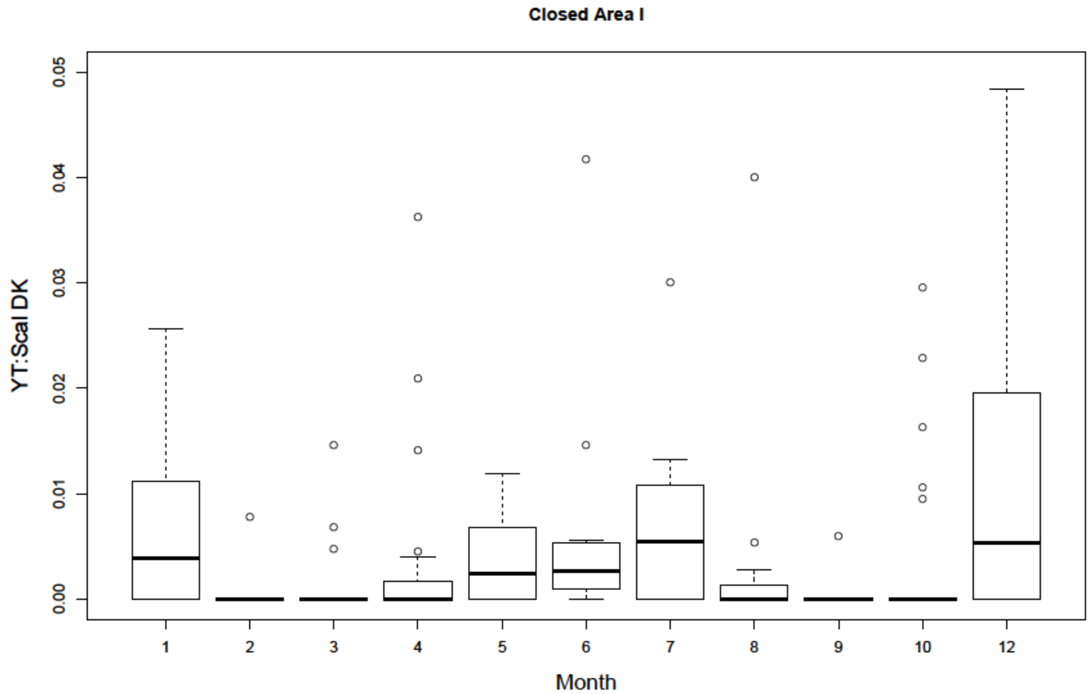


Figure 43: Box and whisker plot of the distribution of the bycatch ratio by station of yellowtail in CAI for each month of the survey showing the means, 25 and 75 percentiles (interquartile range), and outliers. Data from multiple years were combined.

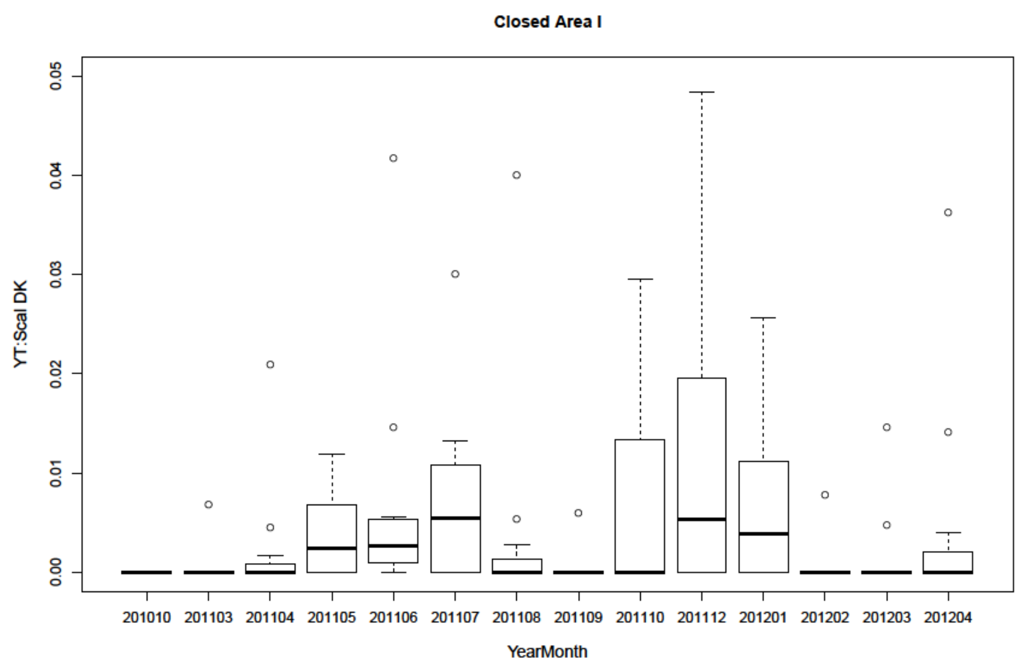


Figure 44: Distribution of the bycatch ratio by station of yellowtail in CAI for each of the fourteen survey trips.

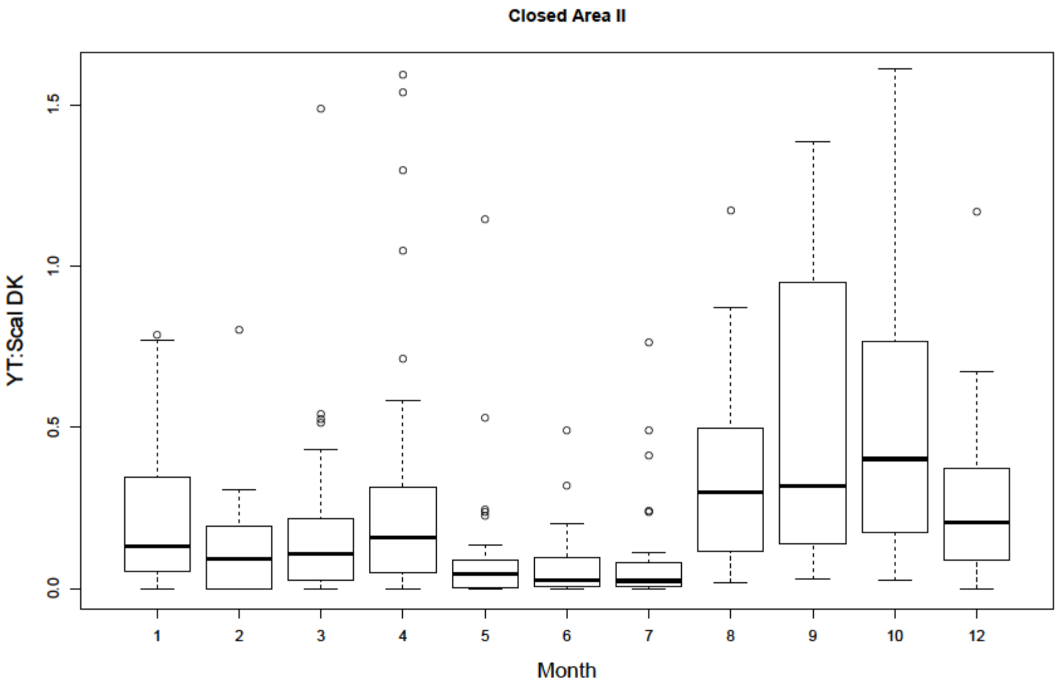


Figure 45: Box and whisker plot of the distribution of the bycatch ratio by station of yellowtail in CAII for each month of the survey showing the means, 25 and 75 percentiles (interquartile range), and outliers. Data from multiple years were combined.

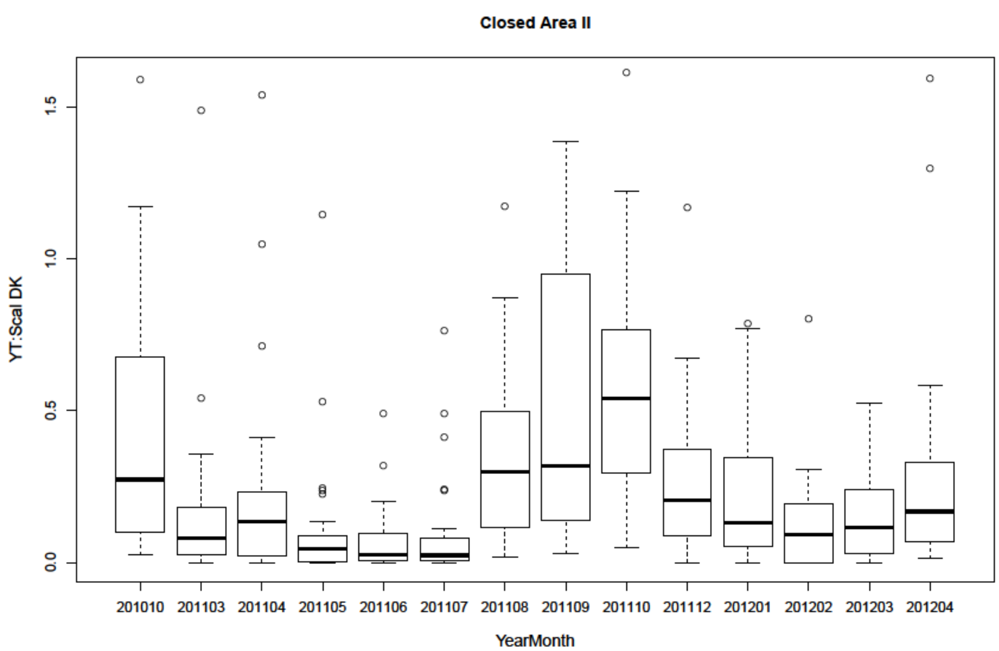


Figure 46: Distribution of the bycatch ratio by station of yellowtail in CAI for each of the fourteen survey trips.

Figure 47: Total pooled catches for sea scallops for the CFTDD vs. standard new Bedford Style Sea Scallop Dredge encountered during all cruises. The black line has a slope of one. The dashed line has a slope equal to the estimated relative efficiency (from the one parameter mixed effects model).

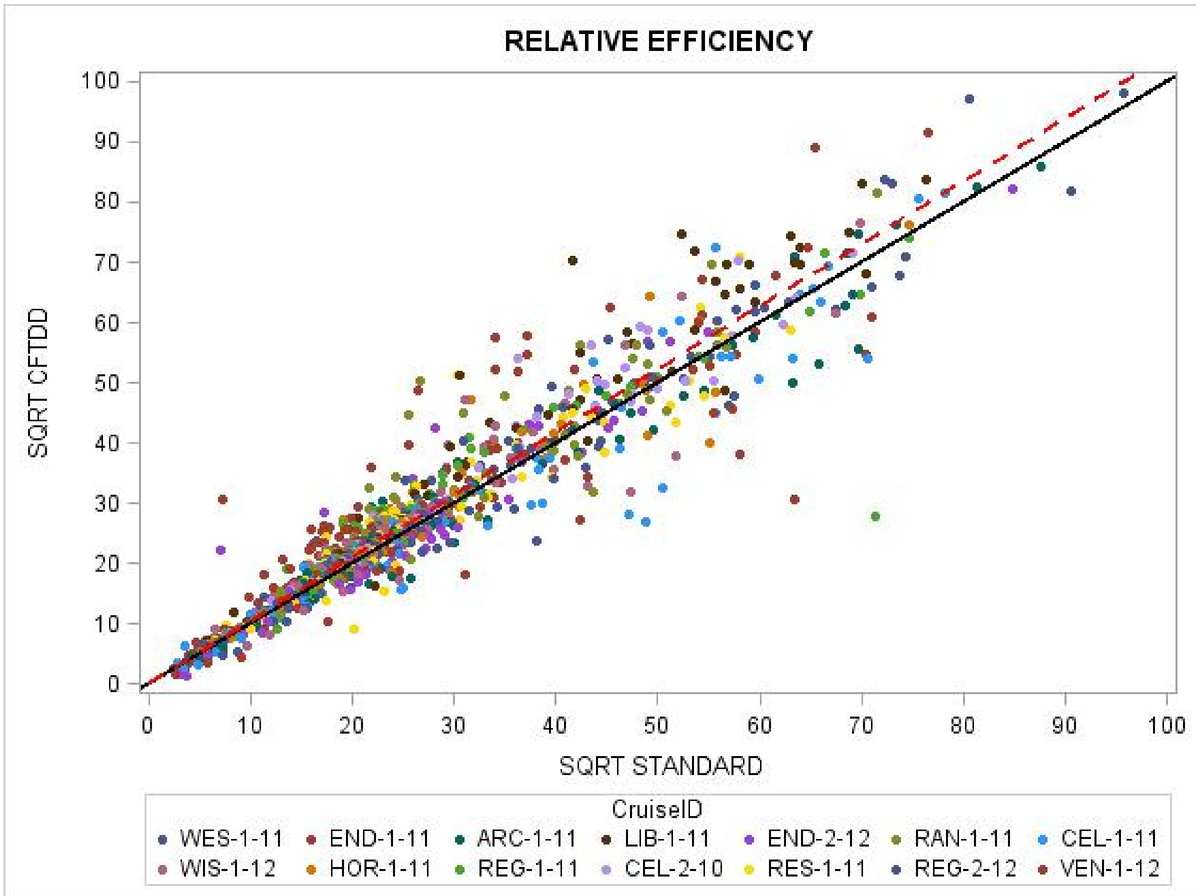


Figure 48: Total pooled catches monkfish for the CFTDD vs. standard new Bedford Style Sea Scallop Dredge encountered during all cruises. The black line has a slope of one. The dashed line has a slope equal to the estimated relative efficiency (from the one parameter mixed effects model).

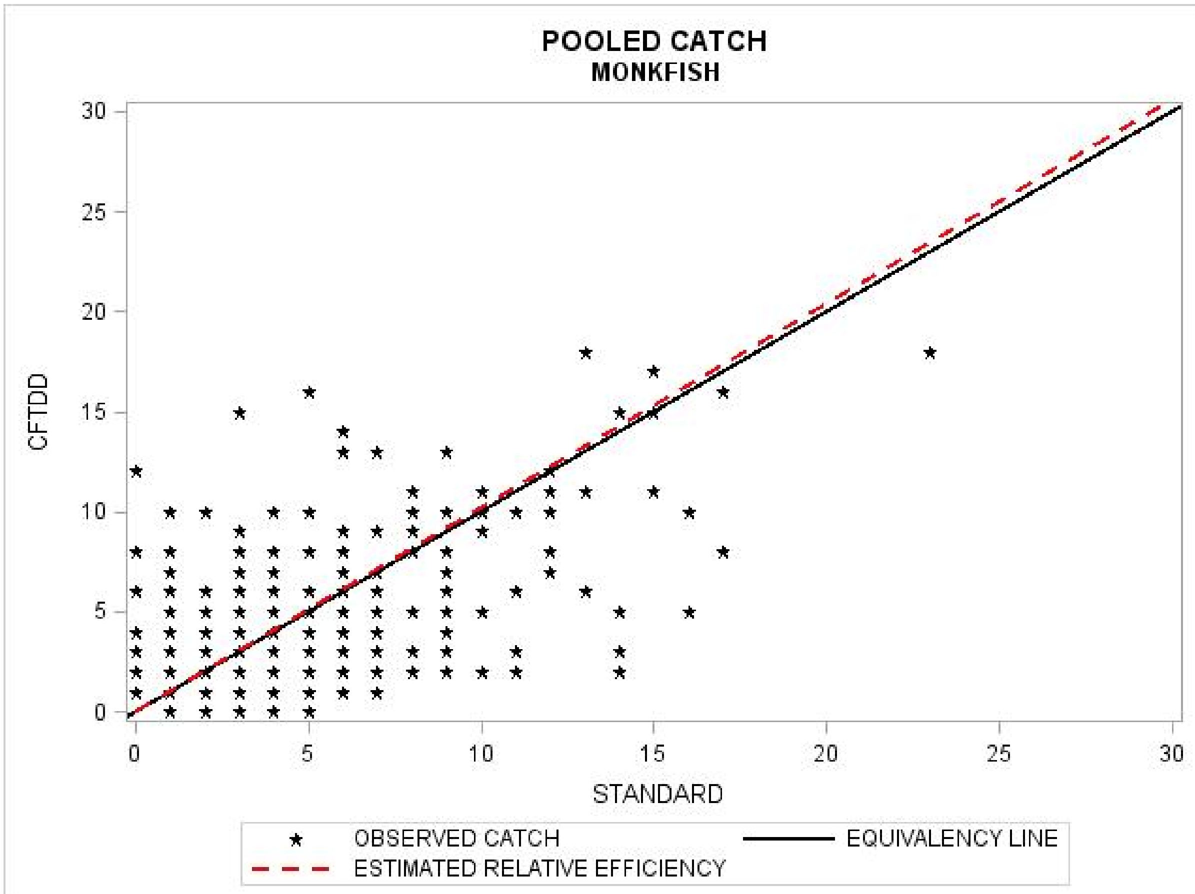


Figure 49: Total pooled catches for windowpane flounder for the CFTDD vs. standard new Bedford Style Sea Scallop Dredge encountered during all cruises. The black line has a slope of one. The dashed line has a slope equal to the estimated relative efficiency (from the one parameter mixed effects model).

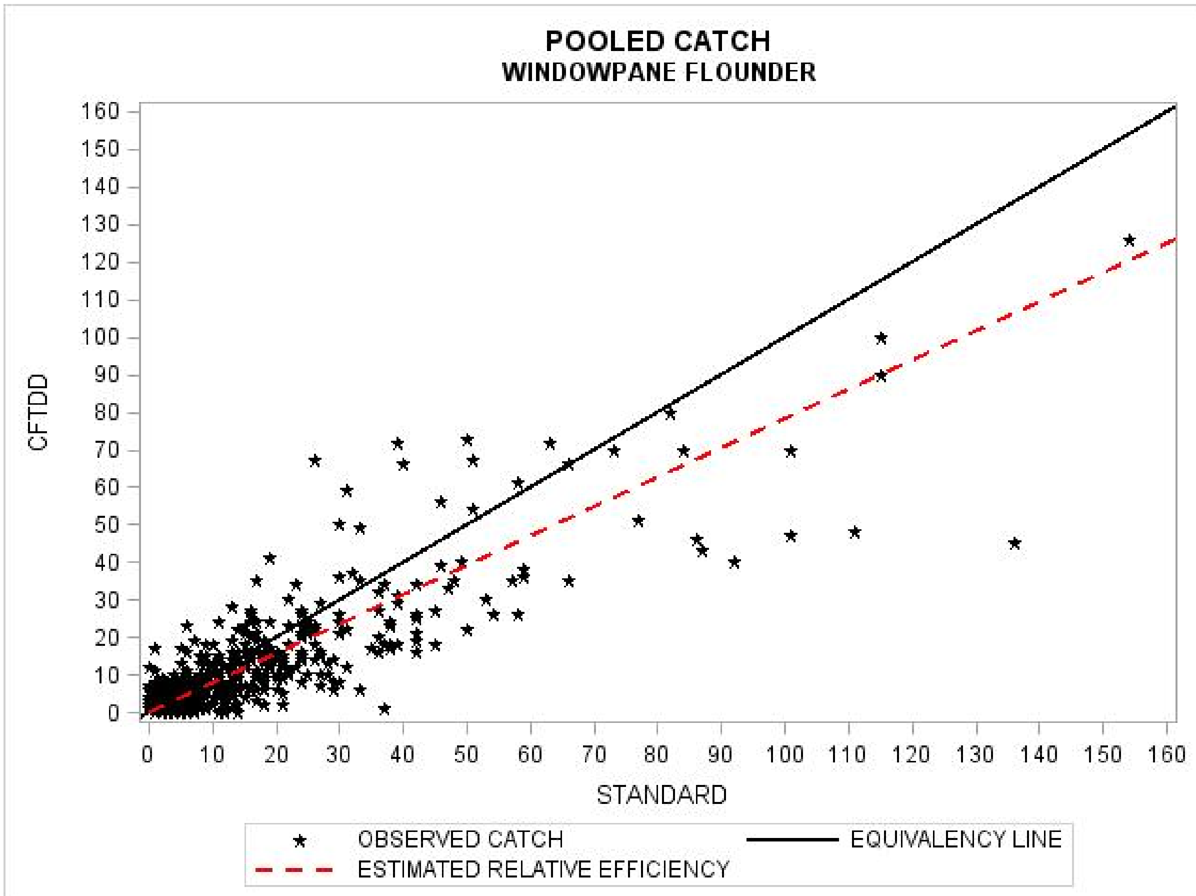


Figure 50: Total pooled catches grey sole for the CFTDD vs. standard new Bedford Style Sea Scallop Dredge encountered during all cruises. The black line has a slope of one. The dashed line has a slope equal to the estimated relative efficiency (from the one parameter mixed effects model).

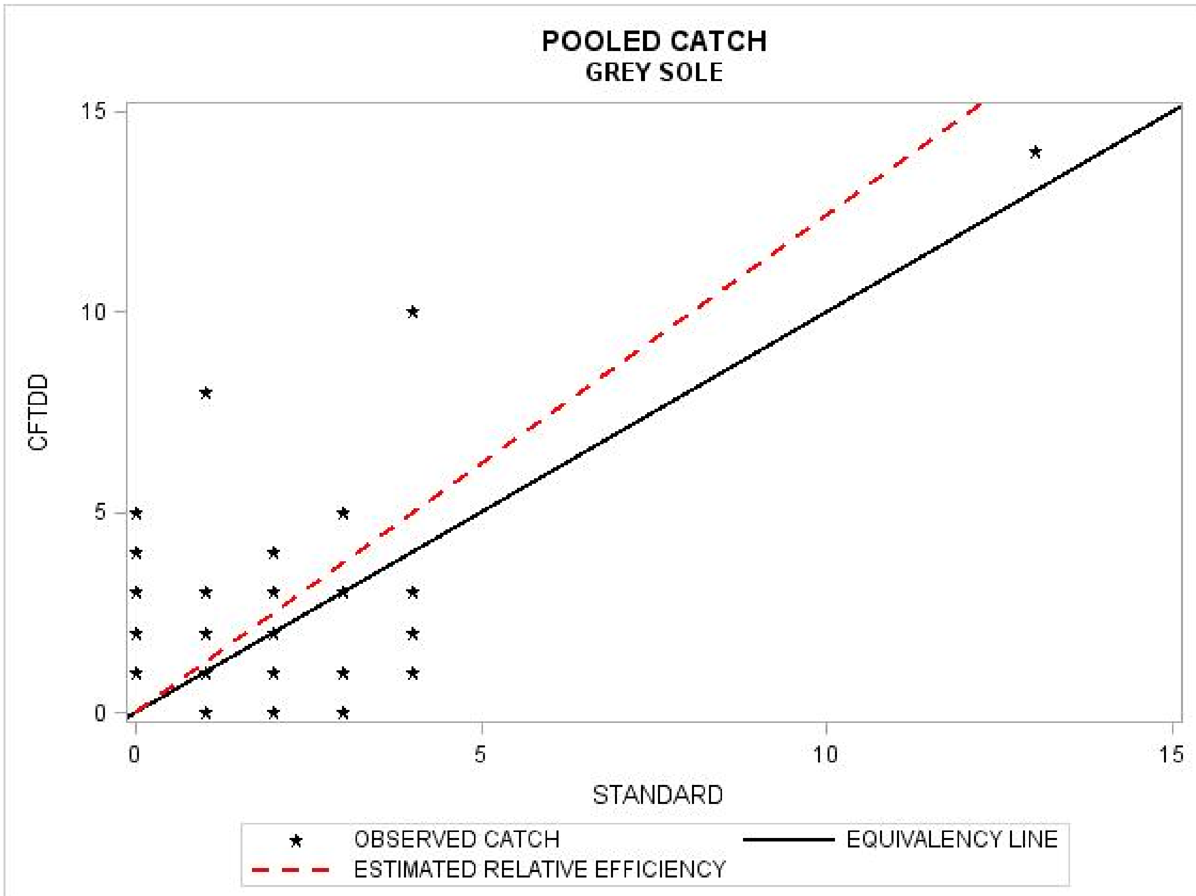


Figure 51: Total pooled catches for winter flounder for the CFTDD vs. standard new Bedford Style Sea Scallop Dredge encountered during all cruises. The black line has a slope of one. The dashed line has a slope equal to the estimated relative efficiency (from the one parameter mixed effects model).

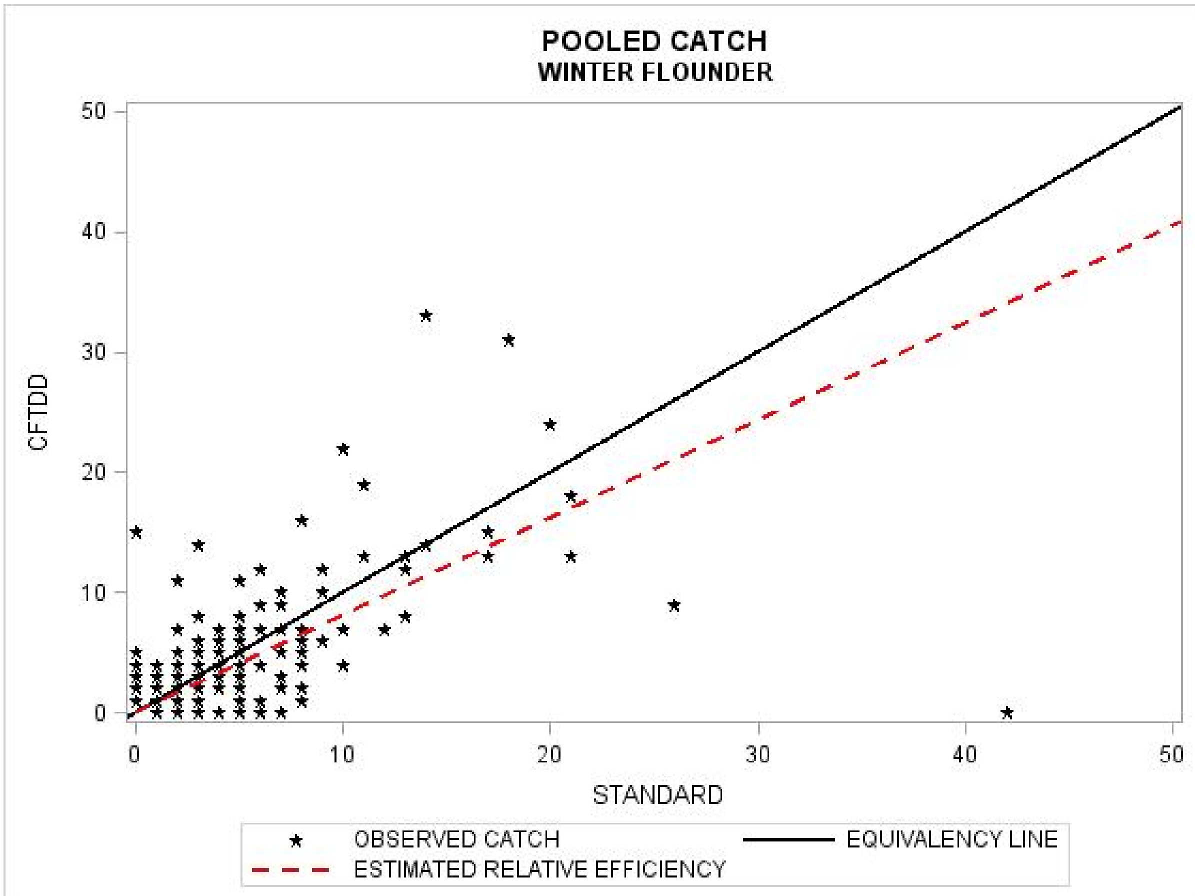


Figure 52: Total pooled catches for yellowtail flounder for the CFTDD vs. standard new Bedford Style Sea Scallop Dredge encountered during all cruises. The black line has a slope of one. The dashed line has a slope equal to the estimated relative efficiency (from the one parameter mixed effects model).

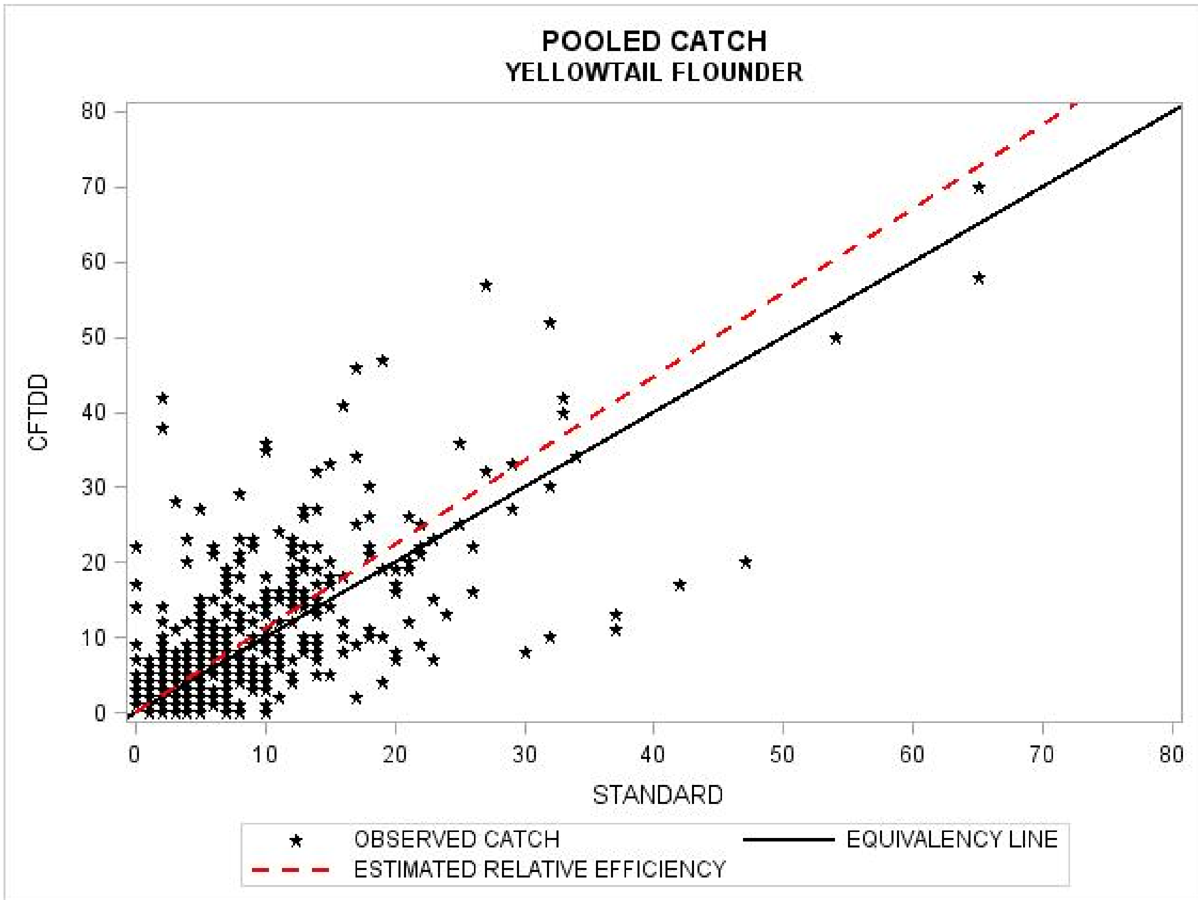


Figure 53: Total pooled catches for fourspot flounder for the CFTDD vs. standard new Bedford Style Sea Scallop Dredge encountered during all cruises. The black line has a slope of one. The dashed line has a slope equal to the estimated relative efficiency (from the one parameter mixed effects model).

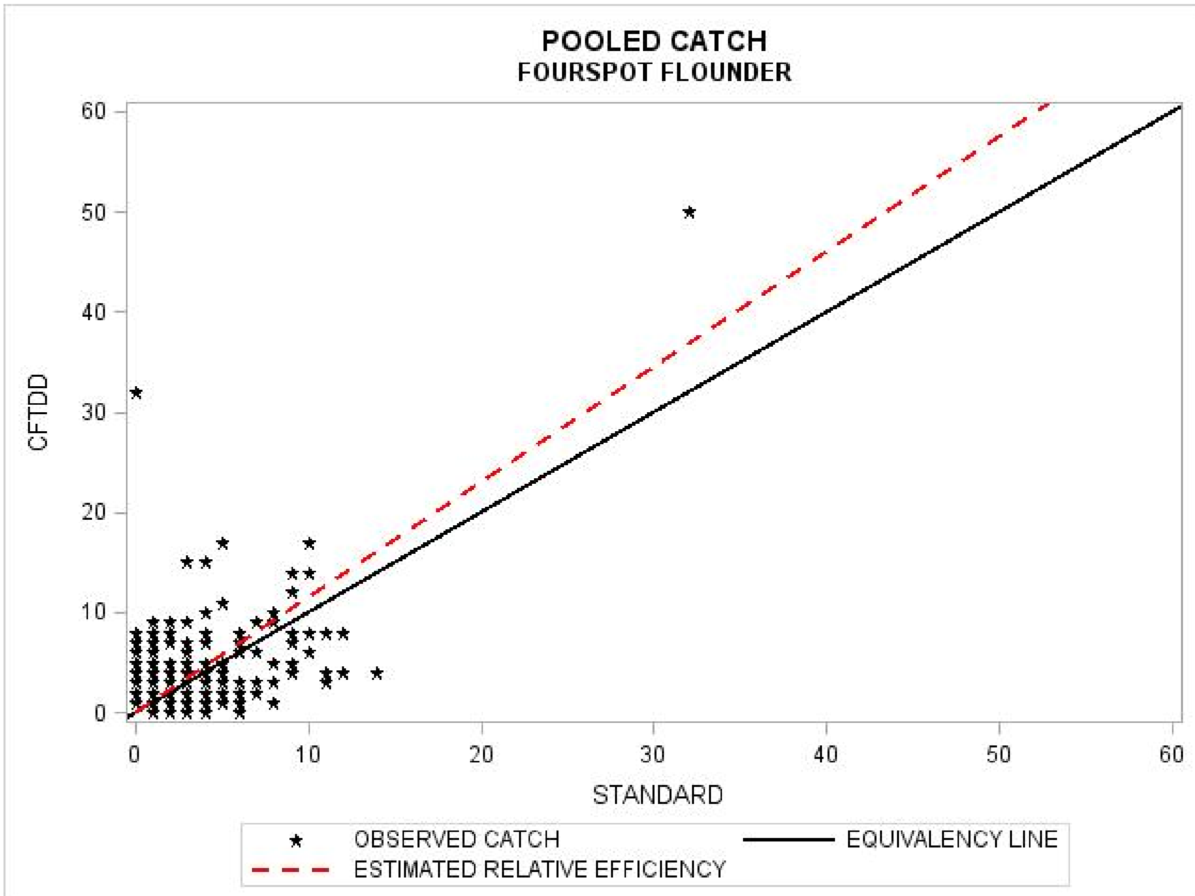


Figure 54: Total pooled catches for summer flounder for the CFTDD vs. standard new Bedford Style Sea Scallop Dredge encountered during all cruises. The black line has a slope of one. The dashed line has a slope equal to the estimated relative efficiency (from the one parameter mixed effects model).

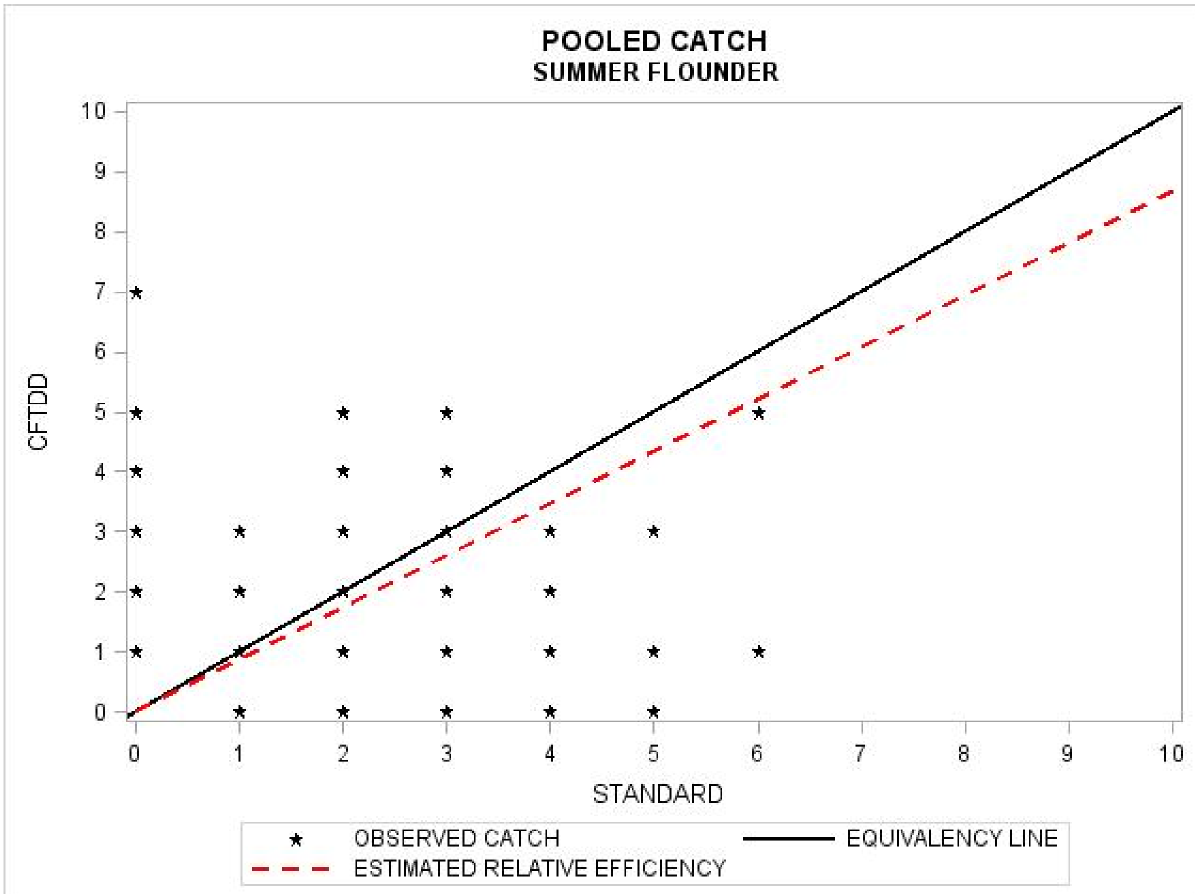


Figure 55: Total pooled catches for American plaice for the CFTDD vs. standard new Bedford Style Sea Scallop Dredge encountered during all cruises. The black line has a slope of one. The dashed line has a slope equal to the estimated relative efficiency (from the one parameter mixed effects model).

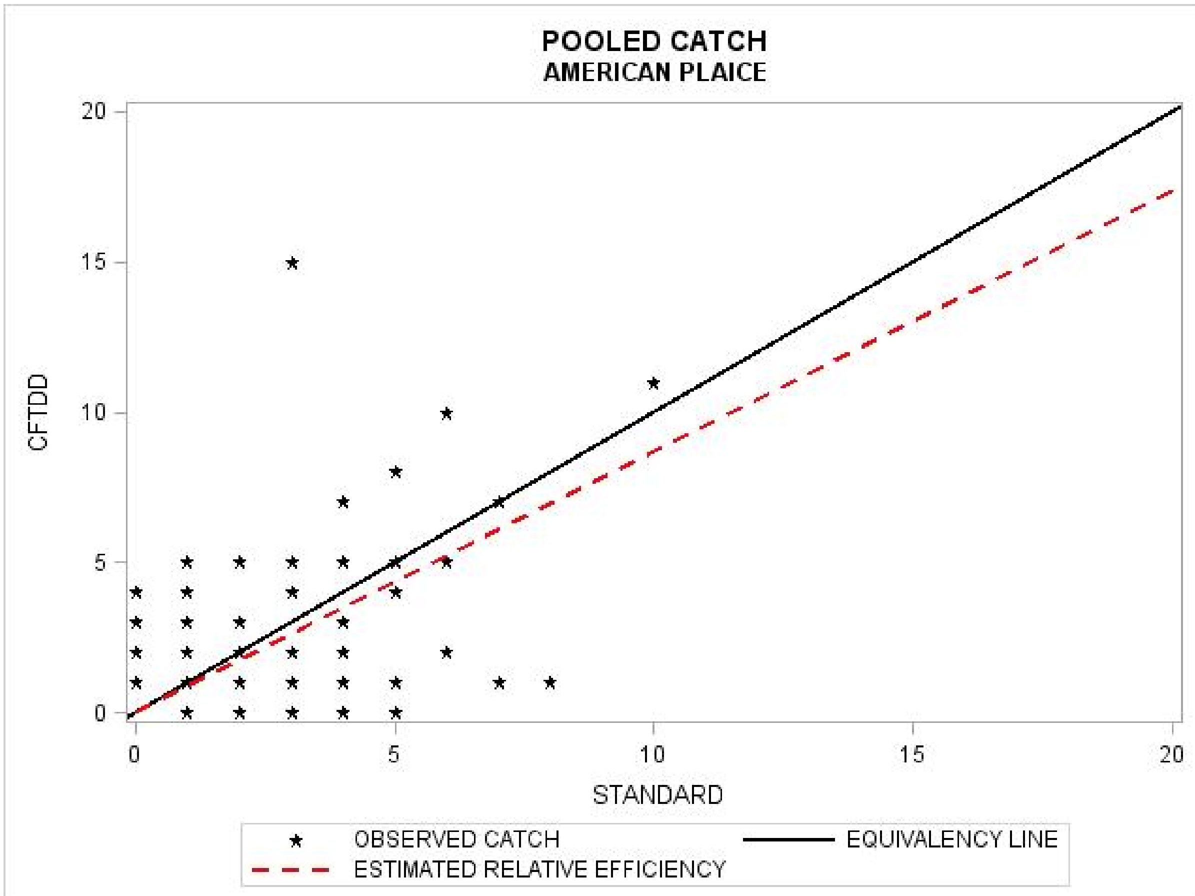


Figure 56: Total pooled catches for haddock for the CFTDD vs. standard new Bedford Style Sea Scallop Dredge encountered during all cruises. The black line has a slope of one. The dashed line has a slope equal to the estimated relative efficiency (from the one parameter mixed effects model).

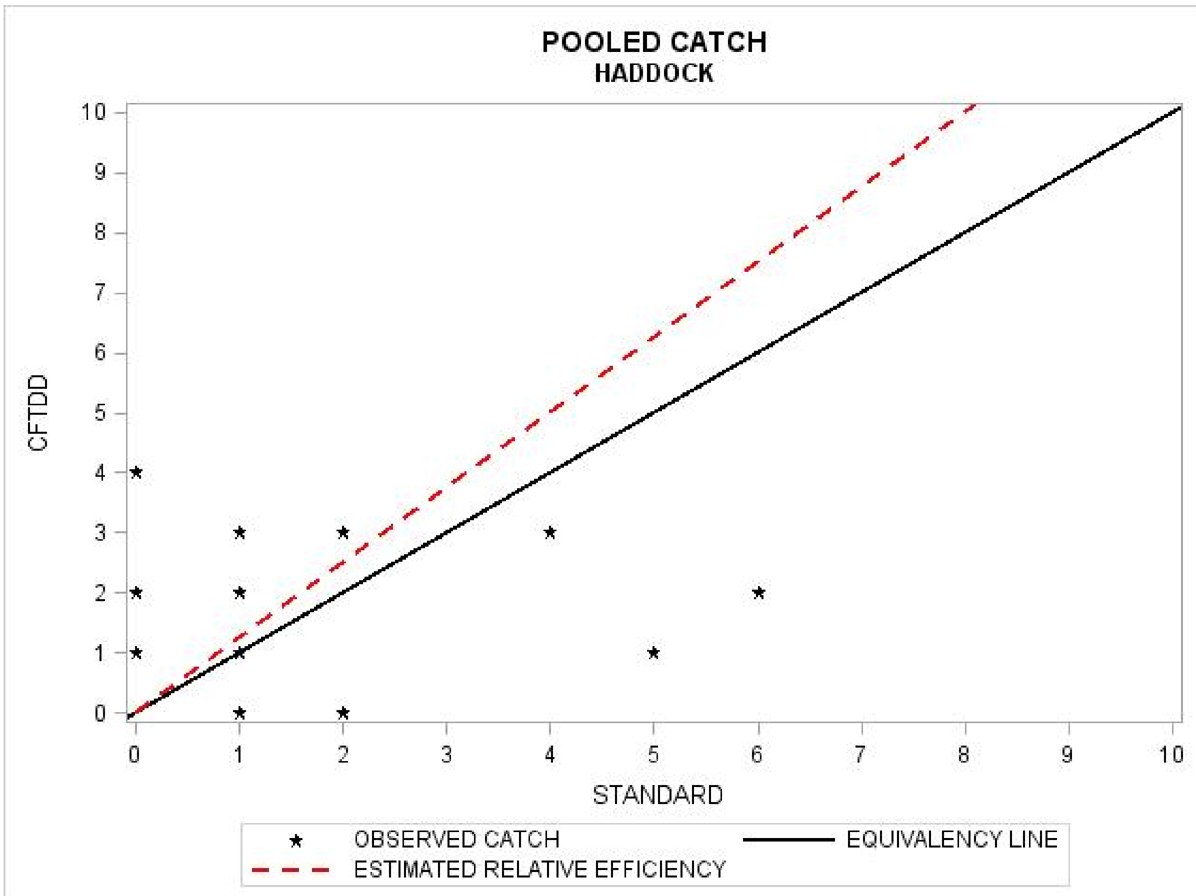


Figure 57: Total pooled catches for Atlantic Cod sea scallops for the CFTDD vs. standard new Bedford Style Sea Scallop Dredge encountered during all cruises. The black line has a slope of one. The dashed line has a slope equal to the estimated relative efficiency (from the one parameter mixed effects model).

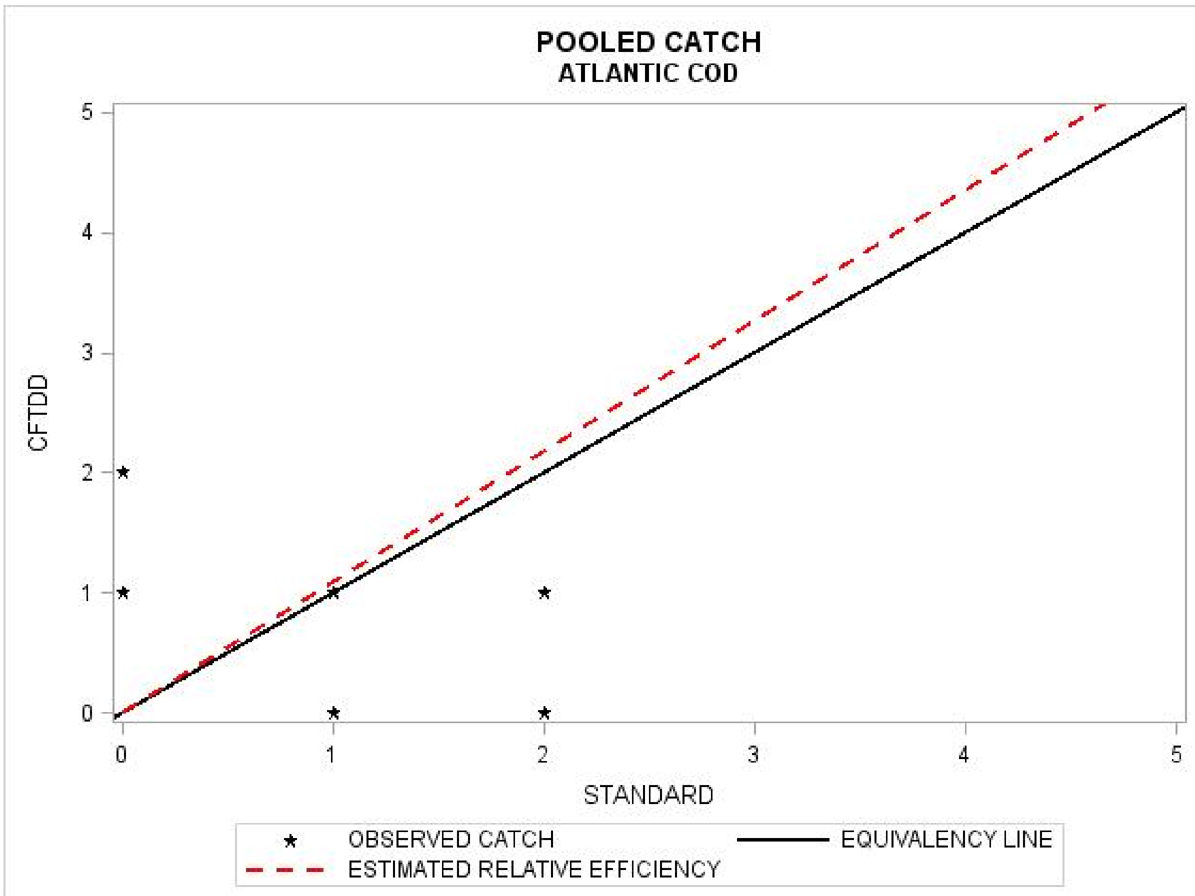


Figure 58: Total pooled catches for little skate for the CFTDD vs. standard new Bedford Style Sea Scallop Dredge encountered during all cruises. The black line has a slope of one. The dashed line has a slope equal to the estimated relative efficiency (from the one parameter mixed effects model).

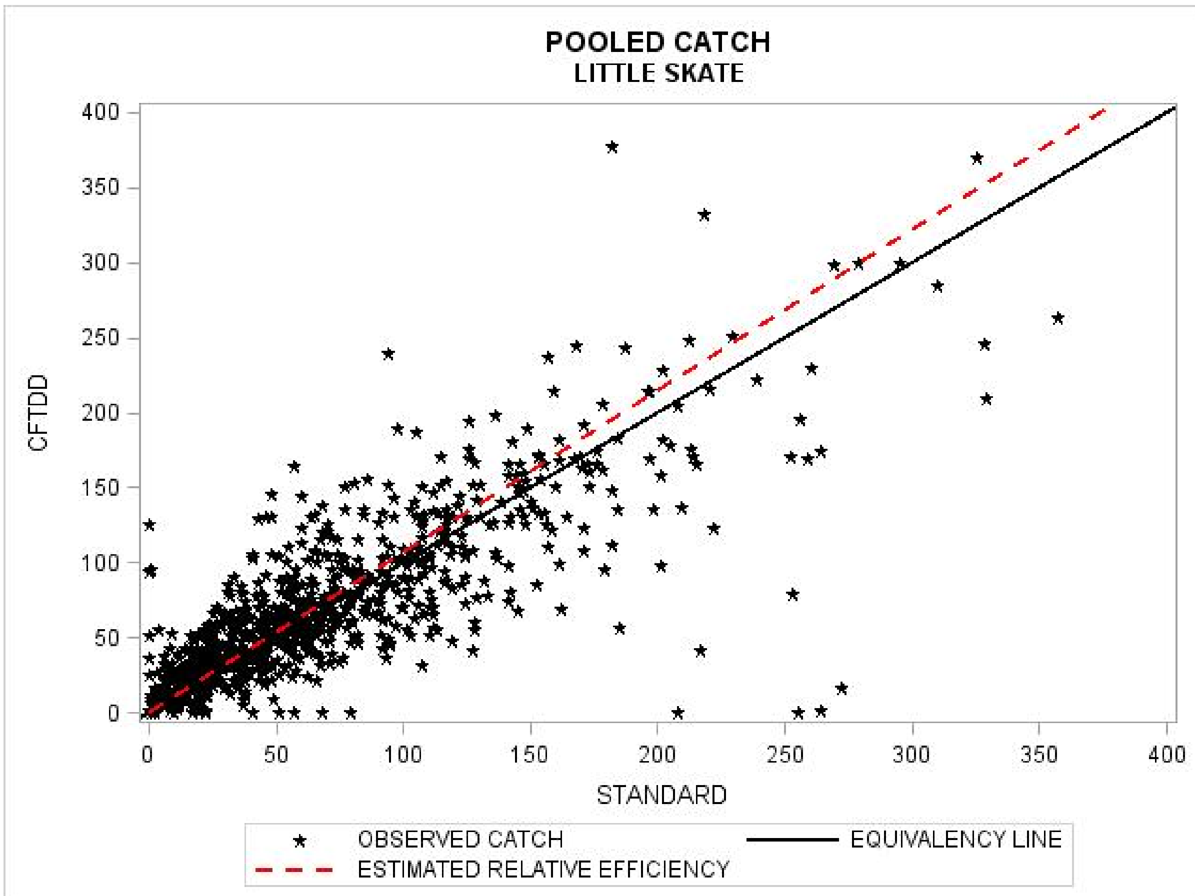


Figure 59: Total pooled catches for winter skate for the CFTDD vs. standard new Bedford Style Sea Scallop Dredge encountered during all cruises. The black line has a slope of one. The dashed line has a slope equal to the estimated relative efficiency (from the one parameter mixed effects model).

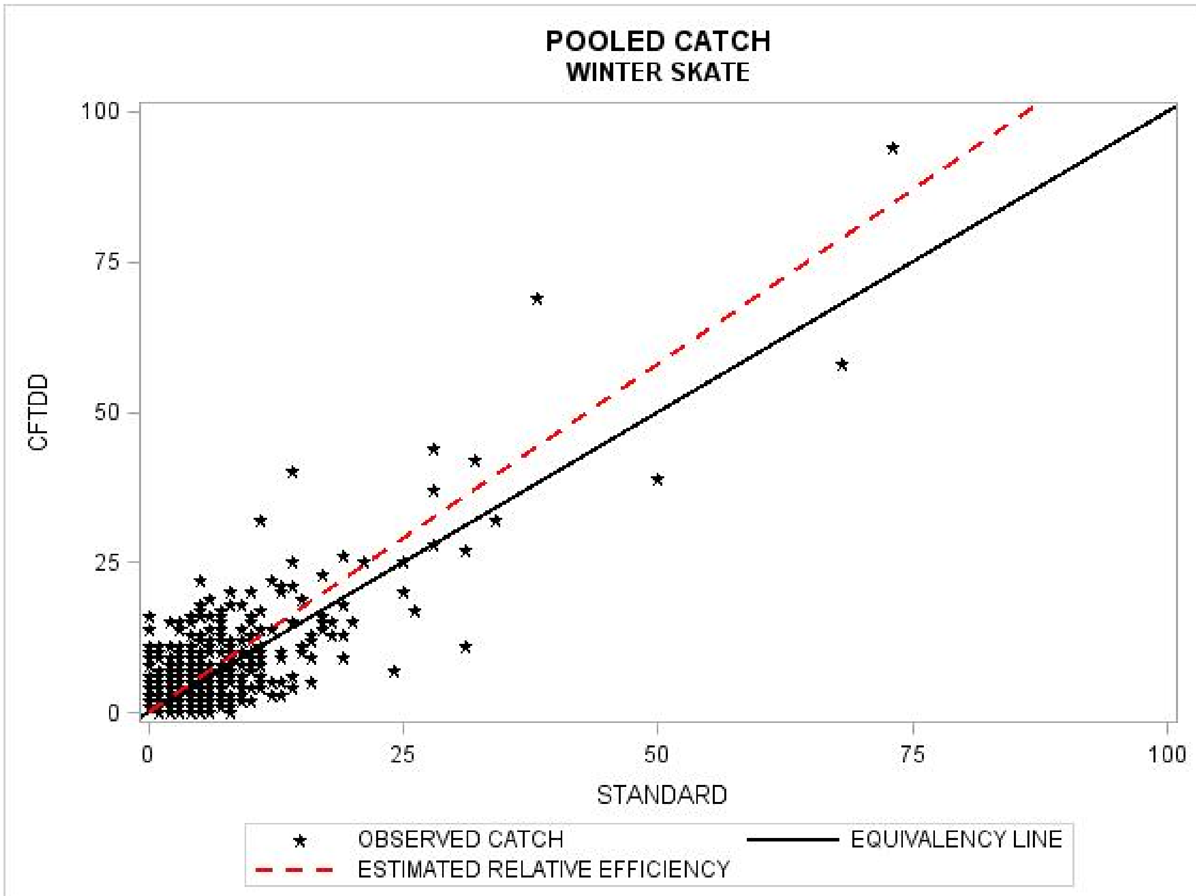


Figure 60: Total pooled catches for barndoor skate for the CFTDD vs. standard new Bedford Style Sea Scallop Dredge encountered during all cruises. The black line has a slope of one. The dashed line has a slope equal to the estimated relative efficiency (from the one parameter mixed effects model).

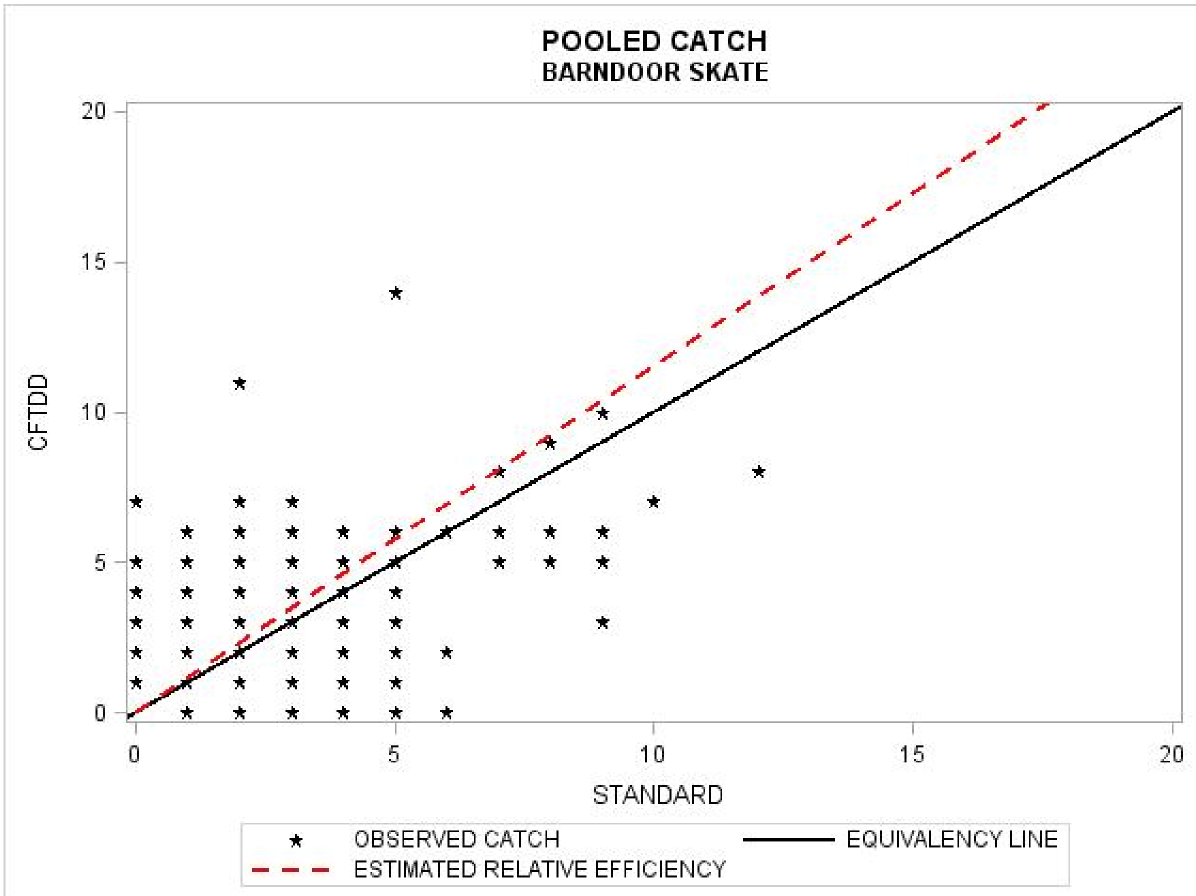


Figure 61: Total pooled catches for unclassified skates for the CFTDD vs. standard new Bedford Style Sea Scallop Dredge encountered during all cruises. The black line has a slope of one. The dashed line has a slope equal to the estimated relative efficiency (from the one parameter mixed effects model).

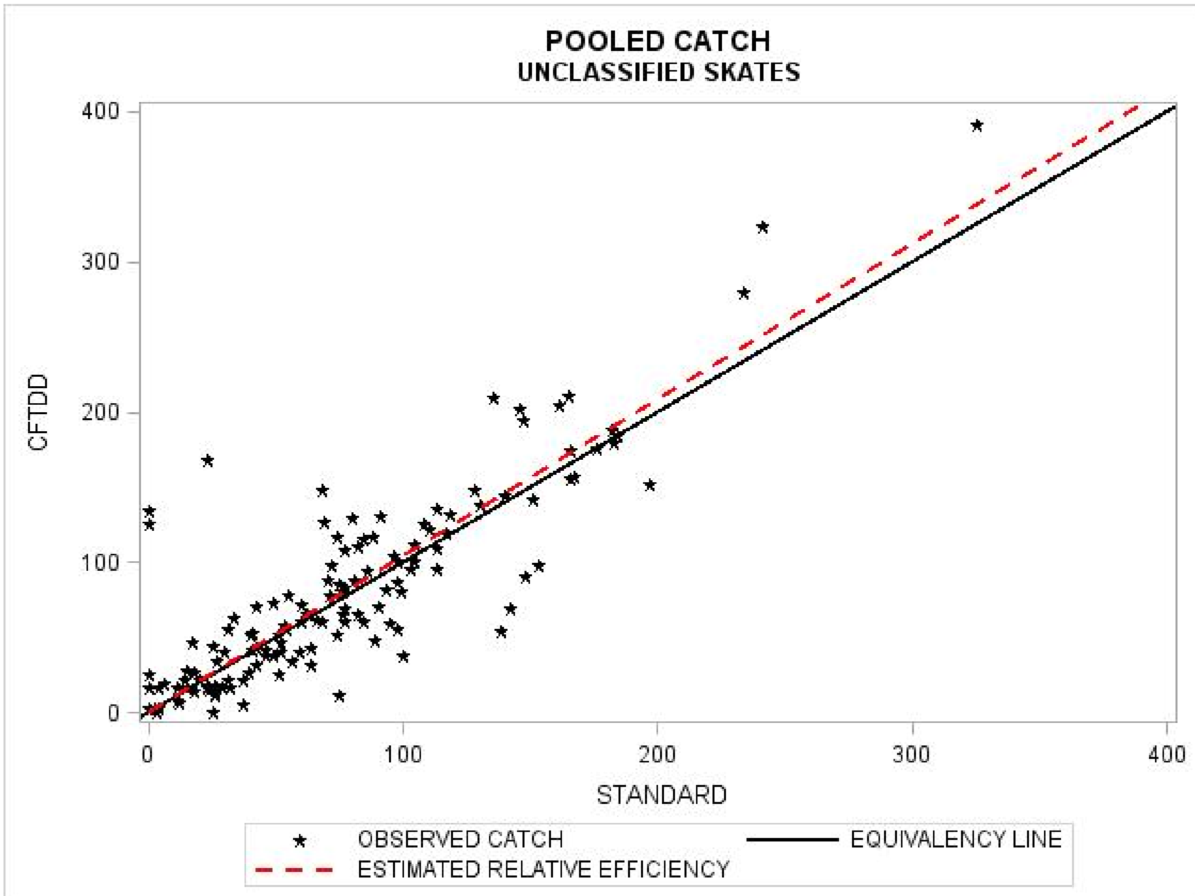


Figure 62: Total pooled catches for spiny dogfish for the CFTDD vs. standard new Bedford Style Sea Scallop Dredge encountered during all cruises. The black line has a slope of one. The dashed line has a slope equal to the estimated relative efficiency (from the one parameter mixed effects model).

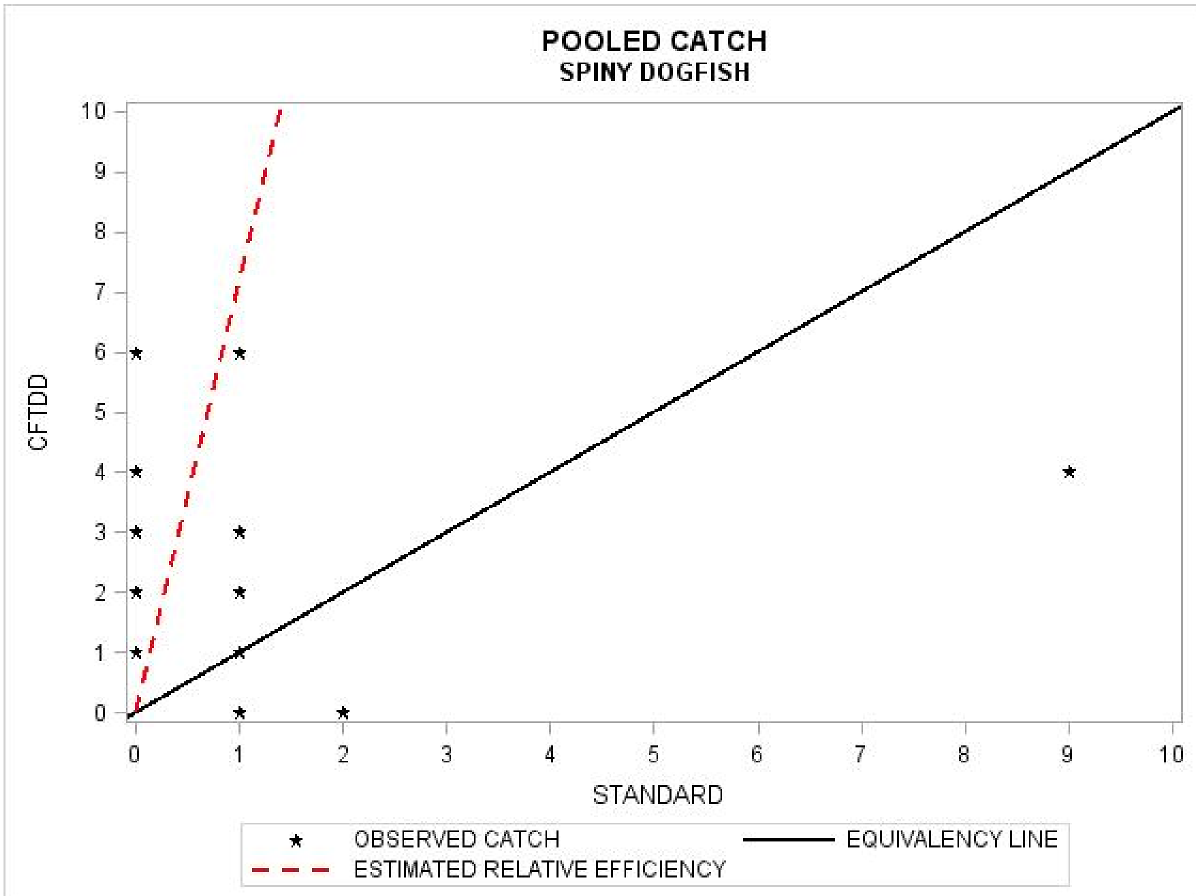


Figure 63: The proportion of scallops retained by the two dredge designs tested during all bycatch survey cruises. A proportion >0.5 represents more animals at length were captured by the CFTDD. The triangles represent the observed proportion at length ($Catch_{CFTDD}/(Catch_{CFTDD} + Catch_{standard})$). The grey area represents the 95% confidence band for the modeled proportion (solid black line).

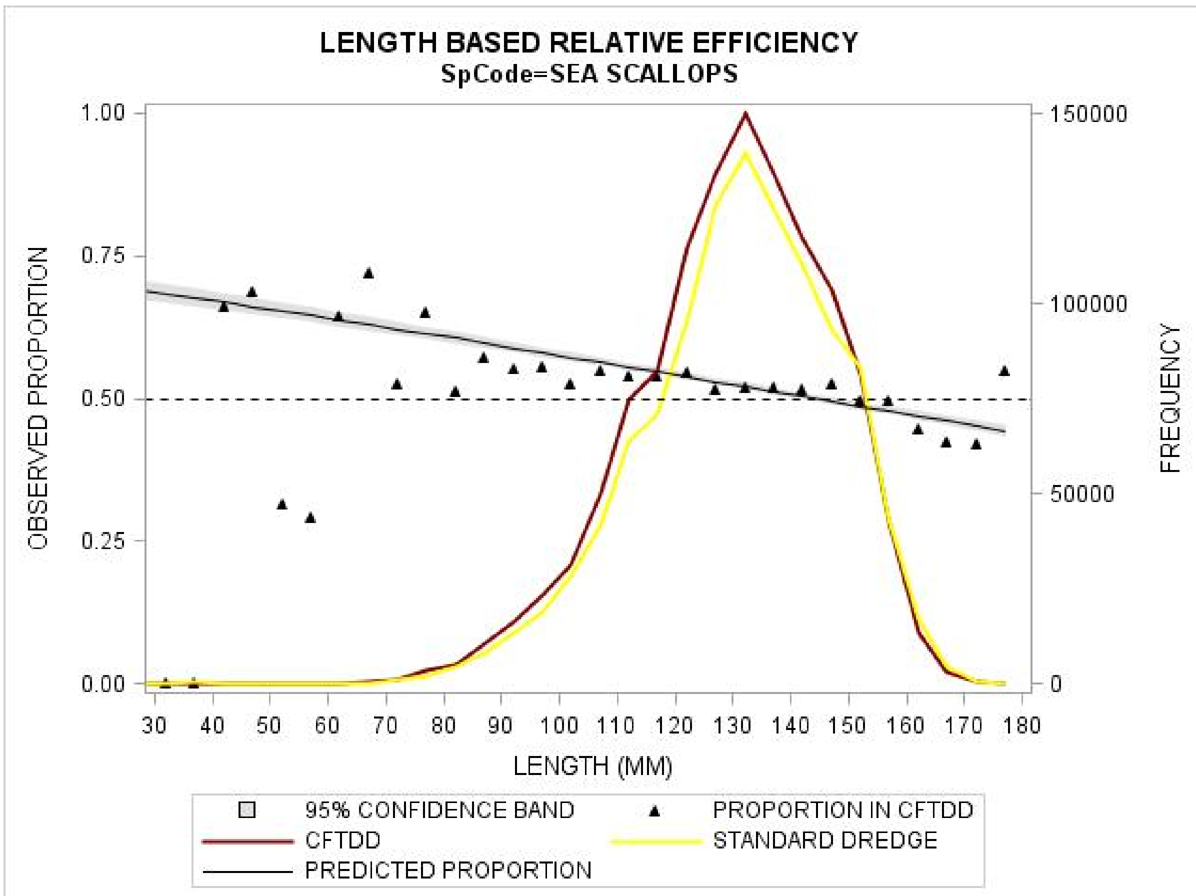
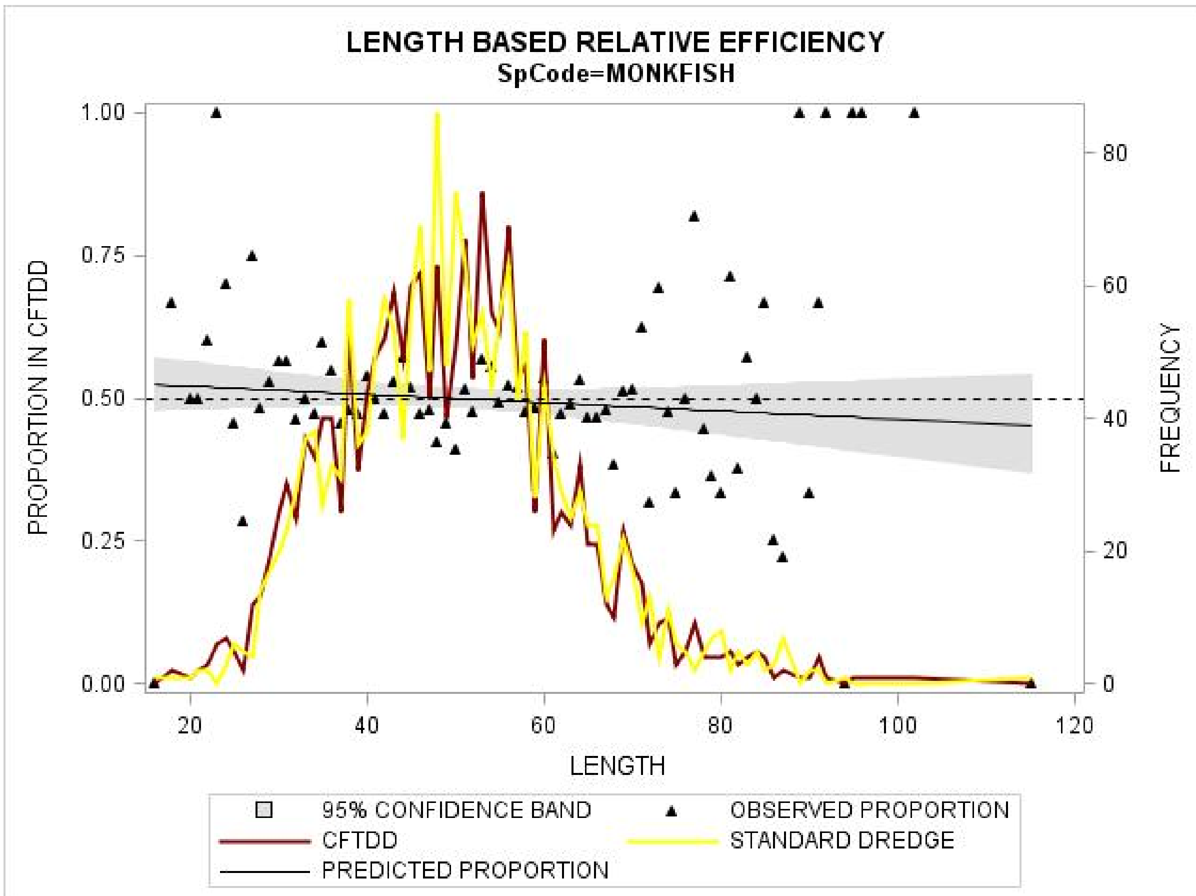


Figure 64: The proportion of monkfish retained by the two dredge designs tested during all bycatch survey cruises. A proportion >0.5 represents more animals at length were captured by the CFTDD. The triangles represent the observed proportion at length ($Catch_{CFTDD}/(Catch_{CFTDD} + Catch_{standard})$). The grey area represents the 95% confidence band for the modeled proportion (solid black line).



<u>Figure 65:</u> The proportion of Atlantic cod retained by the two dredge designs tested during all bycatch survey cruises. A proportion >0.5 represents more animals at length were captured by the CFTDD. The triangles represent the observed proportion at length ($Catch_{CFTDD}/(Catch_{CFTDD} + Catch_{standard})$). The grey area represents the 95% confidence band for the modeled proportion (solid black line).

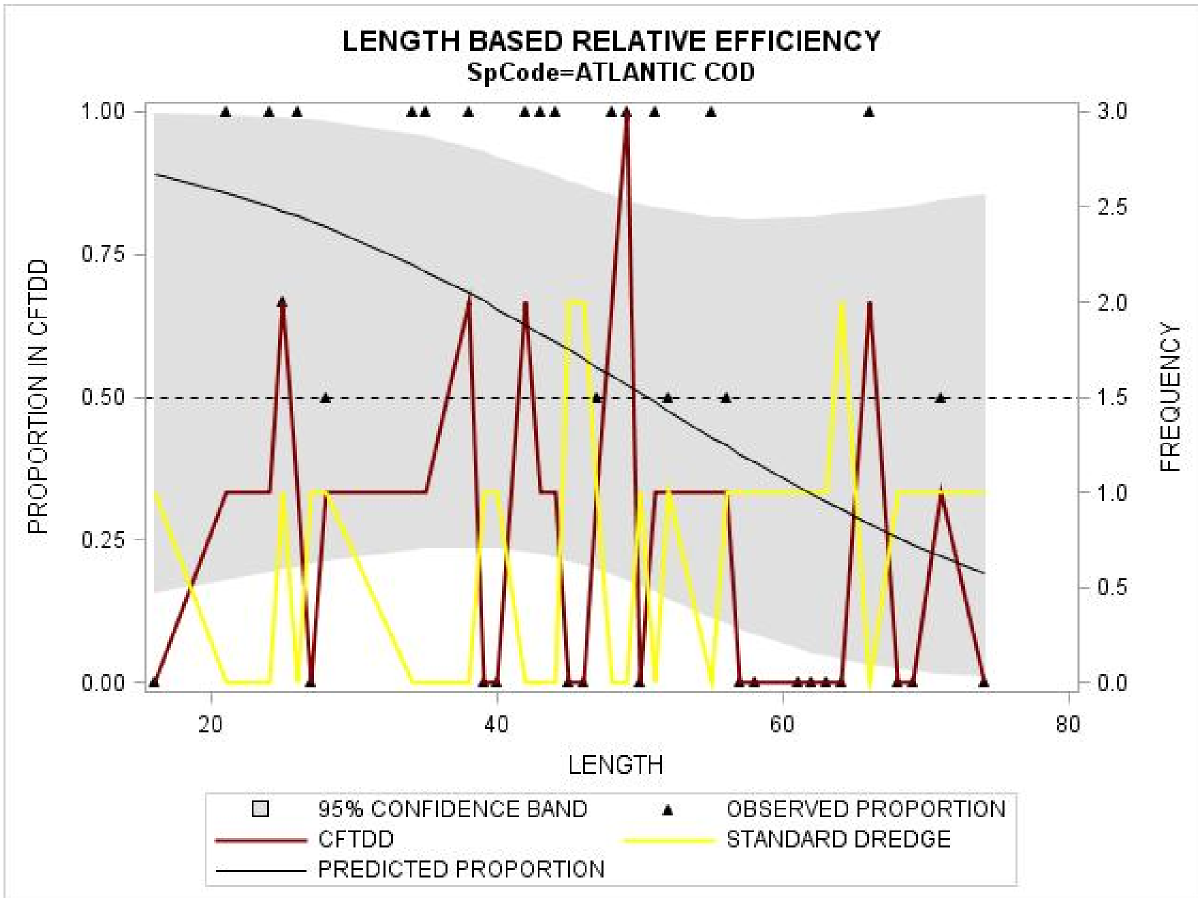


Figure 66: The proportion of haddock retained by the two dredge designs tested during all bycatch survey cruises. A proportion >0.5 represents more animals at length were captured by the CFTDD. The triangles represent the observed proportion at length ($Catch_{CFTDD}/(Catch_{CFTDD} + Catch_{standard})$). The grey area represents the 95% confidence band for the modeled proportion (solid black line).

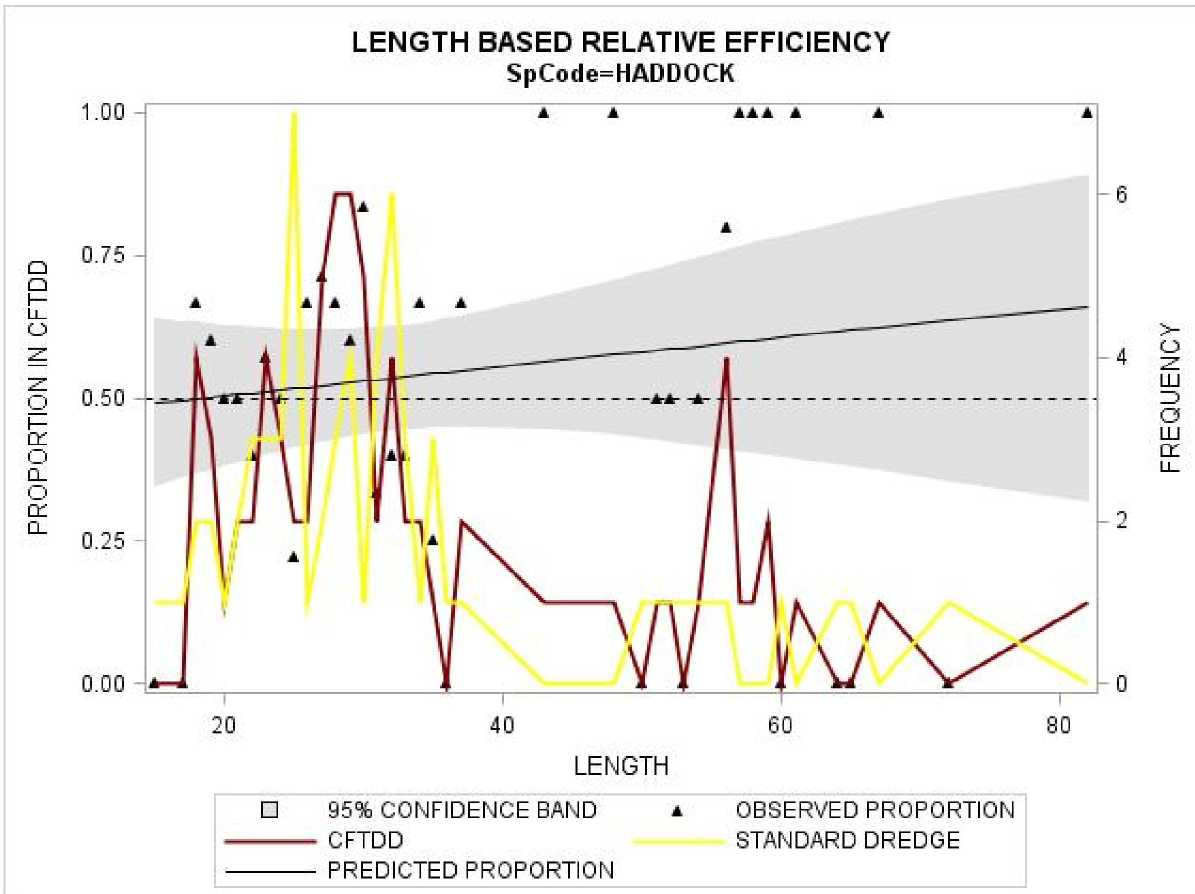
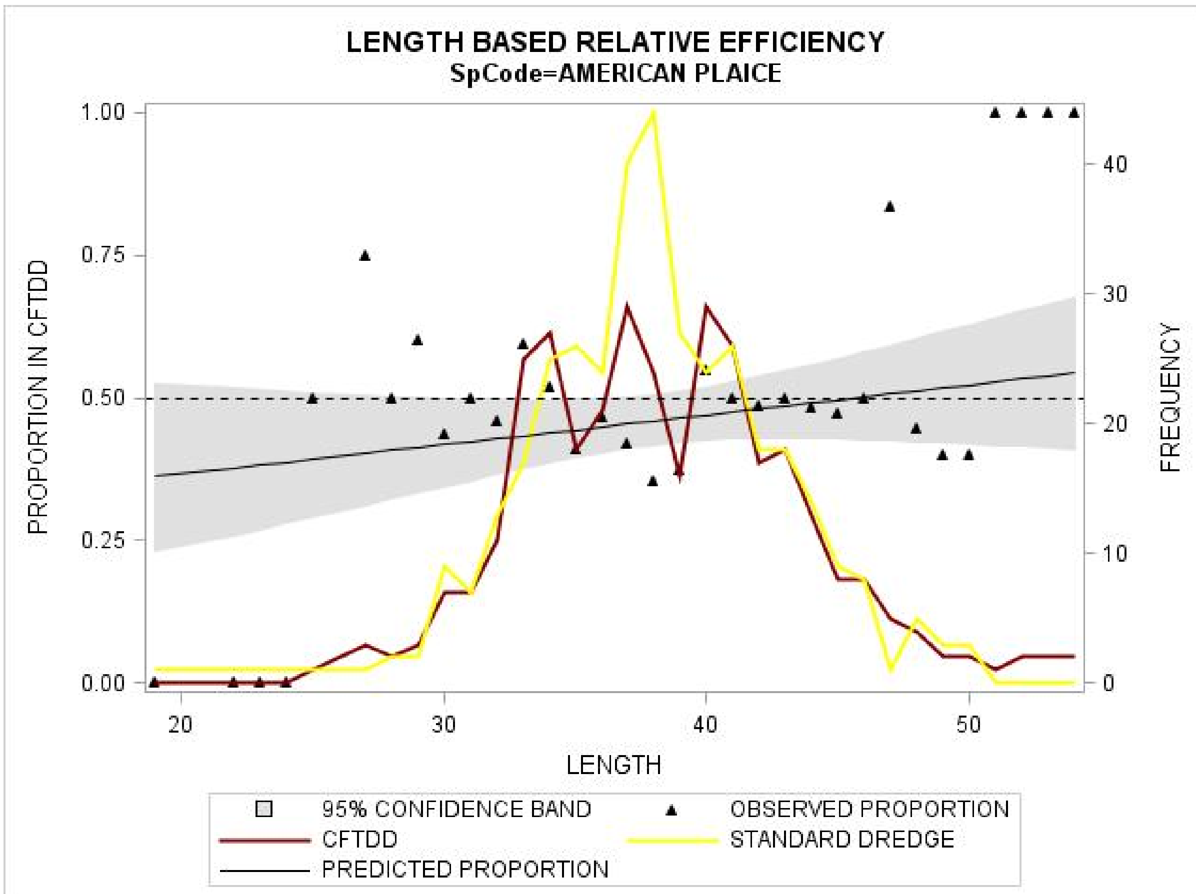


Figure 67: The proportion of American plaice retained by the two dredge designs tested during all bycatch survey cruises. A proportion >0.5 represents more animals at length were captured by the CFTDD. The triangles represent the observed proportion at length ($Catch_{CFTDD}$/($Catch_{CFTDD}$ + $Catch_{standard}$). The grey area represents the 95% confidence band for the modeled proportion (solid black line).



<u>Figure 68:</u> The proportion of summer flounder retained by the two dredge designs tested during all bycatch survey cruises. A proportion >0.5 represents more animals at length were captured by the CFTDD. The triangles represent the observed proportion at length ($Catch_{CFTDD}/(Catch_{CFTDD} + Catch_{standard})$). The grey area represents the 95% confidence band for the modeled proportion (solid black line).

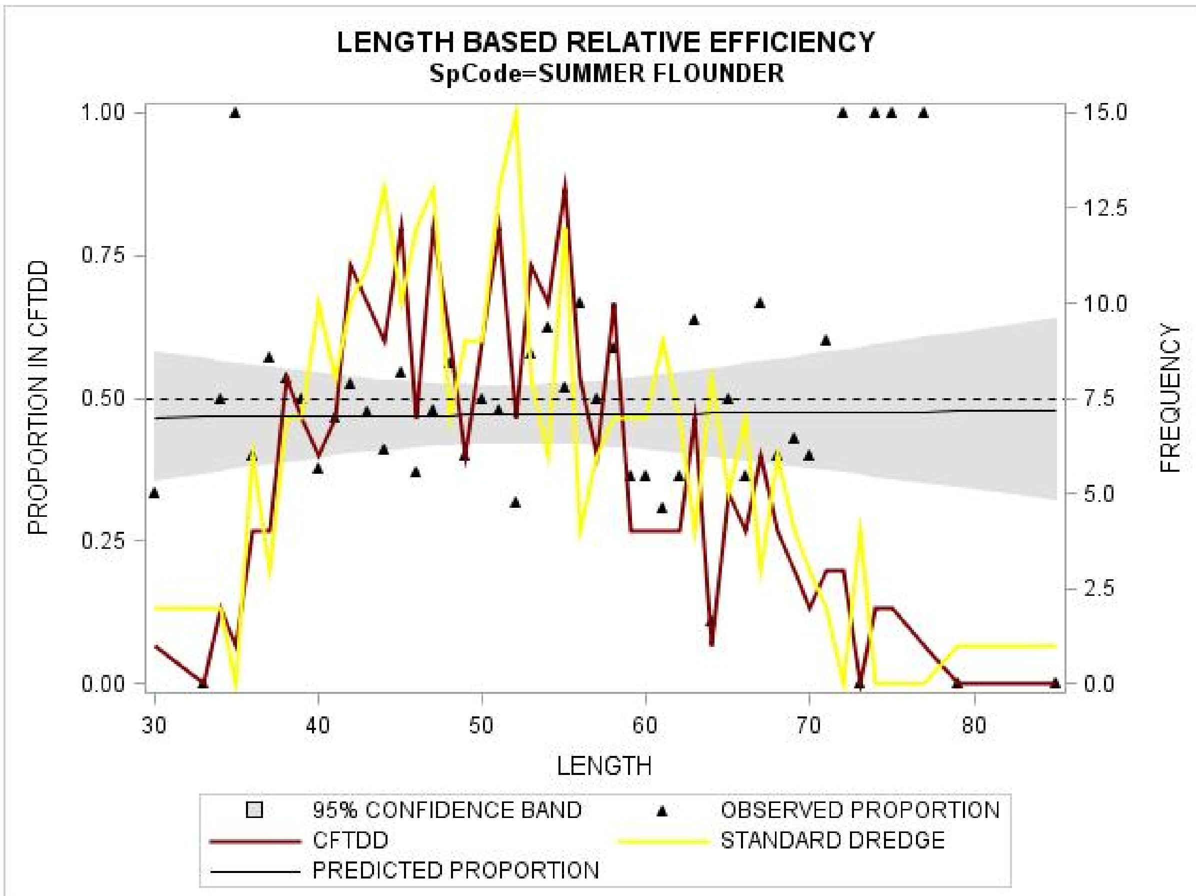


Figure 69: The proportion of fourspot flounder retained by the two dredge designs tested during all bycatch survey cruises. A proportion >0.5 represents more animals at length were captured by the CFTDD. The triangles represent the observed proportion at length ($Catch_{CFTDD}/(Catch_{CFTDD} + Catch_{standard})$). The grey area represents the 95% confidence band for the modeled proportion (solid black line).

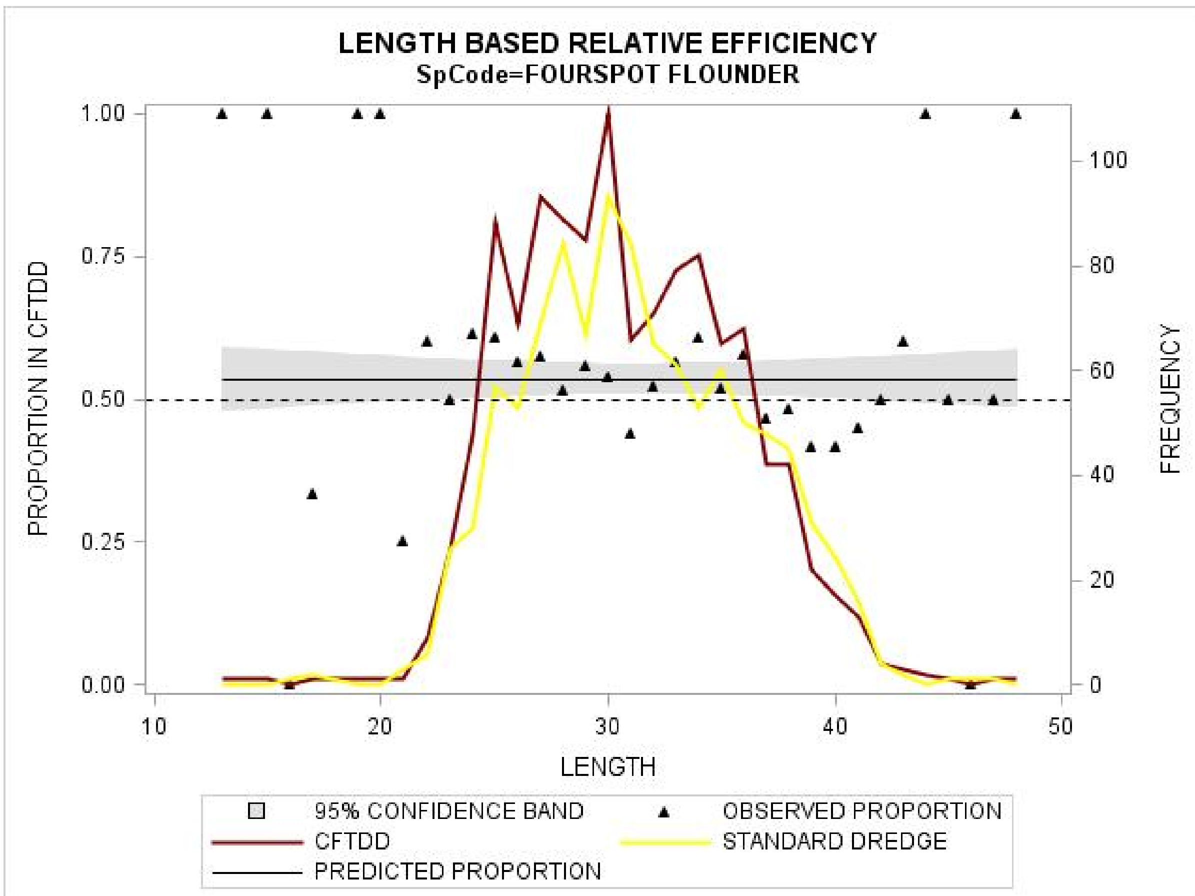


Figure 70: The proportion of yellowtail flounder retained by the two dredge designs tested during all bycatch survey cruises. A proportion >0.5 represents more animals at length were captured by the CFTDD. The triangles represent the observed proportion at length ($Catch_{CFTDD}$/($Catch_{CFTDD}$ + $Catch_{standard}$). The grey area represents the 95% confidence band for the modeled proportion (solid black line).

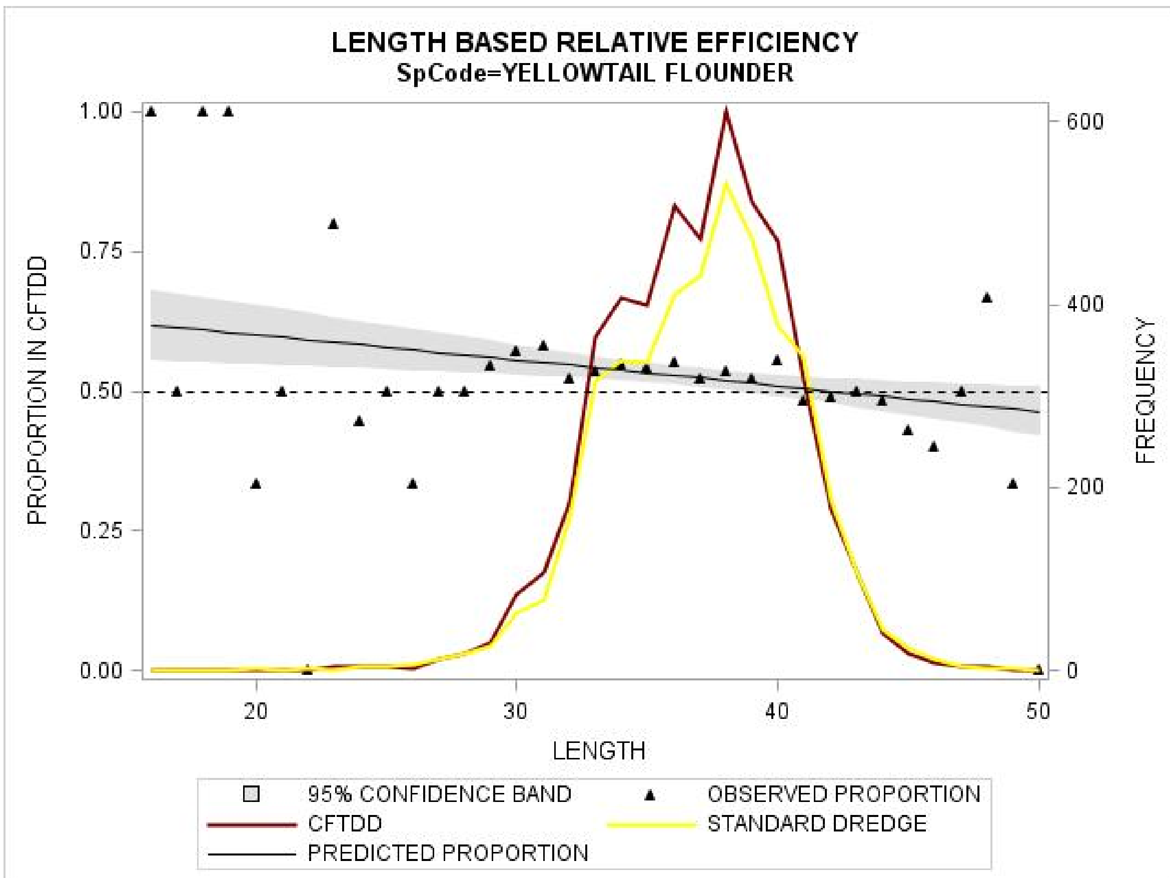


Figure 71: The proportion of winter flounder retained by the two dredge designs tested during all bycatch survey cruises. A proportion >0.5 represents more animals at length were captured by the CFTDD. The triangles represent the observed proportion at length ($Catch_{CFTDD}/(Catch_{CFTDD} + Catch_{standard})$). The grey area represents the 95% confidence band for the modeled proportion (solid black line).

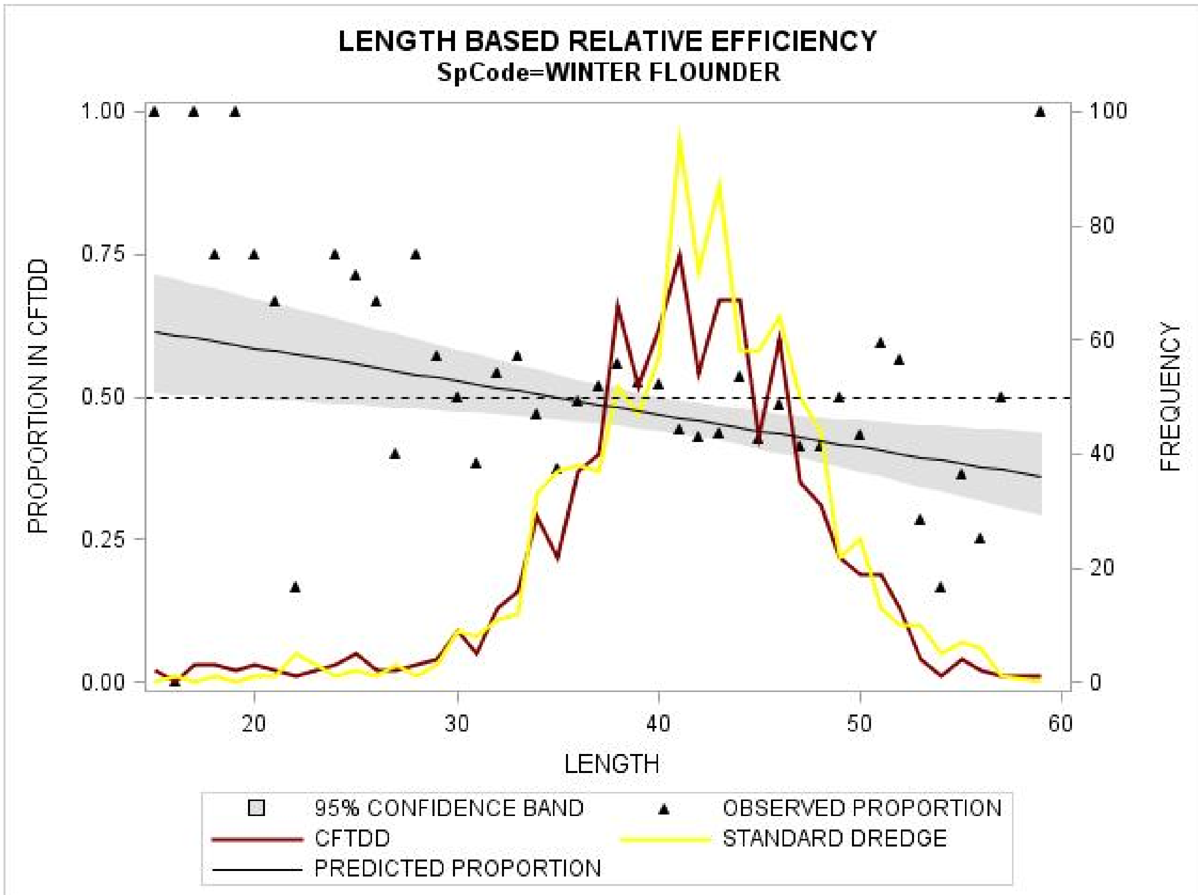


Figure 72: The proportion of grey sole retained by the two dredge designs tested during all bycatch survey cruises. A proportion >0.5 represents more animals at length were captured by the CFTDD. The triangles represent the observed proportion at length ($Catch_{CFTDD}/(Catch_{CFTDD} + Catch_{standard})$). The grey area represents the 95% confidence band for the modeled proportion (solid black line).

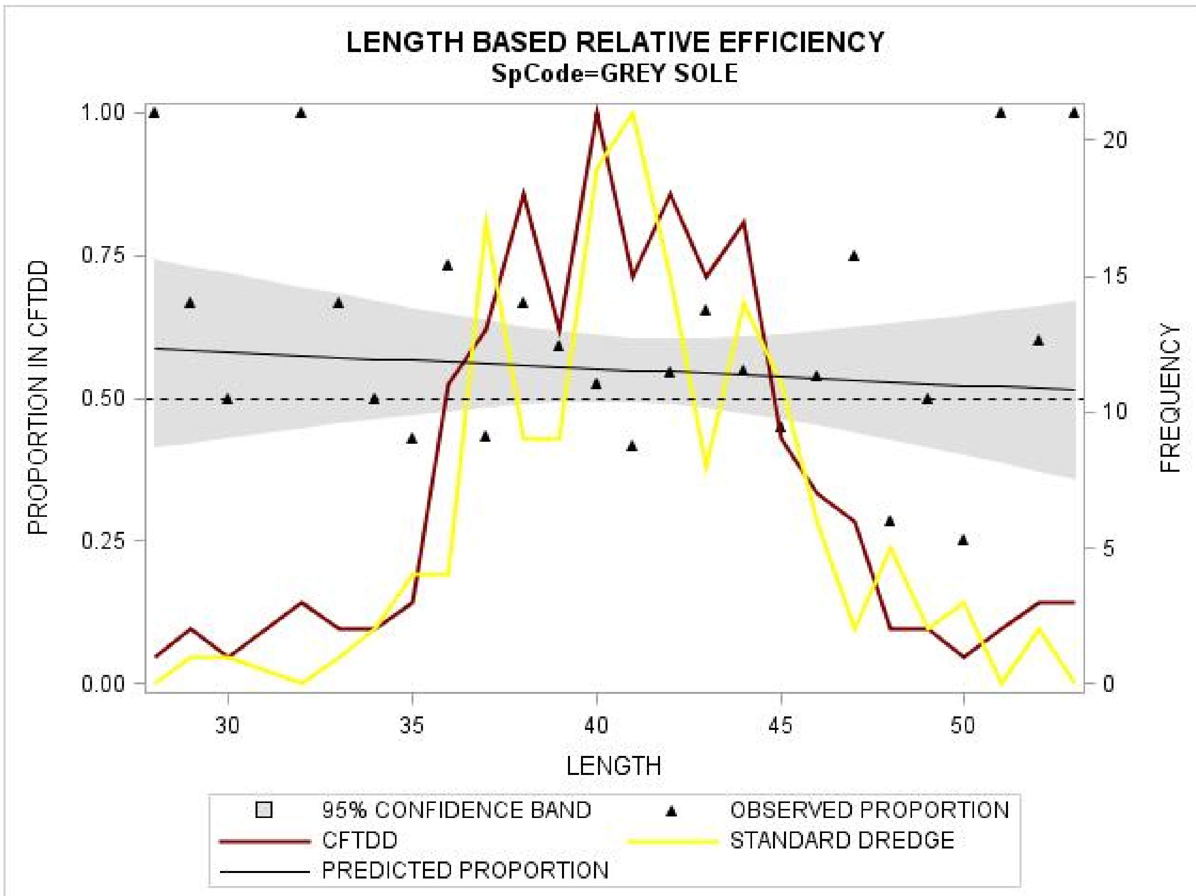
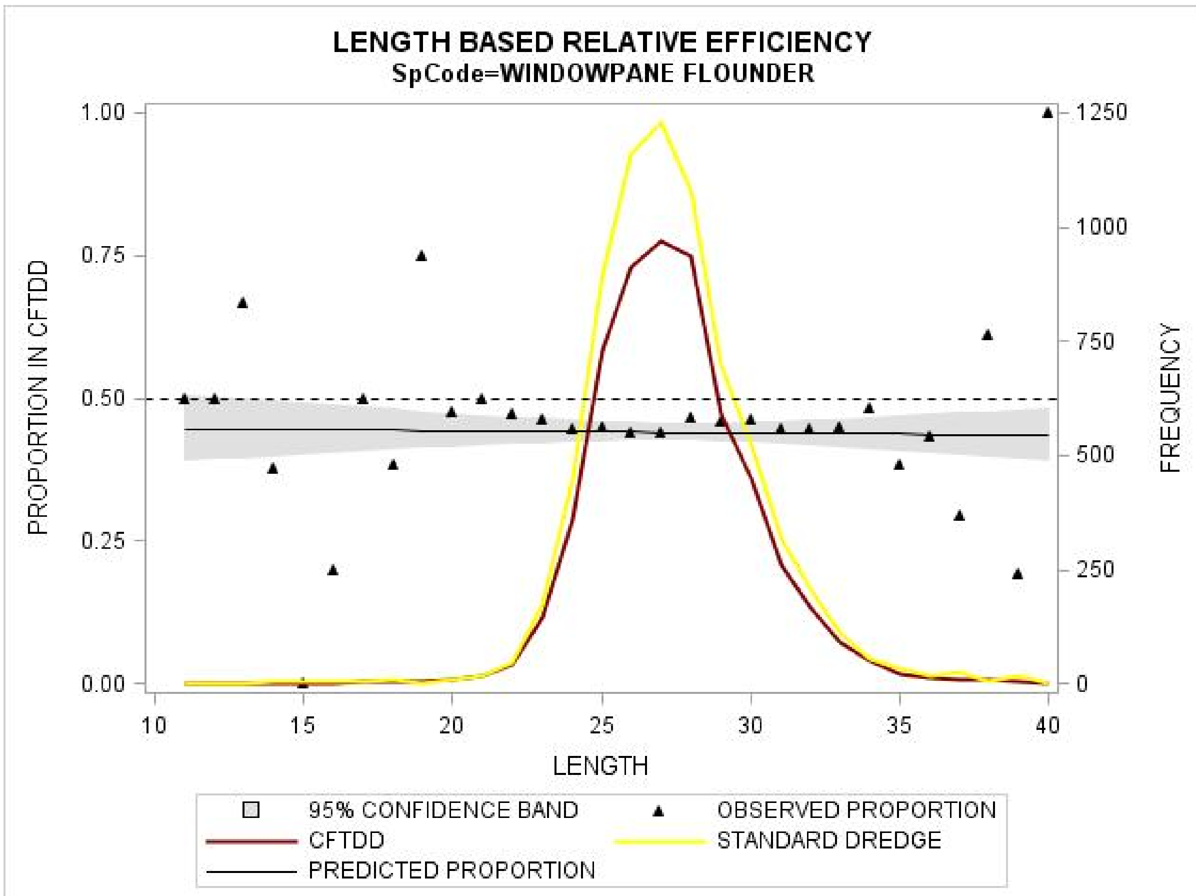
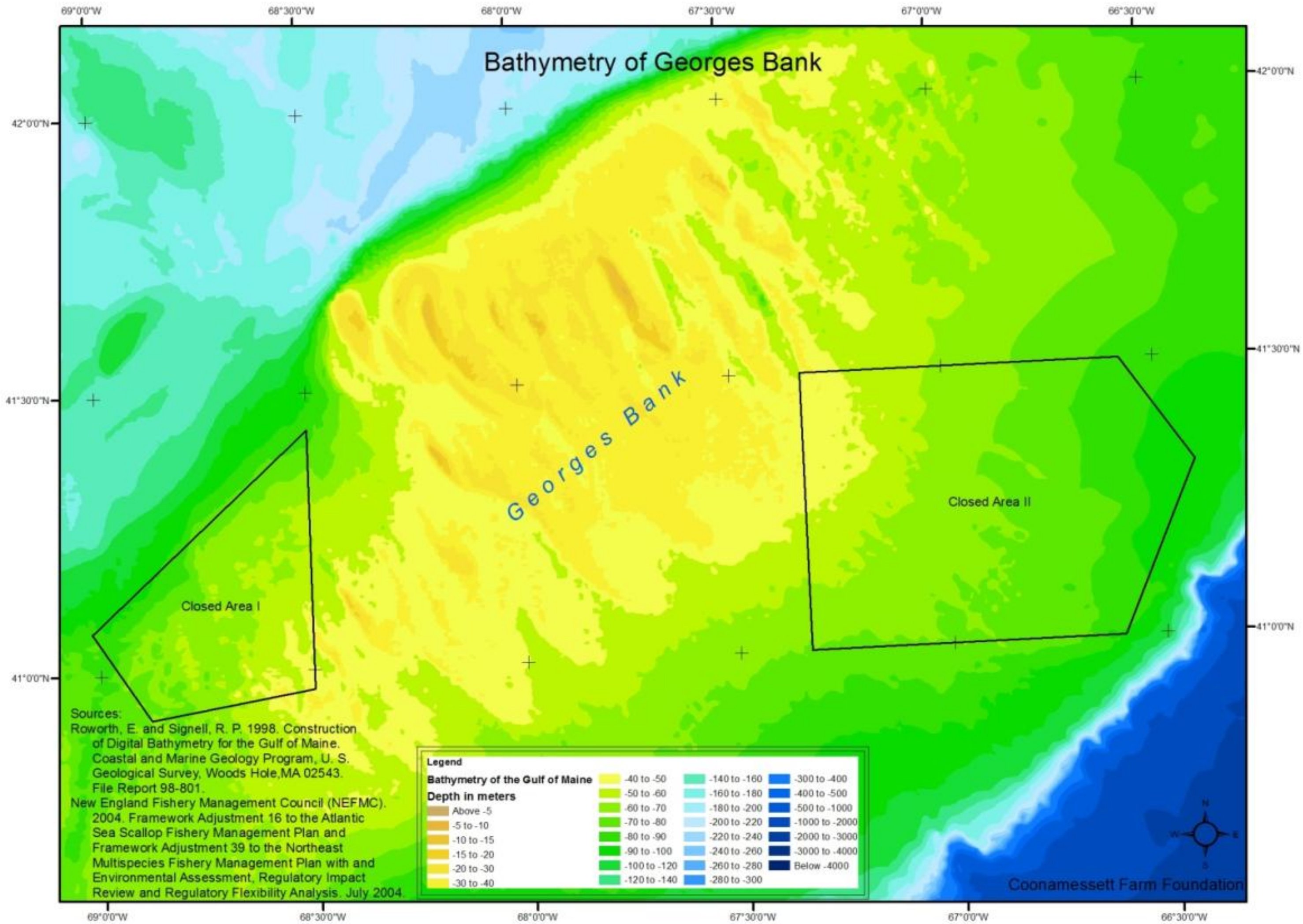


Figure 73: The proportion of windowpane flounder retained by the two dredge designs tested during all bycatch survey cruises. A proportion >0.5 represents more animals at length were captured by the CFTDD. The triangles represent the observed proportion at length ($Catch_{CFTDD}/(Catch_{CFTDD} + Catch_{standard})$). The grey area represents the 95% confidence band for the modeled proportion (solid black line).

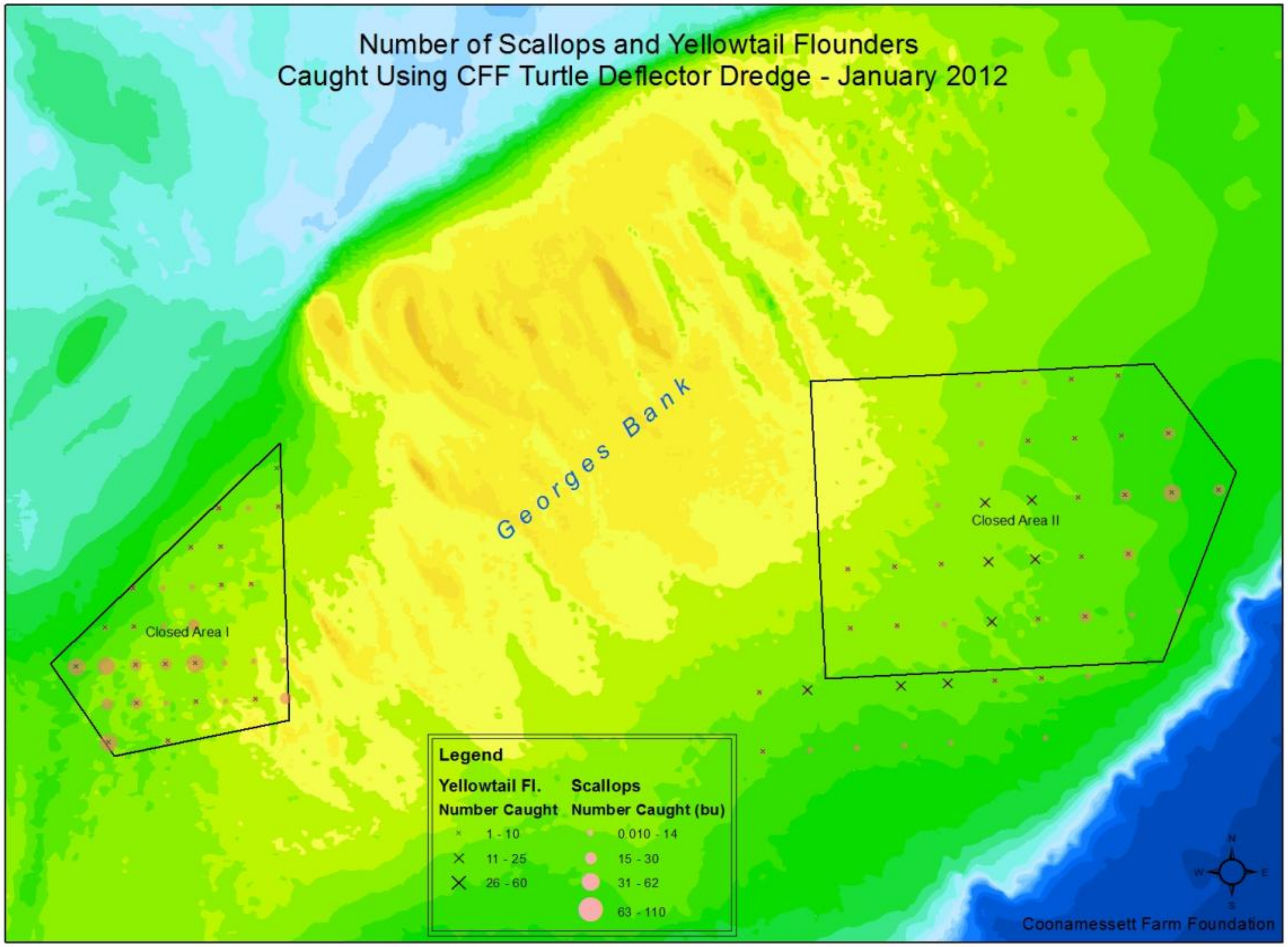


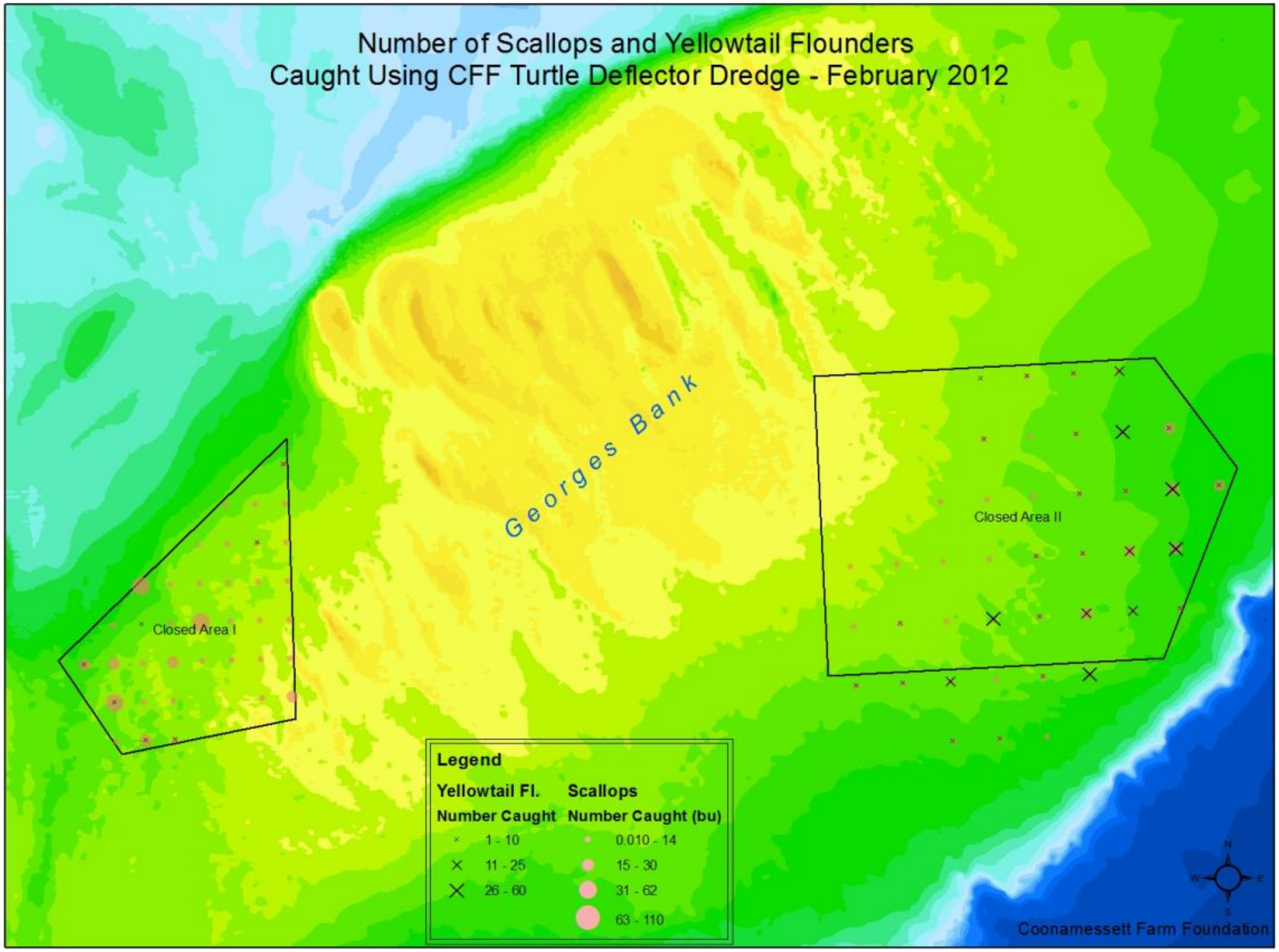
Appendix A
Scallop and By Catch Figures
Caught Using CFTDD
by Month



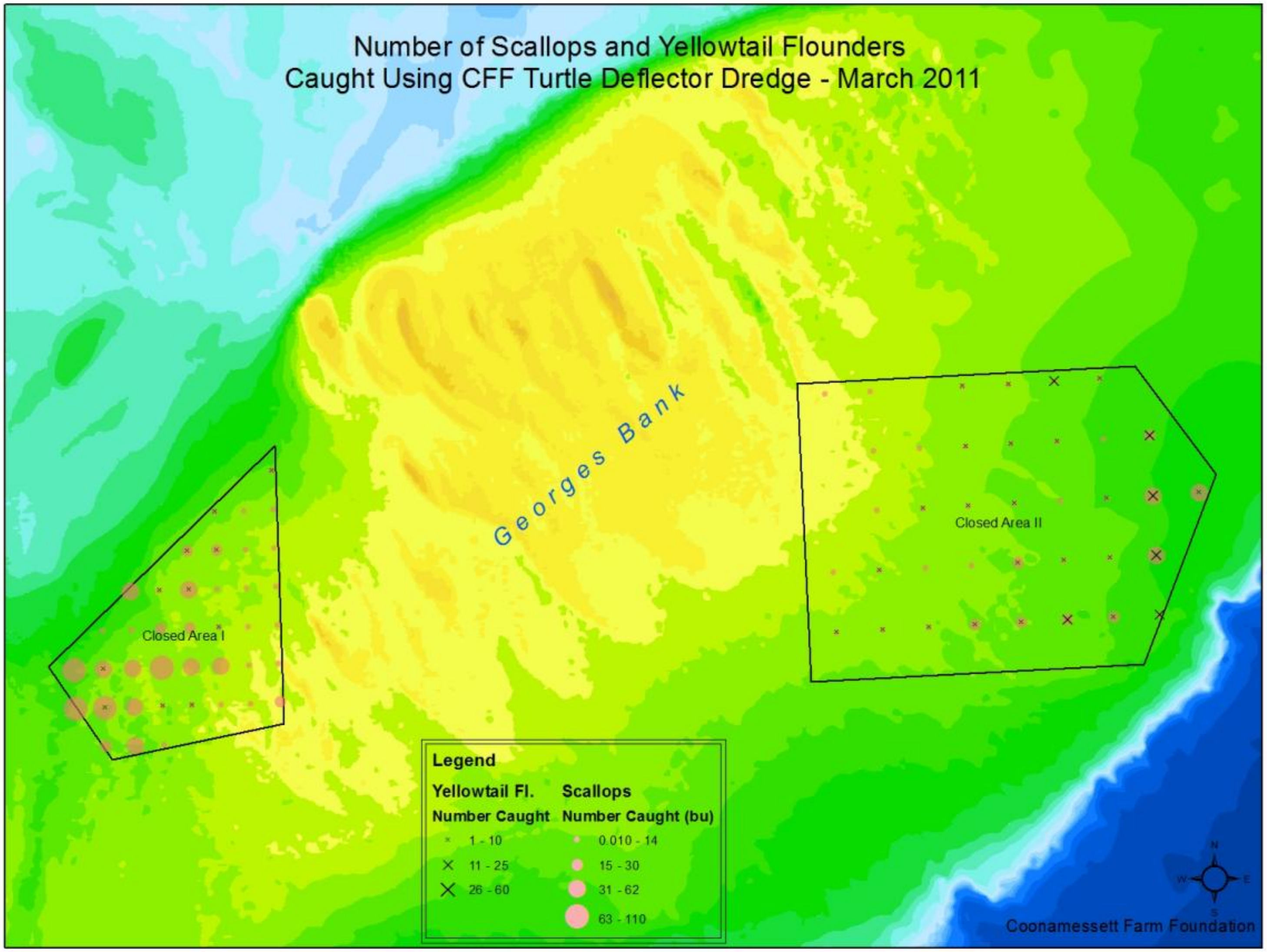
Note: The bathymetry legend, sources, and latitude and longitude information is not repeated on the following figures.

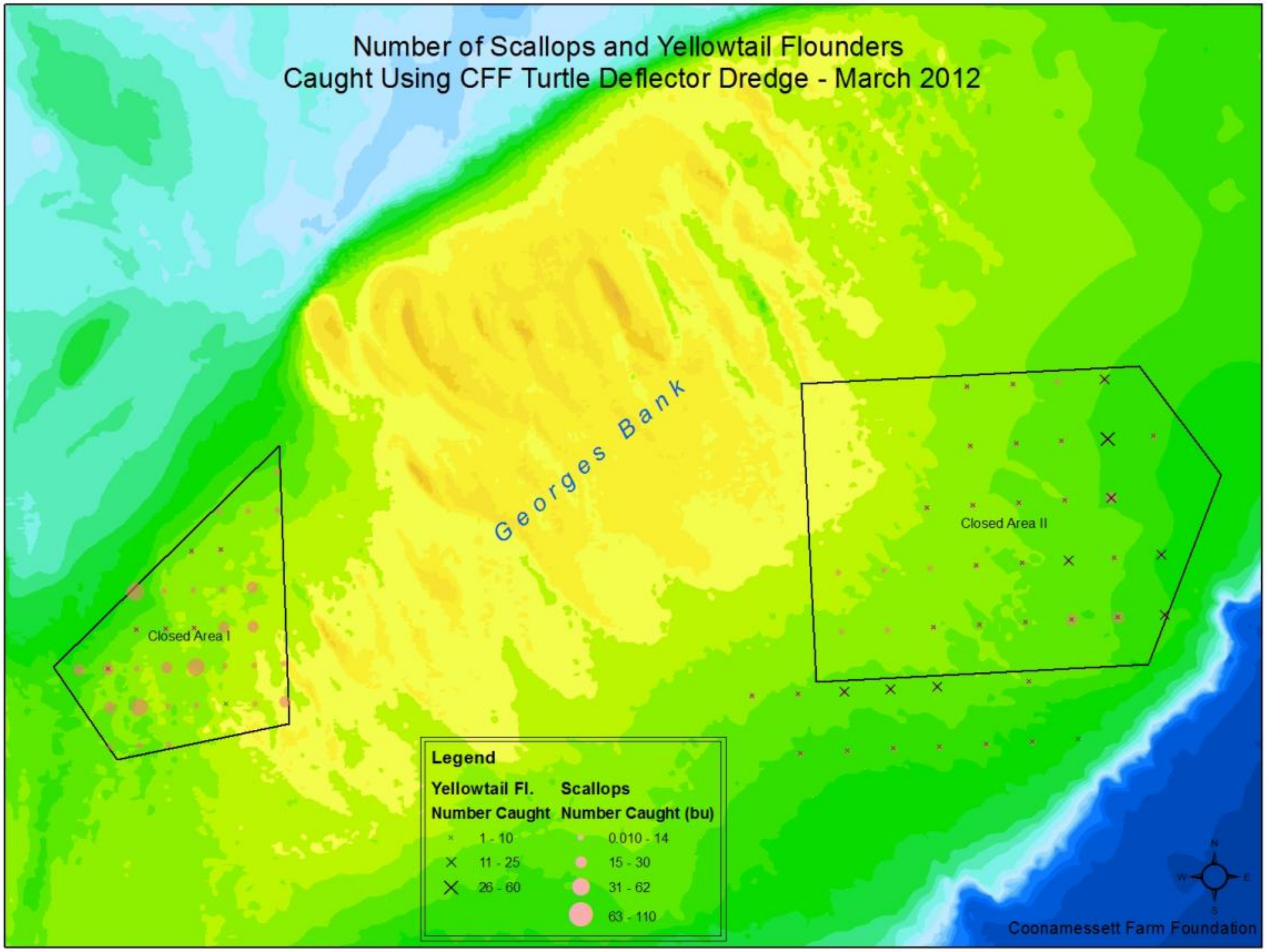
Scallops and Yellowtail Flounder



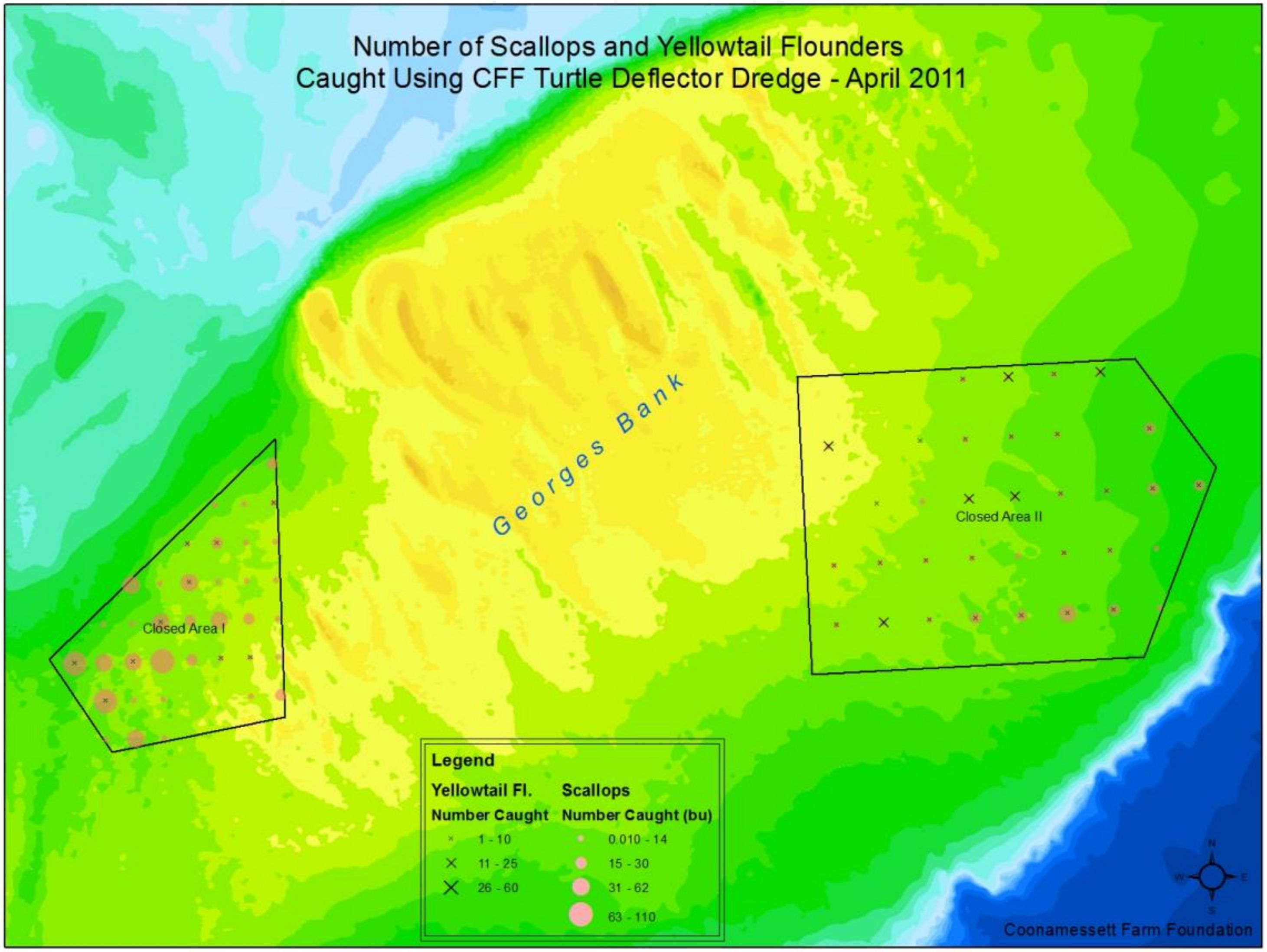


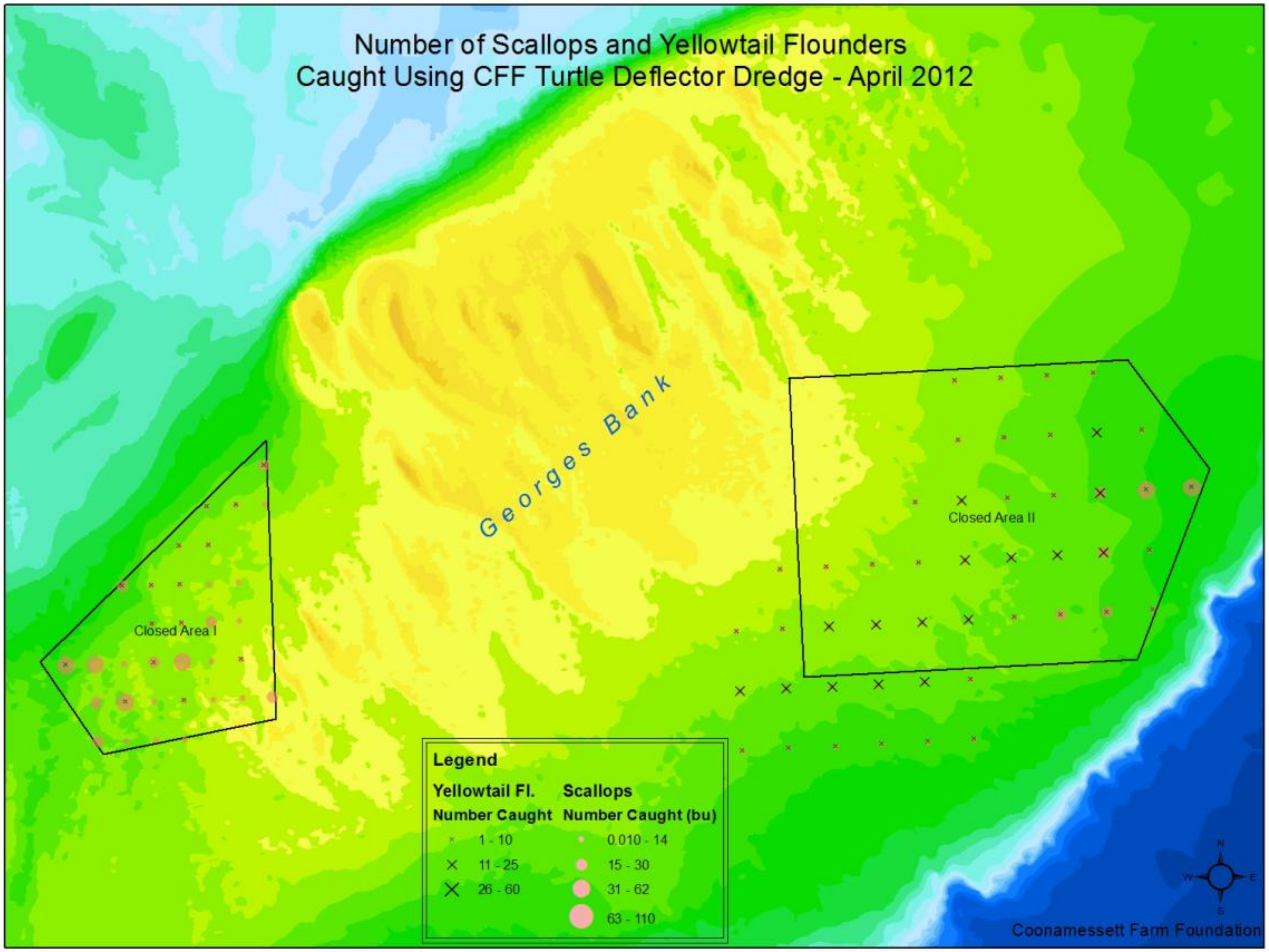
Number of Scallops and Yellowtail Flounders
Caught Using CFF Turtle Deflector Dredge - February 2012
Georges Bank
Closed Area I
Closed Area II
Legend
Yellowtail Fl.
Number Caught
1 - 10
11 - 25
26 - 60
Scallops
Number Caught (bu)
0.010 - 14
15 - 30
31 - 62
63 - 110
Coonamessett Farm Foundation

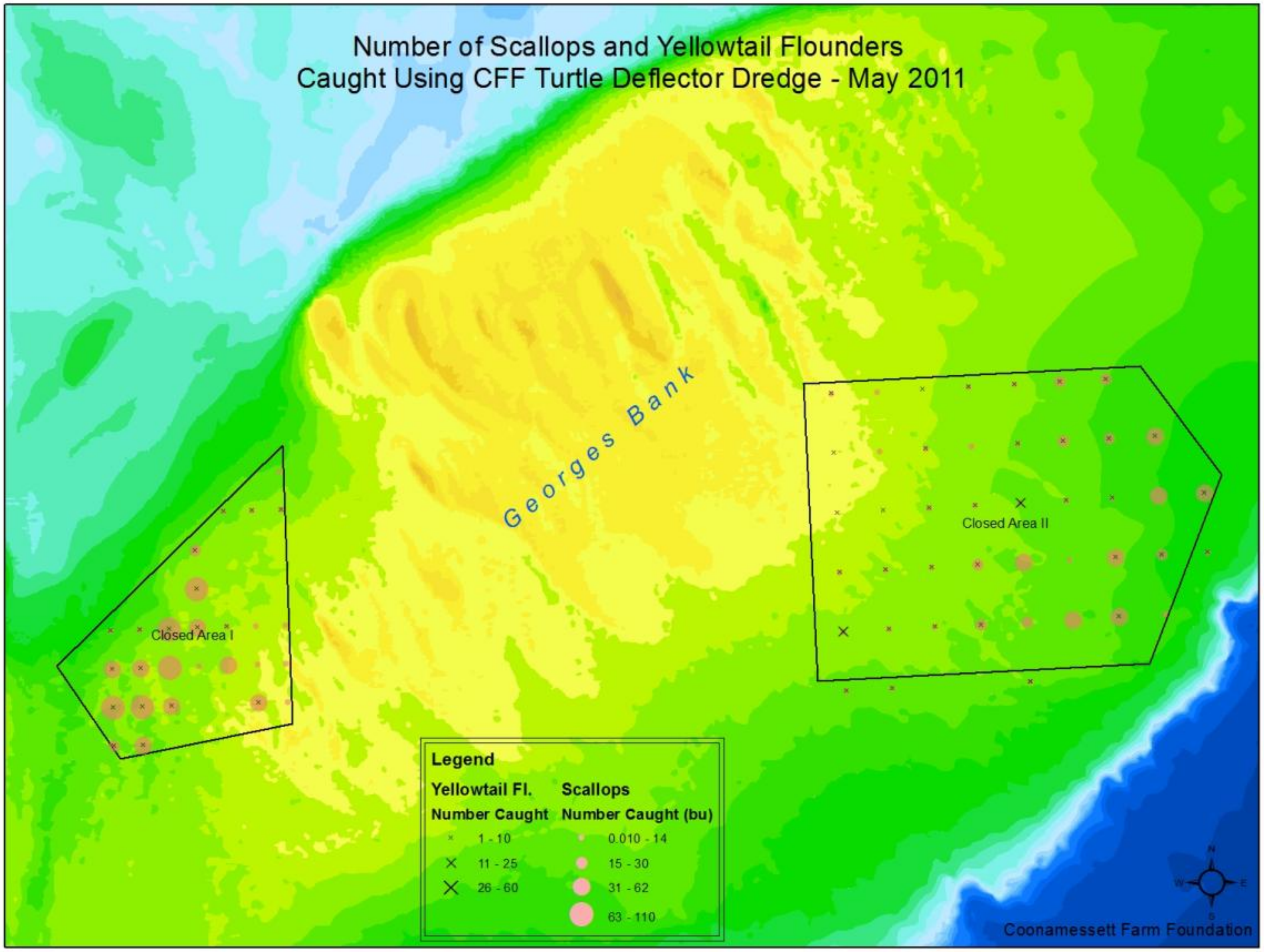

Number of Scallops and Yellowtail Flounders
Caught Using CFF Turtle Deflector Dredge - March 2011
Georges Bank
Closed Area I
Closed Area II
Legend
Yellowtail Fl. Number Caught
1 - 10
11 - 25
26 - 60
Scallops Number Caught (bu)
0.010 - 14
15 - 30
31 - 62
63 - 110
Coonamessett Farm Foundation



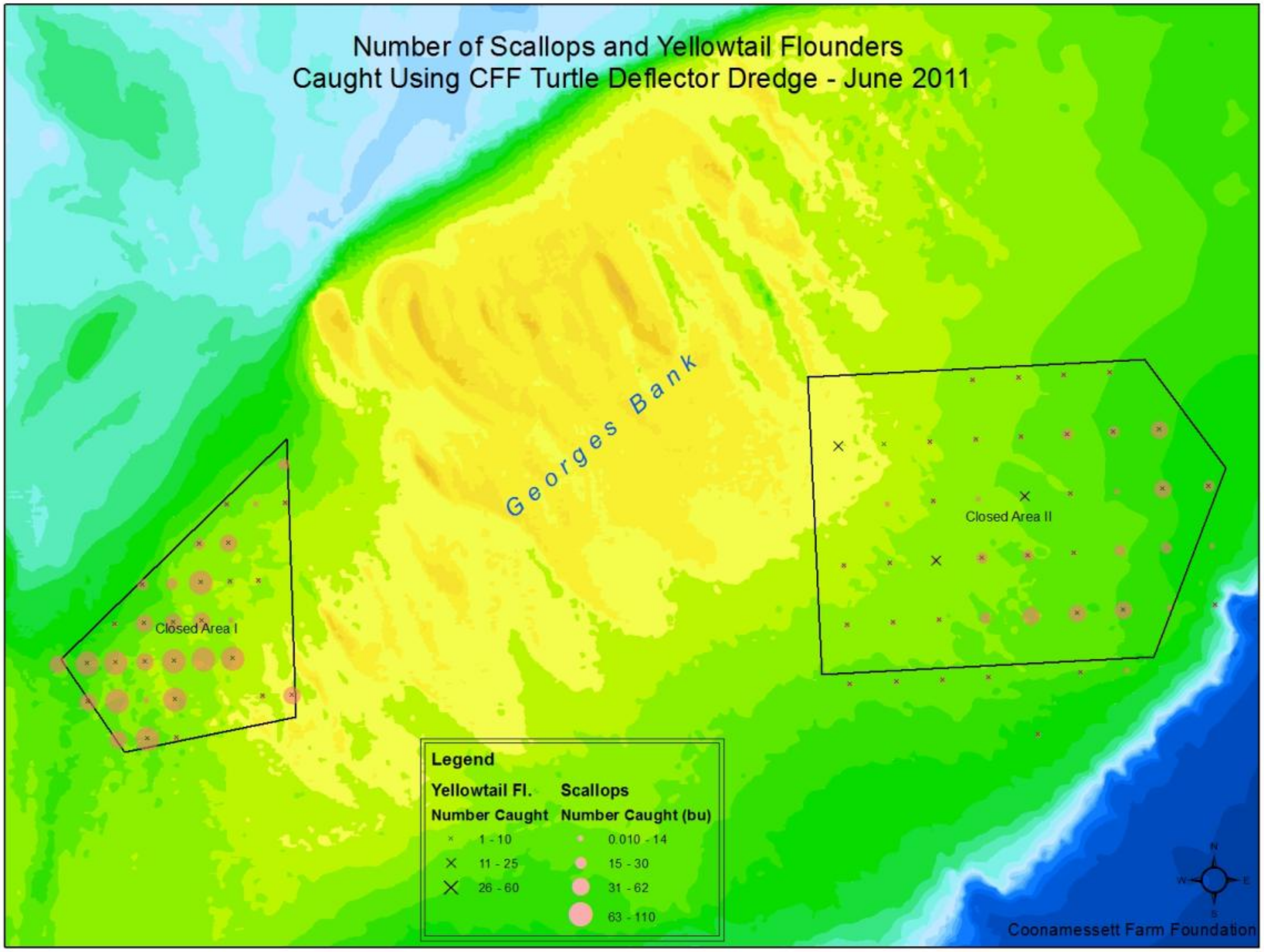
Number of Scallops and Yellowtail Flounders
Caught Using CFF Turtle Deflector Dredge - March 2012
Georges Bank
Closed Area I
Closed Area II
Legend
Yellowtail Fl.
Number Caught
1 - 10
11 - 25
26 - 60
Scallops
Number Caught (bu)
0.010 - 14
15 - 30
31 - 62
63 - 110
N
W
E
S
Coonamessett Farm Foundation

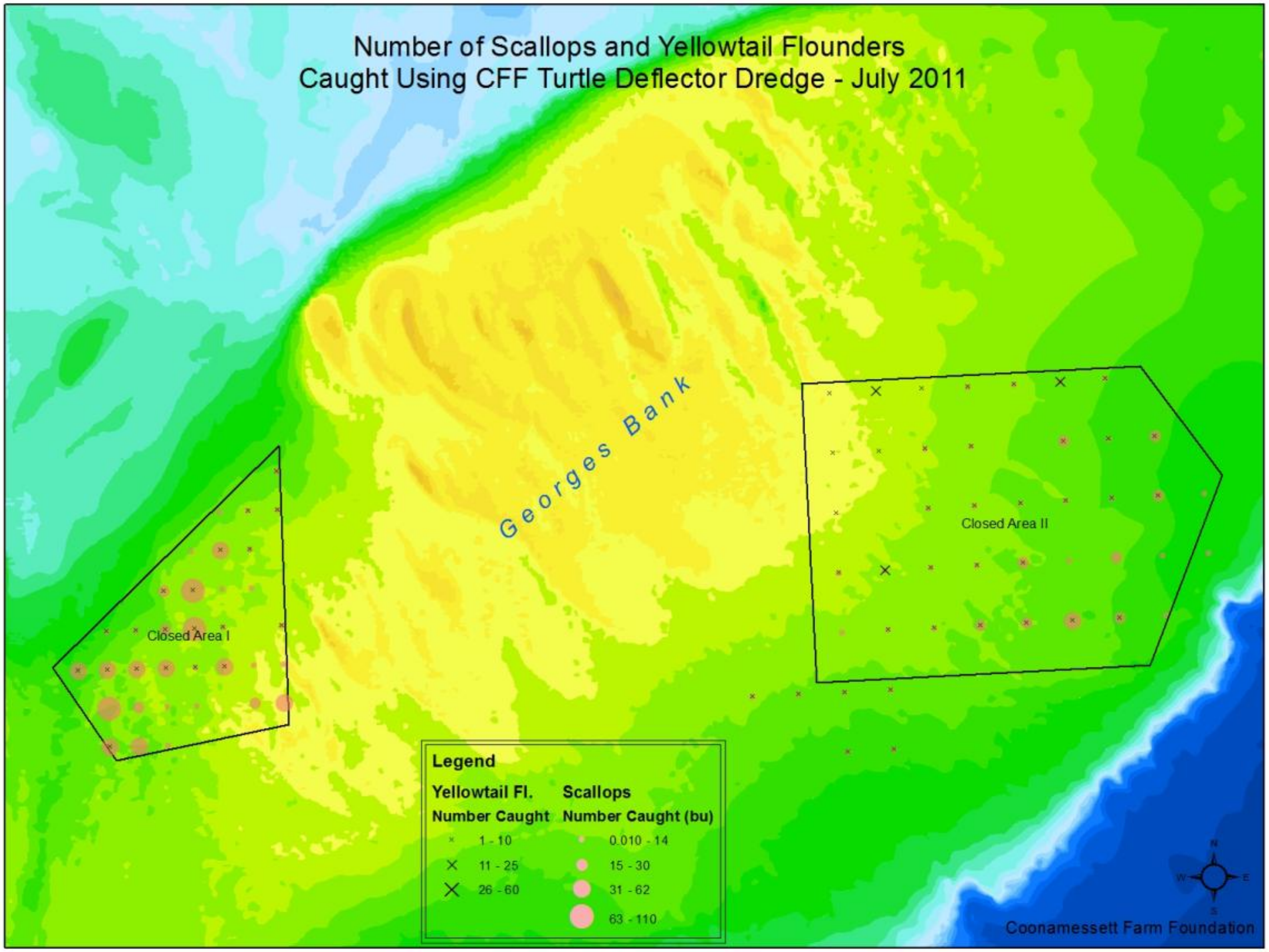

Number of Scallops and Yellowtail Flounders
Caught Using CFF Turtle Deflector Dredge - April 2011
Georges Bank
Closed Area I
Closed Area II
Legend
Yellowtail Fl.
Number Caught
1 - 10
11 - 25
26 - 60
Scallops
Number Caught (bu)
0.010 - 14
15 - 30
31 - 62
63 - 110
Coonamessett Farm Foundation

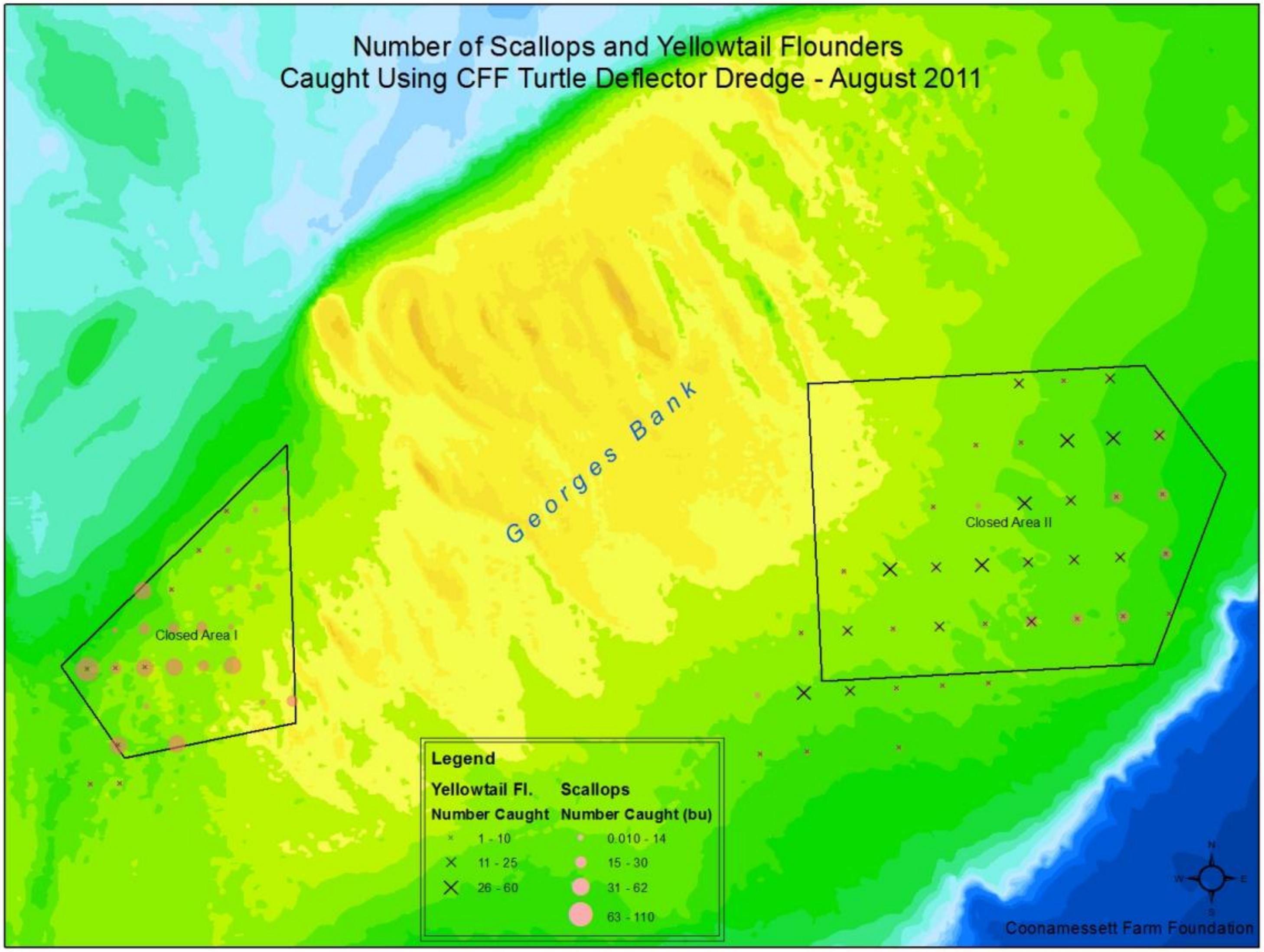

Number of Scallops and Yellowtail Flounders
Caught Using CFF Turtle Deflector Dredge - April 2012
Georges Bank
Closed Area I
Closed Area II
Legend
Yellowtail Fl.
Number Caught
1 - 10
11 - 25
26 - 60
Scallops
Number Caught (bu)
0.010 - 14
15 - 30
31 - 62
63 - 110
Coonamessett Farm Foundation

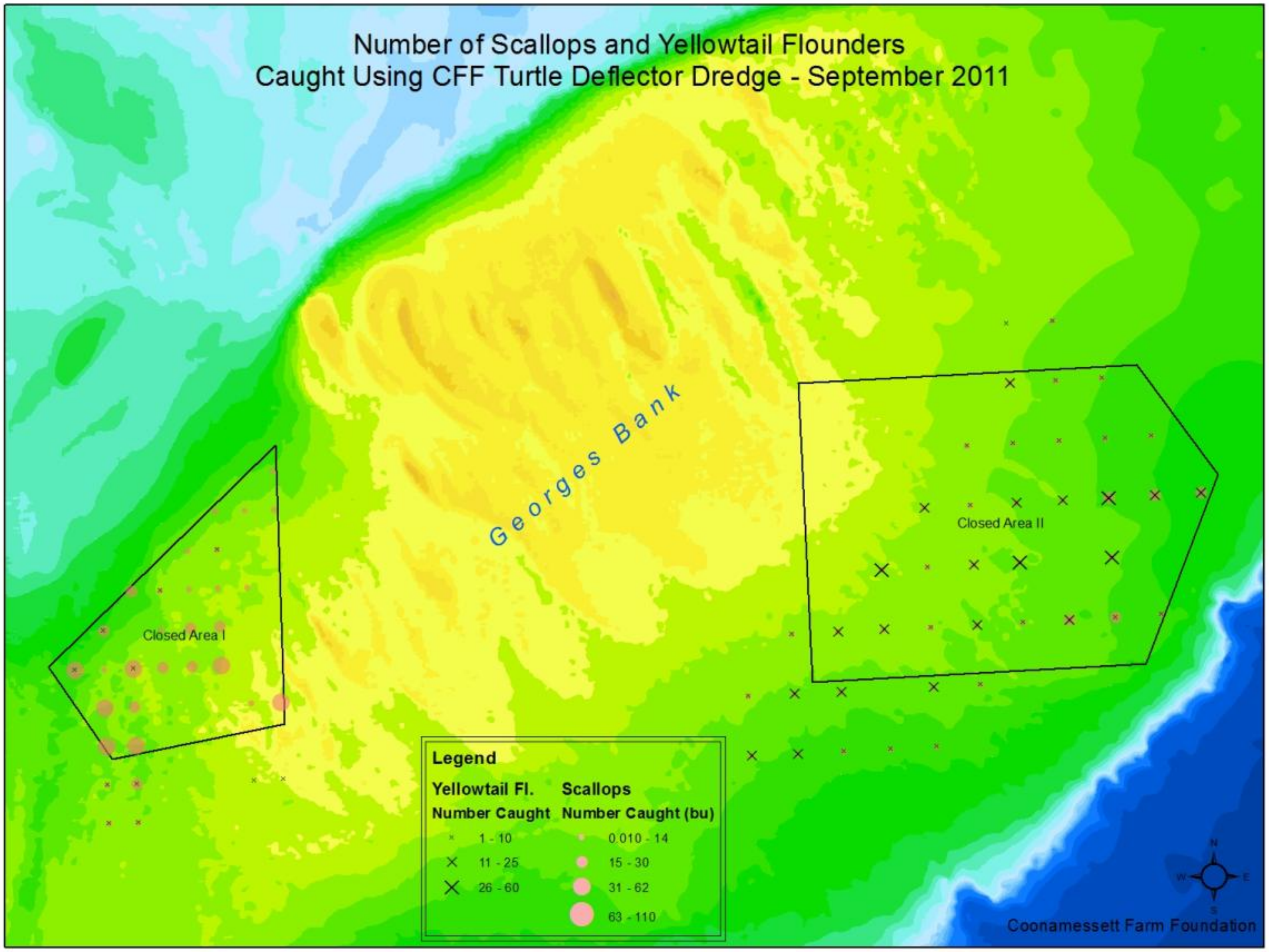


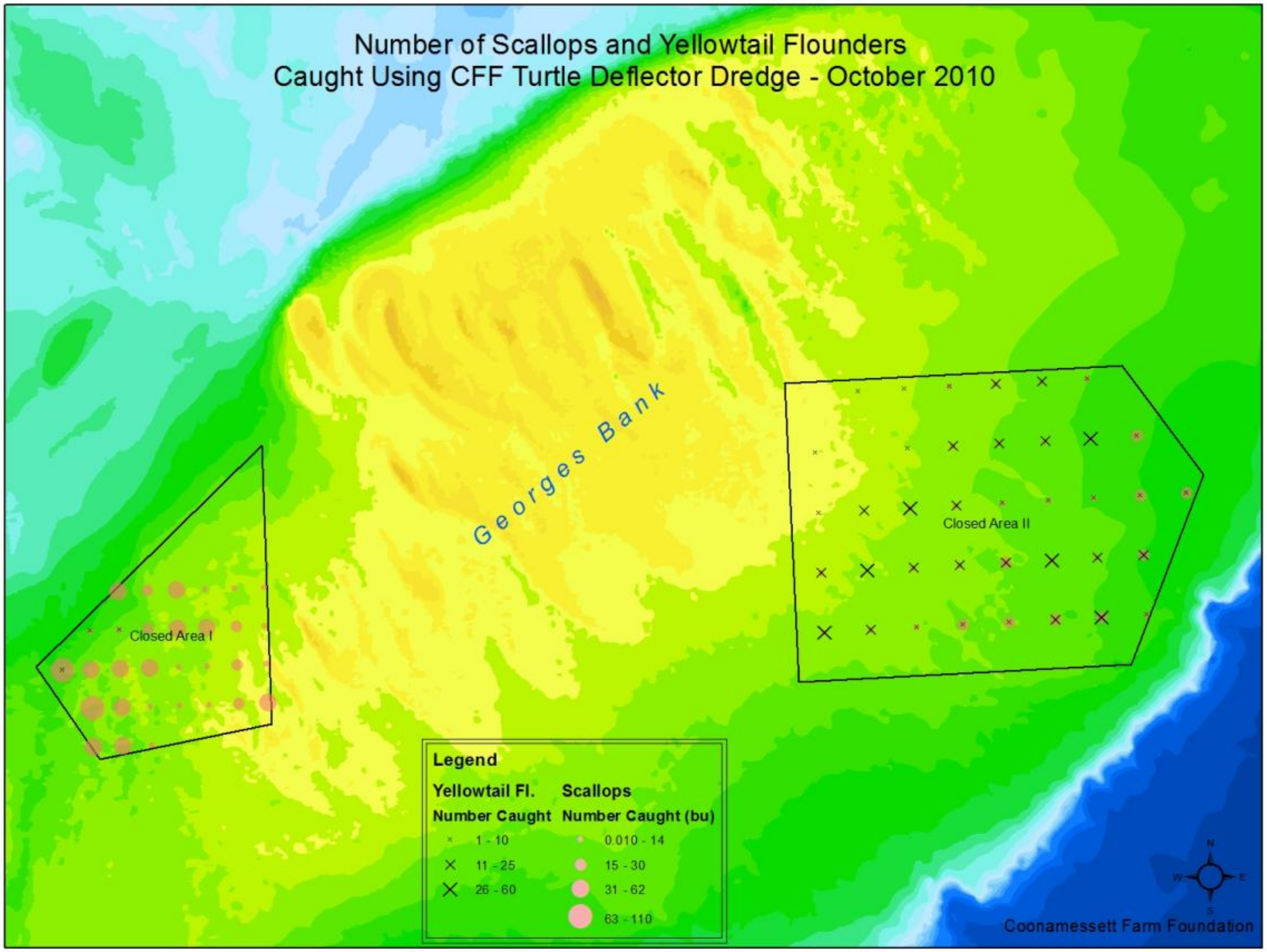
Number of Scallops and Yellowtail Flounders
Caught Using CFF Turtle Deflector Dredge - May 2011
Georges Bank
Closed Area I
Closed Area II
Legend
Yellowtail Fl.
Number Caught
1 - 10
11 - 25
26 - 60
Scallops
Number Caught (bu)
0.010 - 14
15 - 30
31 - 62
63 - 110
Coonamessett Farm Foundation

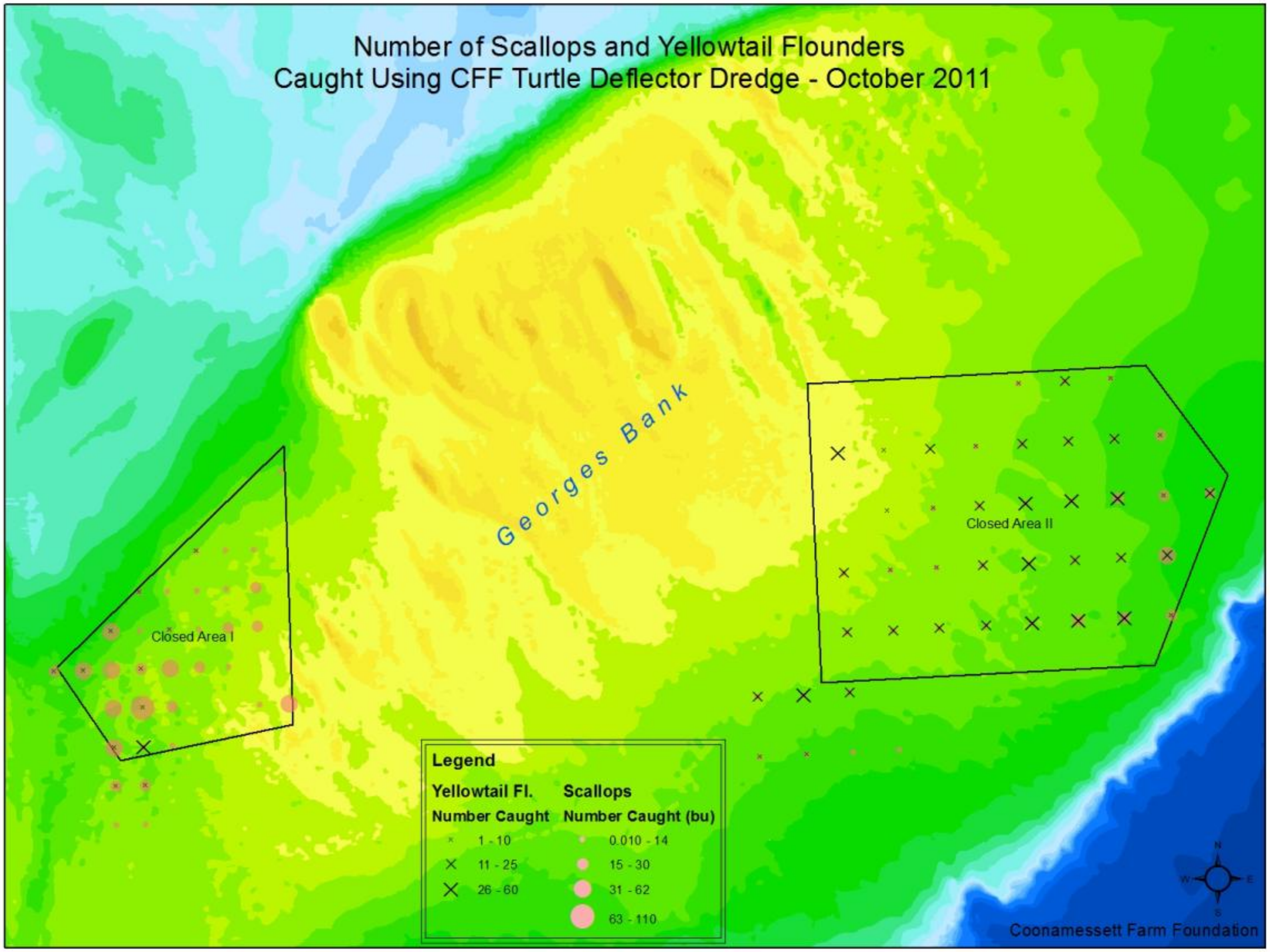

Number of Scallops and Yellowtail Flounders
Caught Using CFF Turtle Deflector Dredge - June 2011
Georges Bank
Closed Area I
Closed Area II
Legend
Yellowtail Fl.
Number Caught
1 - 10
11 - 25
26 - 60
Scallops
Number Caught (bu)
0.010 - 14
15 - 30
31 - 62
63 - 110
Coonamessett Farm Foundation


Number of Scallops and Yellowtail Flounders
Caught Using CFF Turtle Deflector Dredge - July 2011
Georges Bank
Closed Area I
Closed Area II
Legend
Yellowtail Fl.
Number Caught
1 - 10
11 - 25
26 - 60
Scallops
Number Caught (bu)
0.010 - 14
15 - 30
31 - 62
63 - 110
Coonamessett Farm Foundation

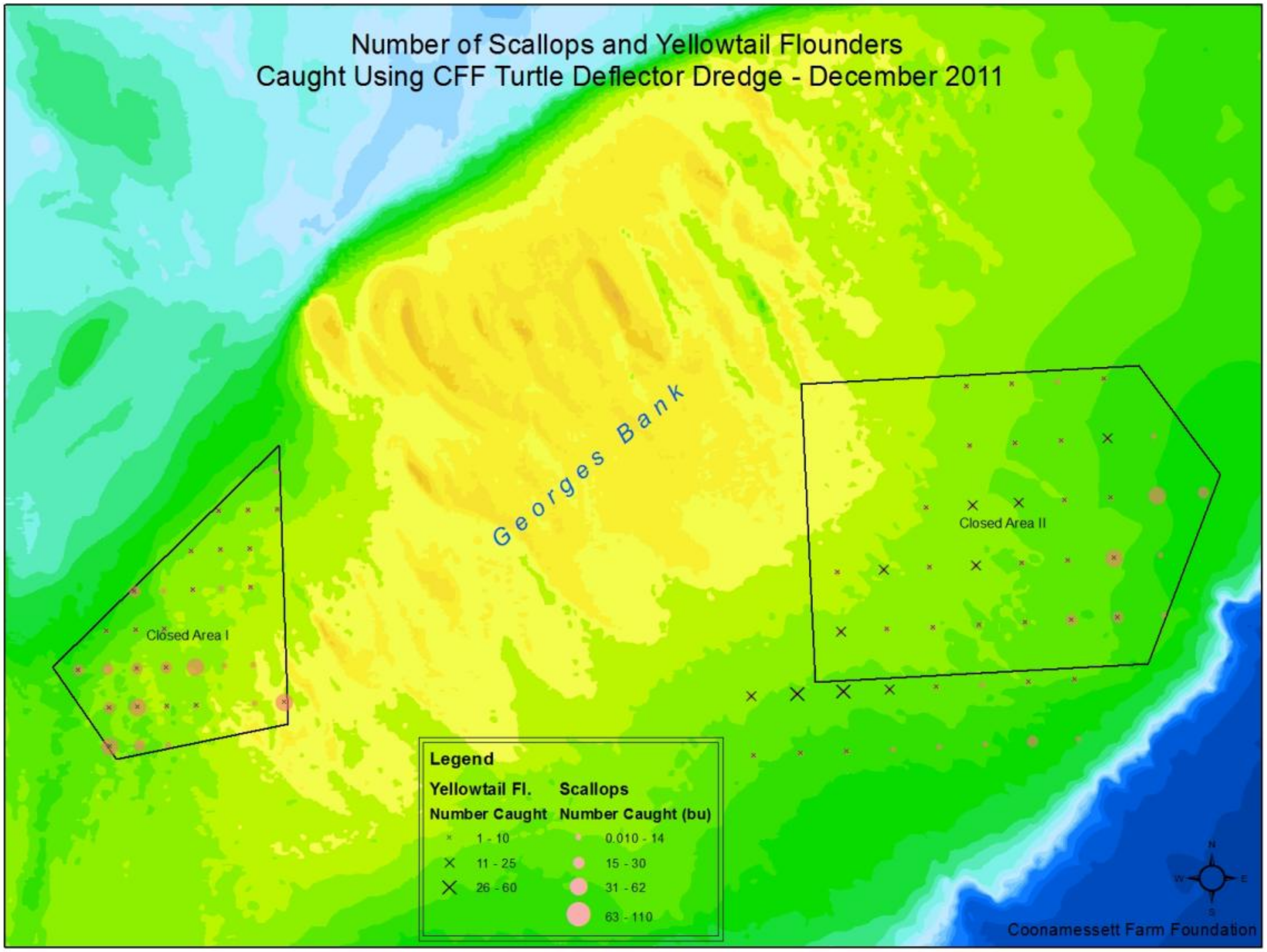

Number of Scallops and Yellowtail Flounders
Caught Using CFF Turtle Deflector Dredge - August 2011
Georges Bank
Closed Area I
Closed Area II
Legend
Yellowtail Fl.
Number Caught
1 - 10
11 - 25
26 - 60
Scallops
Number Caught (bu)
0.010 - 14
15 - 30
31 - 62
63 - 110
Coonamessett Farm Foundation


Number of Scallops and Yellowtail Flounders
Caught Using CFF Turtle Deflector Dredge - September 2011
Georges Bank
Closed Area I
Closed Area II
Legend
Yellowtail Fl.
Number Caught
1 - 10
11 - 25
26 - 60
Scallops
Number Caught (bu)
0.010 - 14
15 - 30
31 - 62
63 - 110
Coonamessett Farm Foundation

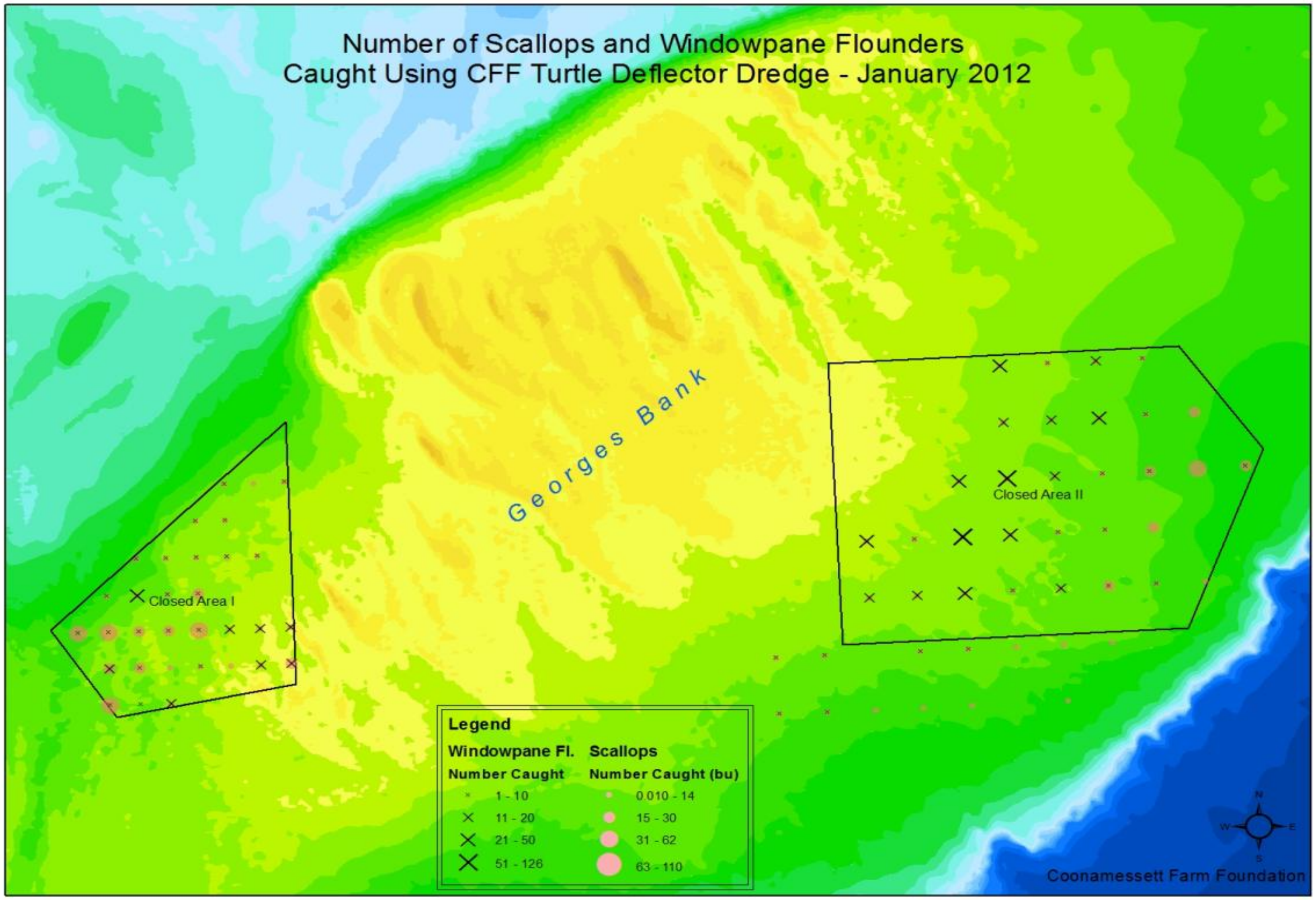

Number of Scallops and Yellowtail Flounders
Caught Using CFF Turtle Deflector Dredge - October 2010
Georges Bank
Closed Area I
Closed Area II
Legend
Yellowtail Fl.
Number Caught
1 - 10
11 - 25
26 - 60
Scallops
Number Caught (bu)
0.010 - 14
15 - 30
31 - 62
63 - 110
Coonamessett Farm Foundation

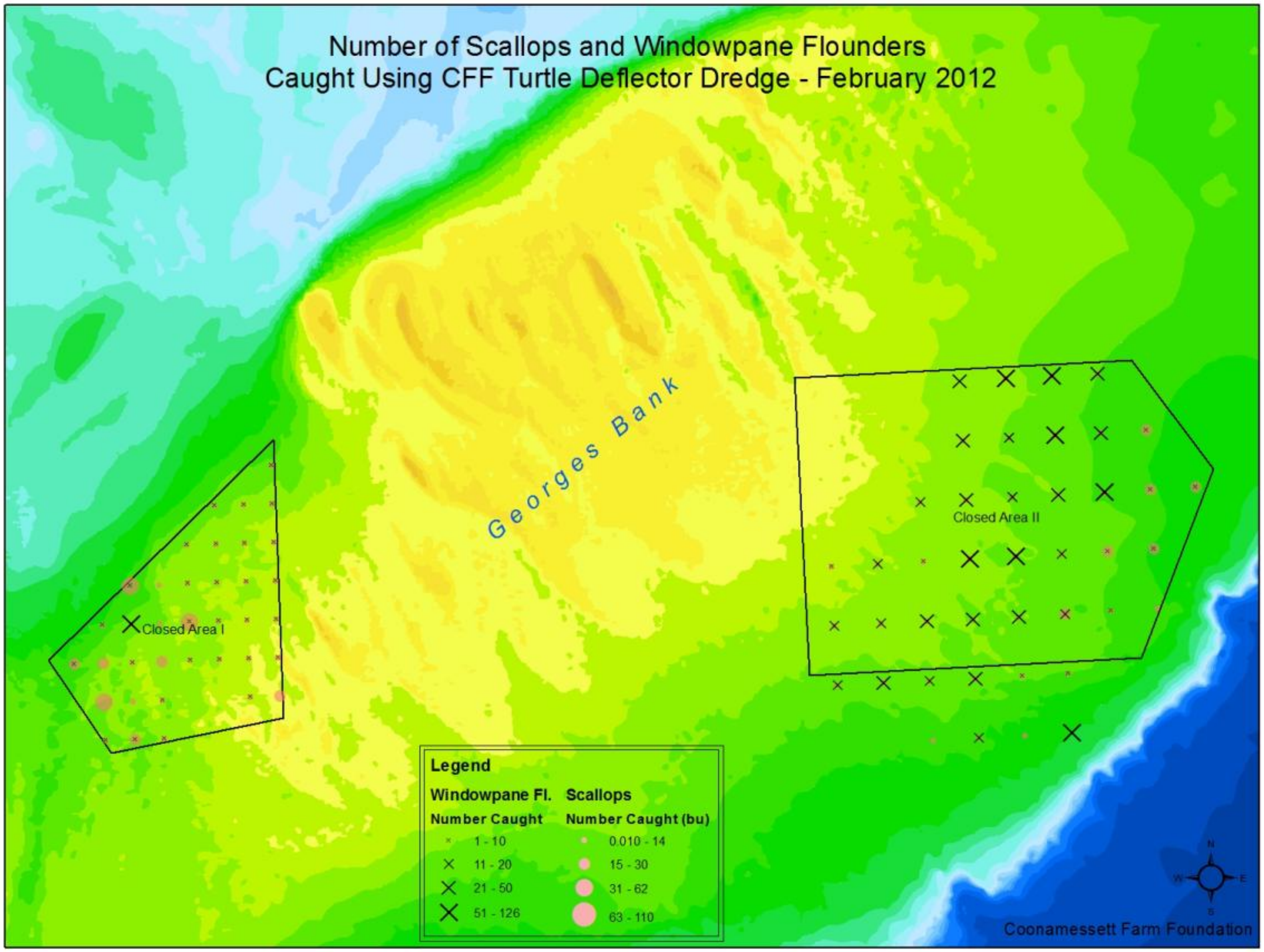


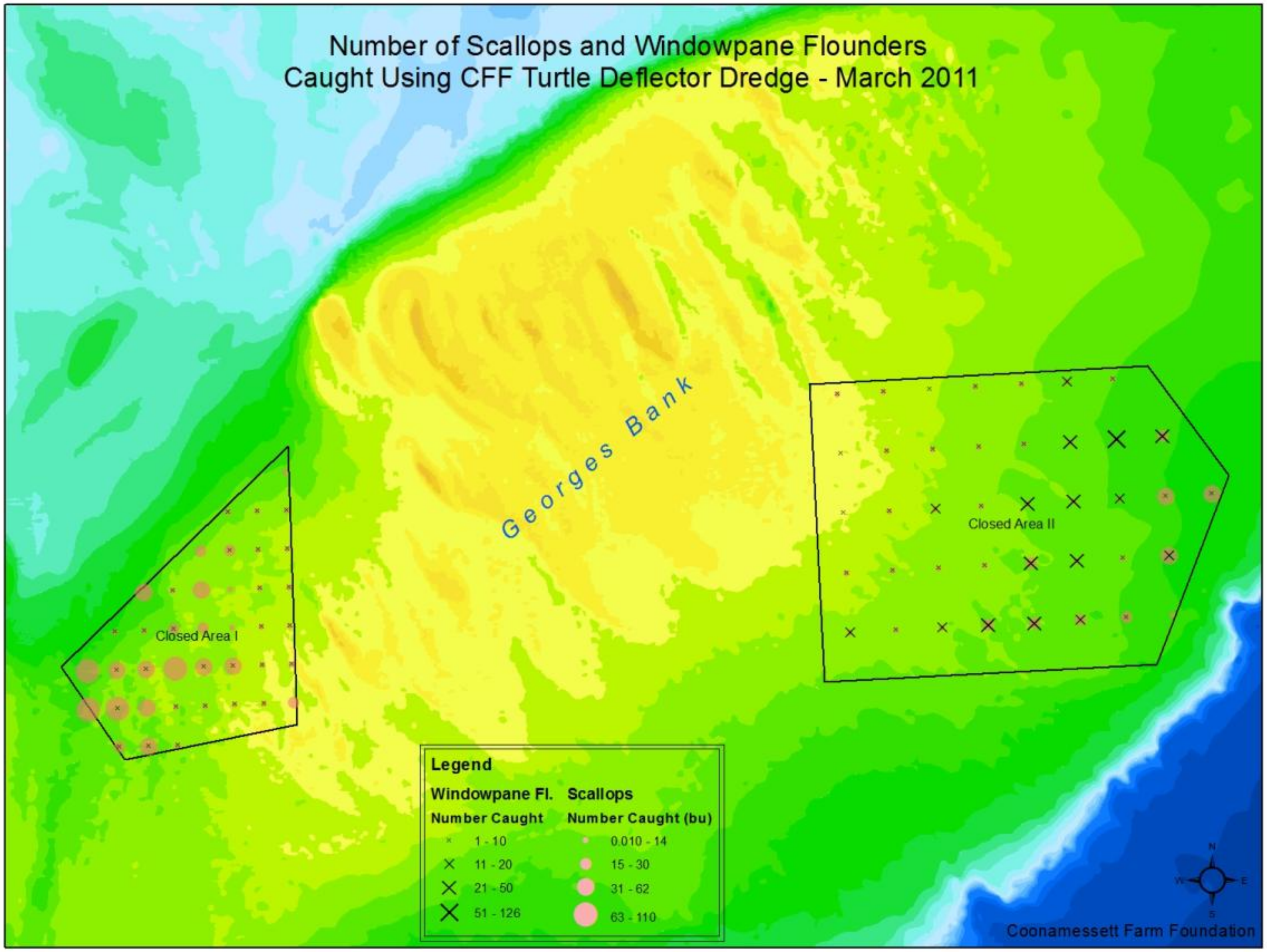
Number of Scallops and Yellowtail Flounders
Caught Using CFF Turtle Deflector Dredge - October 2011
Georges Bank
Closed Area I
Closed Area II
Legend
Yellowtail Fl.
Number Caught
1 - 10
11 - 25
26 - 60
Scallops
Number Caught (bu)
0.010 - 14
15 - 30
31 - 62
63 - 110
Coonamessett Farm Foundation


Number of Scallops and Yellowtail Flounders
Caught Using CFF Turtle Deflector Dredge - December 2011
Georges Bank
Closed Area I
Closed Area II
Legend
Yellowtail Fl.
Number Caught
1 - 10
11 - 25
26 - 60
Scallops
Number Caught (bu)
0.010 - 14
15 - 30
31 - 62
63 - 110
Coonamessett Farm Foundation

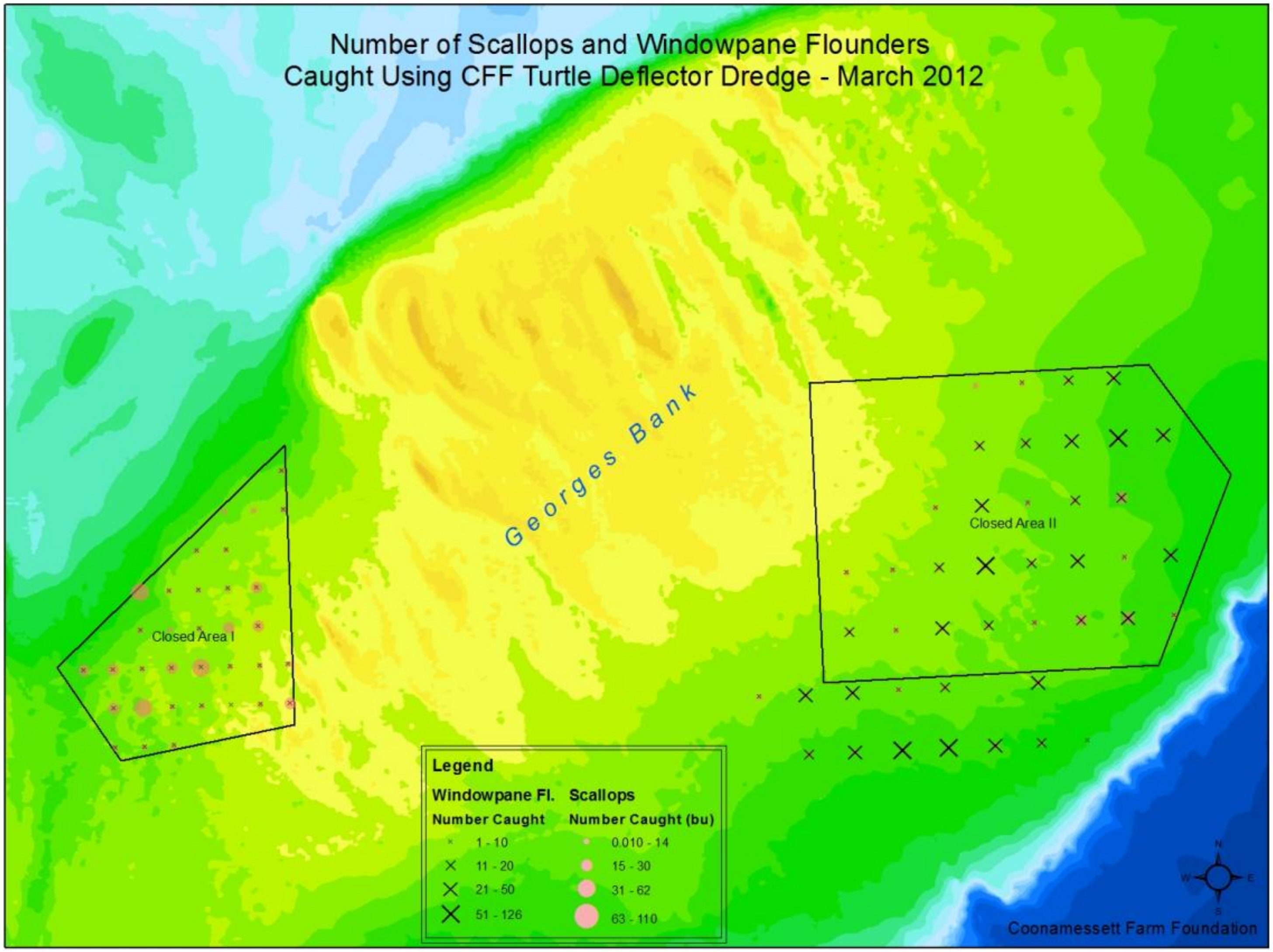
Scallops and Windowpane Flounder



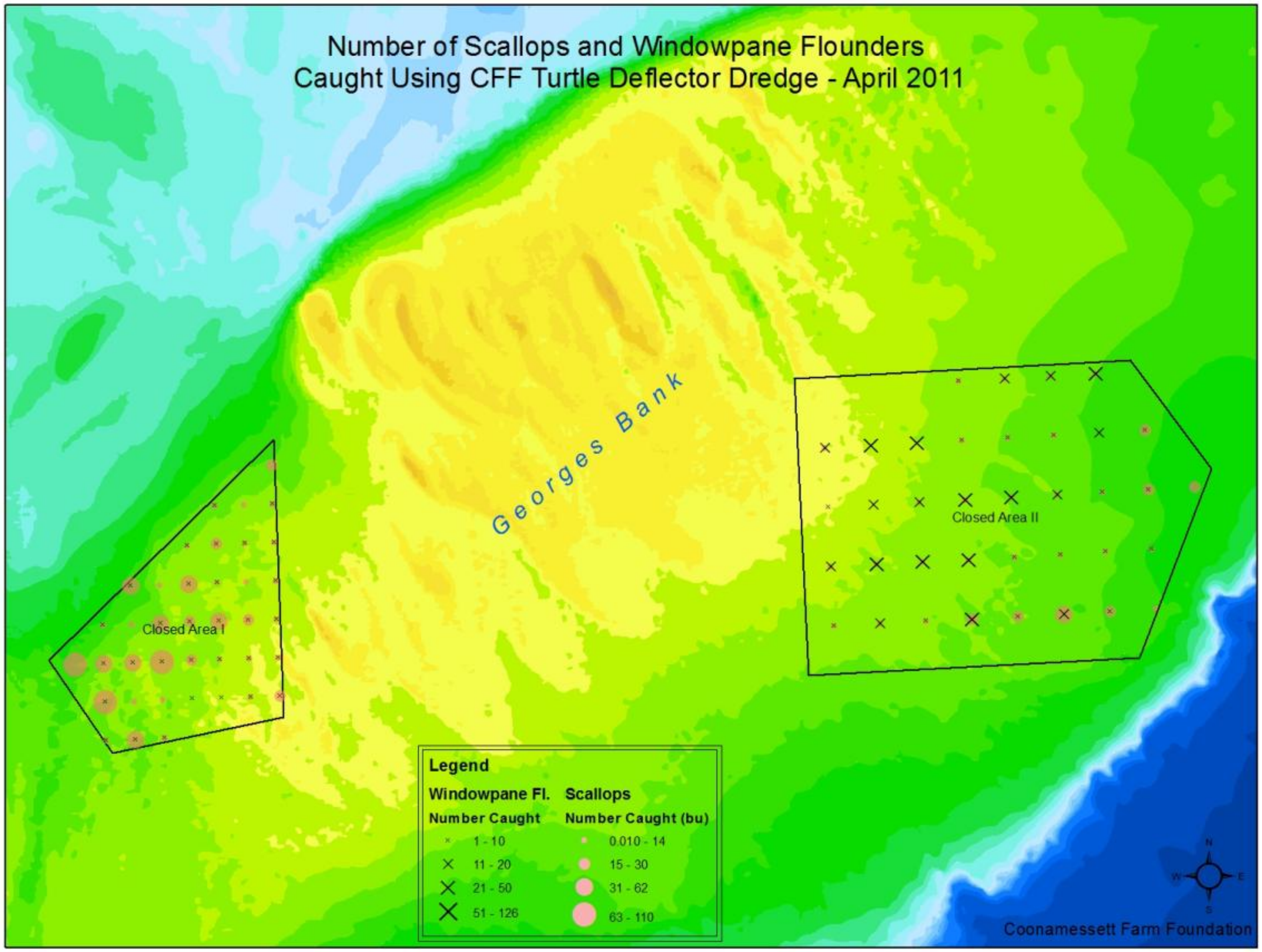

Number of Scallops and Windowpane Flounders
Caught Using CFF Turtle Deflector Dredge - February 2012
Georges Bank
Closed Area I
Closed Area II
Legend
Windowpane Fl.
Number Caught
1 - 10
11 - 20
21 - 50
51 - 126
Scallops
Number Caught (bu)
0.010 - 14
15 - 30
31 - 62
63 - 110
Coonamessett Farm Foundation

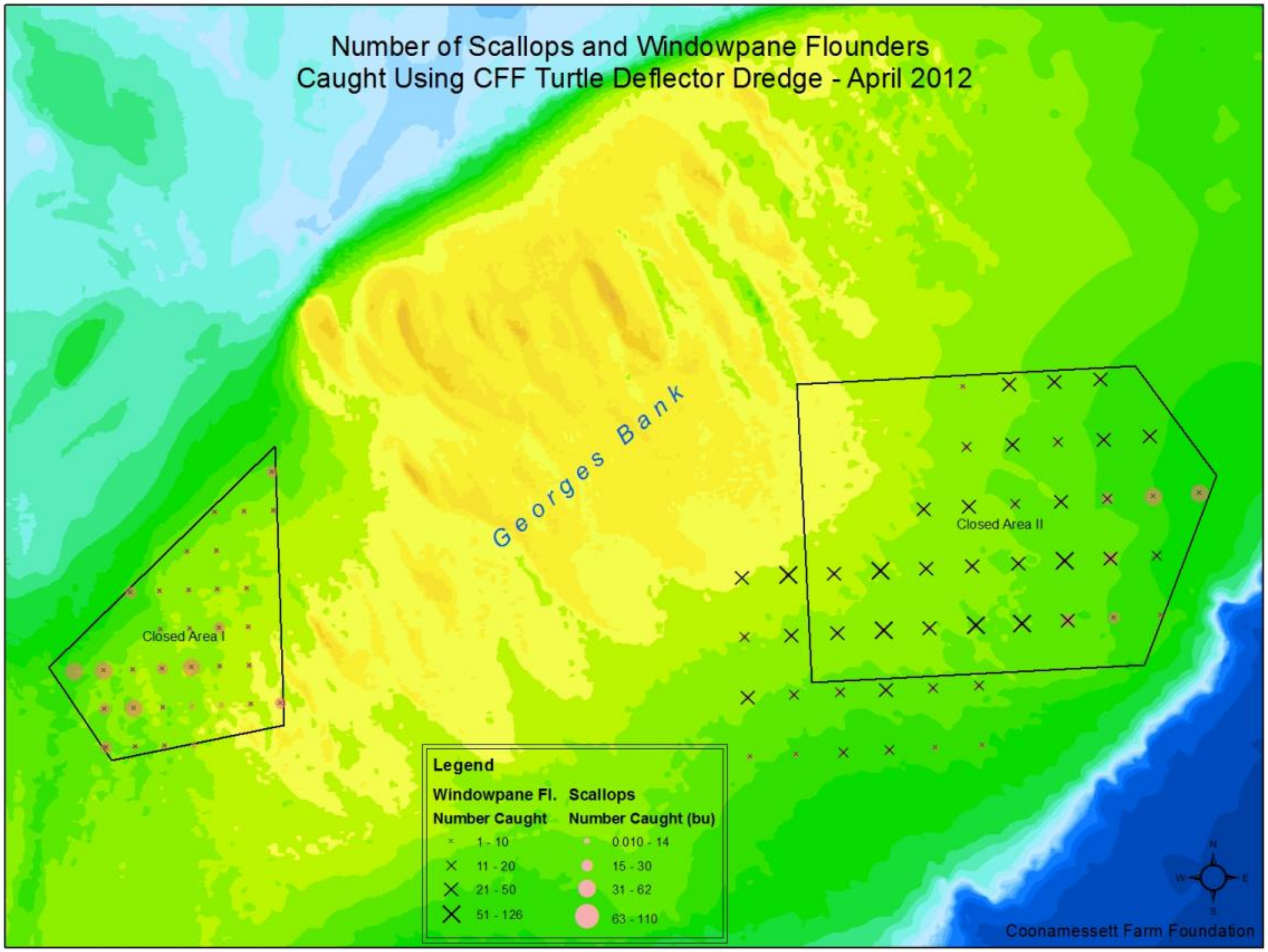


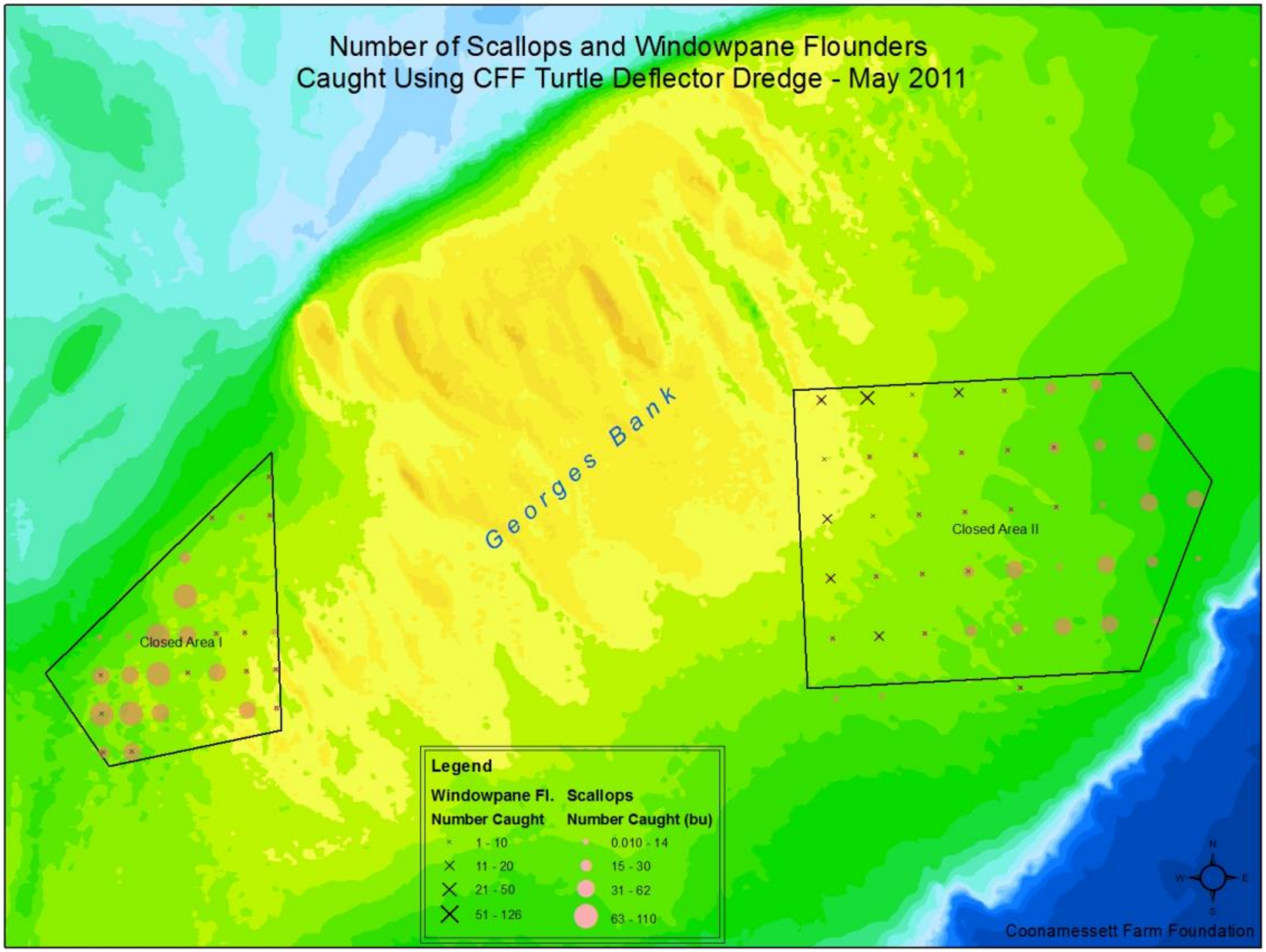
Number of Scallops and Windowpane Flounders
Caught Using CFF Turtle Deflector Dredge - March 2011
Georges Bank
Closed Area I
Closed Area II
Legend
Windowpane Fl.
Number Caught
1 - 10
11 - 20
21 - 50
51 - 126
Scallops
Number Caught (bu)
0.010 - 14
15 - 30
31 - 62
63 - 110
N
E
S
W
Coonamessett Farm Foundation



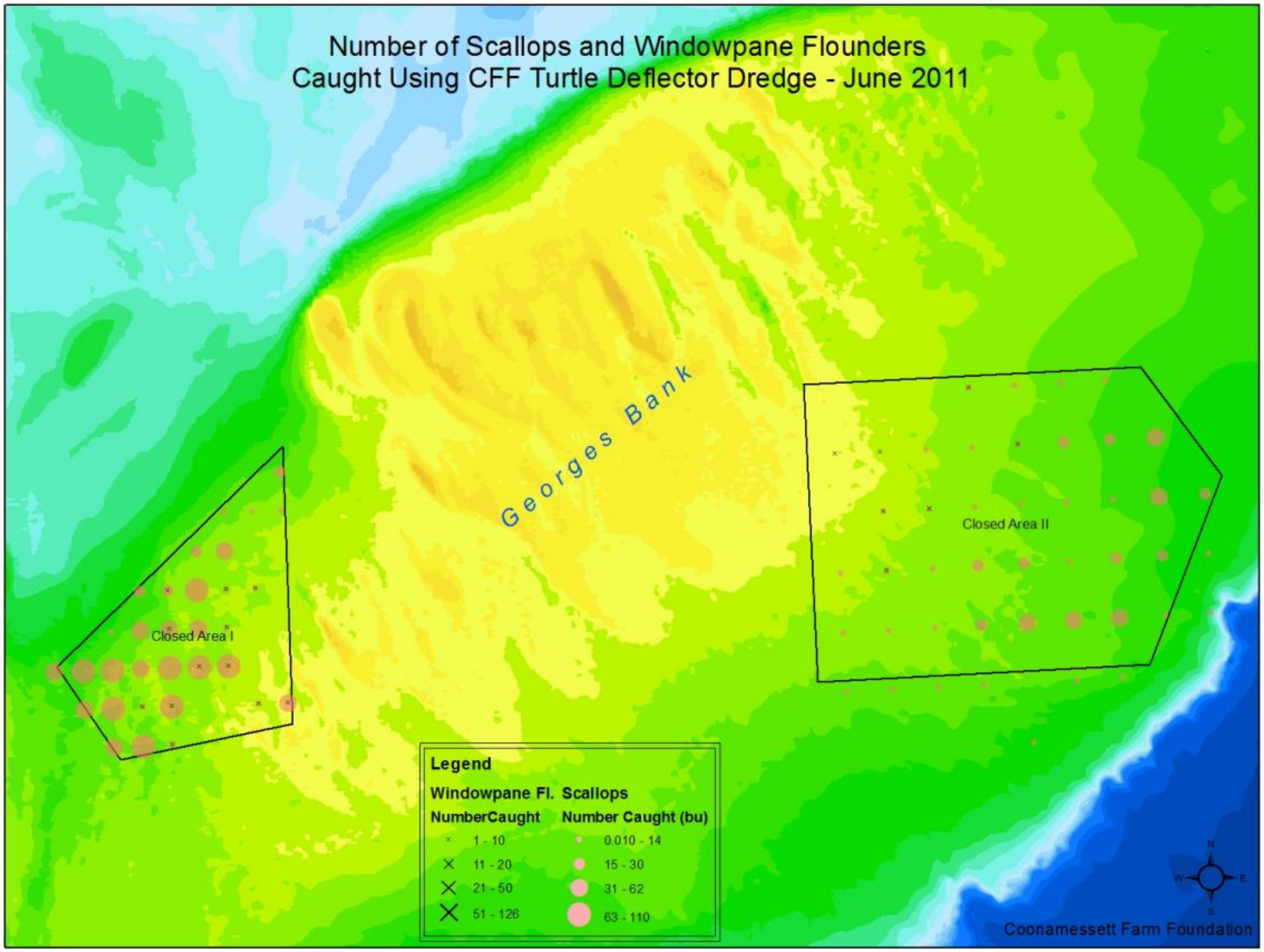
Number of Scallops and Windowpane Flounders
Caught Using CFF Turtle Deflector Dredge - March 2012
Georges Bank
Closed Area I
Closed Area II
Legend
Windowpane Fl.
Number Caught
1 - 10
11 - 20
21 - 50
51 - 126
Scallops
Number Caught (bu)
0.010 - 14
15 - 30
31 - 62
63 - 110
Coonamessett Farm Foundation

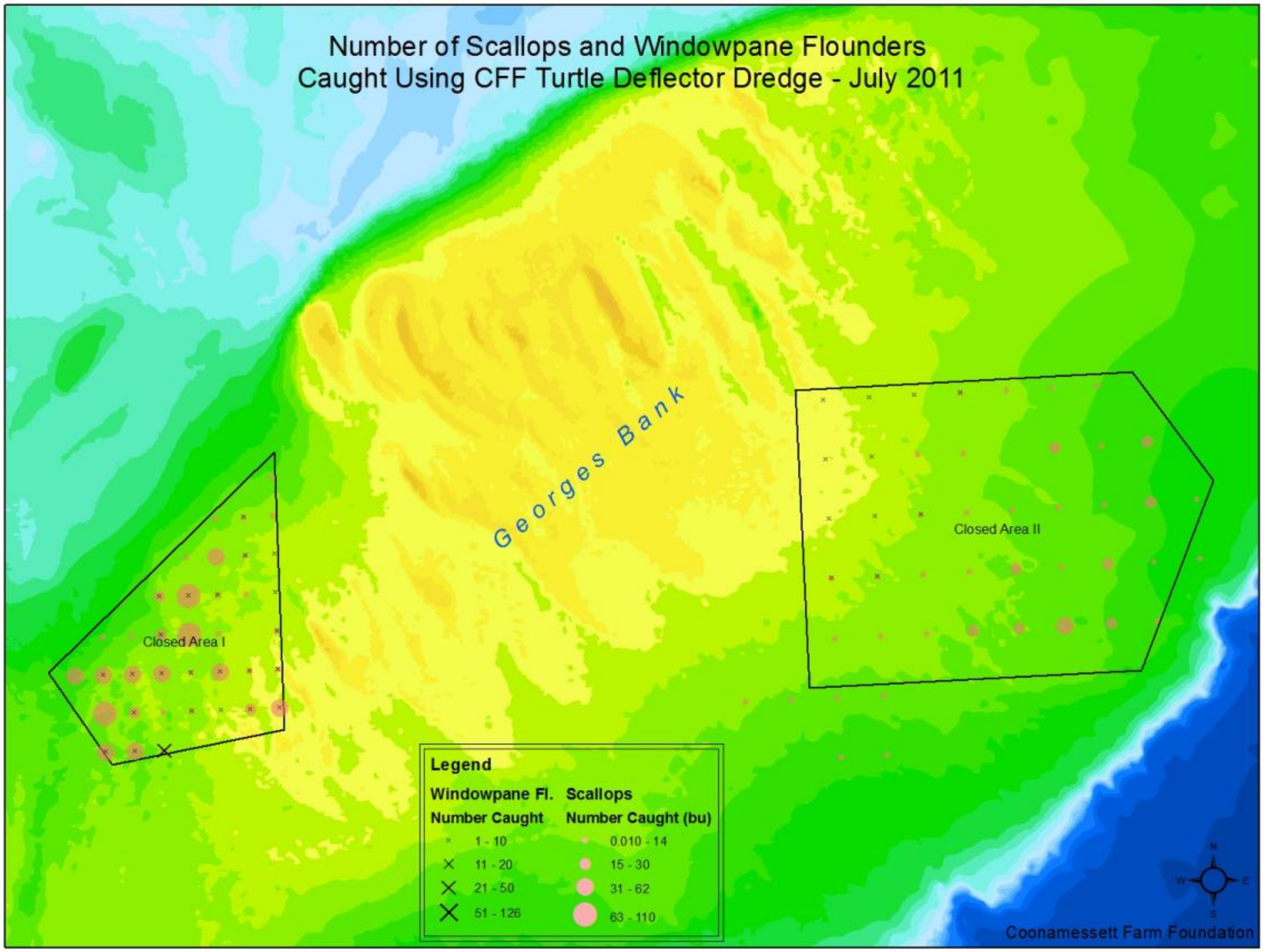

Number of Scallops and Windowpane Flounders
Caught Using CFF Turtle Deflector Dredge - April 2011
Georges Bank
Closed Area I
Closed Area II
Legend
Windowpane Fl.
Number Caught
1 - 10
11 - 20
21 - 50
51 - 126
Scallops
Number Caught (bu)
0.010 - 14
15 - 30
31 - 62
63 - 110
Coonamessett Farm Foundation

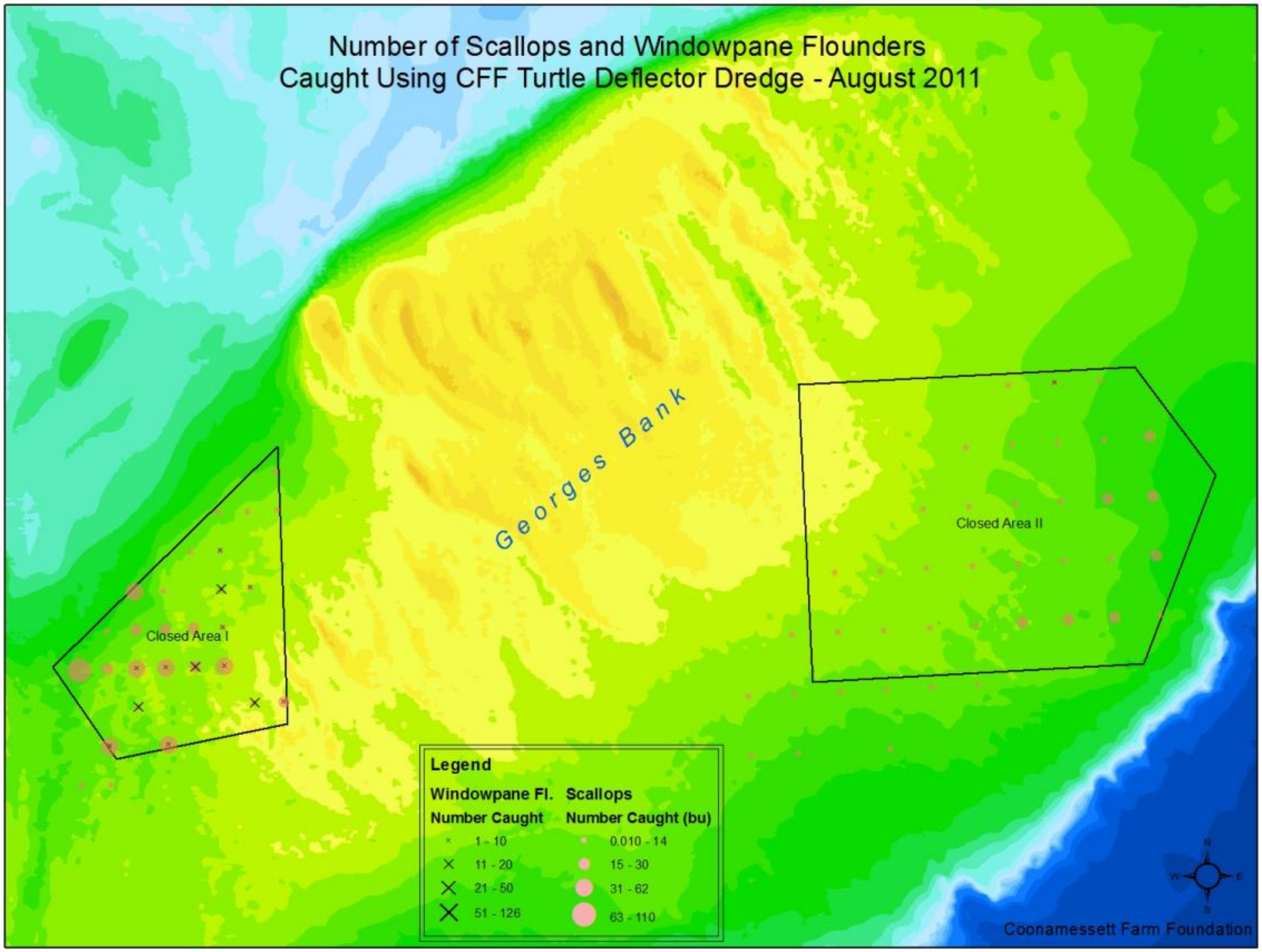

Number of Scallops and Windowpane Flounders
Caught Using CFF Turtle Deflector Dredge - April 2012
Georges Bank
Closed Area I
Closed Area II
Legend
Windowpane Fl. Number Caught
1 - 10
11 - 20
21 - 50
51 - 126
Scallops Number Caught (bu)
0.010 - 14
15 - 30
31 - 62
63 - 110
Coonamessett Farm Foundation

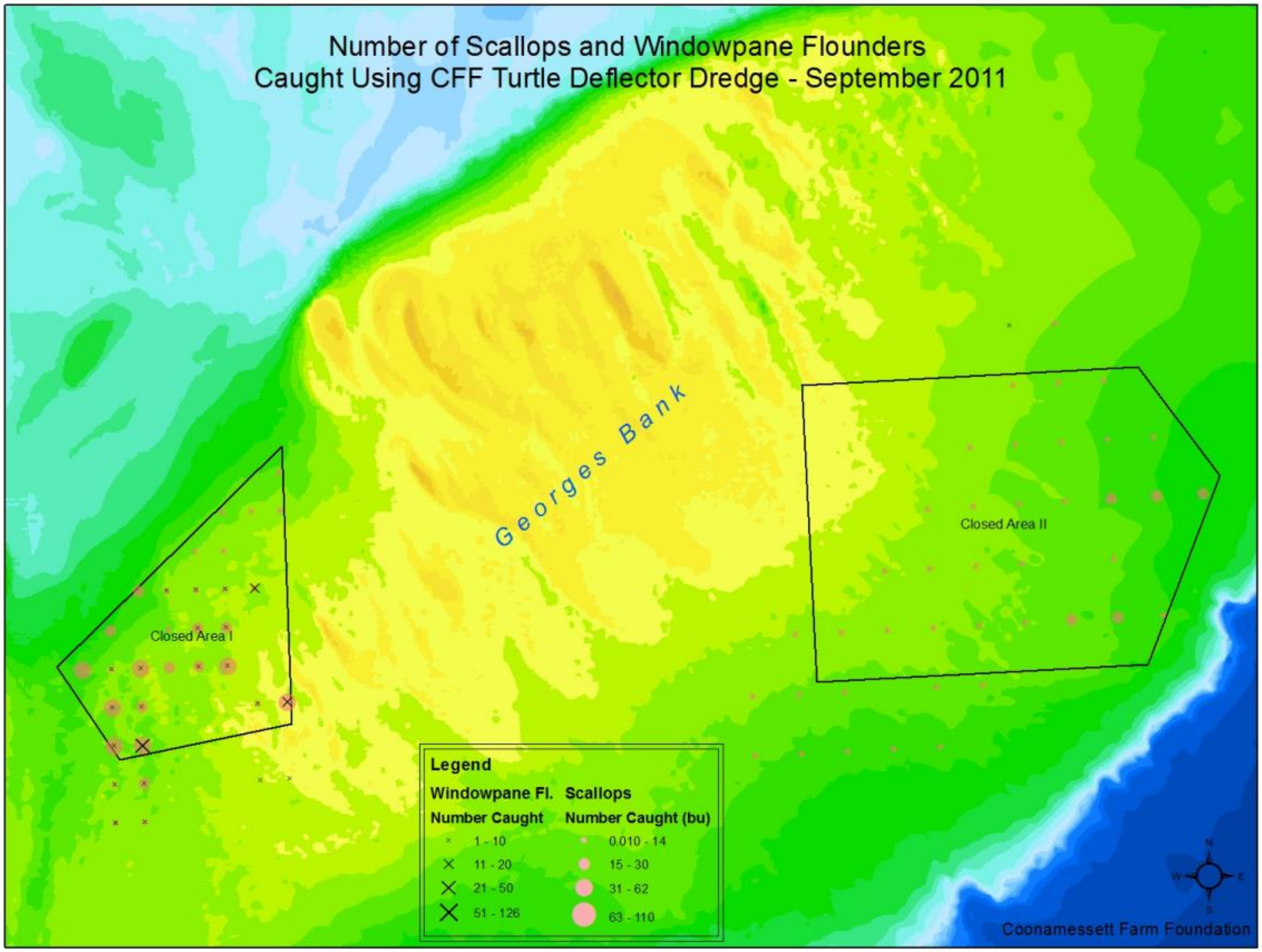


Number of Scallops and Windowpane Flounders
Caught Using CFF Turtle Deflector Dredge - May 2011
Georges Bank
Closed Area I
Closed Area II
Legend
Windowpane Fl.
Number Caught
1 - 10
11 - 20
21 - 50
51 - 126
Scallops
Number Caught (bu)
0.010 - 14
15 - 30
31 - 62
63 - 110
N
W
E
S
Coonamessett Farm Foundation

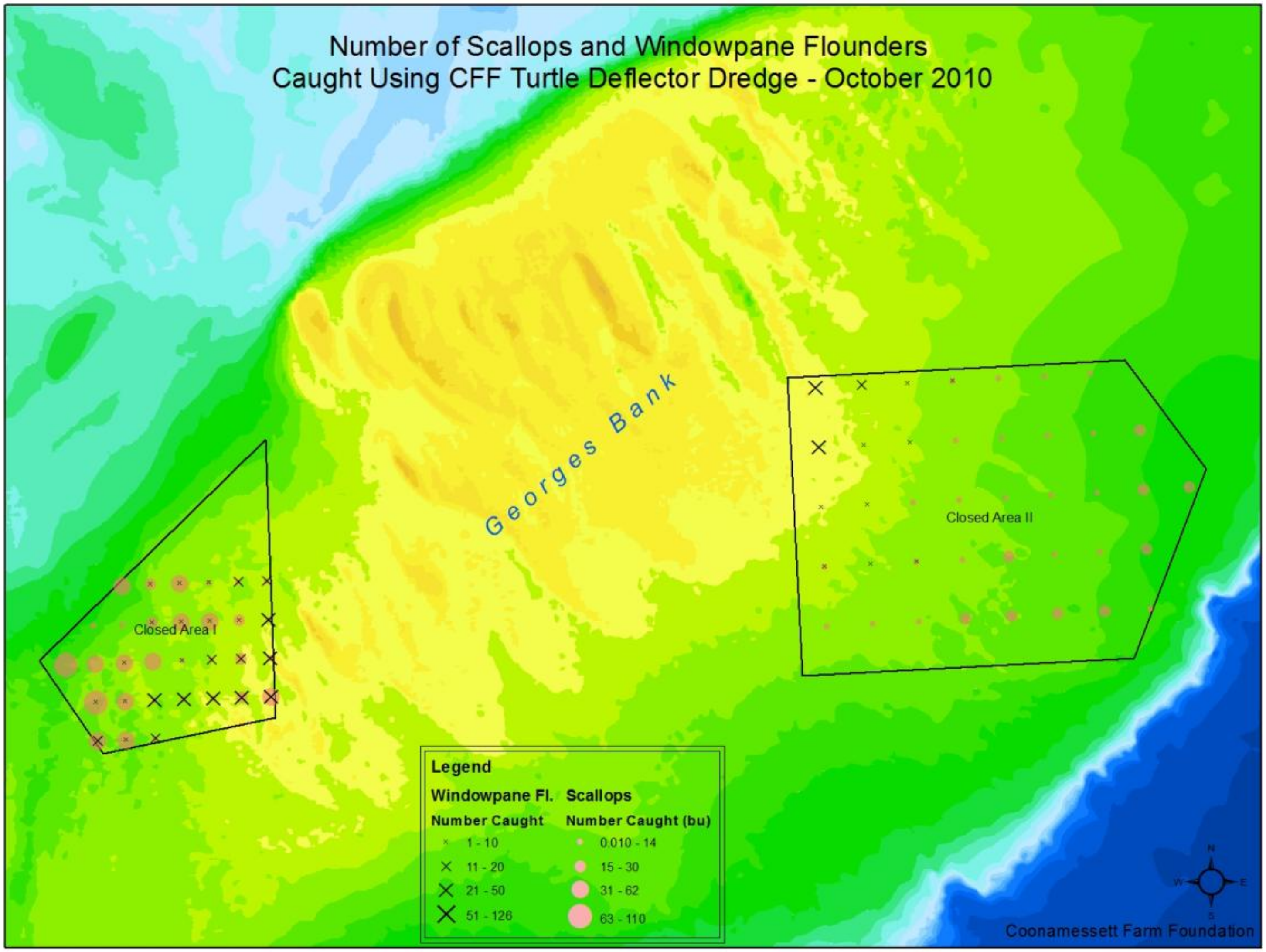

Number of Scallops and Windowpane Flounders
Caught Using CFF Turtle Deflector Dredge - June 2011
Georges Bank
Closed Area I
Closed Area II
Legend
Windowpane Fl.
NumberCaught
1 - 10
11 - 20
21 - 50
51 - 126
Scallops
Number Caught (bu)
0.010 - 14
15 - 30
31 - 62
63 - 110
N
E
S
W
Coonamessett Farm Foundation

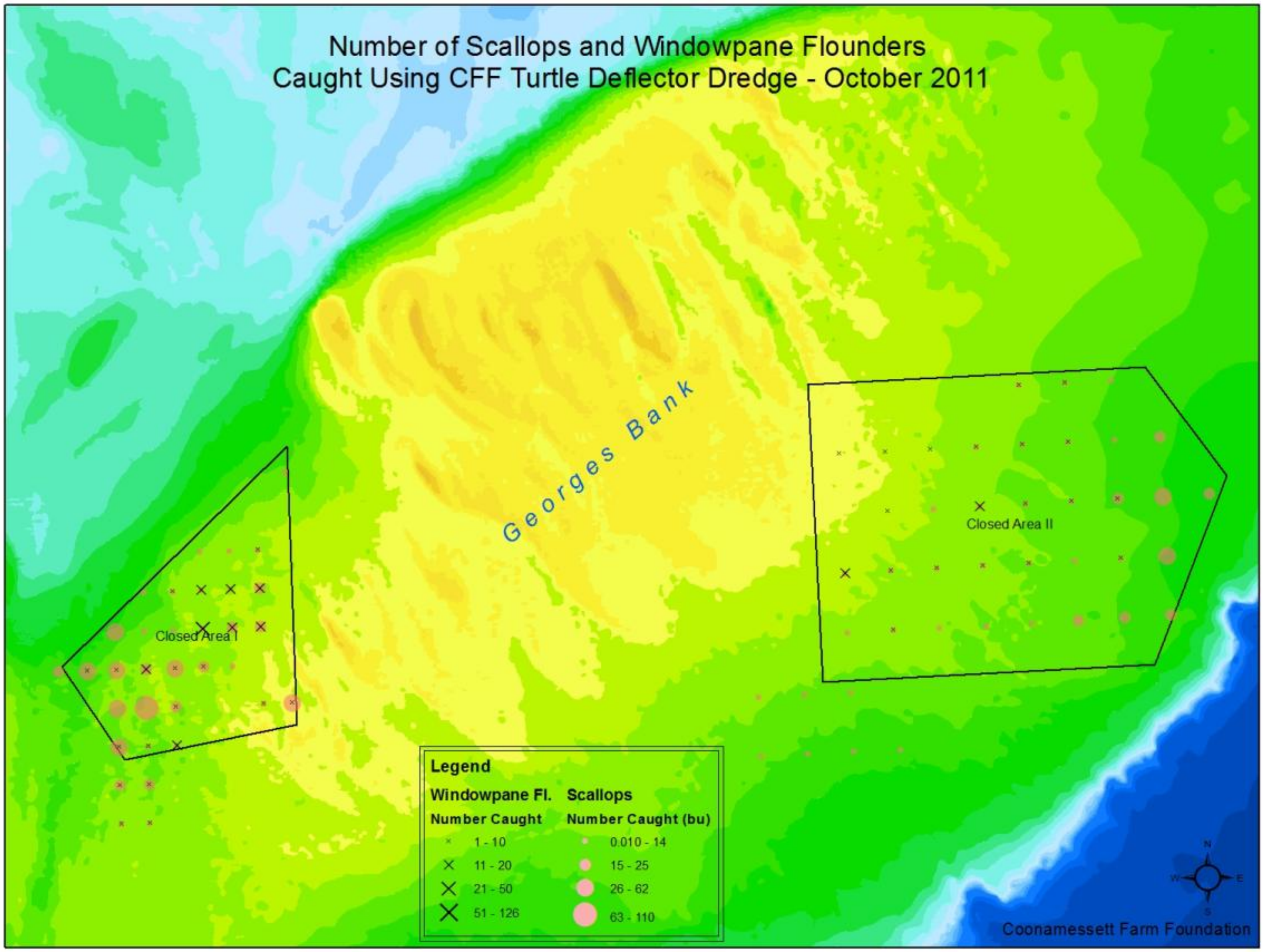

Number of Scallops and Windowpane Flounders
Caught Using CFF Turtle Deflector Dredge - July 2011
Georges Bank
Closed Area I
Closed Area II
Legend
Windowpane Fl.
Number Caught
1 - 10
11 - 20
21 - 50
51 - 126
Scallops
Number Caught (bu)
0.010 - 14
15 - 30
31 - 62
63 - 110
Coonamessett Farm Foundation


Number of Scallops and Windowpane Flounders
Caught Using CFF Turtle Deflector Dredge - August 2011
Georges Bank
Closed Area I
Closed Area II
Legend
Windowpane Fl.
Number Caught
1 - 10
11 - 20
21 - 50
51 - 126
Scallops
Number Caught (bu)
0.010 - 14
15 - 30
31 - 62
63 - 110
Coonamessett Farm Foundation

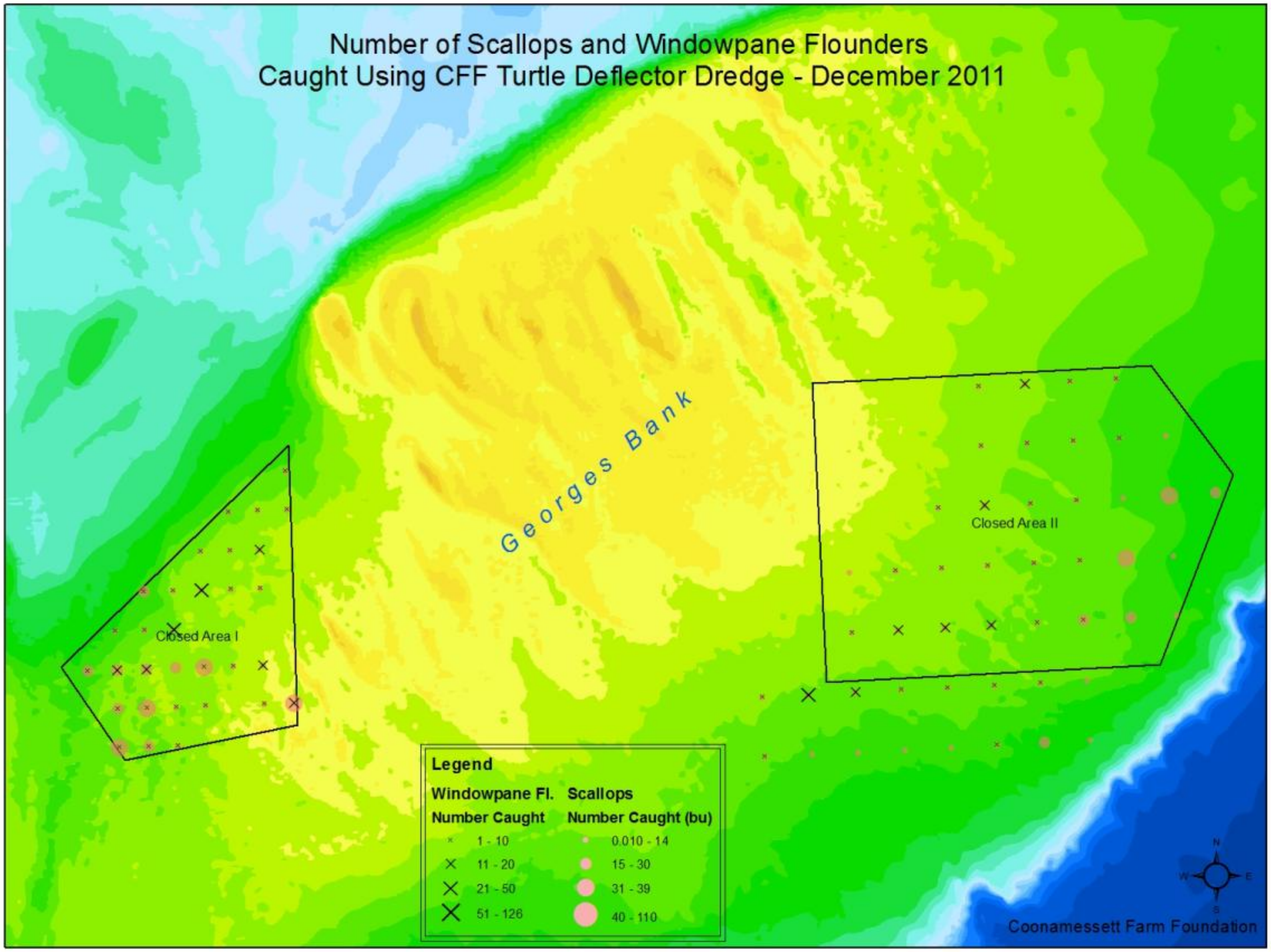


Number of Scallops and Windowpane Flounders
Caught Using CFF Turtle Deflector Dredge - September 2011
Georges Bank
Closed Area I
Closed Area II
Legend
Windowpane Fl.
Number Caught
1 - 10
11 - 20
21 - 50
51 - 126
Scallops
Number Caught (bu)
0.010 - 14
15 - 30
31 - 62
63 - 110
N
W
E
S
Coonamessett Farm Foundation


Number of Scallops and Windowpane Flounders
Caught Using CFF Turtle Deflector Dredge - October 2010
Georges Bank
Closed Area I
Closed Area II
Legend
Windowpane Fl.
Number Caught
1 - 10
11 - 20
21 - 50
51 - 126
Scallops
Number Caught (bu)
0.010 - 14
15 - 30
31 - 62
63 - 110
N
W
E
S
Coonamessett Farm Foundation

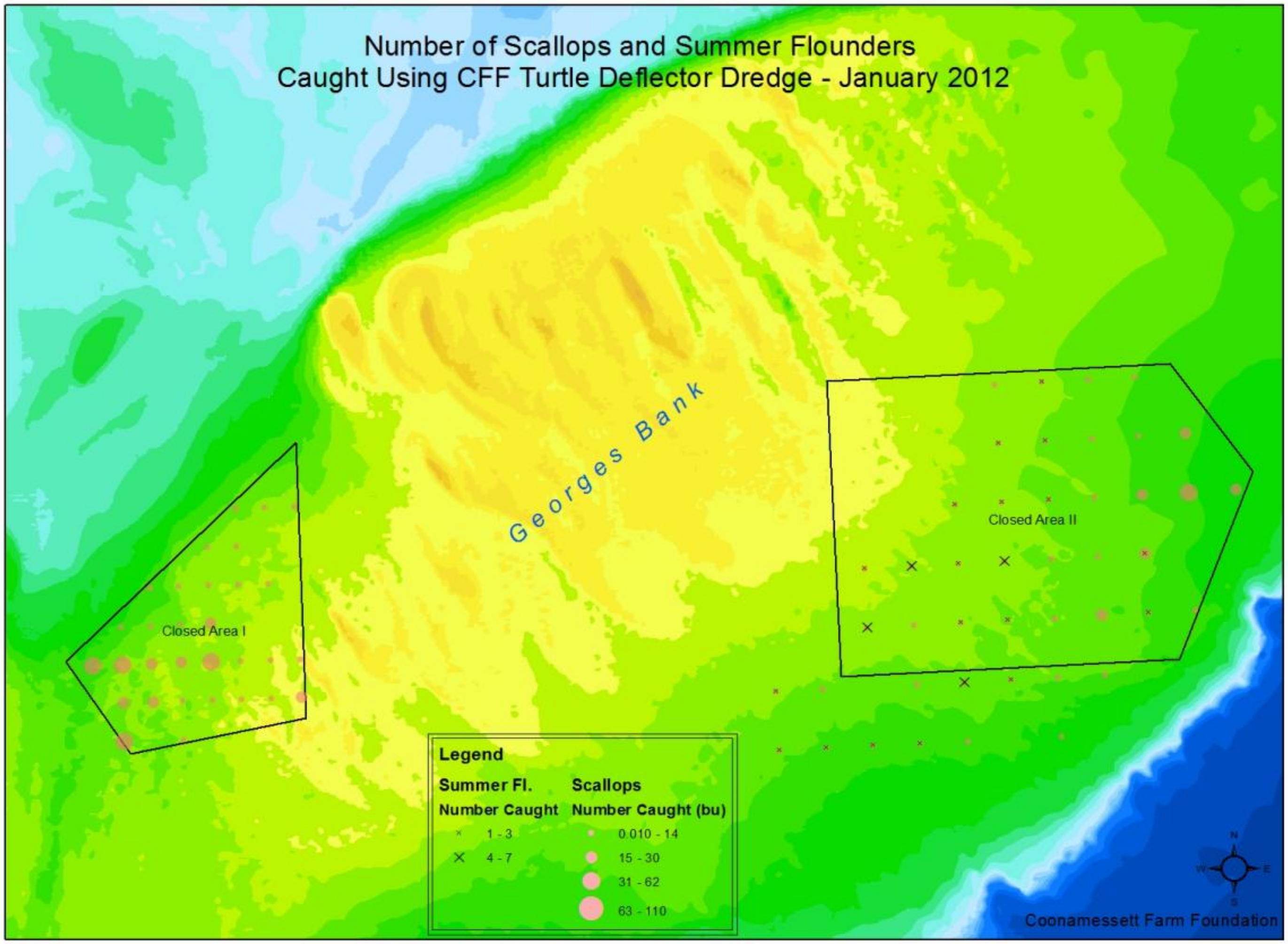


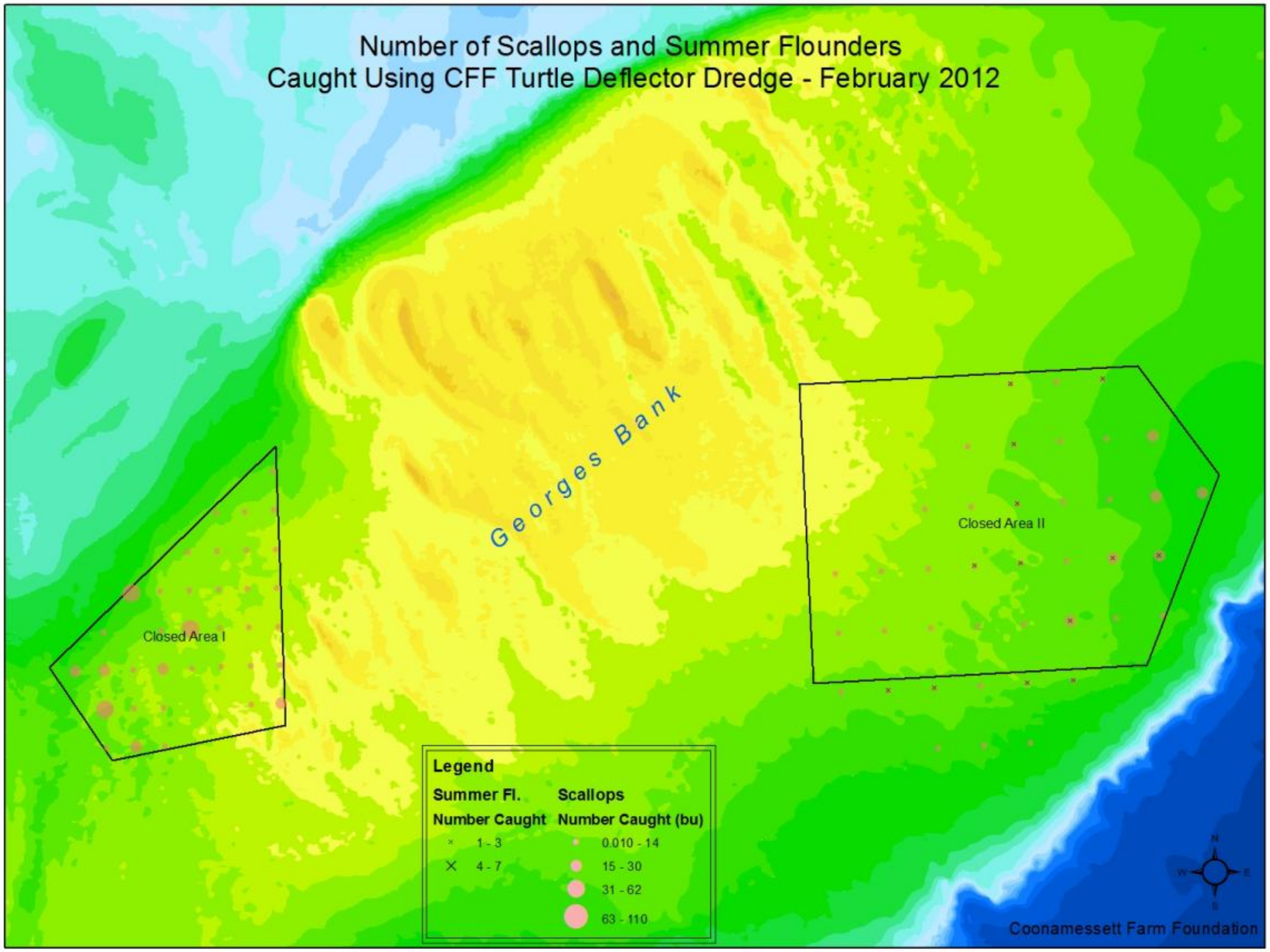
Number of Scallops and Windowpane Flounders
Caught Using CFF Turtle Deflector Dredge - October 2011
Georges Bank
Closed Area I
Closed Area II
Legend
Windowpane Fl.
Number Caught
1 - 10
11 - 20
21 - 50
51 - 126
Scallops
Number Caught (bu)
0.010 - 14
15 - 25
26 - 62
63 - 110
Coonamessett Farm Foundation



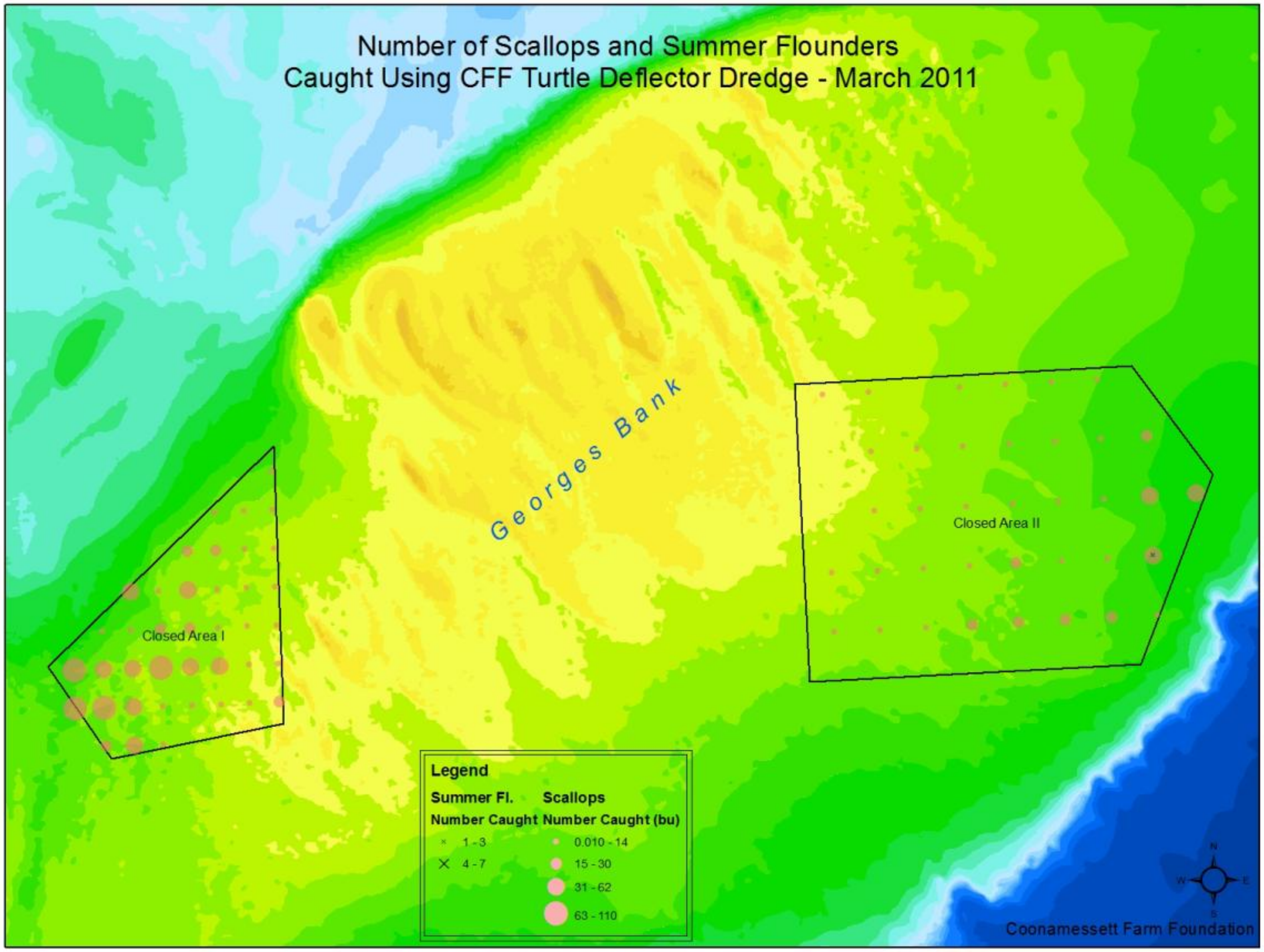
Number of Scallops and Windowpane Flounders
Caught Using CFF Turtle Deflector Dredge - December 2011
Georges Bank
Closed Area I
Closed Area II
Legend
Windowpane Fl. Number Caught
1 - 10
11 - 20
21 - 50
51 - 126
Scallops Number Caught (bu)
0.010 - 14
15 - 30
31 - 39
40 - 110
Coonamessett Farm Foundation

Scallops and Summer Flounder

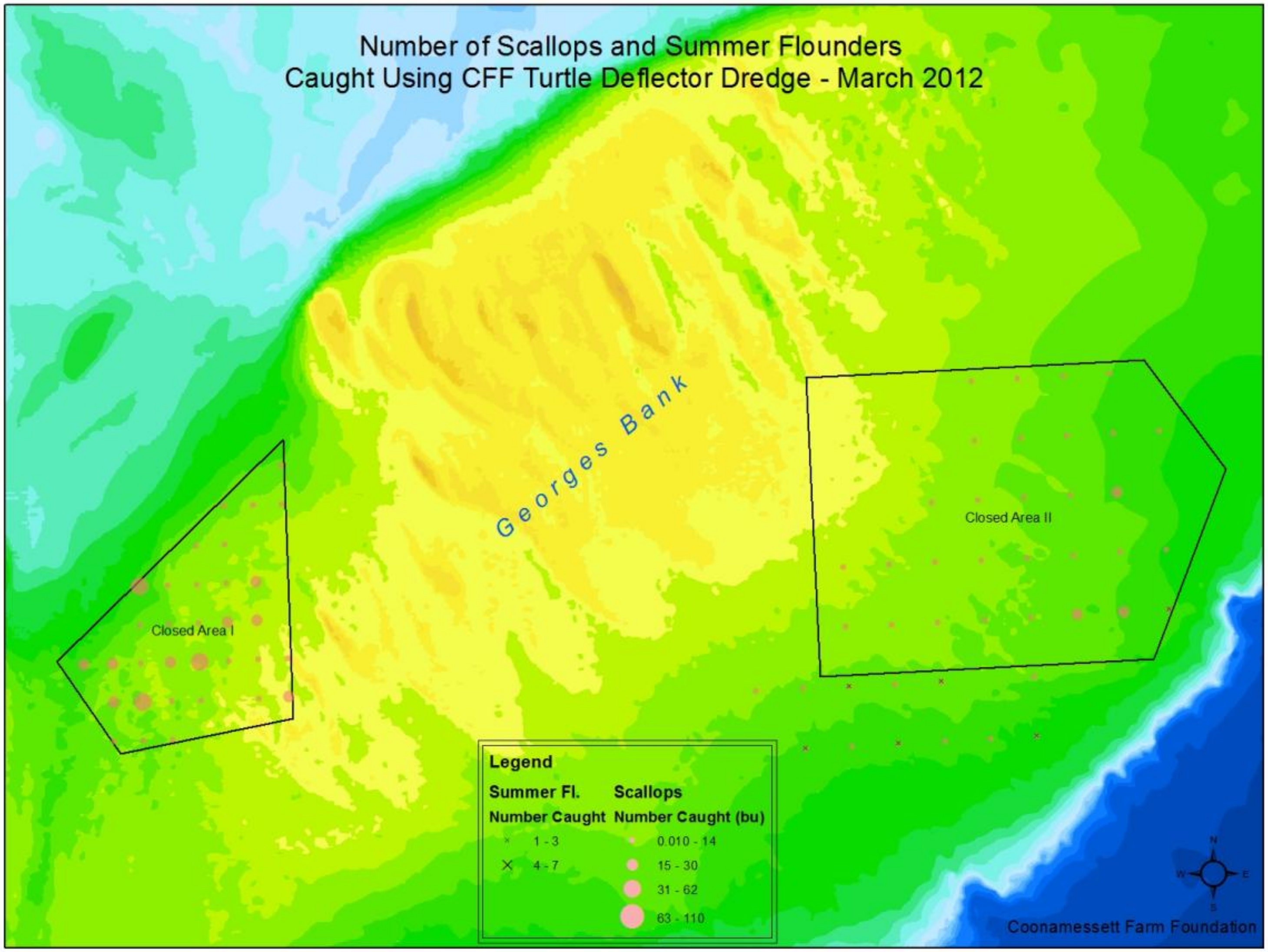




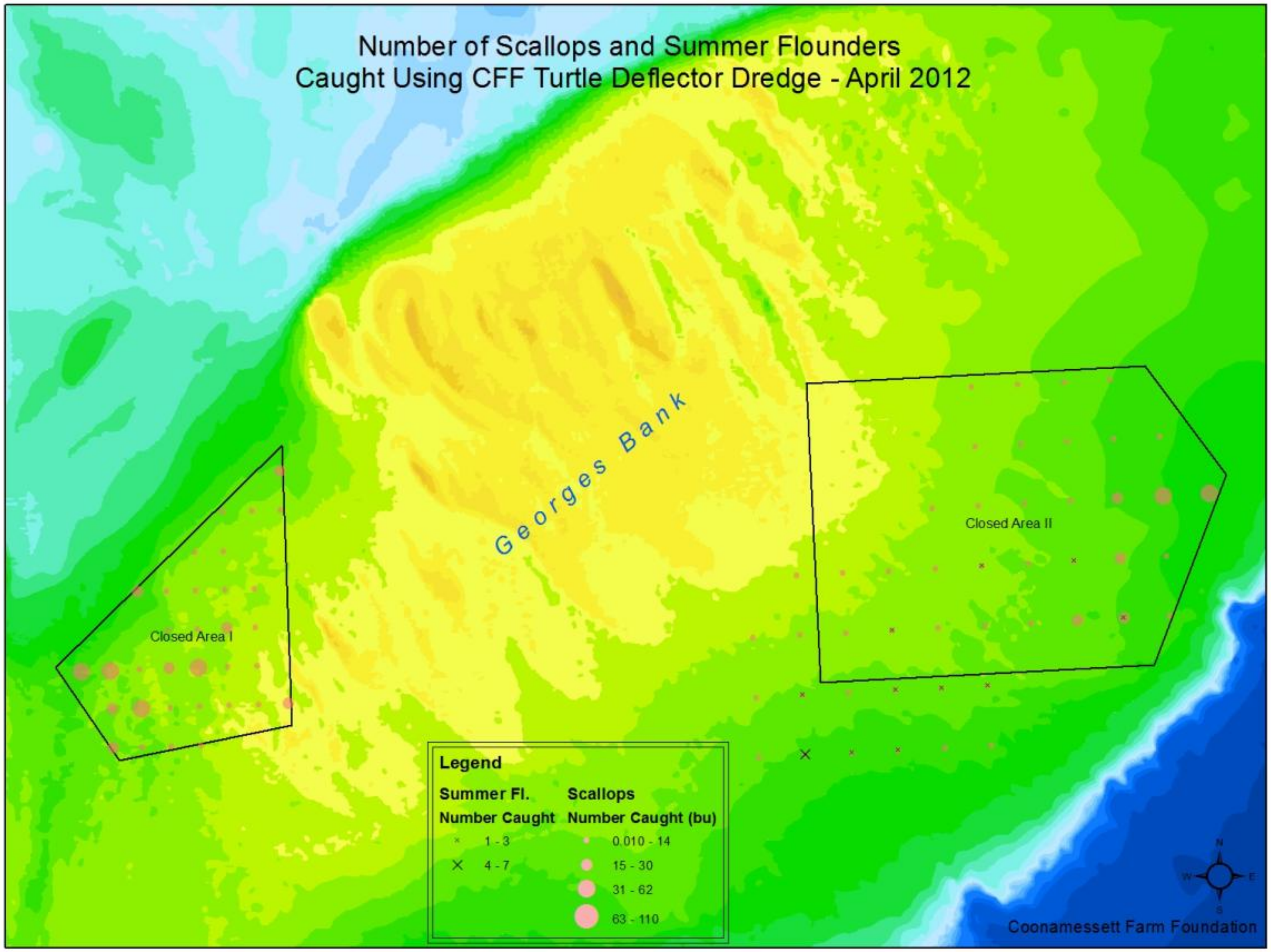
Number of Scallops and Summer Flounders
Caught Using CFF Turtle Deflector Dredge - February 2012
Georges Bank
Closed Area I
Closed Area II
Legend
Summer Fl.
Number Caught
1 - 3
4 - 7
Scallops
Number Caught (bu)
0.010 - 14
15 - 30
31 - 62
63 - 110
Coonamessett Farm Foundation

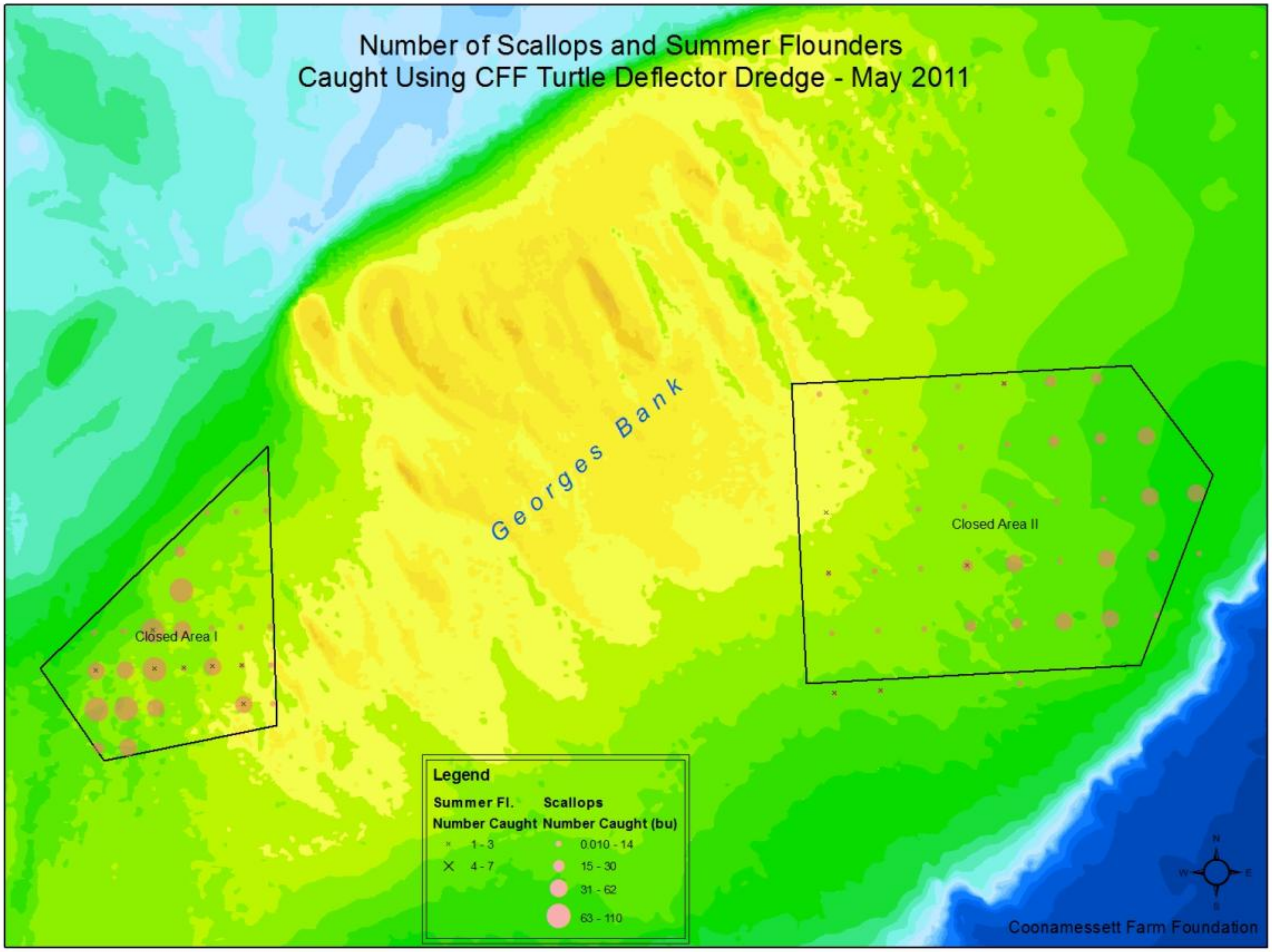


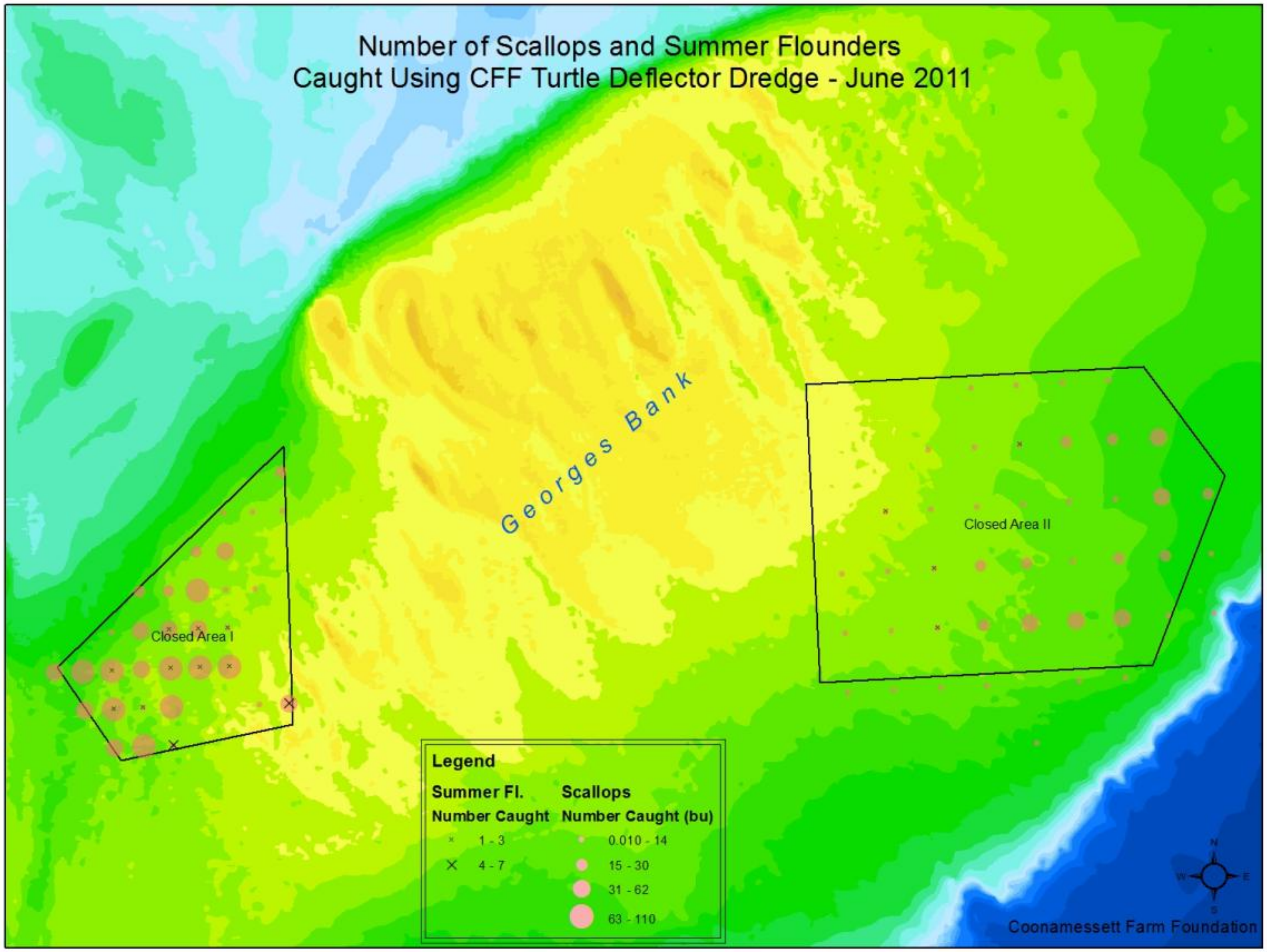
Number of Scallops and Summer Flounders
Caught Using CFF Turtle Deflector Dredge - March 2011
Georges Bank
Closed Area I
Closed Area II
Legend
Summer Fl.
Number Caught
1 - 3
4 - 7
Scallops
Number Caught (bu)
0.010 - 14
15 - 30
31 - 62
63 - 110
N
W
E
S
Coonamessett Farm Foundation


Number of Scallops and Summer Flounders
Caught Using CFF Turtle Deflector Dredge - March 2012
Georges Bank
Closed Area I
Closed Area II
Legend
Summer Fl.
Number Caught
1 - 3
4 - 7
Scallops
Number Caught (bu)
0.010 - 14
15 - 30
31 - 62
63 - 110
Coonamessett Farm Foundation

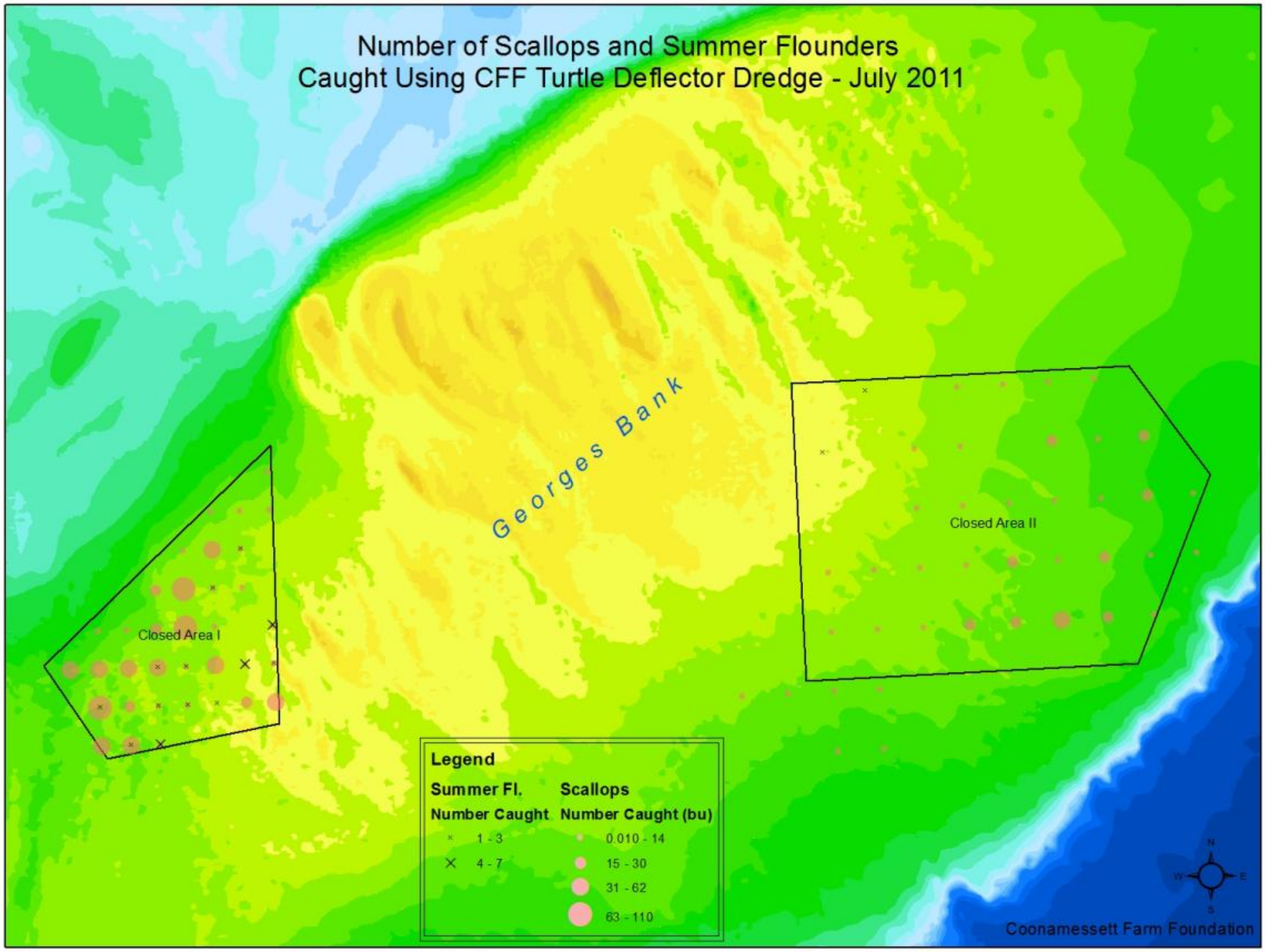
Note: No summer flounder were caught in April 2011.

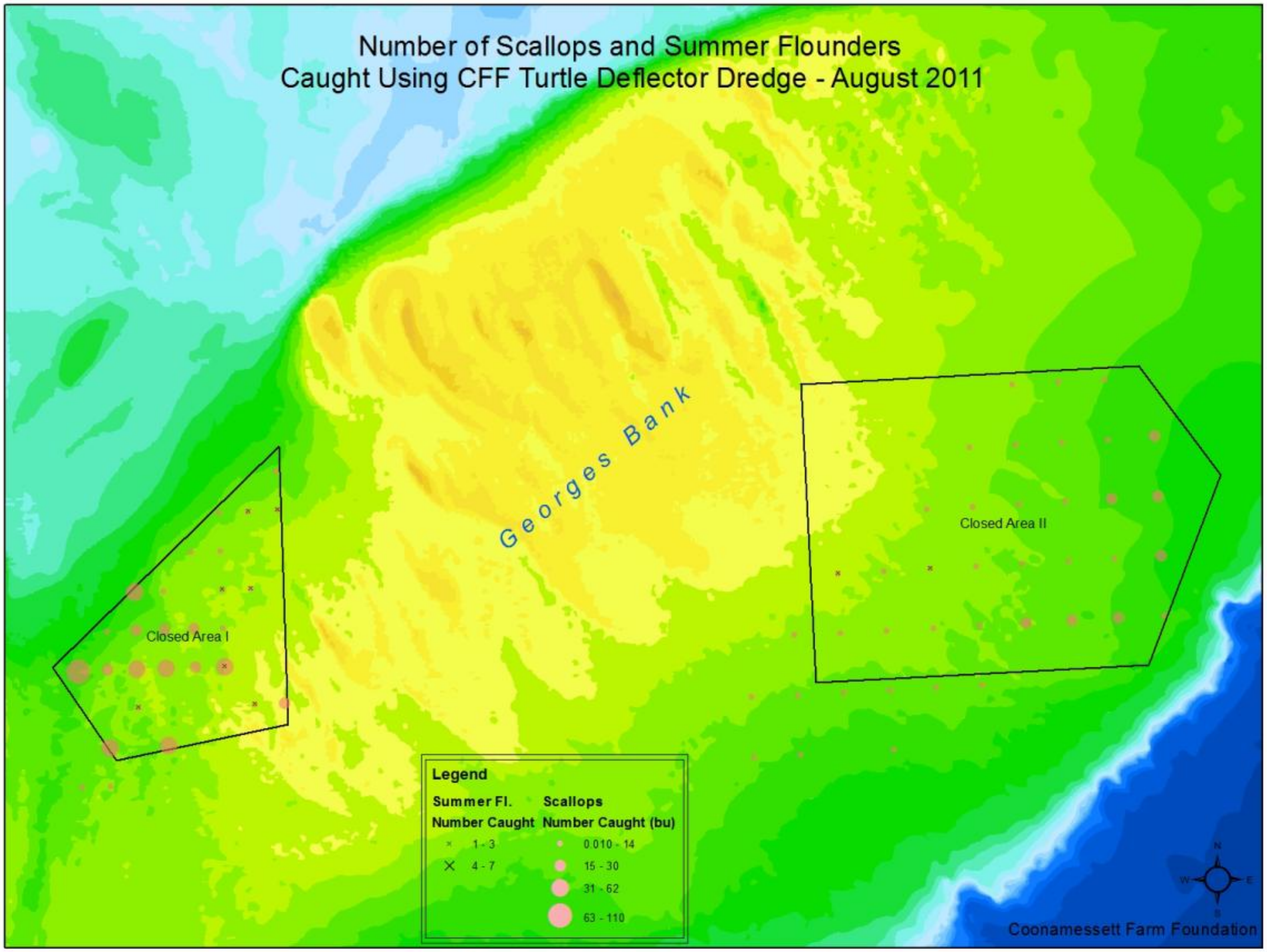

Number of Scallops and Summer Flounders
Caught Using CFF Turtle Deflector Dredge - April 2012
Georges Bank
Closed Area I
Closed Area II
Legend
Summer Fl. Number Caught
1 - 3
4 - 7
Scallops Number Caught (bu)
0.010 - 14
15 - 30
31 - 62
63 - 110
N
W
E
S
Coonamessett Farm Foundation


Number of Scallops and Summer Flounders
Caught Using CFF Turtle Deflector Dredge - May 2011
Georges Bank
Closed Area I
Closed Area II
Legend
Summer Fl.
Number Caught
1 - 3
4 - 7
Scallops
Number Caught (bu)
0.010 - 14
15 - 30
31 - 62
63 - 110
Coonamessett Farm Foundation

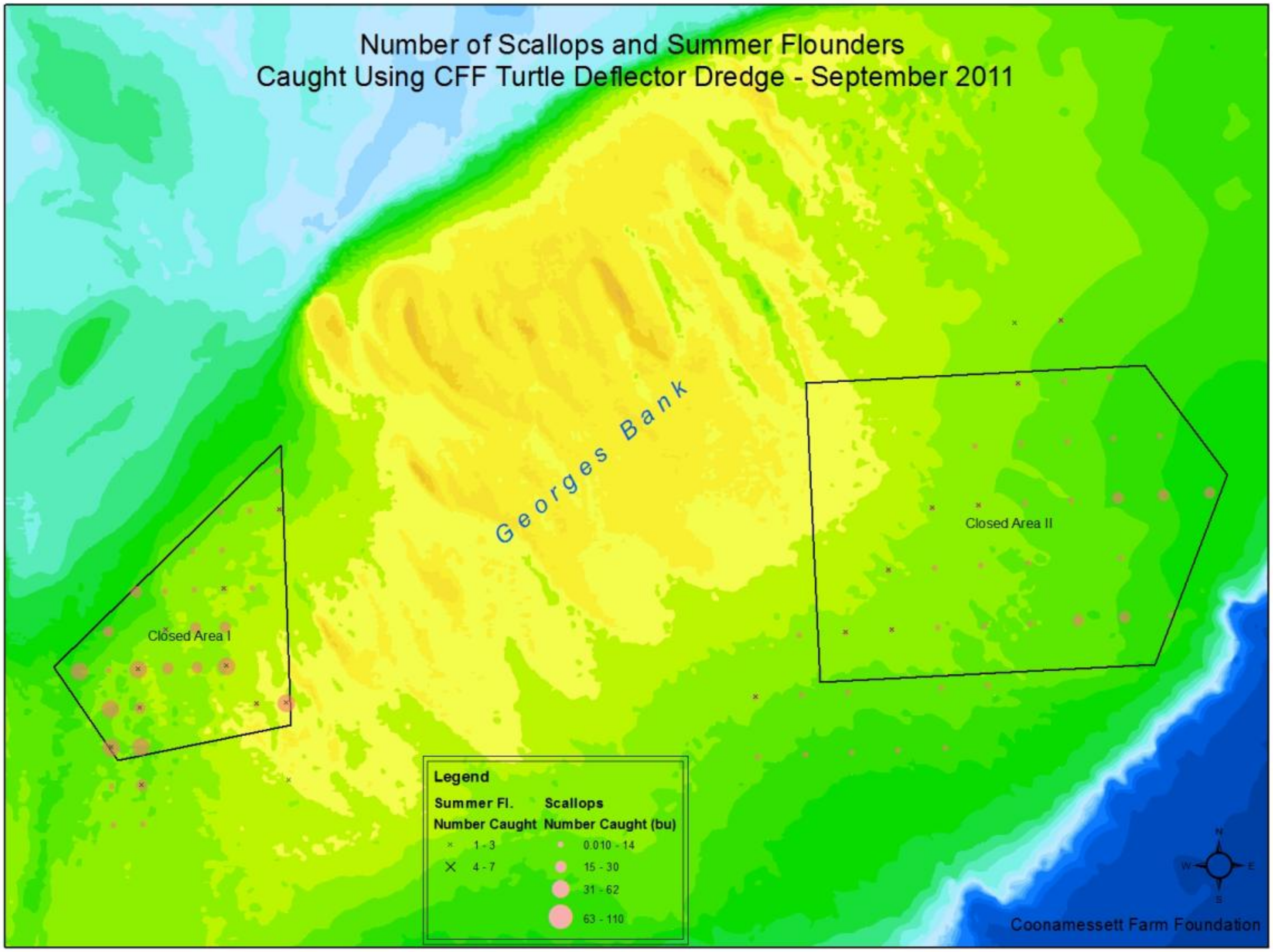


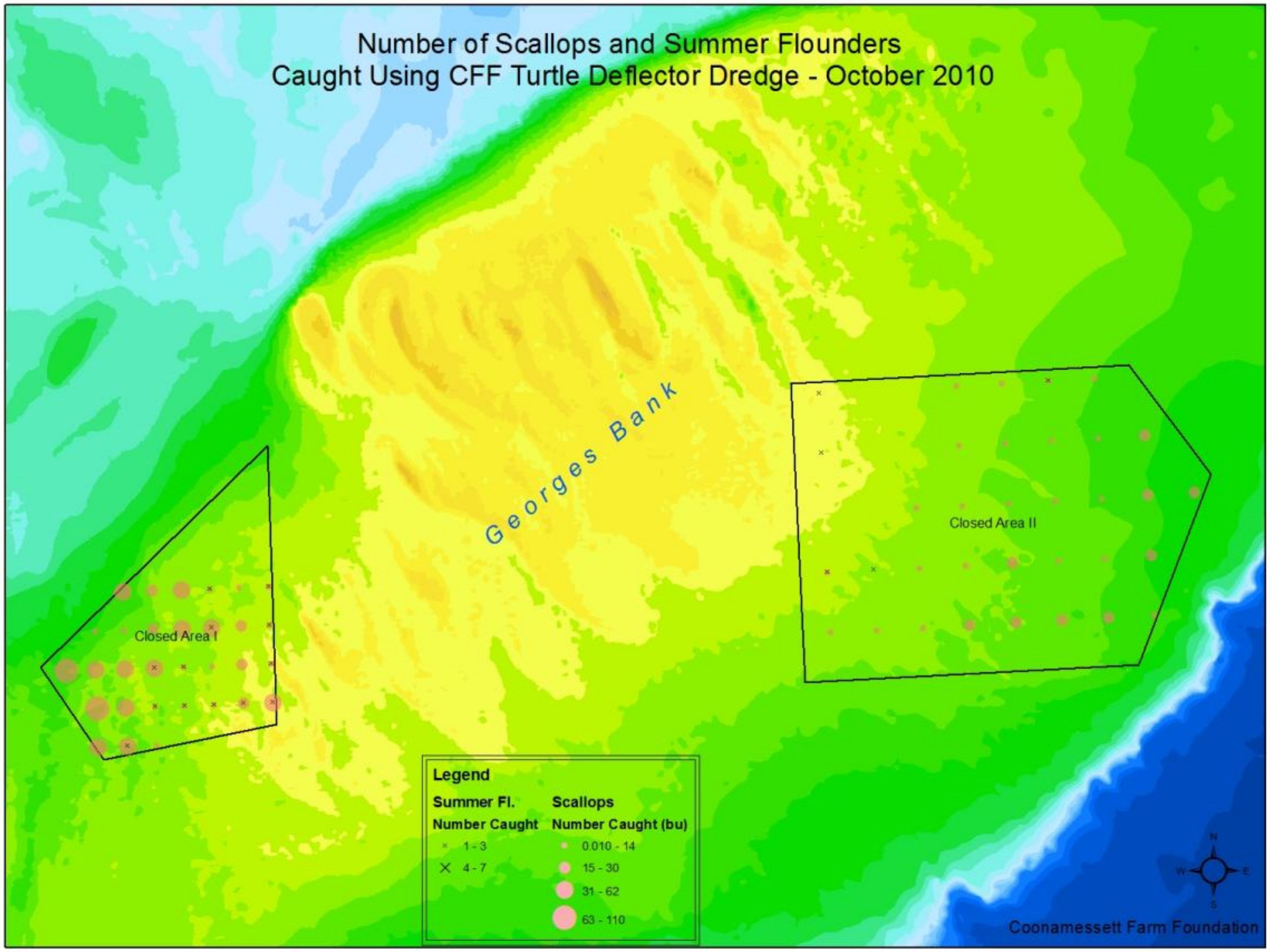
Number of Scallops and Summer Flounders
Caught Using CFF Turtle Deflector Dredge - June 2011
Georges Bank
Closed Area I
Closed Area II
Legend
Summer Fl.
Number Caught
1 - 3
4 - 7
Scallops
Number Caught (bu)
0.010 - 14
15 - 30
31 - 62
63 - 110
Coonamessett Farm Foundation

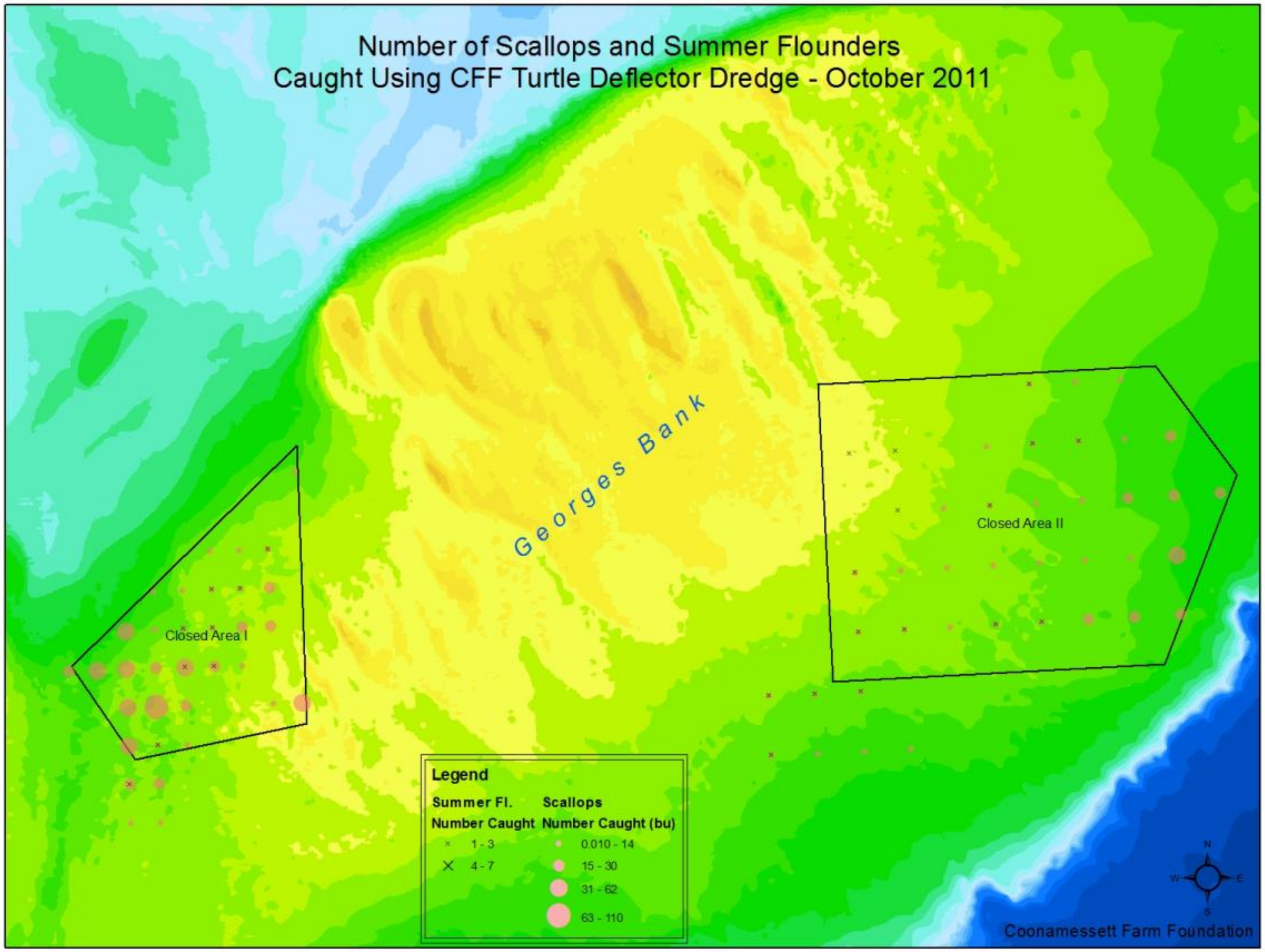

Number of Scallops and Summer Flounders
Caught Using CFF Turtle Deflector Dredge - July 2011
Georges Bank
Closed Area I
Closed Area II
Legend
Summer Fl.
Number Caught
1 - 3
4 - 7
Scallops
Number Caught (bu)
0.010 - 14
15 - 30
31 - 62
63 - 110
Coonamessett Farm Foundation

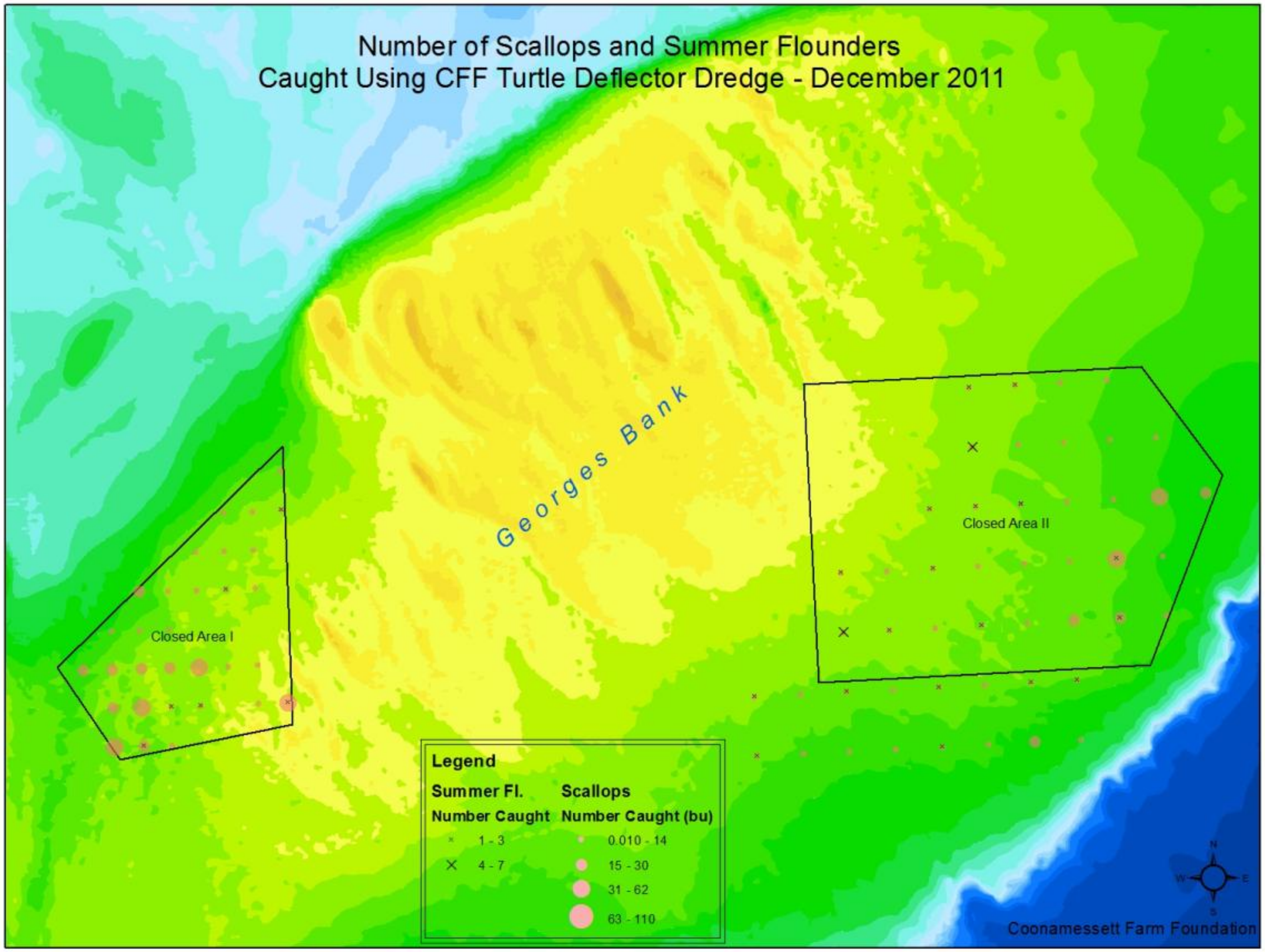


Number of Scallops and Summer Flounders
Caught Using CFF Turtle Deflector Dredge - August 2011
Georges Bank
Closed Area I
Closed Area II
Legend
Summer Fl. Number Caught
1 - 3
4 - 7
Scallops Number Caught (bu)
0.010 - 14
15 - 30
31 - 62
63 - 110
Coonamessett Farm Foundation

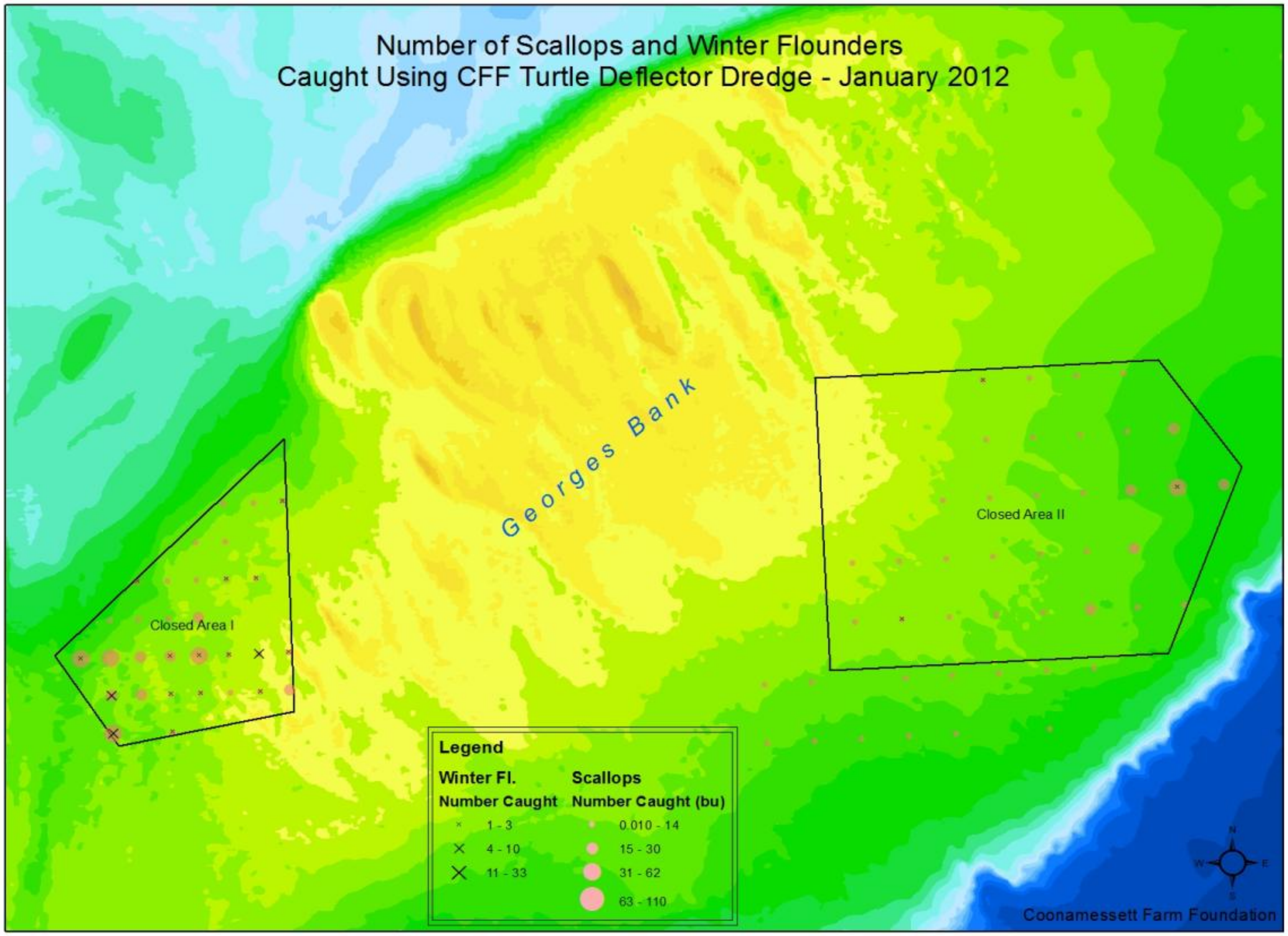

Number of Scallops and Summer Flounders
Caught Using CFF Turtle Deflector Dredge - September 2011
Georges Bank
Closed Area I
Closed Area II
Legend
Summer Fl.
Number Caught
1 - 3
4 - 7
Scallops
Number Caught (bu)
0.010 - 14
15 - 30
31 - 62
63 - 110
N
W
E
S
Coonamessett Farm Foundation

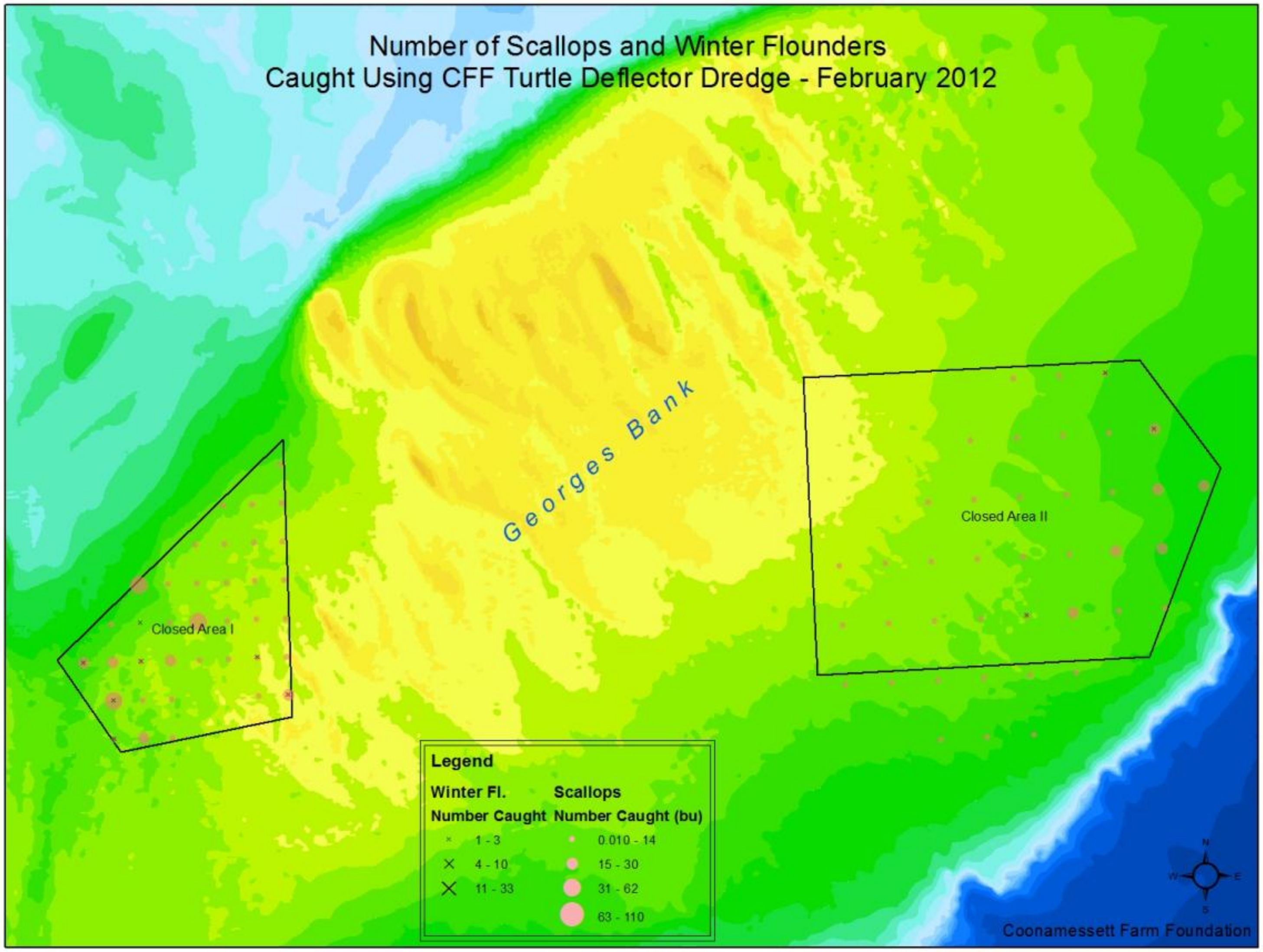

Number of Scallops and Summer Flounders
Caught Using CFF Turtle Deflector Dredge - October 2010
Georges Bank
Closed Area I
Closed Area II
Legend
Summer Fl.
Number Caught
1 - 3
4 - 7
Scallops
Number Caught (bu)
0.010 - 14
15 - 30
31 - 62
63 - 110
N
S
E
W
Coonamessett Farm Foundation

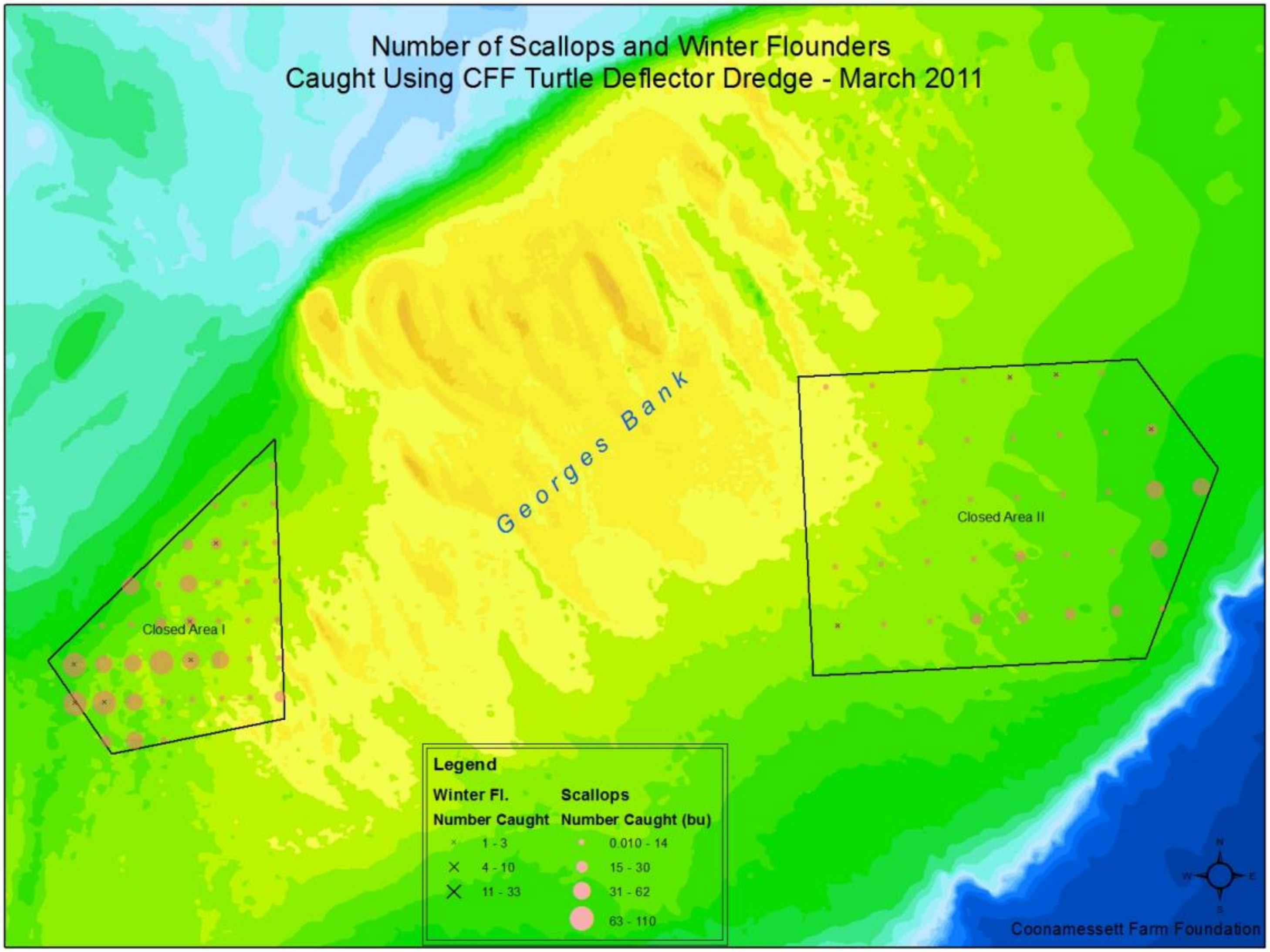

Number of Scallops and Summer Flounders
Caught Using CFF Turtle Deflector Dredge - October 2011
Georges Bank
Closed Area I
Closed Area II
Legend
Summer Fl.
Number Caught
1 - 3
4 - 7
Scallops
Number Caught (bu)
0.010 - 14
15 - 30
31 - 62
63 - 110
N
W
E
S
Coonamessett Farm Foundation

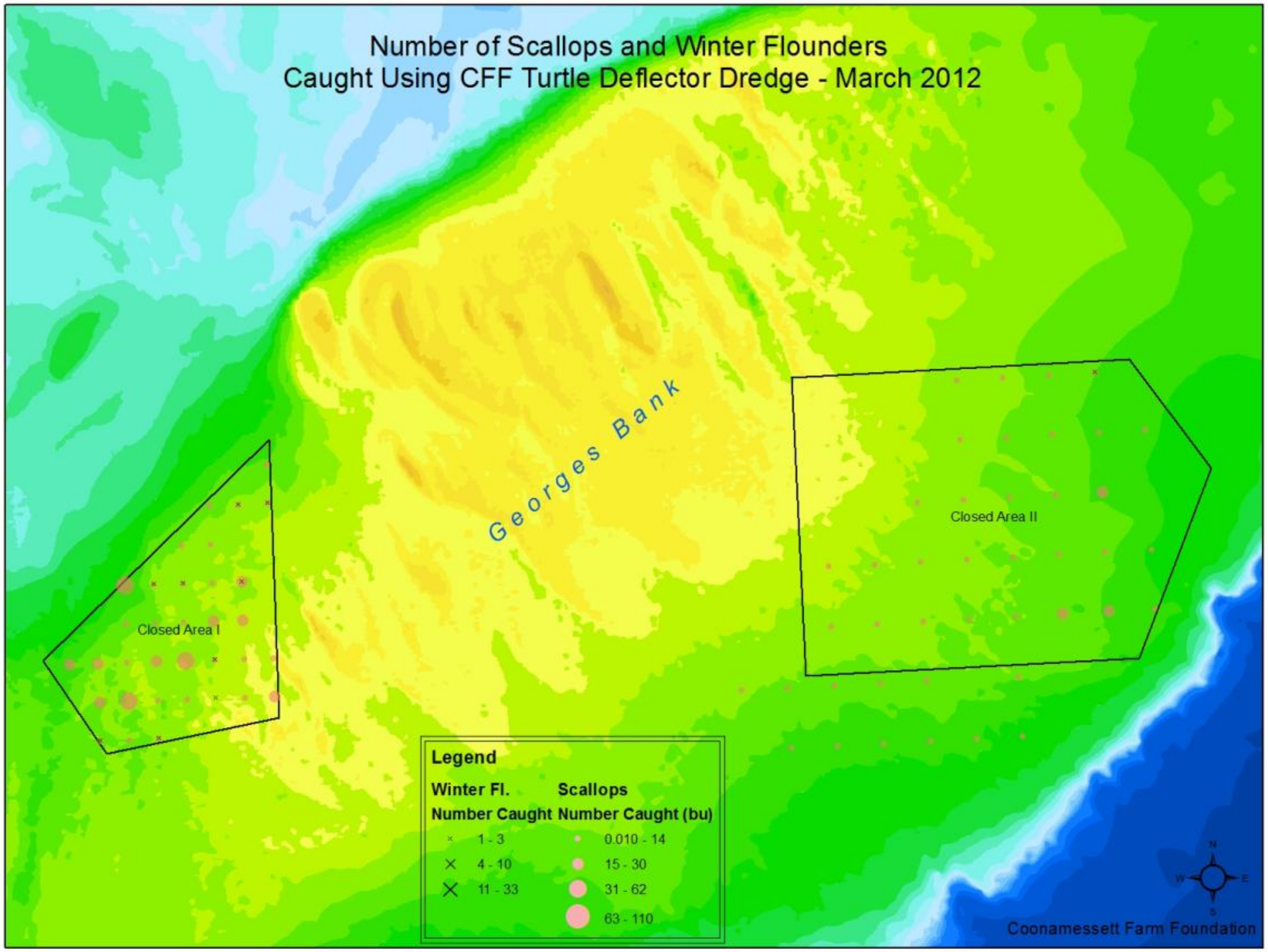

Number of Scallops and Summer Flounders
Caught Using CFF Turtle Deflector Dredge - December 2011
Georges Bank
Closed Area I
Closed Area II
Legend
Summer Fl.
Number Caught
1 - 3
4 - 7
Scallops
Number Caught (bu)
0.010 - 14
15 - 30
31 - 62
63 - 110
Coonamessett Farm Foundation

Scallops and Winter Flounder




Number of Scallops and Winter Flounders
Caught Using CFF Turtle Deflector Dredge - February 2012
Georges Bank
Closed Area I
Closed Area II
Legend
Winter Fl.
Number Caught
1 - 3
4 - 10
11 - 33
Scallops
Number Caught (bu)
0.010 - 14
15 - 30
31 - 62
63 - 110
Coonamessett Farm Foundation


Number of Scallops and Winter Flounders
Caught Using CFF Turtle Deflector Dredge - March 2011
Georges Bank
Closed Area I
Closed Area II
Legend
Winter Fl.
Number Caught
1 - 3
4 - 10
11 - 33
Scallops
Number Caught (bu)
0.010 - 14
15 - 30
31 - 62
63 - 110
Coonamessett Farm Foundation



Number of Scallops and Winter Flounders
Caught Using CFF Turtle Deflector Dredge - March 2012
Georges Bank
Closed Area I
Closed Area II
Legend
Winter Fl.
Number Caught
1 - 3
4 - 10
11 - 33
Scallops
Number Caught (bu)
0.010 - 14
15 - 30
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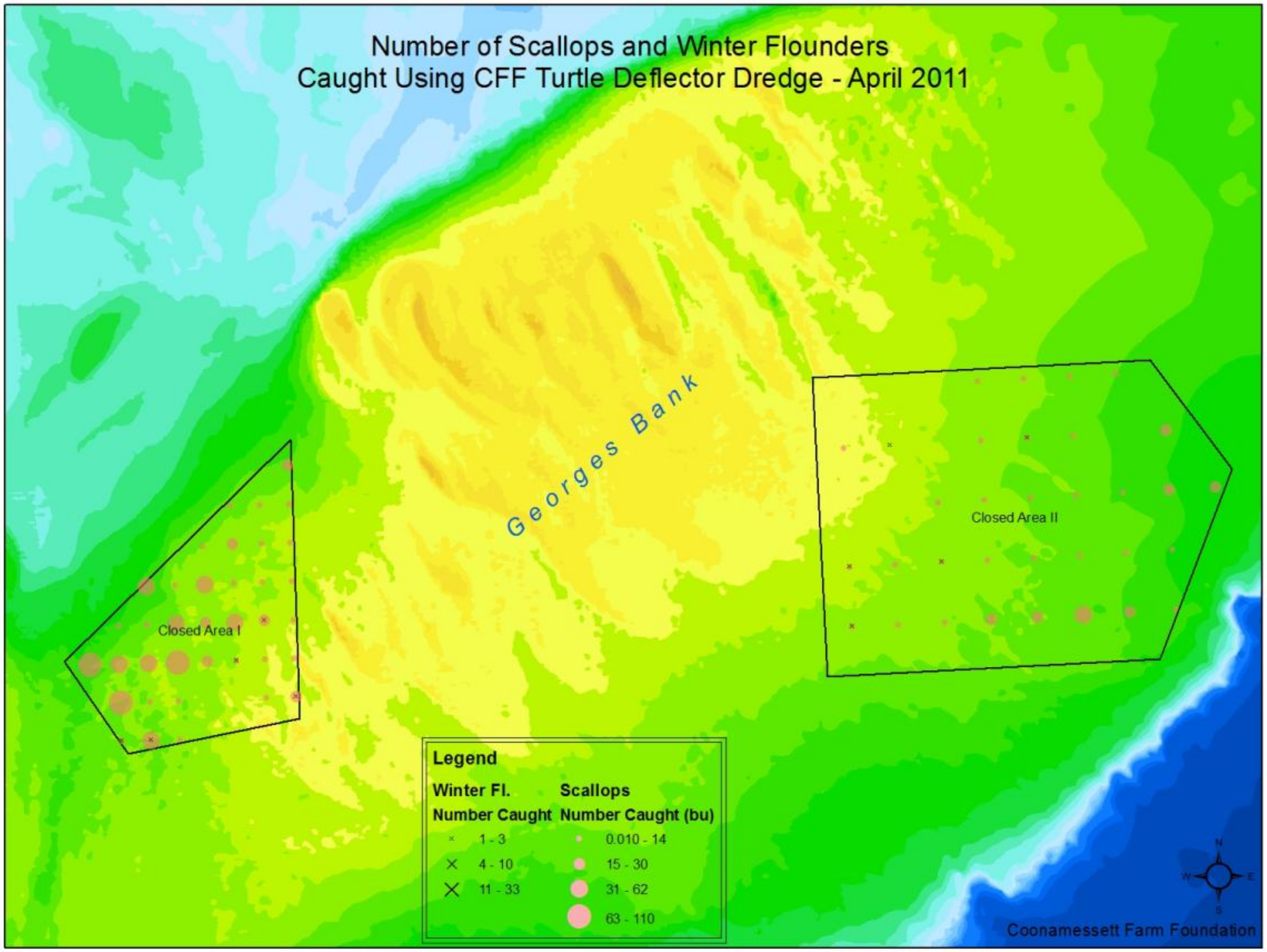
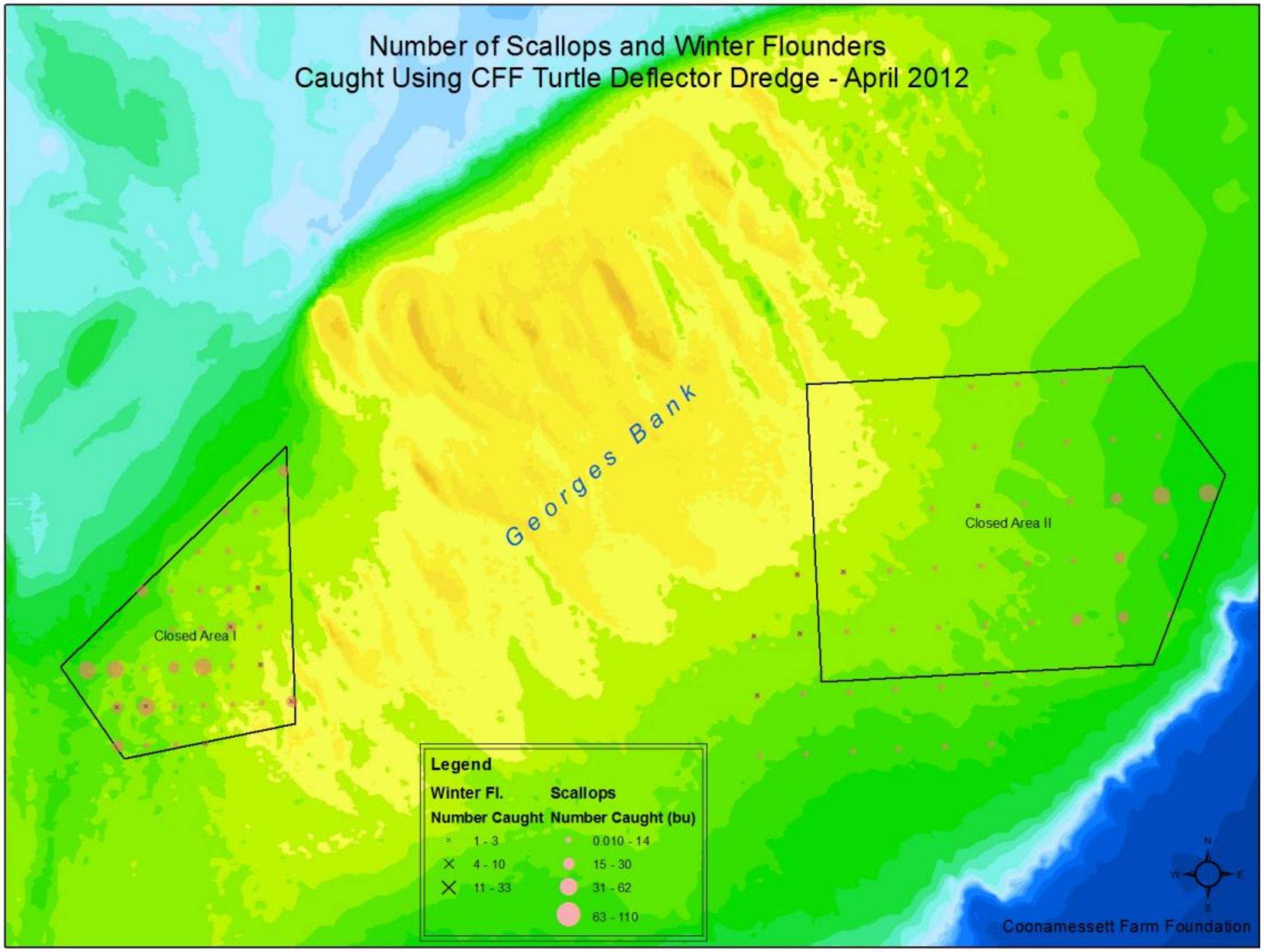
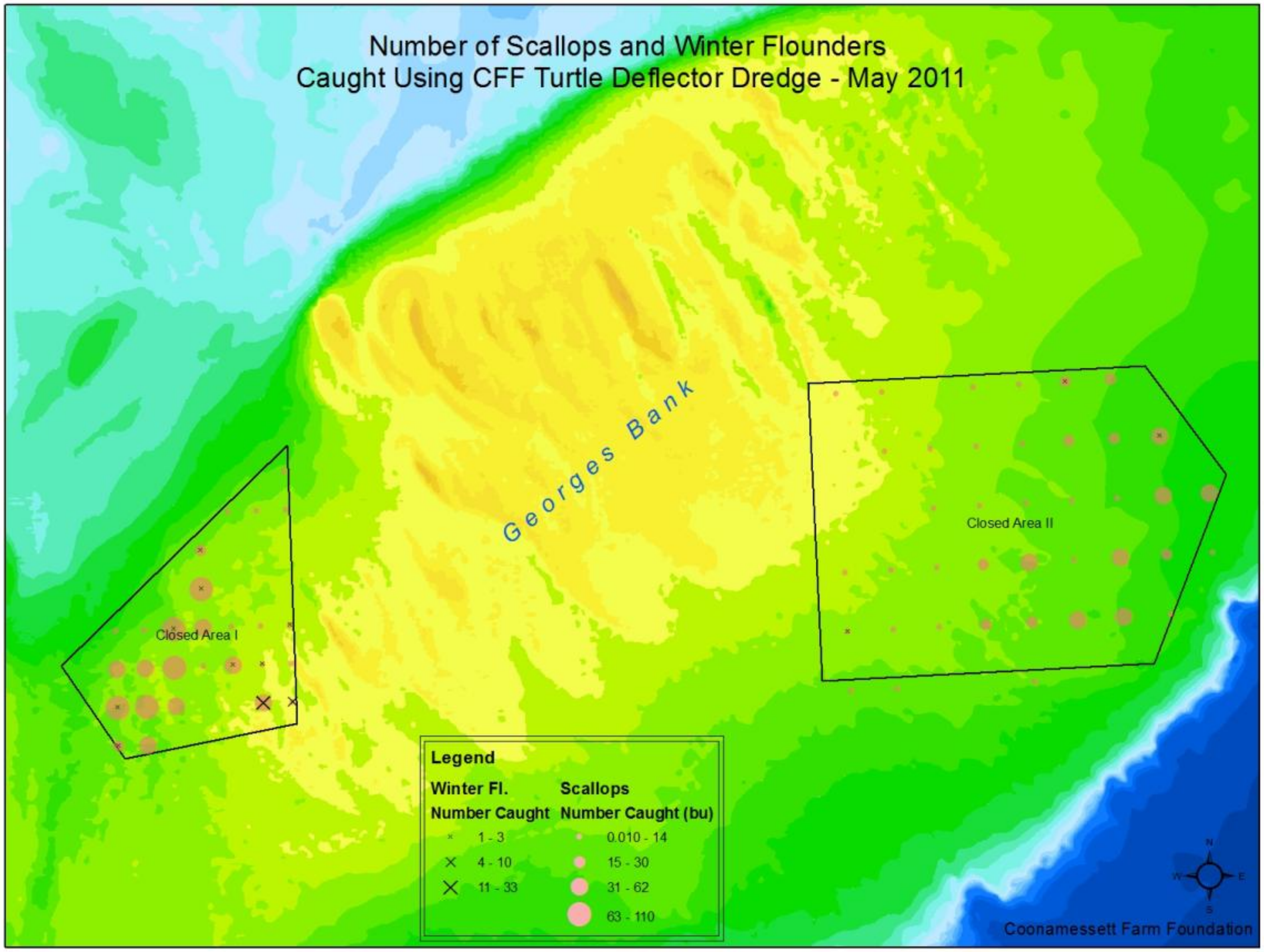
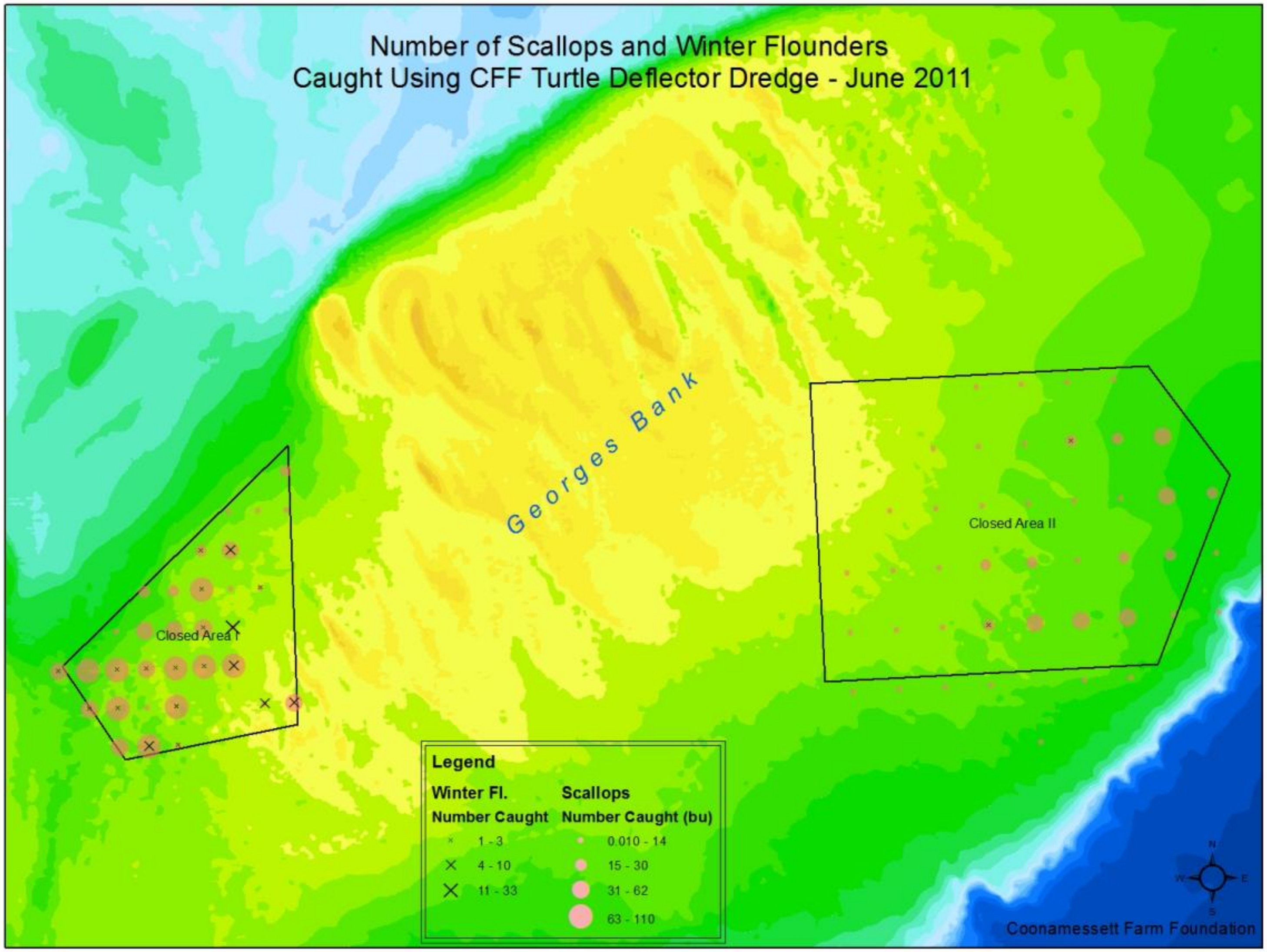
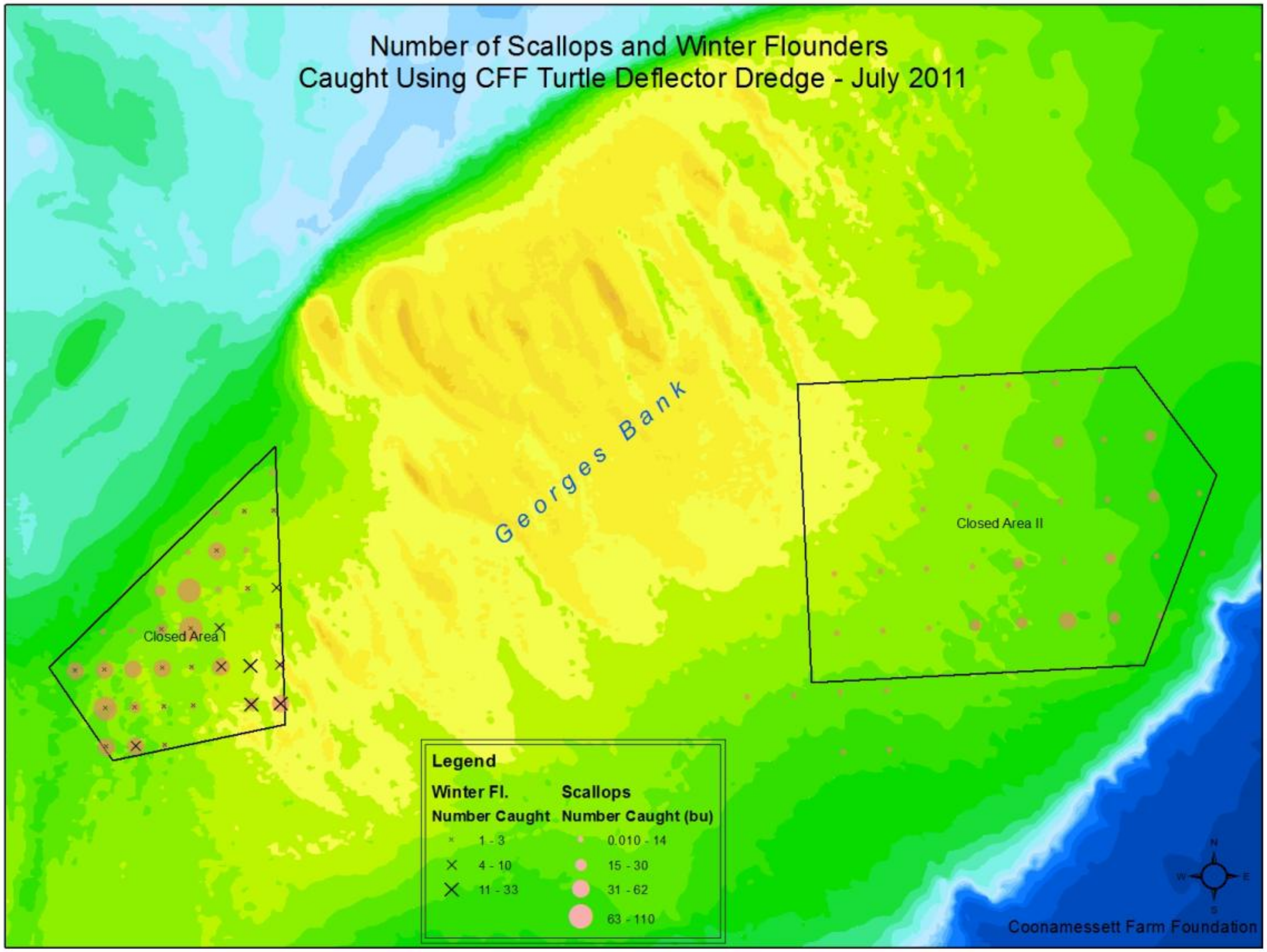
63 - 110
Coonamessett Farm Foundation

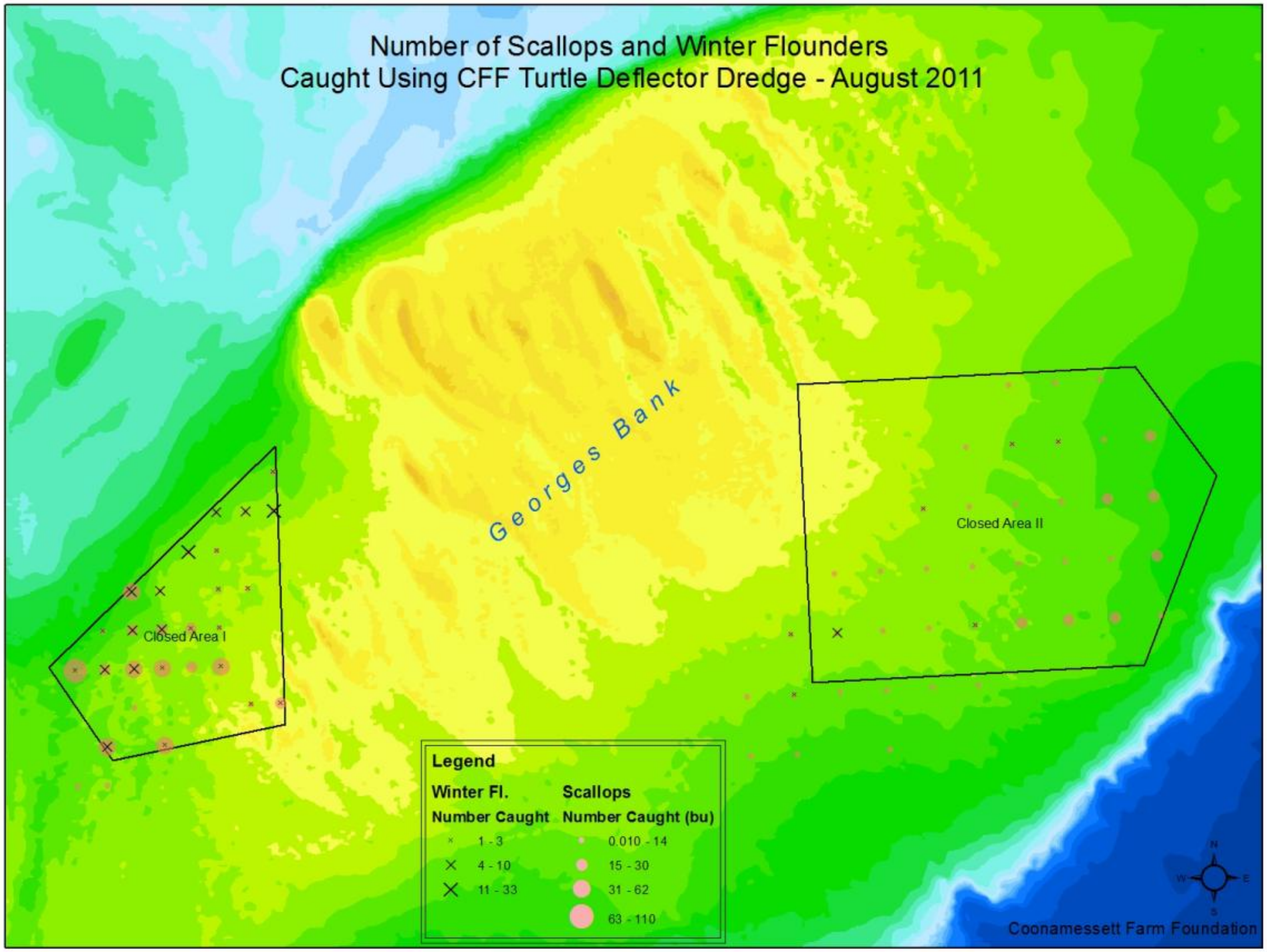

Number of Scallops and Winter Flounders
Caught Using CFF Turtle Deflector Dredge - April 2011
Georges Bank
Closed Area I
Closed Area II
Legend
Winter Fl.
Number Caught
1 - 3
4 - 10
11 - 33
Scallops
Number Caught (bu)
0.010 - 14
15 - 30
31 - 62
63 - 110
Coonamessett Farm Foundation

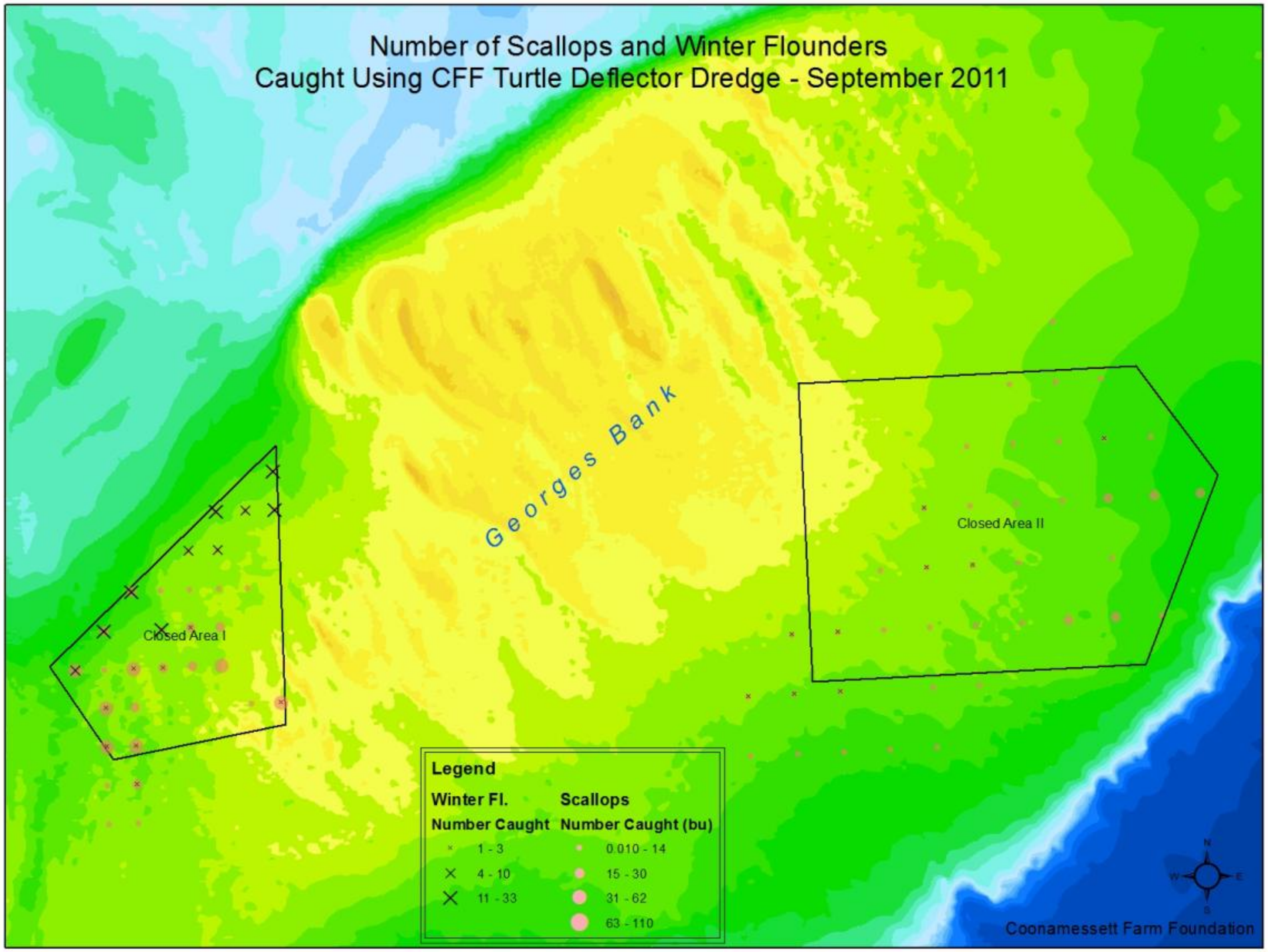

Number of Scallops and Winter Flounders
Caught Using CFF Turtle Deflector Dredge - April 2012
Georges Bank
Closed Area I
Closed Area II
Legend
Winter Fl.
Number Caught
1 - 3
4 - 10
11 - 33
Scallops
Number Caught (bu)
0.010 - 14
15 - 30
31 - 62
63 - 110
N
E
S
W
Coonamessett Farm Foundation

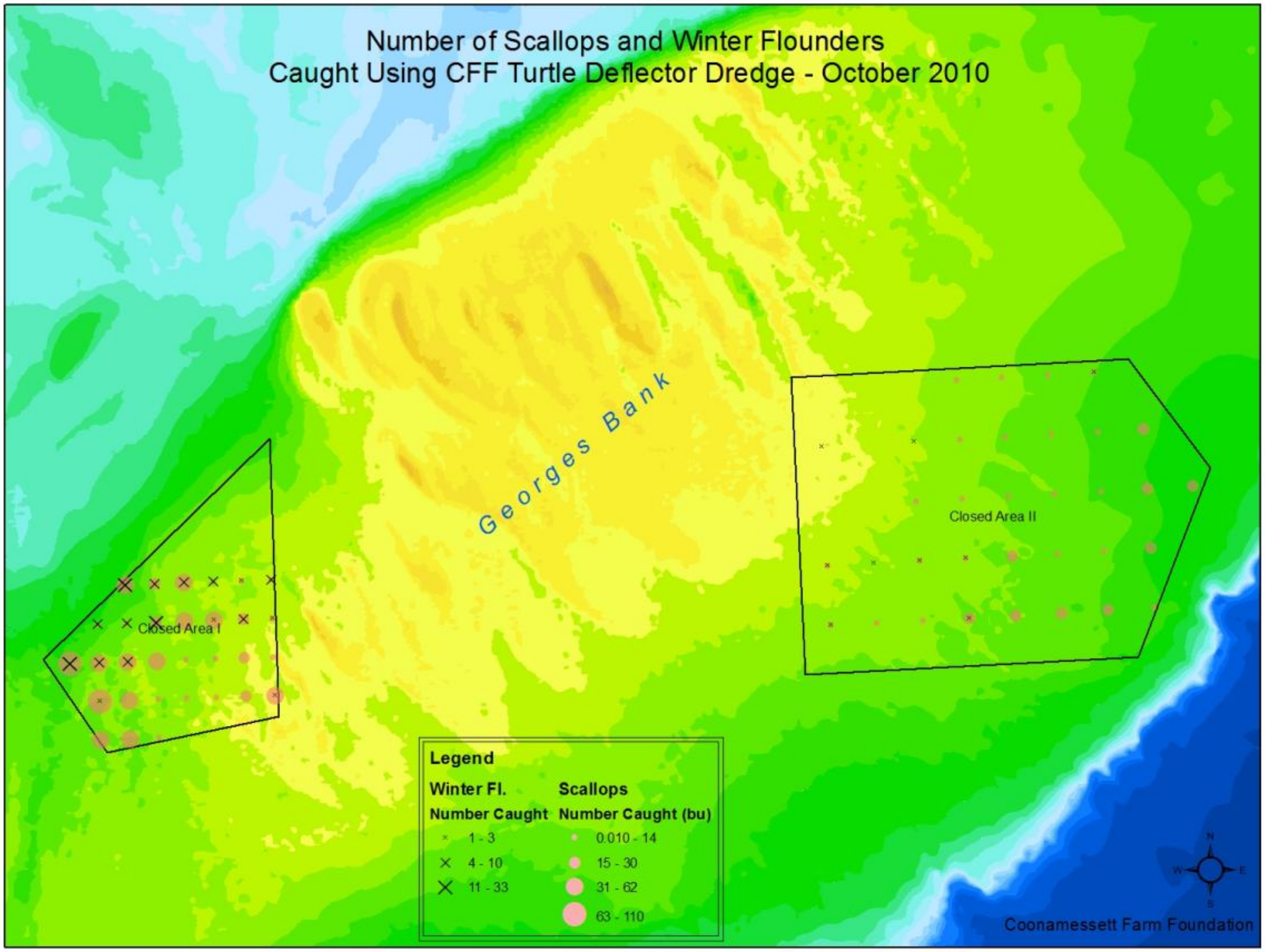

Number of Scallops and Winter Flounders
Caught Using CFF Turtle Deflector Dredge - May 2011
Georges Bank
Closed Area I
Closed Area II
Legend
Winter Fl.
Number Caught
1 - 3
4 - 10
11 - 33
Scallops
Number Caught (bu)
0.010 - 14
15 - 30
31 - 62
63 - 110
Coonamessett Farm Foundation


Number of Scallops and Winter Flounders
Caught Using CFF Turtle Deflector Dredge - June 2011
Georges Bank
Closed Area I
Closed Area II
Legend
Winter Fl.
Number Caught
1 - 3
4 - 10
11 - 33
Scallops
Number Caught (bu)
0.010 - 14
15 - 30
31 - 62
63 - 110
Coonamessett Farm Foundation

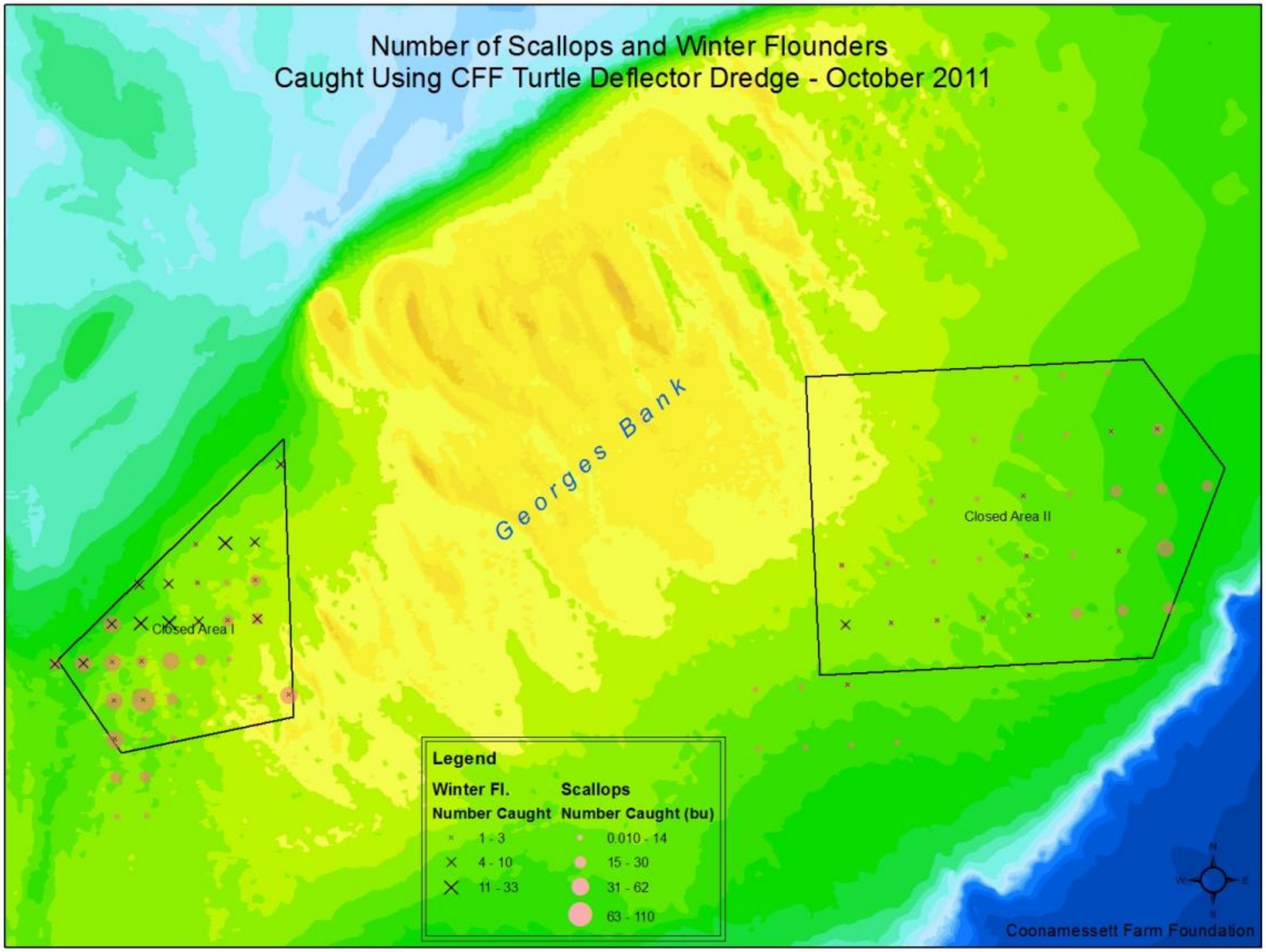

Number of Scallops and Winter Flounders
Caught Using CFF Turtle Deflector Dredge - July 2011
Georges Bank
Closed Area I
Closed Area II
Legend
Winter Fl.
Number Caught
1 - 3
4 - 10
11 - 33
Scallops
Number Caught (bu)
0.010 - 14
15 - 30
31 - 62
63 - 110
Coonamessett Farm Foundation

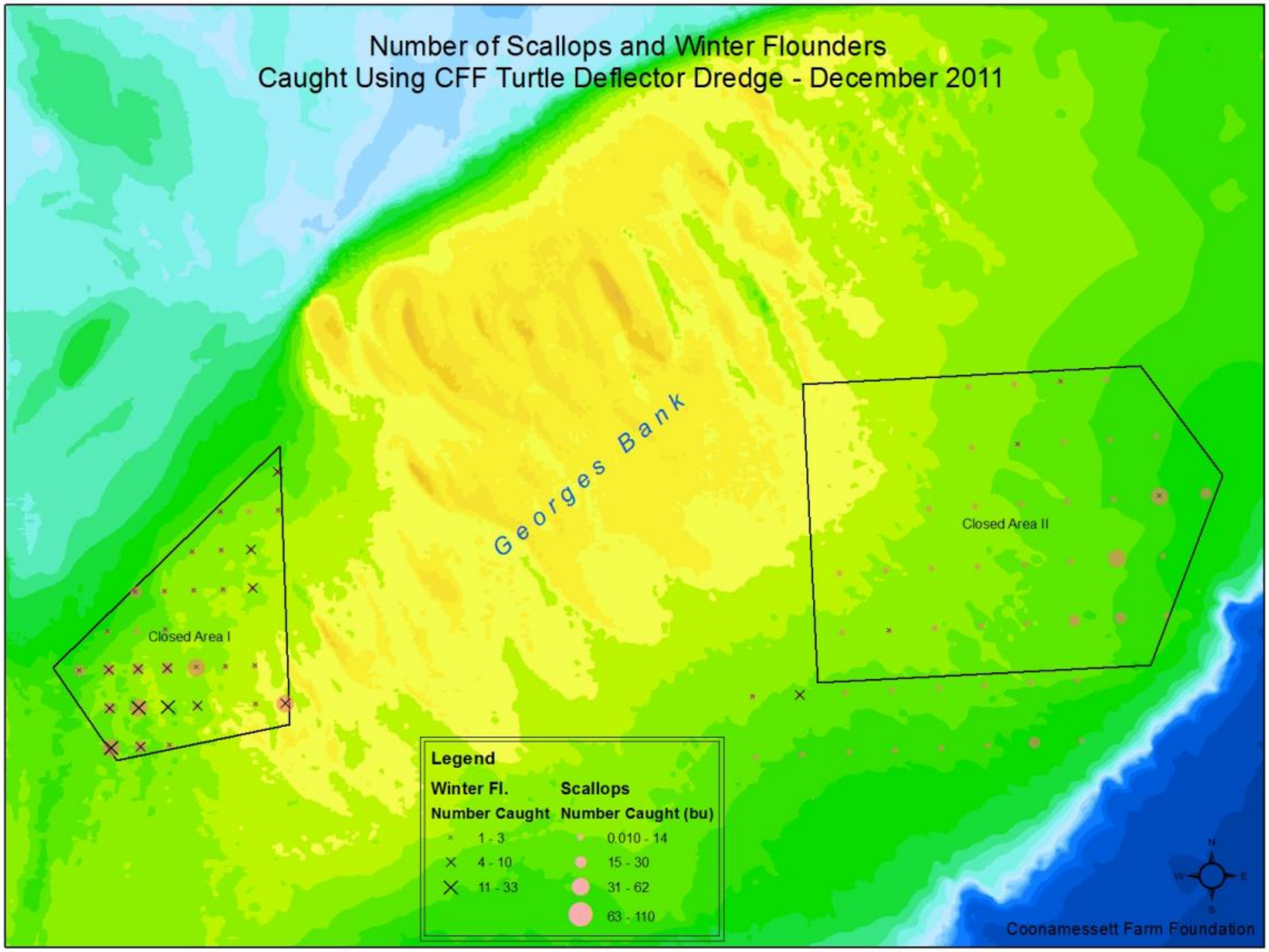

Number of Scallops and Winter Flounders
Caught Using CFF Turtle Deflector Dredge - August 2011
Georges Bank
Closed Area I
Closed Area II
Legend
Winter Fl.
Number Caught
1 - 3
4 - 10
11 - 33
Scallops
Number Caught (bu)
0.010 - 14
15 - 30
31 - 62
63 - 110
Coonamessett Farm Foundation


Number of Scallops and Winter Flounders
Caught Using CFF Turtle Deflector Dredge - September 2011
Georges Bank
Closed Area I
Closed Area II
Legend
Winter Fl.
Number Caught
1 - 3
4 - 10
11 - 33
Scallops
Number Caught (bu)
0.010 - 14
15 - 30
31 - 62
63 - 110
Coonamessett Farm Foundation



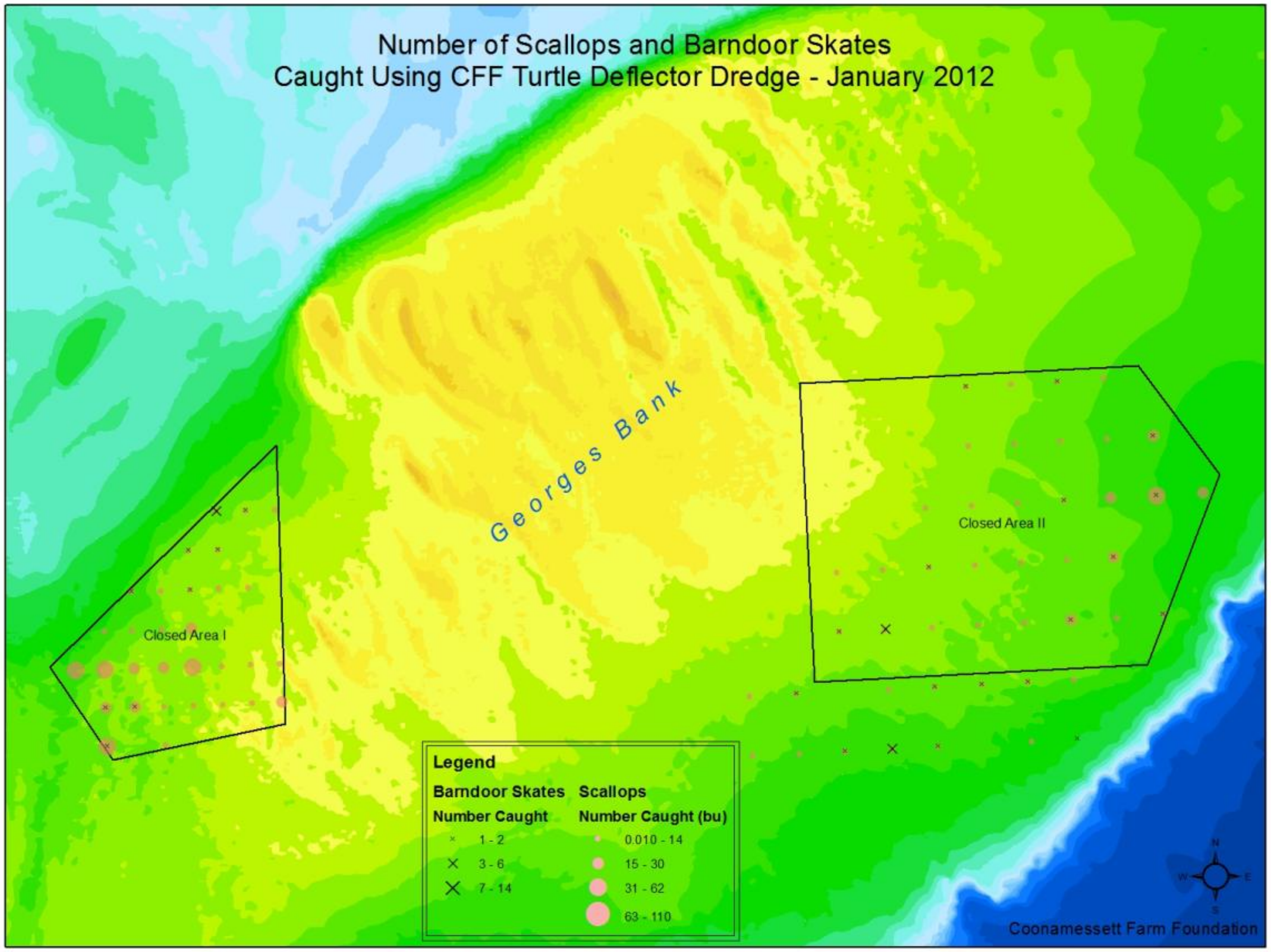
Number of Scallops and Winter Flounders
Caught Using CFF Turtle Deflector Dredge - October 2010
Georges Bank
Closed Area I
Closed Area II
Legend
Winter Fl.
Number Caught
1 - 3
4 - 10
11 - 33
Scallops
Number Caught (bu)
0.010 - 14
15 - 30
31 - 62
63 - 110
N
W
E
S
Coonamessett Farm Foundation

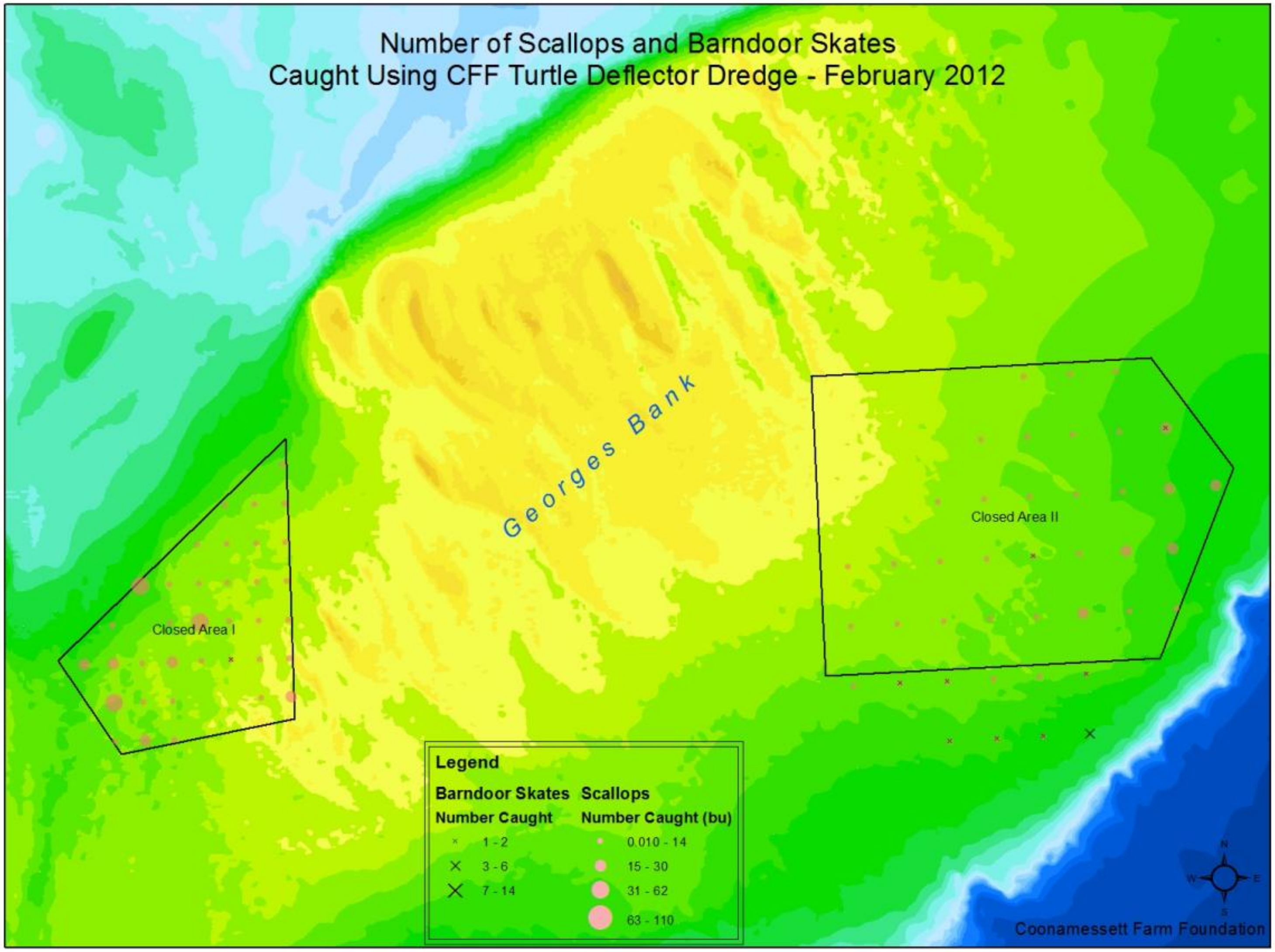

Number of Scallops and Winter Flounders
Caught Using CFF Turtle Deflector Dredge - October 2011
Georges Bank
Closed Area I
Closed Area II
Legend
Winter Fl.
Number Caught
1 - 3
4 - 10
11 - 33
Scallops
Number Caught (bu)
0.010 - 14
15 - 30
31 - 62
63 - 110
Coonamessett Farm Foundation



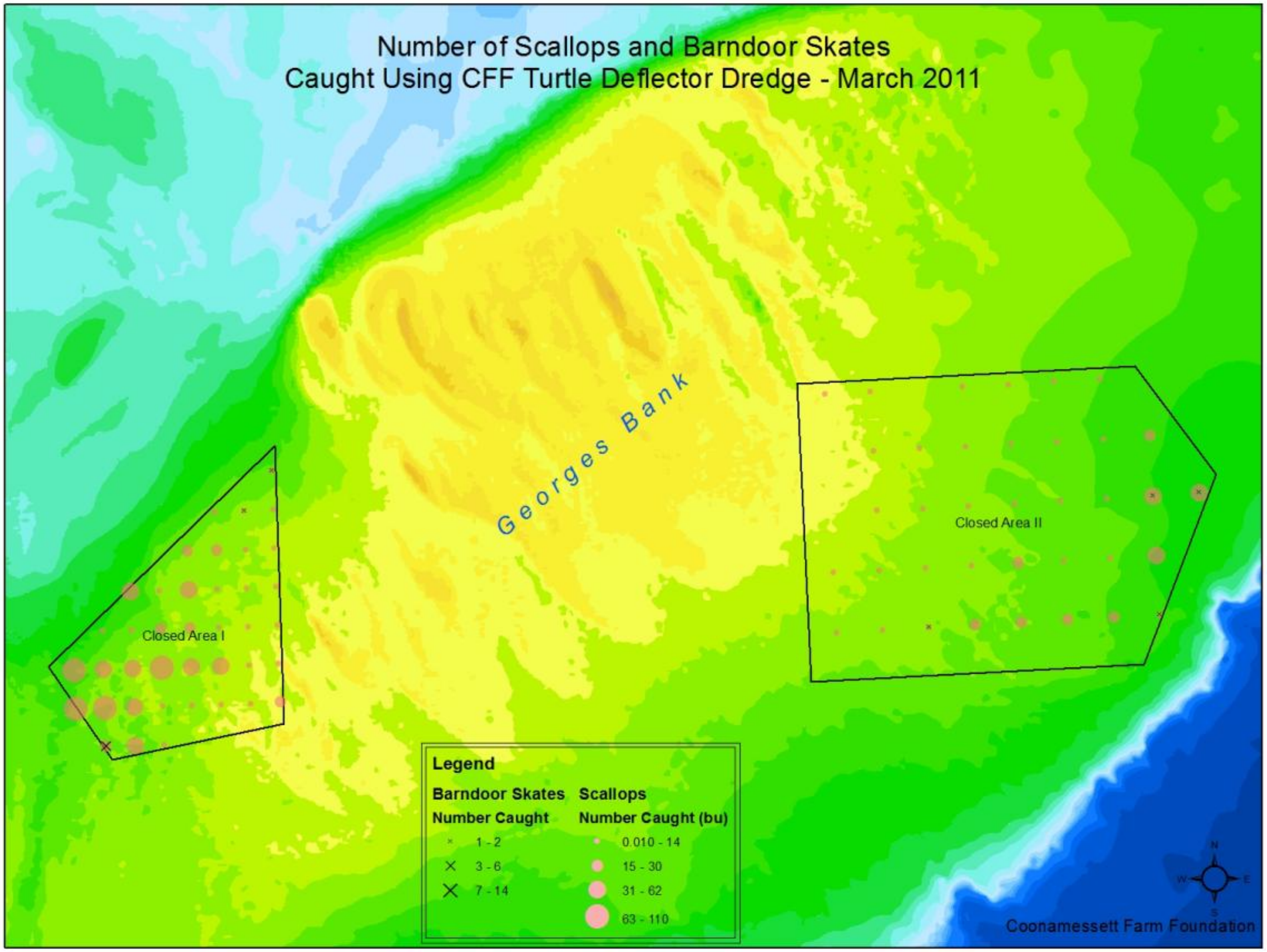
Number of Scallops and Winter Flounders
Caught Using CFF Turtle Deflector Dredge - December 2011
Georges Bank
Closed Area I
Closed Area II
Legend
Winter Fl.
Number Caught
1 - 3
4 - 10
11 - 33
Scallops
Number Caught (bu)
0.010 - 14
15 - 30
31 - 62
63 - 110
Coonamessett Farm Foundation

Scallops and Barndoor Skates

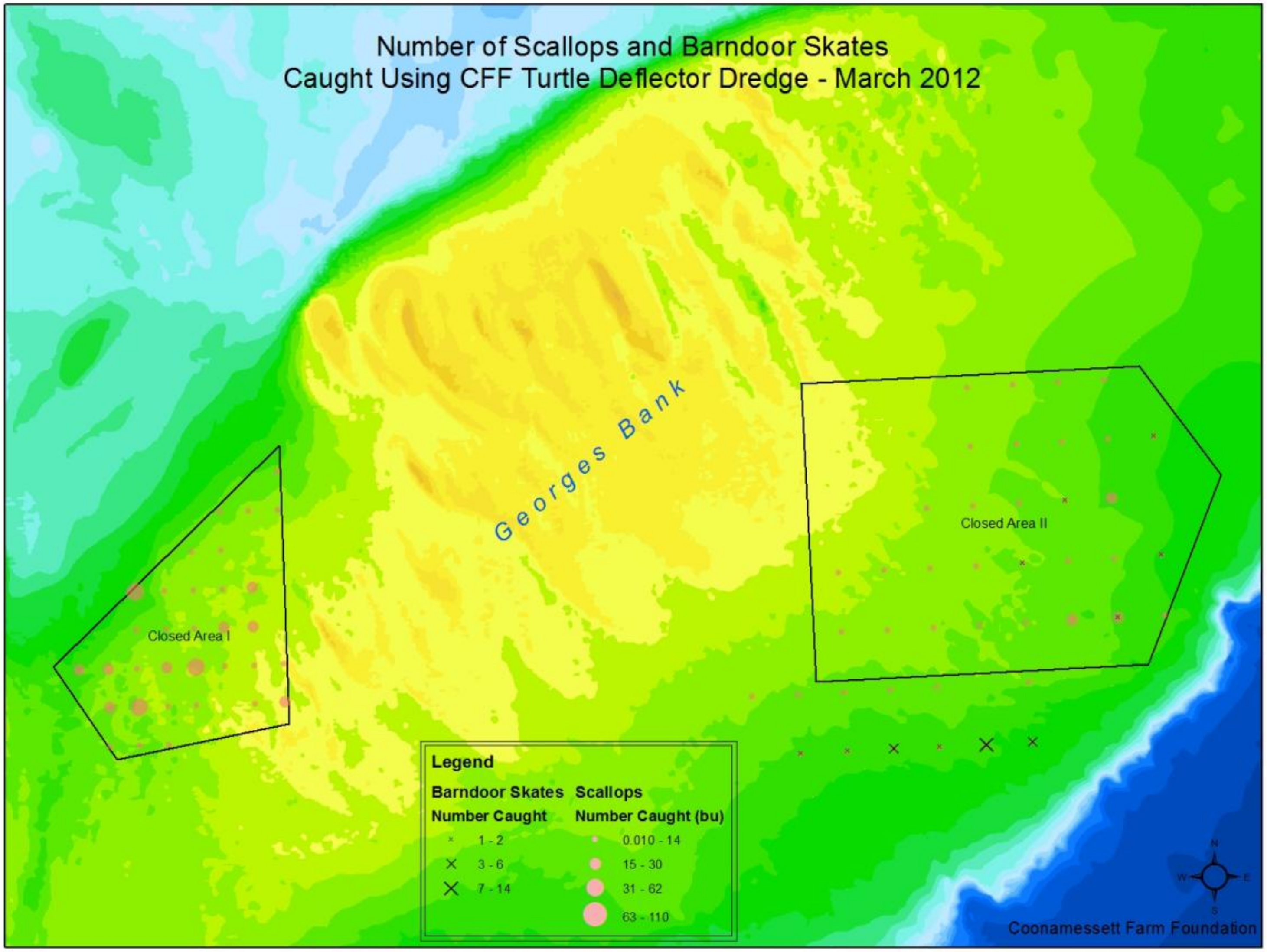




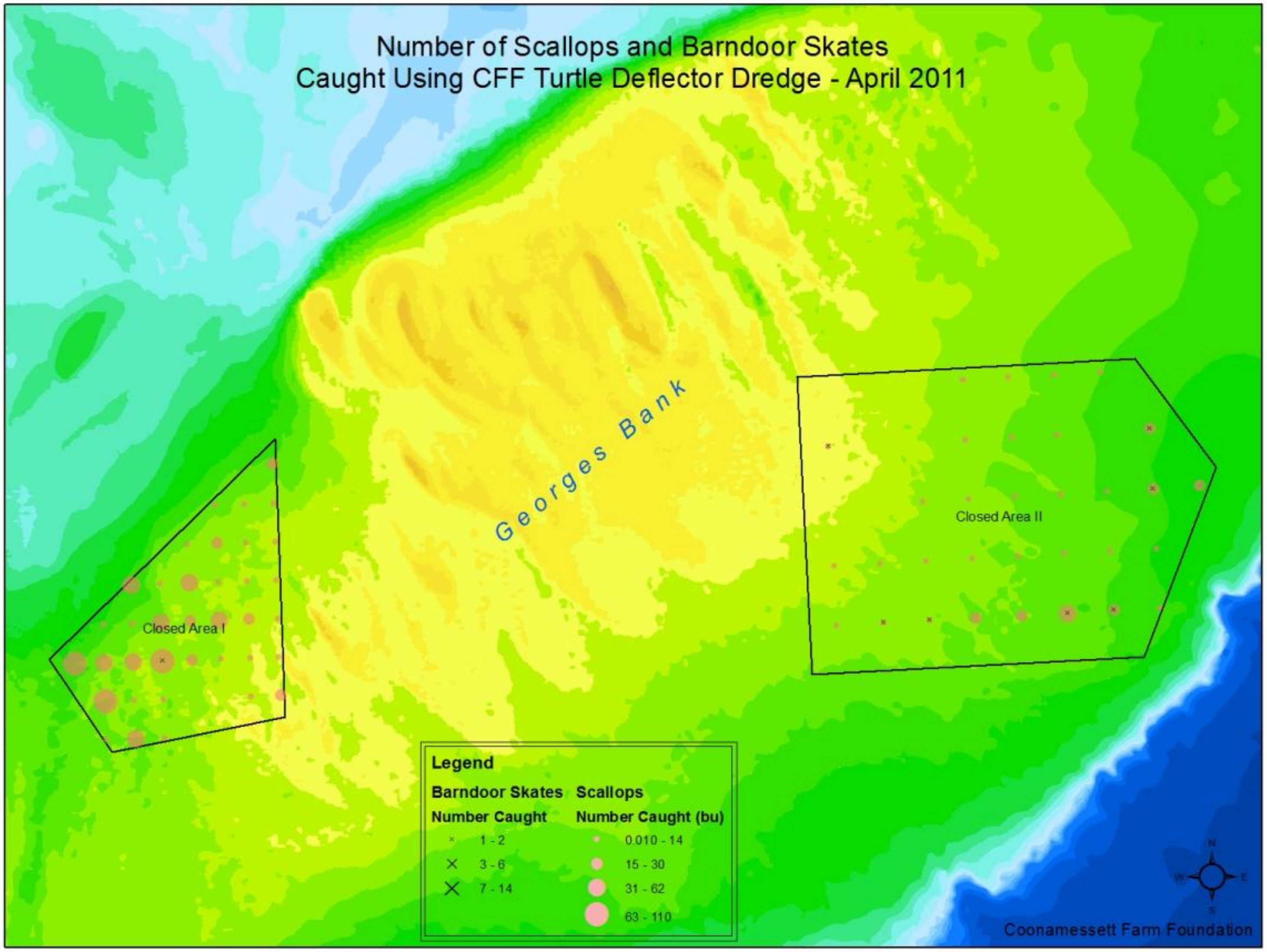
Number of Scallops and Barndoor Skates
Caught Using CFF Turtle Deflector Dredge - February 2012
Georges Bank
Closed Area I
Closed Area II
Legend
Barndoor Skates
Number Caught
1 - 2
3 - 6
7 - 14
Scallops
Number Caught (bu)
0.010 - 14
15 - 30
31 - 62
63 - 110
N
S
E
W
Coonamessett Farm Foundation

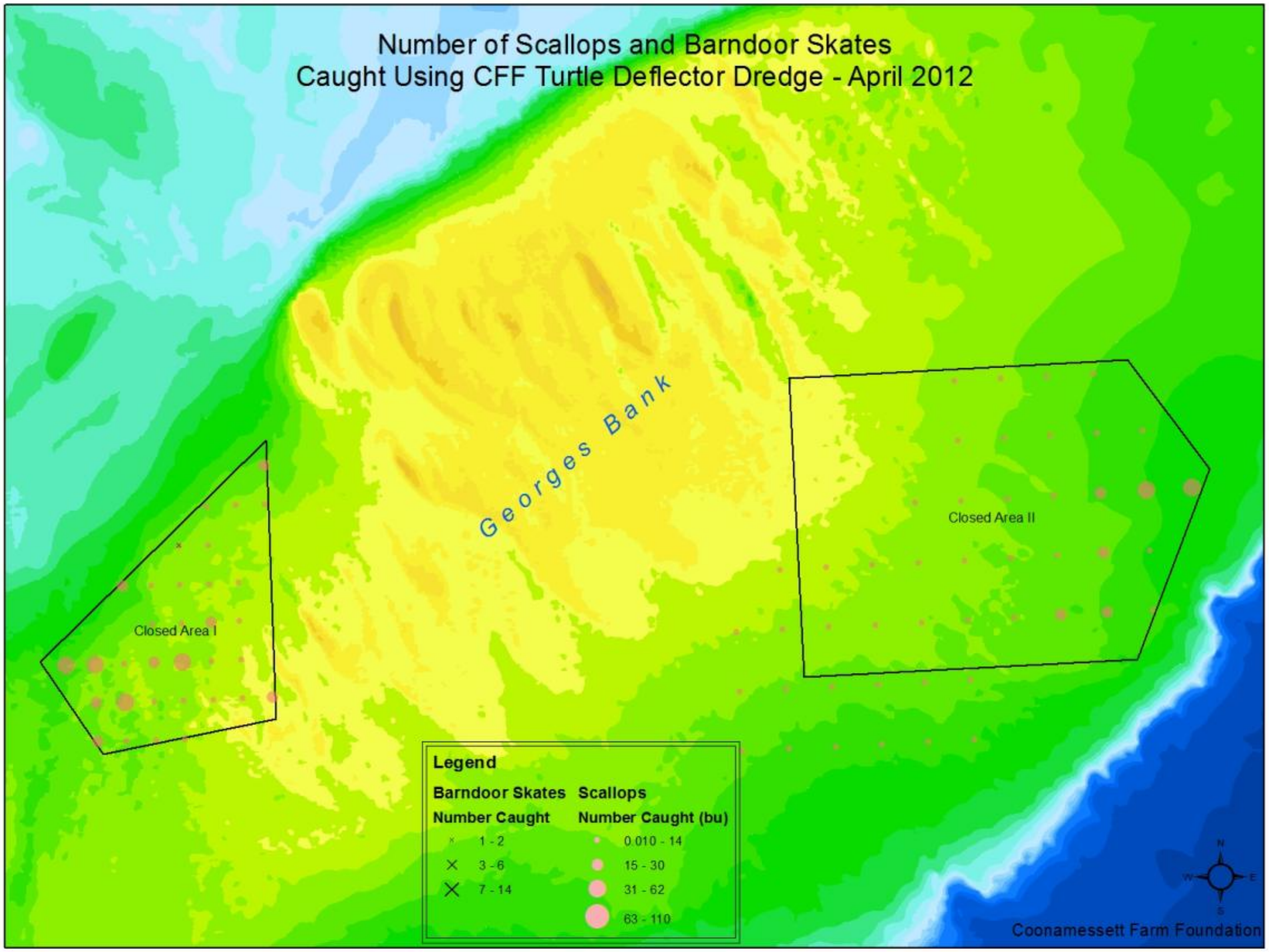


Number of Scallops and Barndoor Skates
Caught Using CFF Turtle Deflector Dredge - March 2011
Georges Bank
Closed Area I
Closed Area II
Legend
Barndoor Skates
Number Caught
1 - 2
3 - 6
7 - 14
Scallops
Number Caught (bu)
0.010 - 14
15 - 30
31 - 62
63 - 110
Coonamessett Farm Foundation

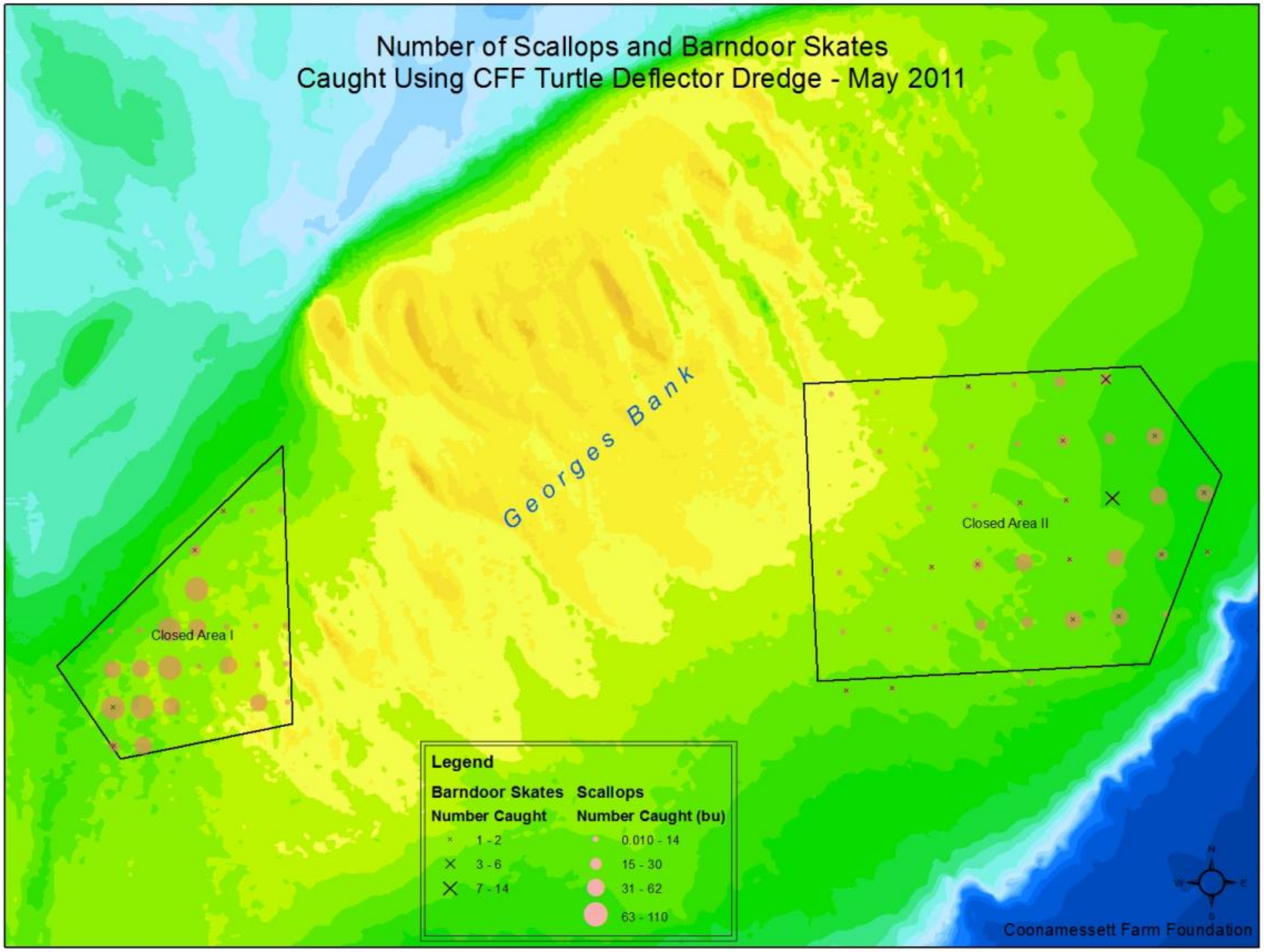


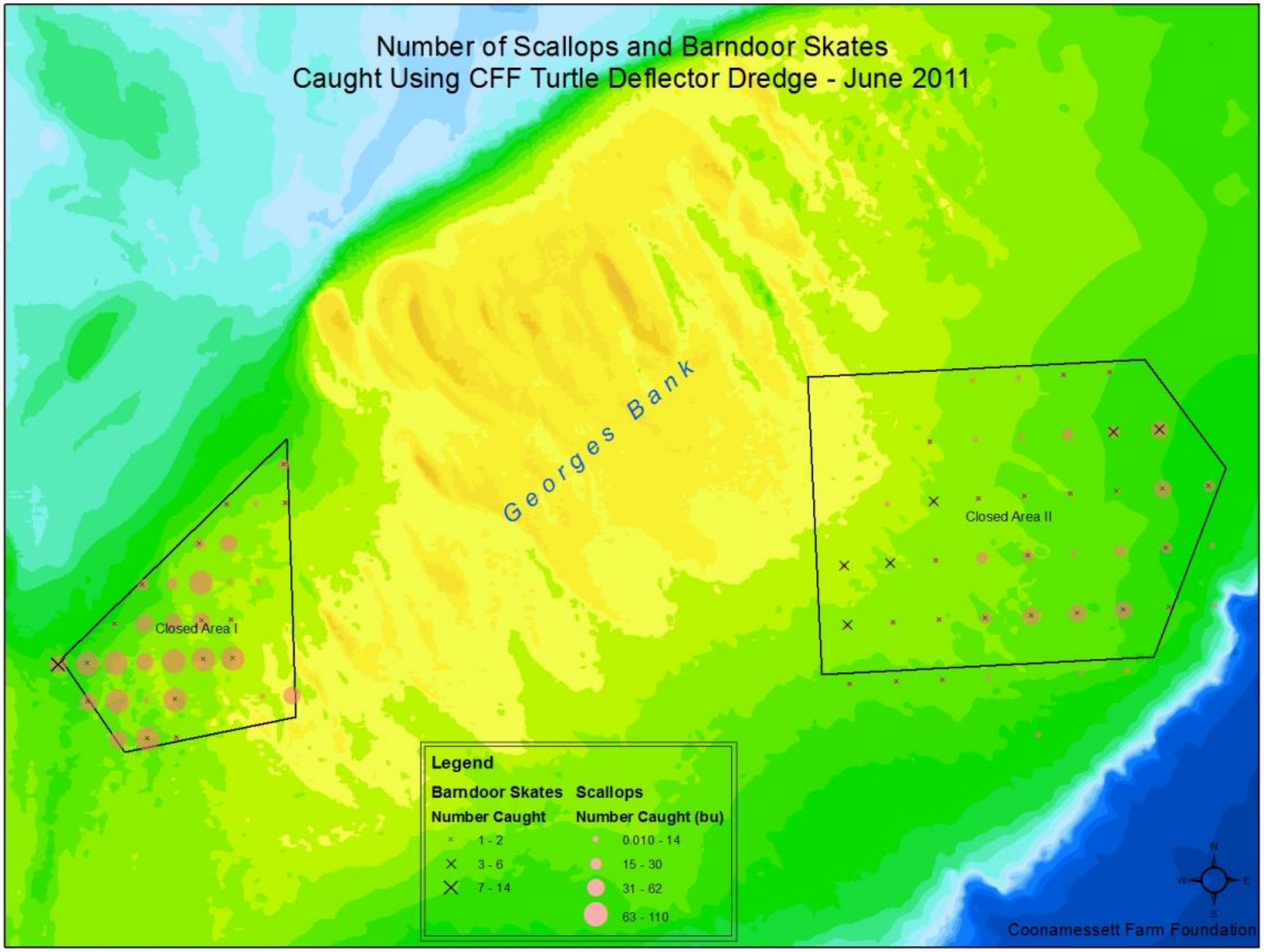
Number of Scallops and Barndoor Skates
Caught Using CFF Turtle Deflector Dredge - March 2012
Georges Bank
Closed Area I
Closed Area II
Legend
Barndoor Skates
Number Caught
1 - 2
3 - 6
7 - 14
Scallops
Number Caught (bu)
0.010 - 14
15 - 30
31 - 62
63 - 110
N
W
E
S
Coonamessett Farm Foundation

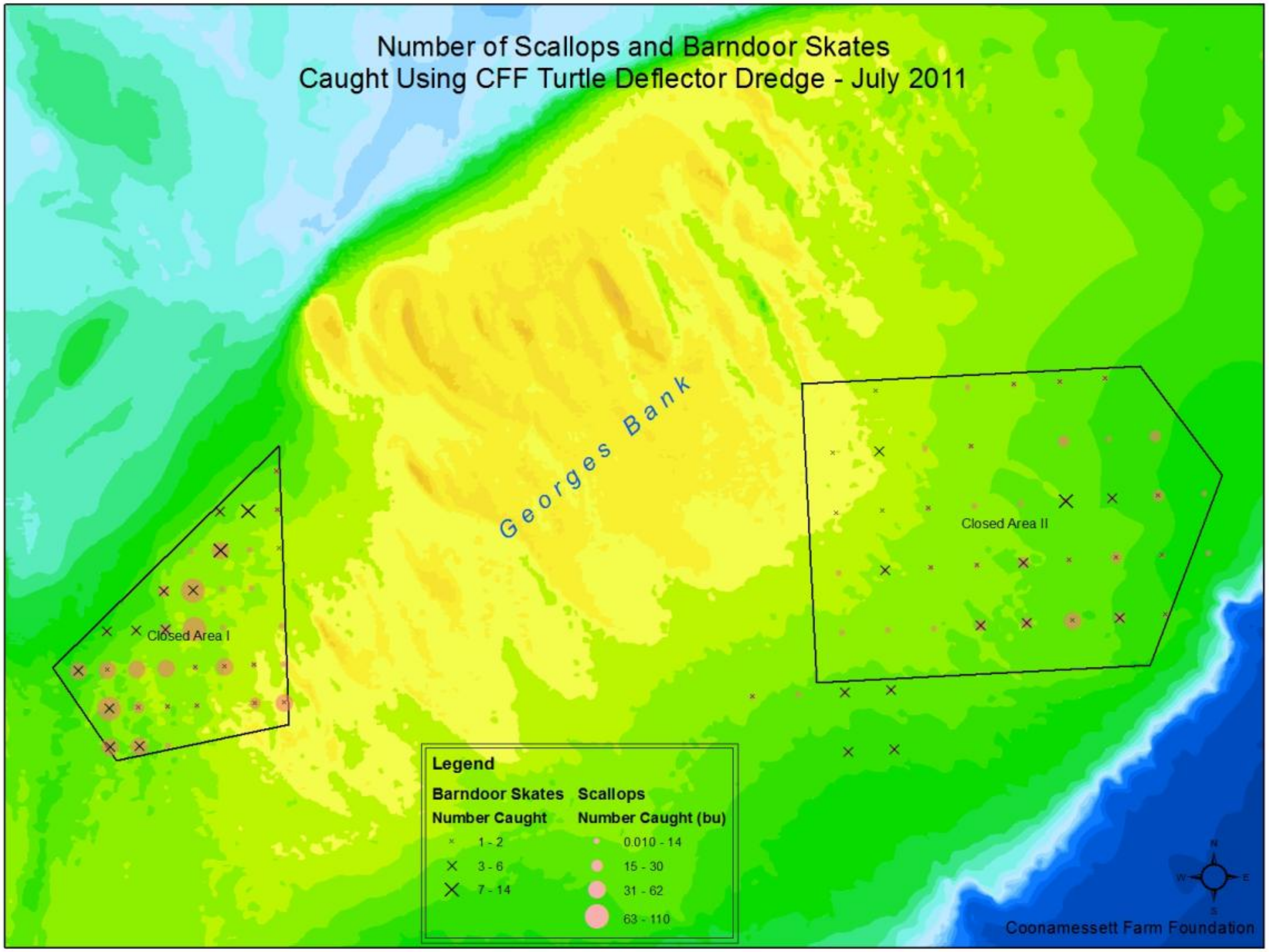

Number of Scallops and Barndoor Skates
Caught Using CFF Turtle Deflector Dredge - April 2011
Georges Bank
Closed Area I
Closed Area II
Legend
Barndoor Skates
Number Caught
1 - 2
3 - 6
7 - 14
Scallops
Number Caught (bu)
0.010 - 14
15 - 30
31 - 62
63 - 110
N
W
E
S
Coonamessett Farm Foundation



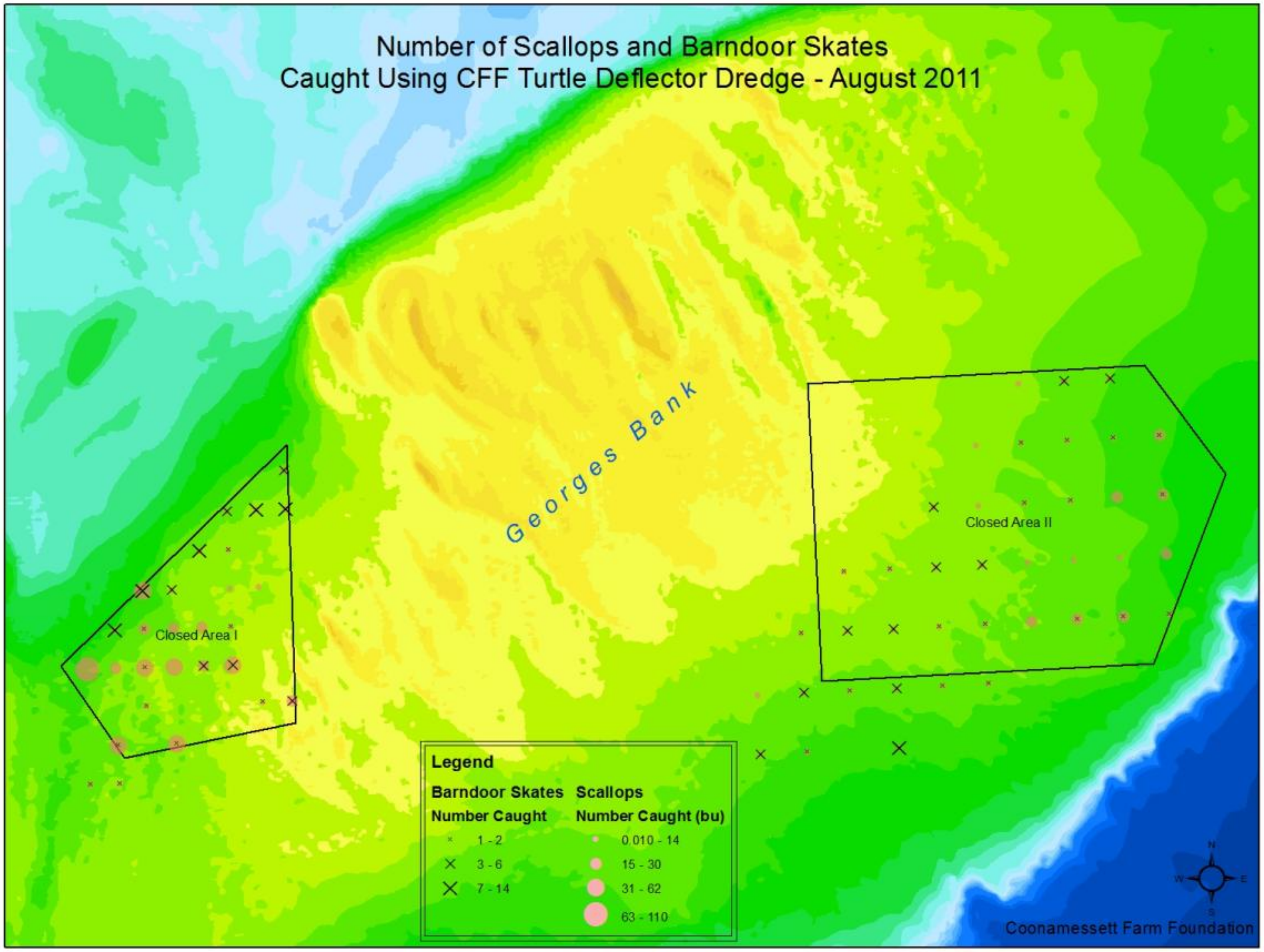
Number of Scallops and Barndoor Skates
Caught Using CFF Turtle Deflector Dredge - April 2012
Georges Bank
Closed Area I
Closed Area II
Legend
Barndoor Skates
Number Caught
1 - 2
3 - 6
7 - 14
Scallops
Number Caught (bu)
0.010 - 14
15 - 30
31 - 62
63 - 110
N
W
E
S
Coonamessett Farm Foundation

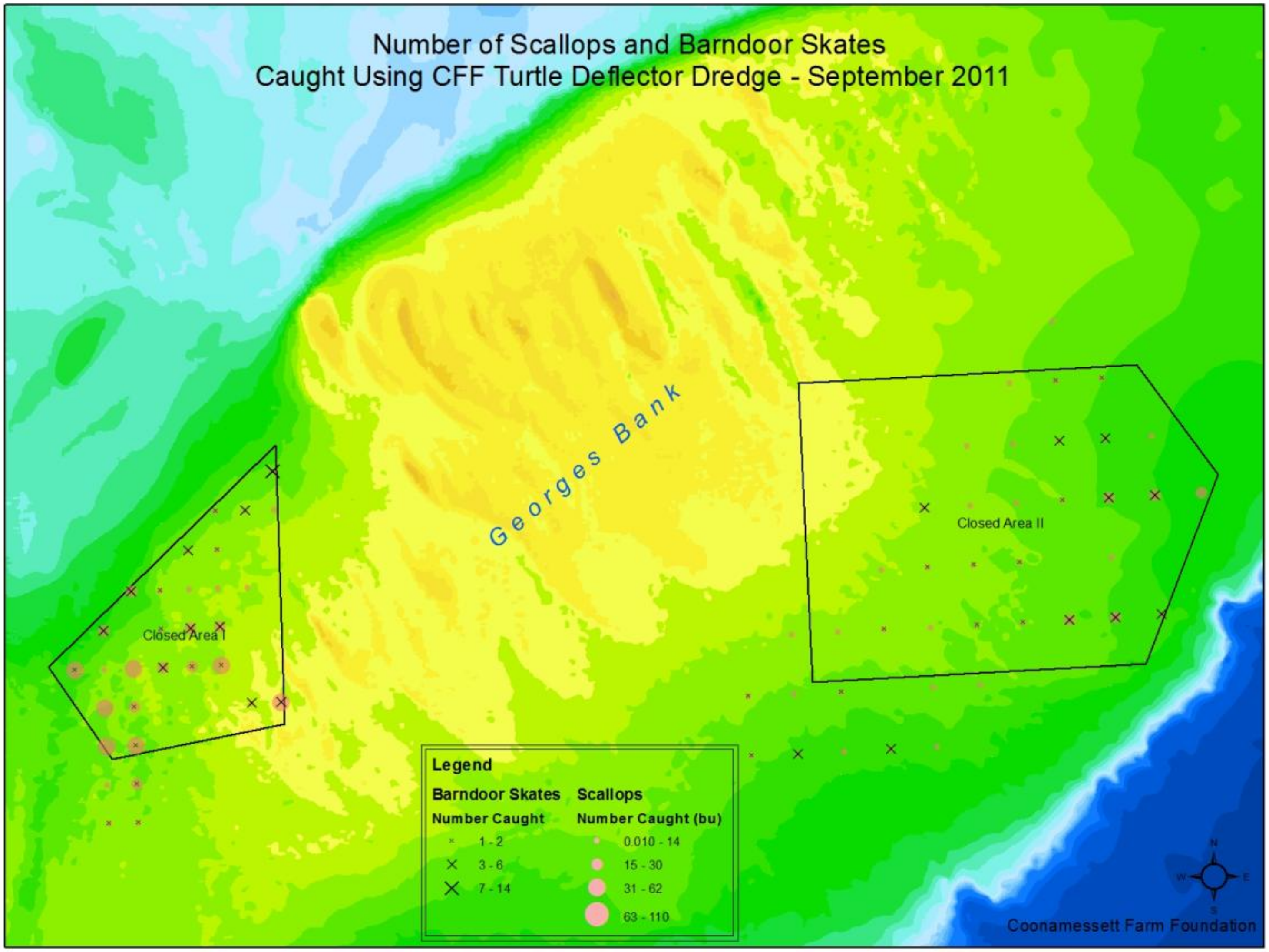

Number of Scallops and Barndoor Skates
Caught Using CFF Turtle Deflector Dredge - May 2011
Georges Bank
Closed Area I
Closed Area II
Legend
Barndoor Skates
Number Caught
1 - 2
3 - 6
7 - 14
Scallops
Number Caught (bu)
0.010 - 14
15 - 30
31 - 62
63 - 110
Coonamessett Farm Foundation

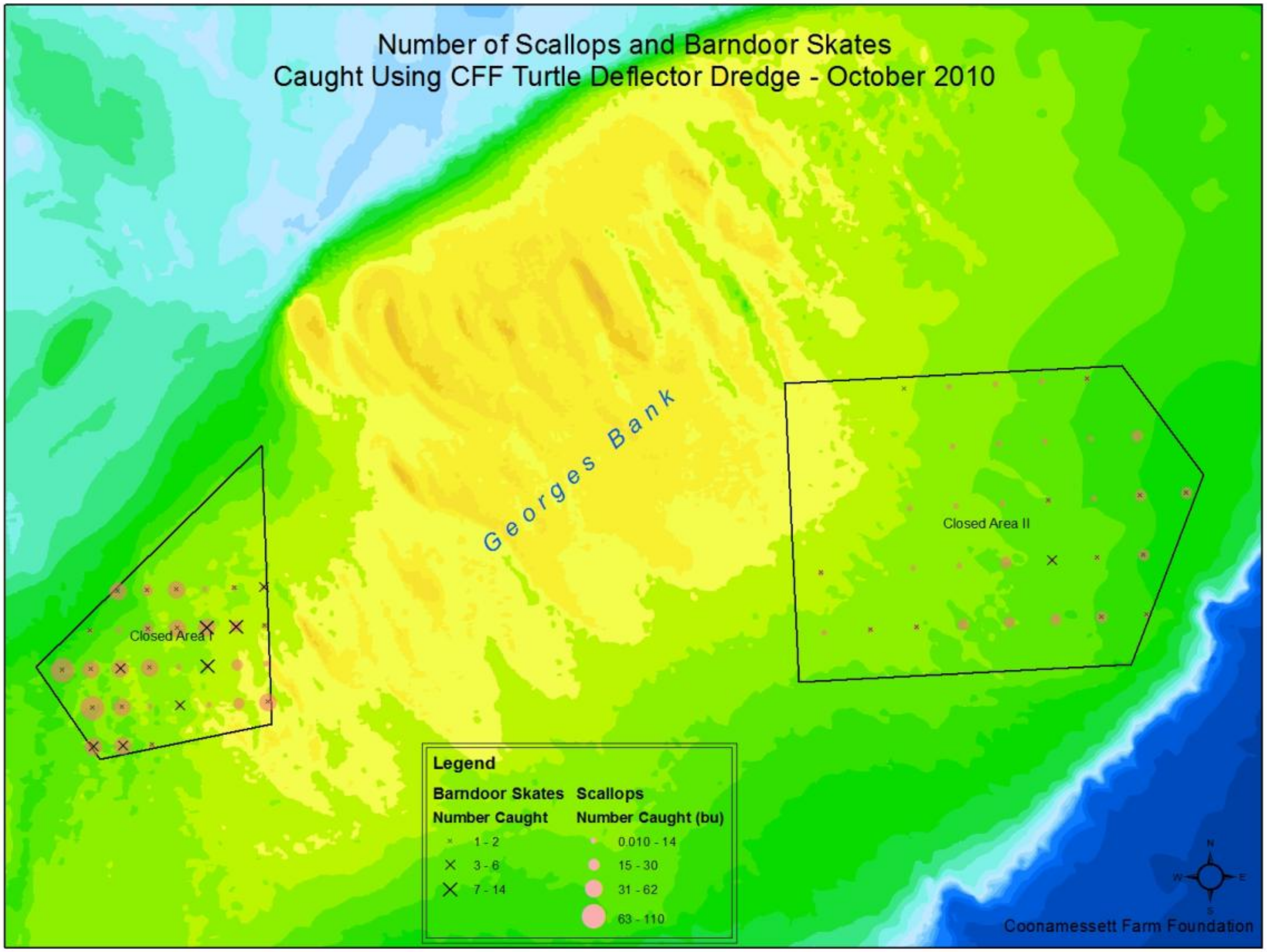

Number of Scallops and Barndoor Skates
Caught Using CFF Turtle Deflector Dredge - June 2011
Georges Bank
Closed Area I
Closed Area II
Legend
Barndoor Skates
Number Caught
1 - 2
3 - 6
7 - 14
Scallops
Number Caught (bu)
0.010 - 14
15 - 30
31 - 62
63 - 110
N
W
E
S
Coonamessett Farm Foundation



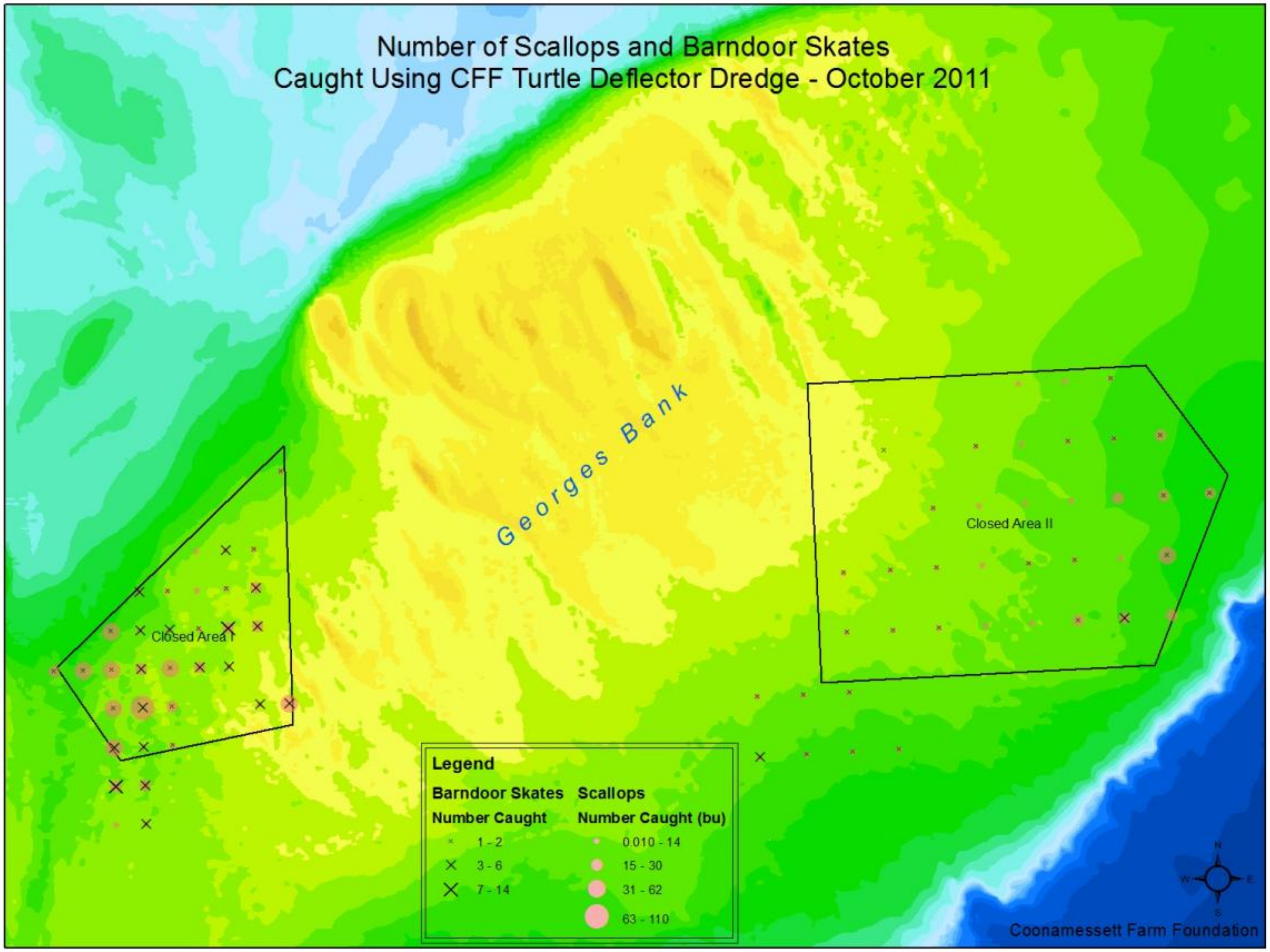
Number of Scallops and Barndoor Skates
Caught Using CFF Turtle Deflector Dredge - July 2011
Georges Bank
Closed Area I
Closed Area II
Legend
Barndoor Skates
Number Caught
1 - 2
3 - 6
7 - 14
Scallops
Number Caught (bu)
0.010 - 14
15 - 30
31 - 62
63 - 110
Coonamessett Farm Foundation

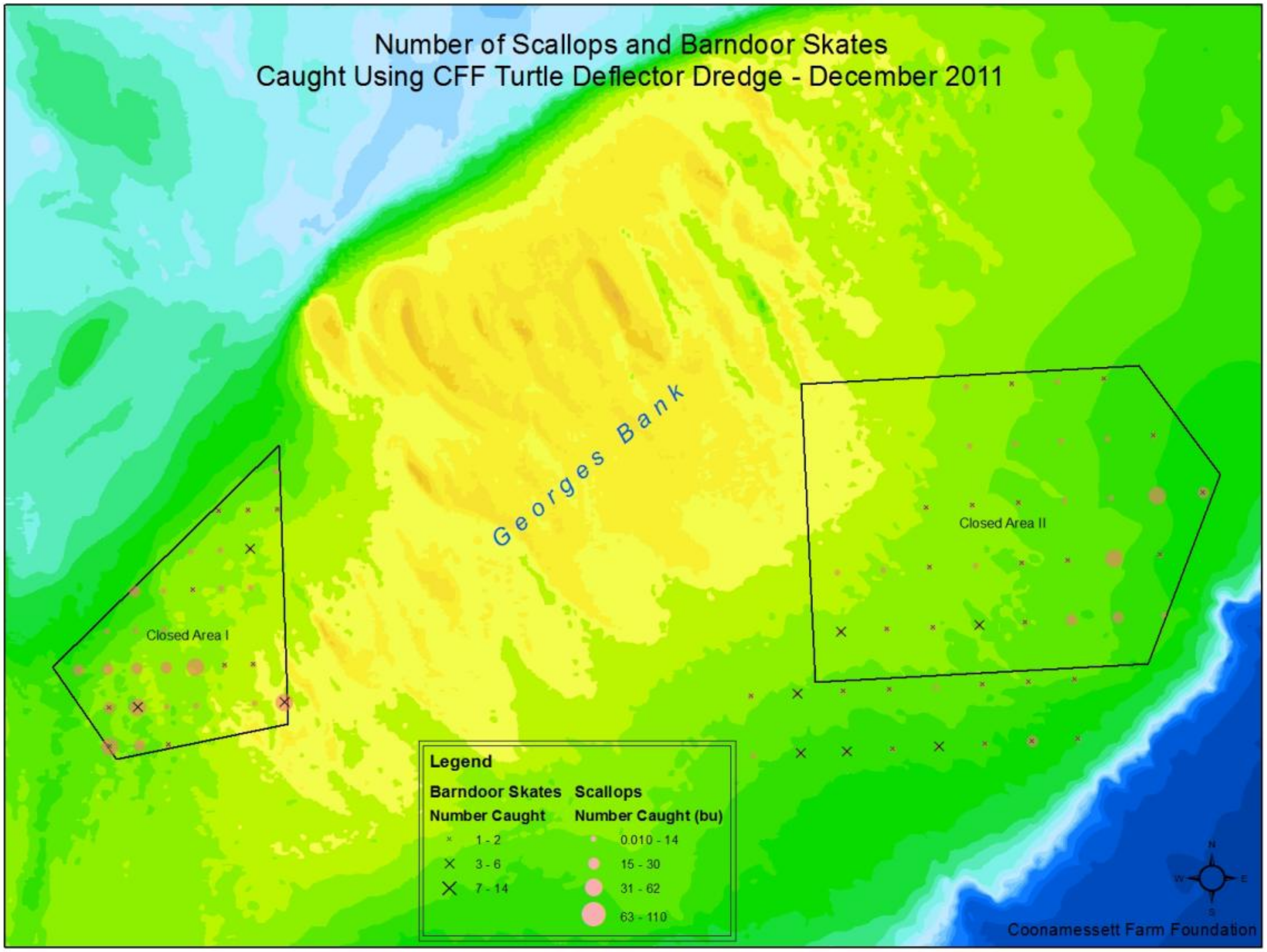

Number of Scallops and Barndoor Skates
Caught Using CFF Turtle Deflector Dredge - August 2011
Georges Bank
Closed Area I
Closed Area II
Legend
Barndoor Skates
Number Caught
1 - 2
3 - 6
7 - 14
Scallops
Number Caught (bu)
0.010 - 14
15 - 30
31 - 62
63 - 110
Coonamessett Farm Foundation


Number of Scallops and Barndoor Skates
Caught Using CFF Turtle Deflector Dredge - September 2011
Georges Bank
Closed Area I
Closed Area II
Legend
Barndoor Skates
Number Caught
1 - 2
3 - 6
7 - 14
Scallops
Number Caught (bu)
0.010 - 14
15 - 30
31 - 62
63 - 110
Coonamessett Farm Foundation

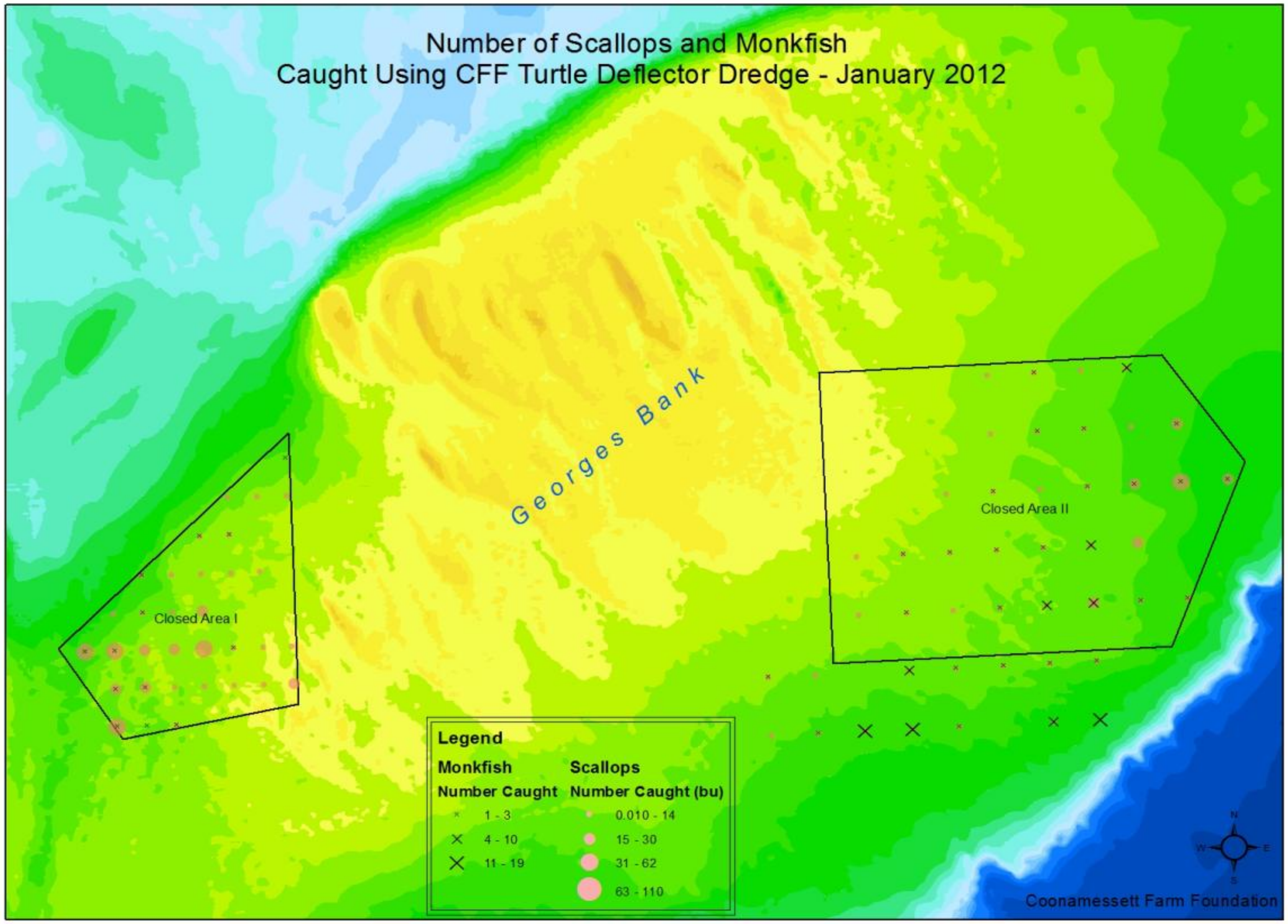


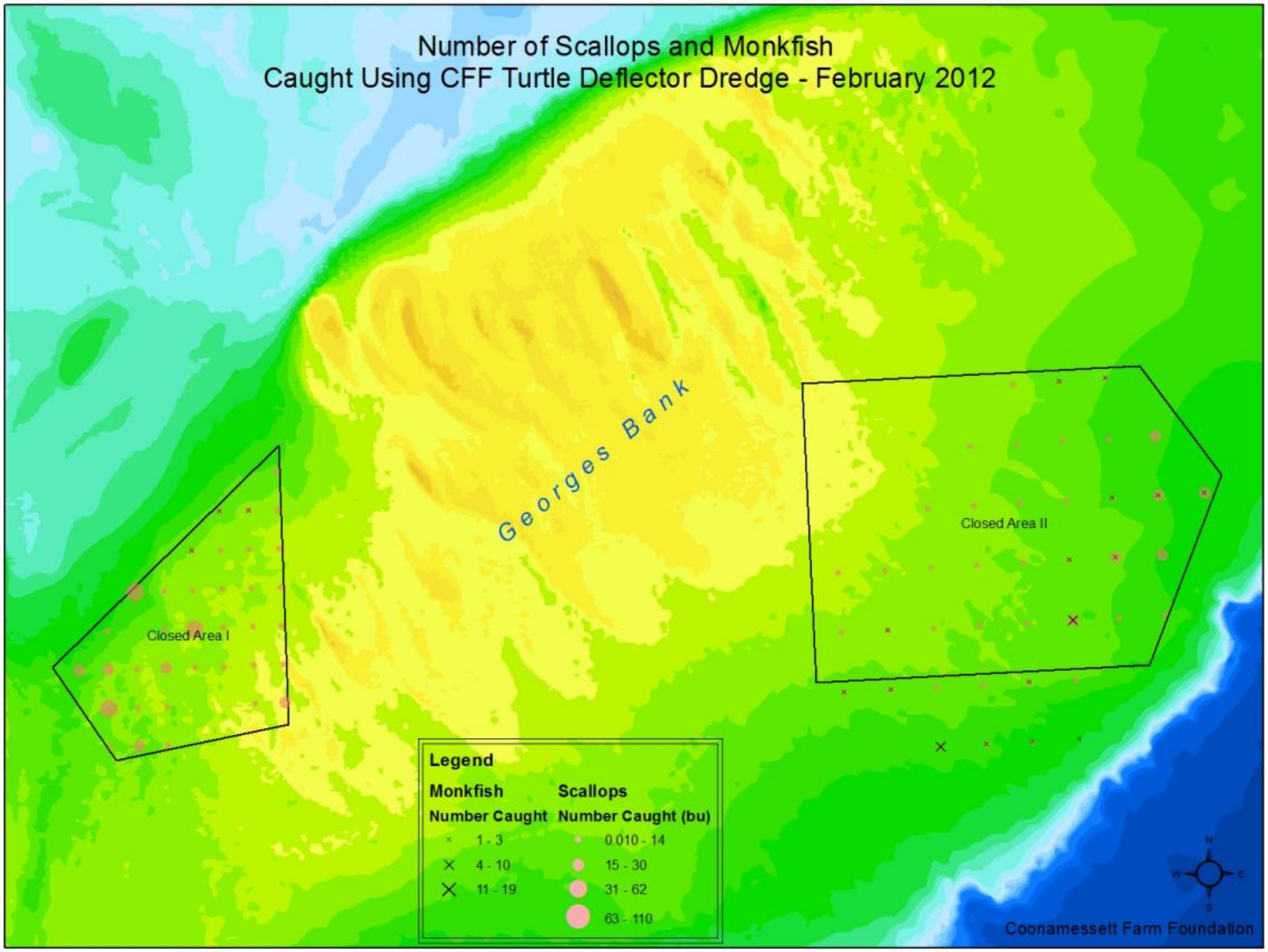
Number of Scallops and Barndoor Skates
Caught Using CFF Turtle Deflector Dredge - October 2010
Georges Bank
Closed Area I
Closed Area II
Legend
Barndoor Skates
Number Caught
1 - 2
3 - 6
7 - 14
Scallops
Number Caught (bu)
0.010 - 14
15 - 30
31 - 62
63 - 110
N
W
E
S
Coonamessett Farm Foundation

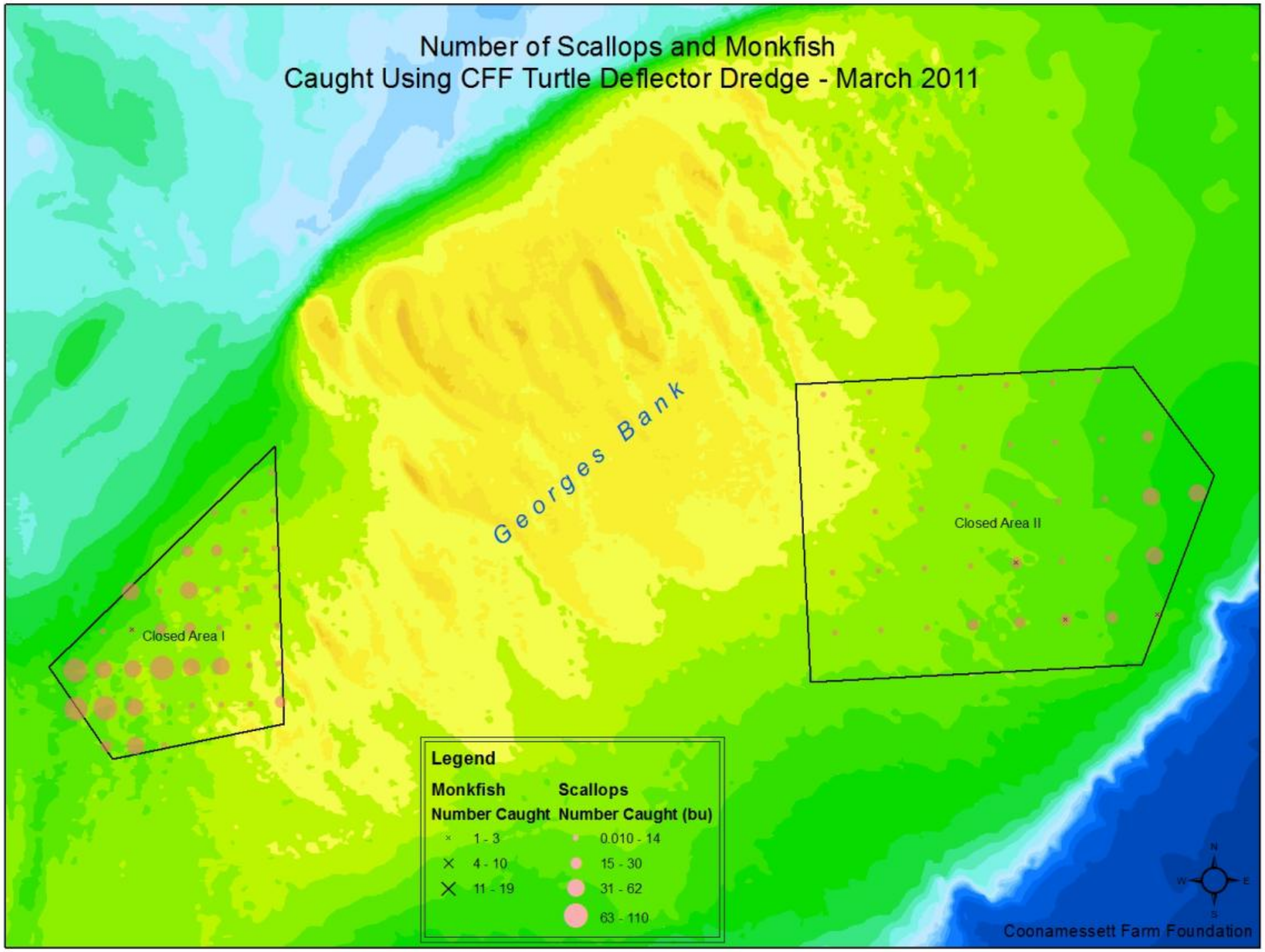

Number of Scallops and Barndoor Skates
Caught Using CFF Turtle Deflector Dredge - October 2011
Georges Bank
Closed Area I
Closed Area II
Legend
Barndoor Skates
Number Caught
1 - 2
3 - 6
7 - 14
Scallops
Number Caught (bu)
0.010 - 14
15 - 30
31 - 62
63 - 110
Coonamessett Farm Foundation


Number of Scallops and Barndoor Skates
Caught Using CFF Turtle Deflector Dredge - December 2011
Georges Bank
Closed Area I
Closed Area II
Legend
Barndoor Skates
Number Caught
1 - 2
3 - 6
7 - 14
Scallops
Number Caught (bu)
0.010 - 14
15 - 30
31 - 62
63 - 110
Coonamessett Farm Foundation

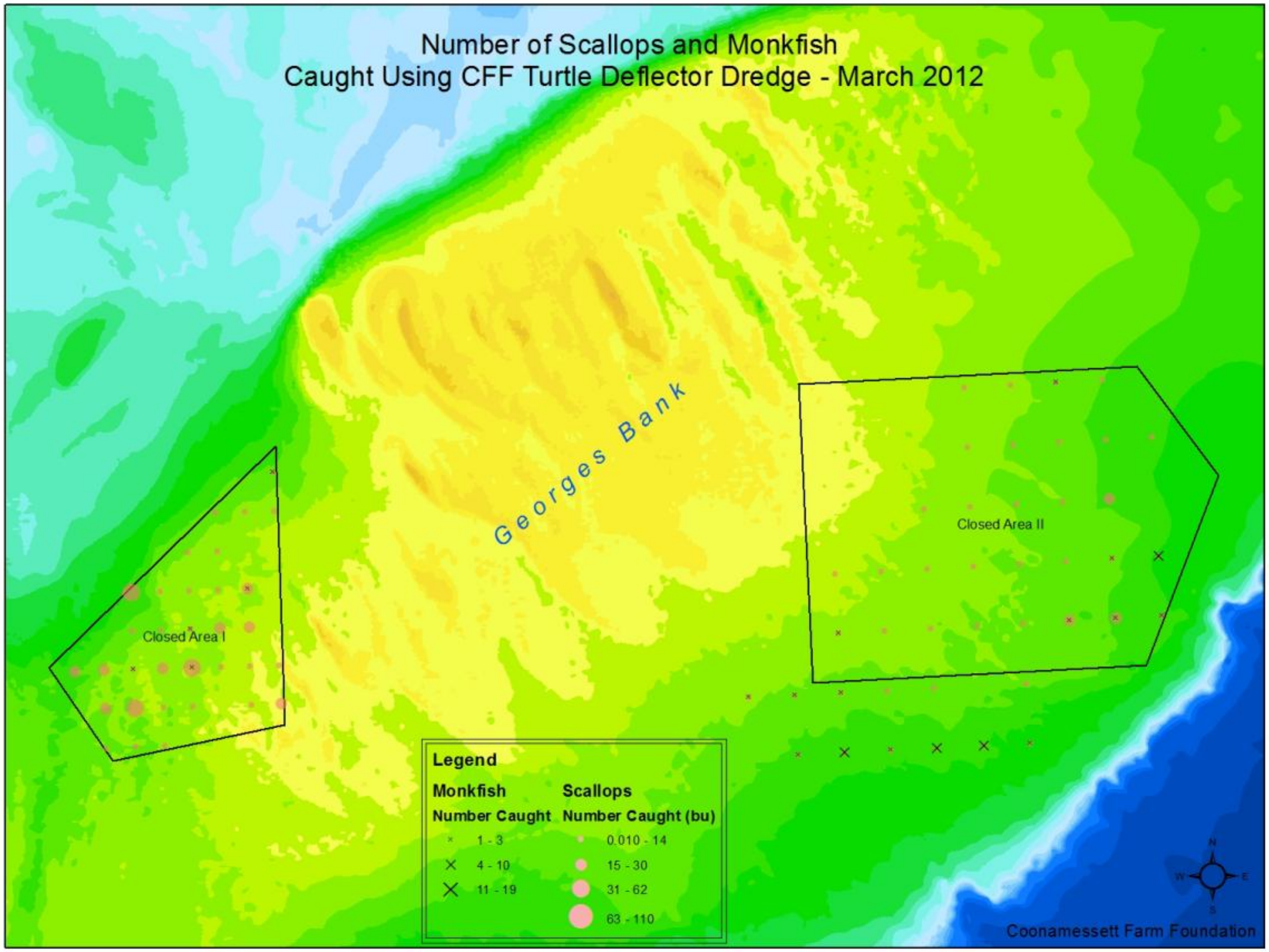
Scallops and Monkfish

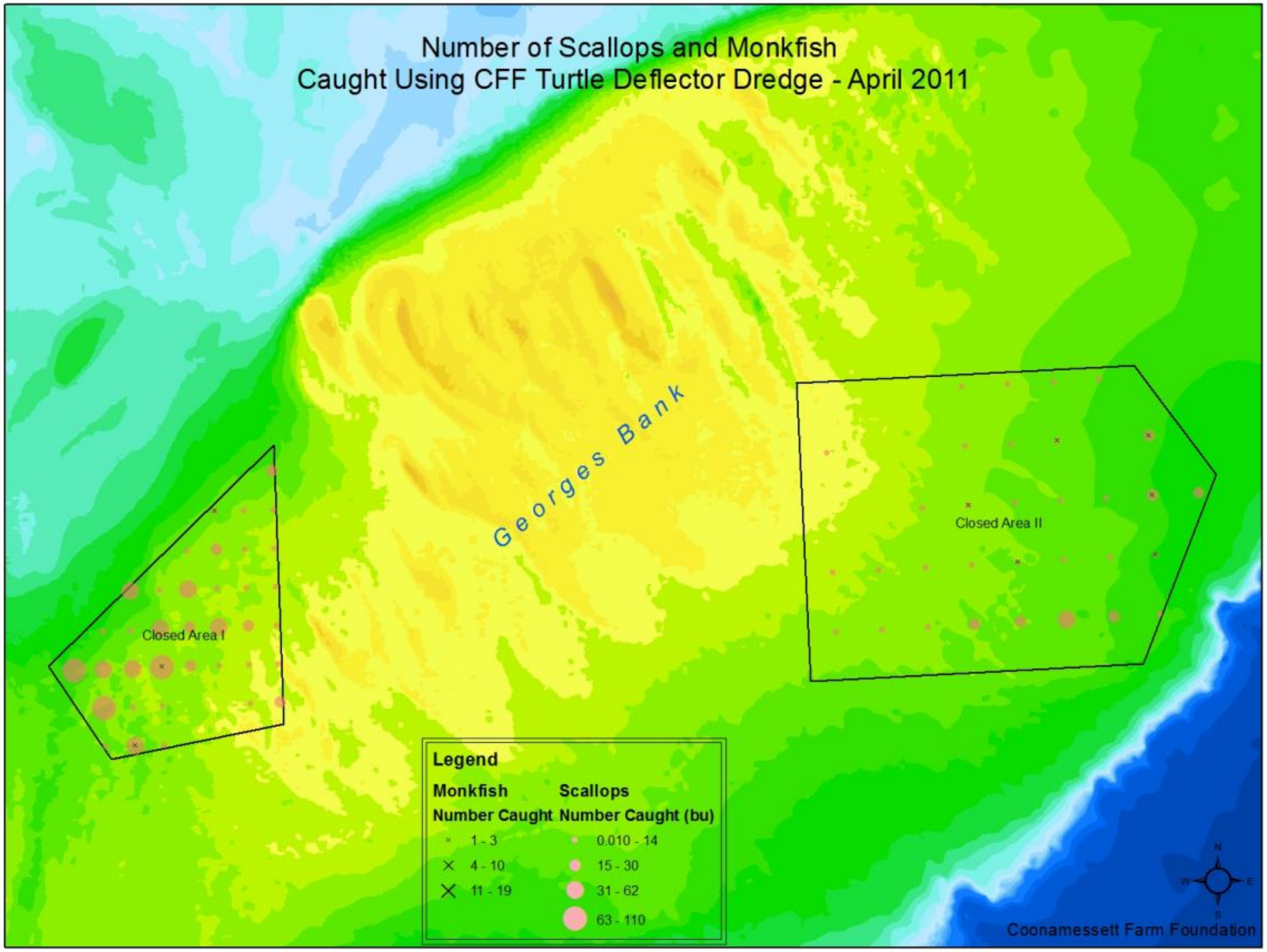


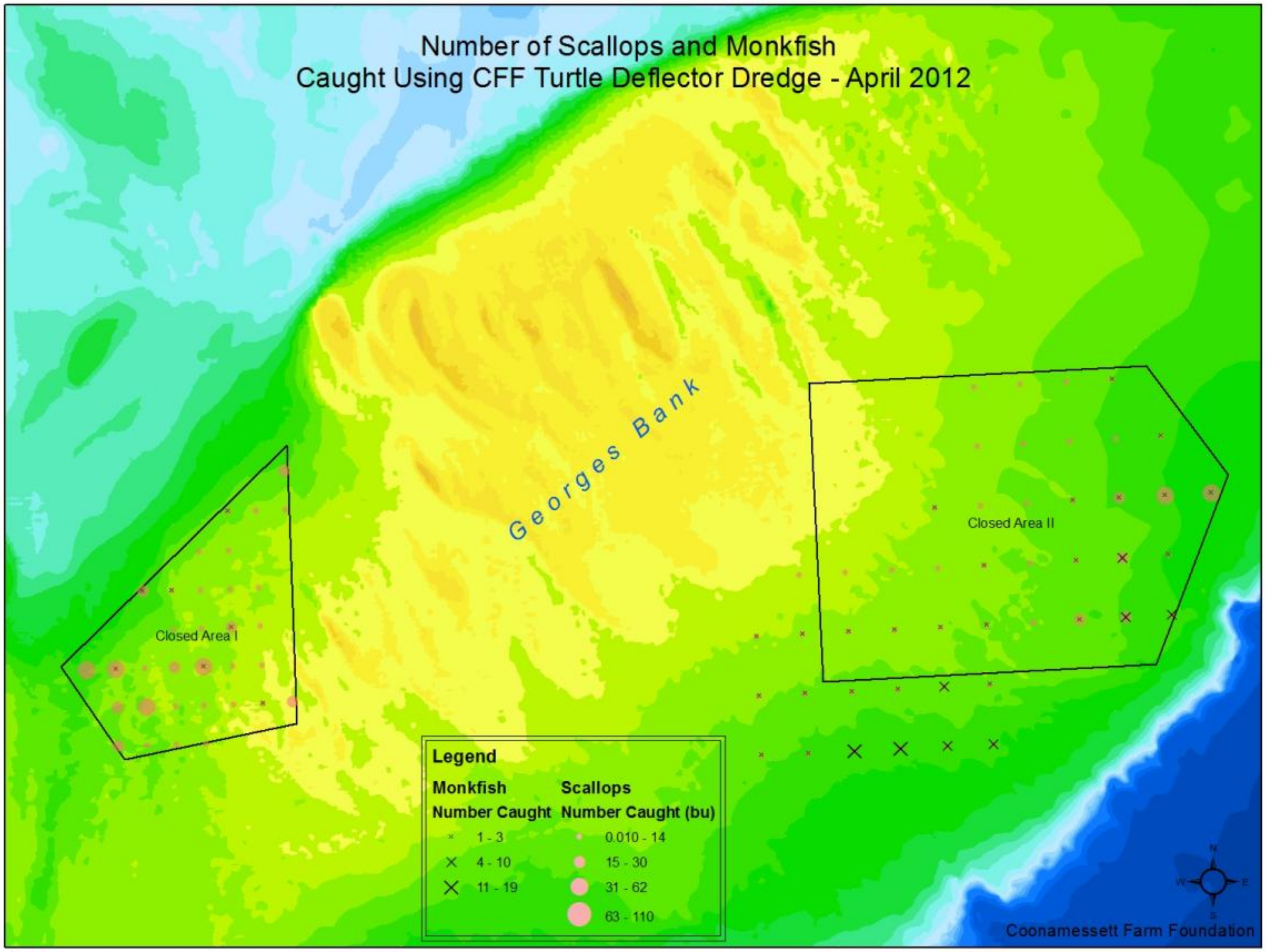

Number of Scallops and Monkfish
Caught Using CFF Turtle Deflector Dredge - February 2012
Georges Bank
Closed Area I
Closed Area II
Legend
Monkfish
Number Caught
1 - 3
4 - 10
11 - 19
Scallops
Number Caught (bu)
0.010 - 14
15 - 30
31 - 62
63 - 110
Coonamessett Farm Foundation

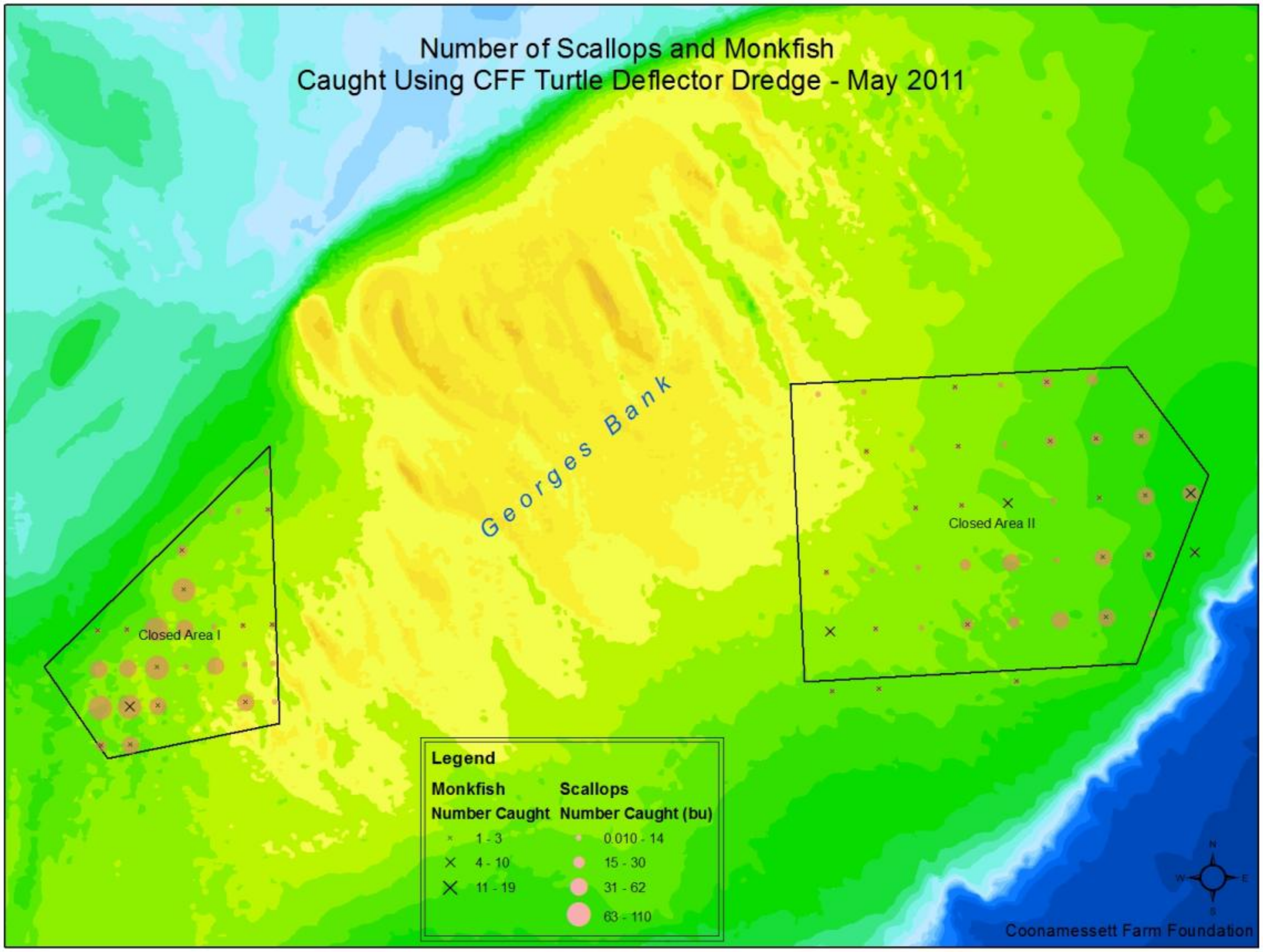


Number of Scallops and Monkfish
Caught Using CFF Turtle Deflector Dredge - March 2011
Georges Bank
Closed Area I
Closed Area II
Legend
Monkfish
Number Caught
1 - 3
4 - 10
11 - 19
Scallops
Number Caught (bu)
0.010 - 14
15 - 30
31 - 62
63 - 110
Coonamessett Farm Foundation

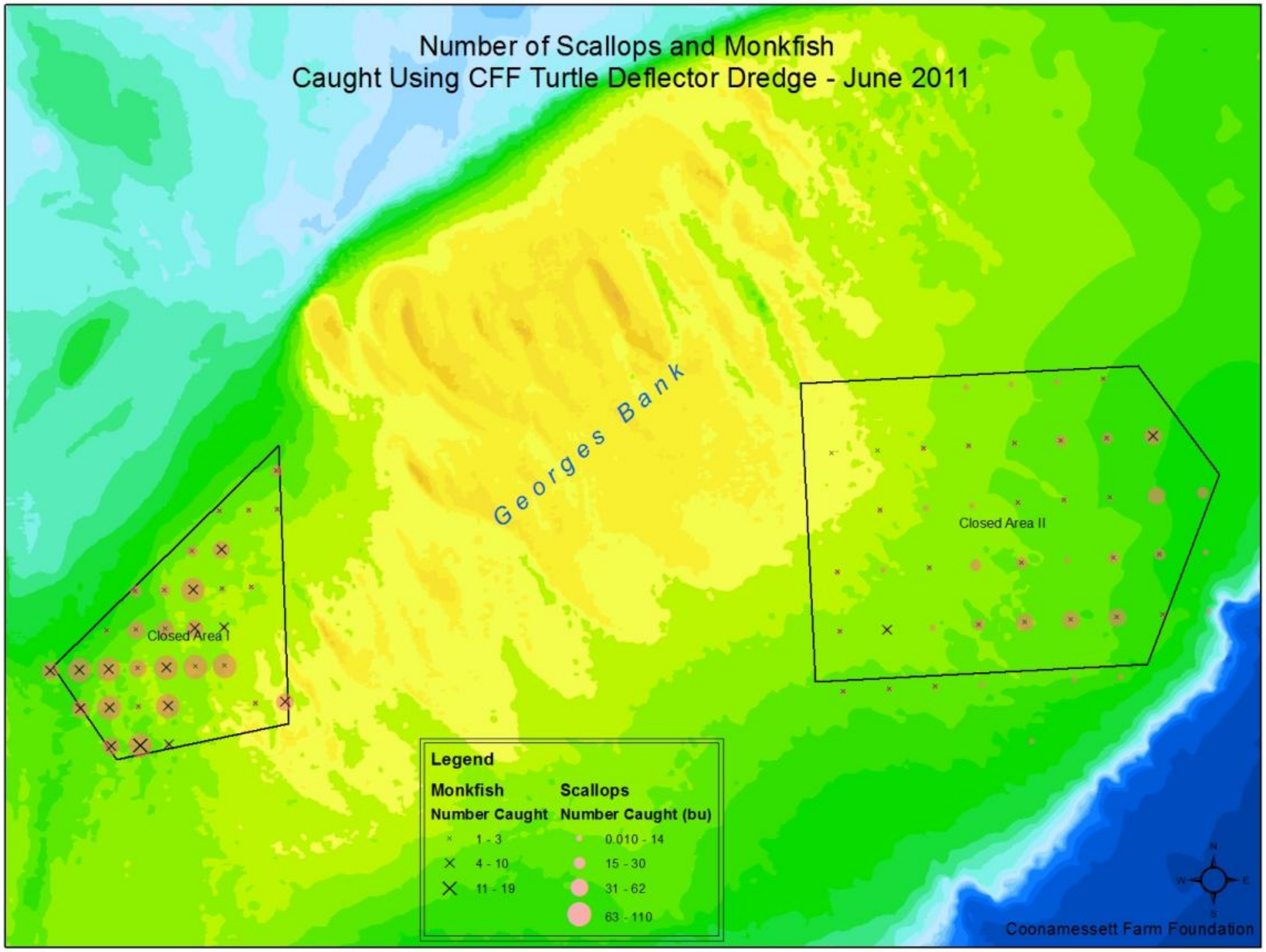

Number of Scallops and Monkfish
Caught Using CFF Turtle Deflector Dredge - March 2012
Georges Bank
Closed Area I
Closed Area II
Legend
Monkfish
Number Caught
1 - 3
4 - 10
11 - 19
Scallops
Number Caught (bu)
0.010 - 14
15 - 30
31 - 62
63 - 110
N
E
S
W
Coonamessett Farm Foundation

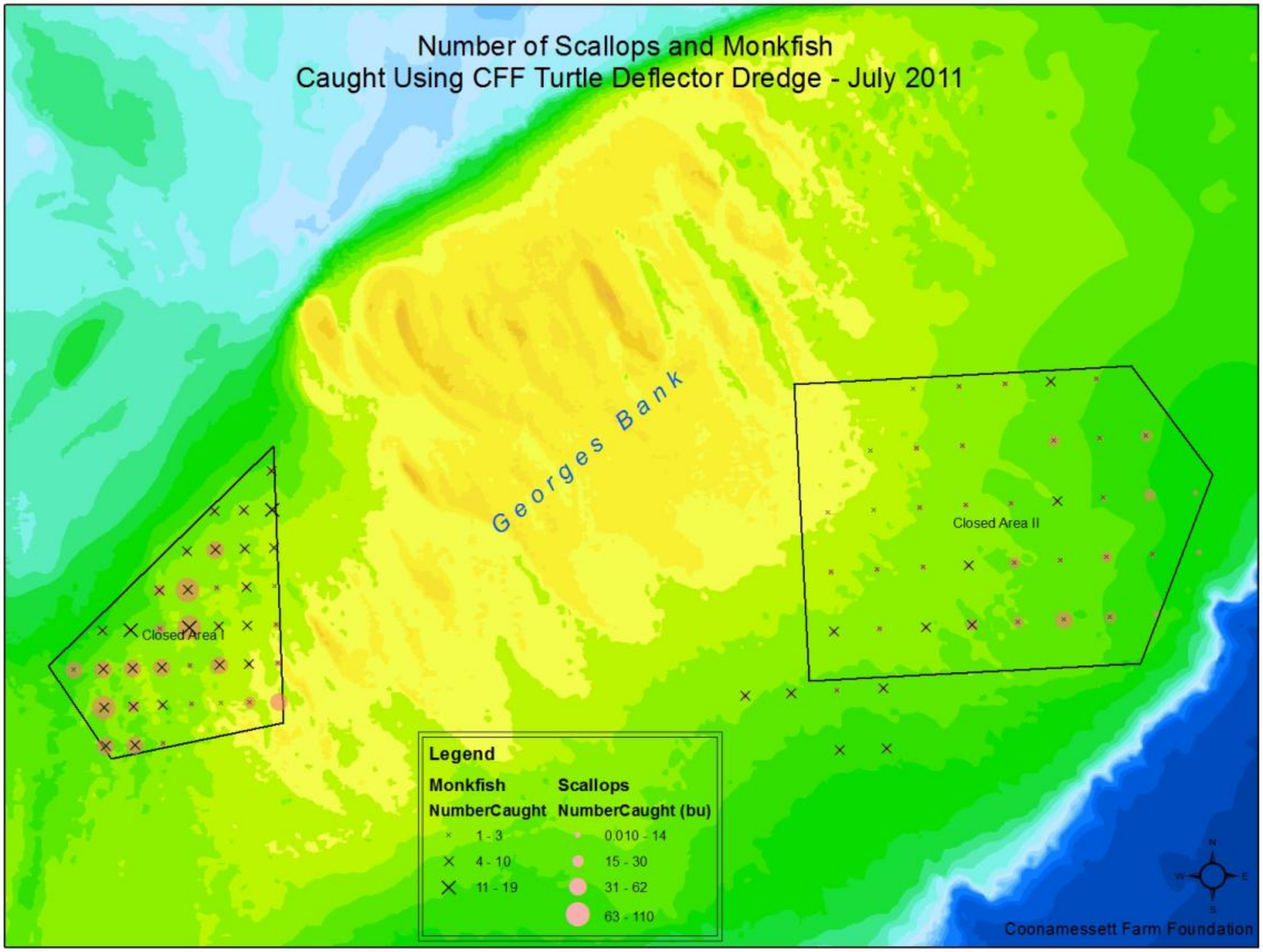

Number of Scallops and Monkfish
Caught Using CFF Turtle Deflector Dredge - April 2011
Georges Bank
Closed Area I
Closed Area II
Legend
Monkfish
Number Caught
1 - 3
4 - 10
11 - 19
Scallops
Number Caught (bu)
0.010 - 14
15 - 30
31 - 62
63 - 110
N
W
E
S
Coonamessett Farm Foundation

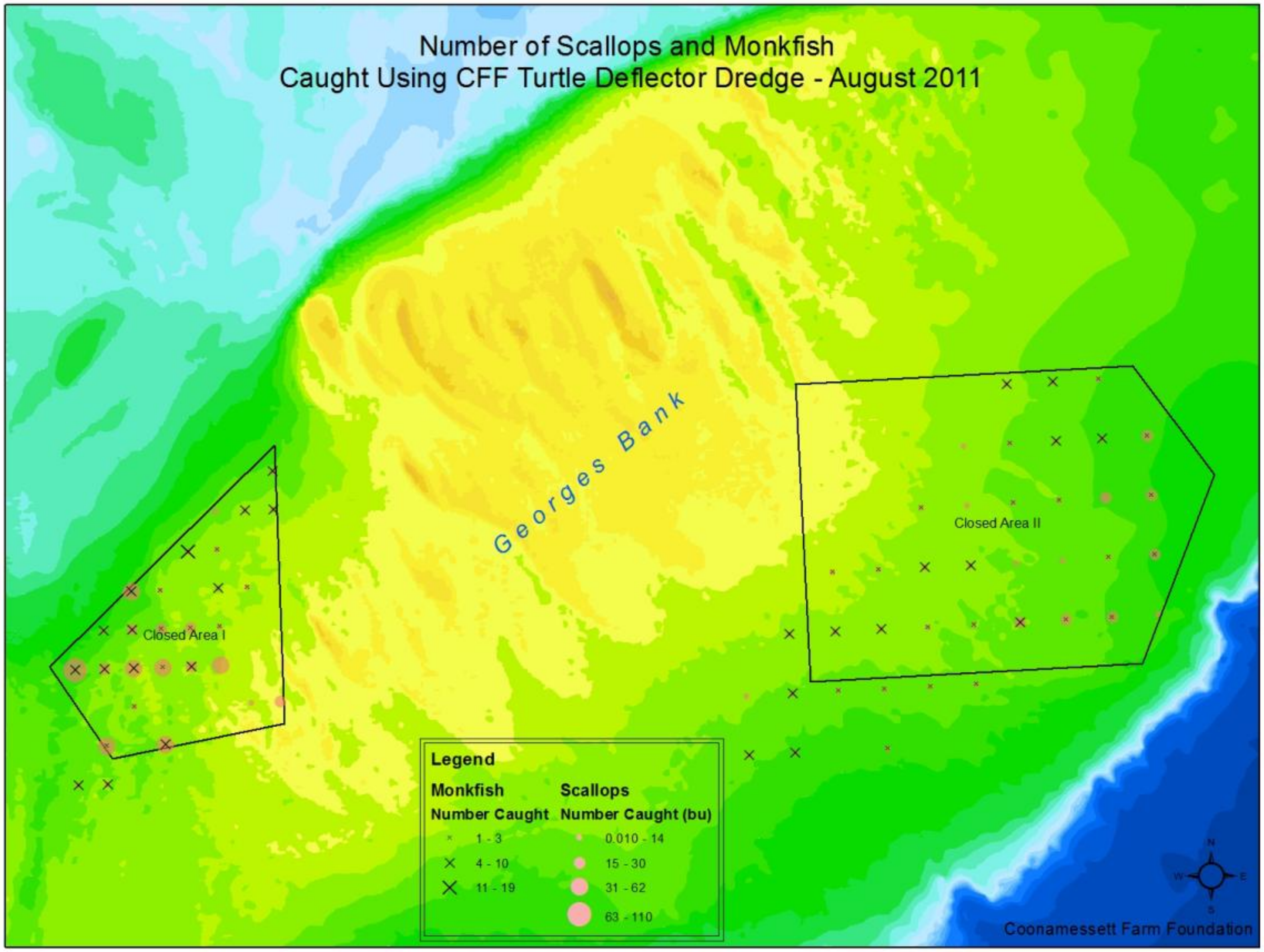

Number of Scallops and Monkfish
Caught Using CFF Turtle Deflector Dredge - April 2012
Georges Bank
Closed Area I
Closed Area II
Legend
Monkfish
Number Caught
1 - 3
4 - 10
11 - 19
Scallops
Number Caught (bu)
0.010 - 14
15 - 30
31 - 62
63 - 110
Coonamessett Farm Foundation

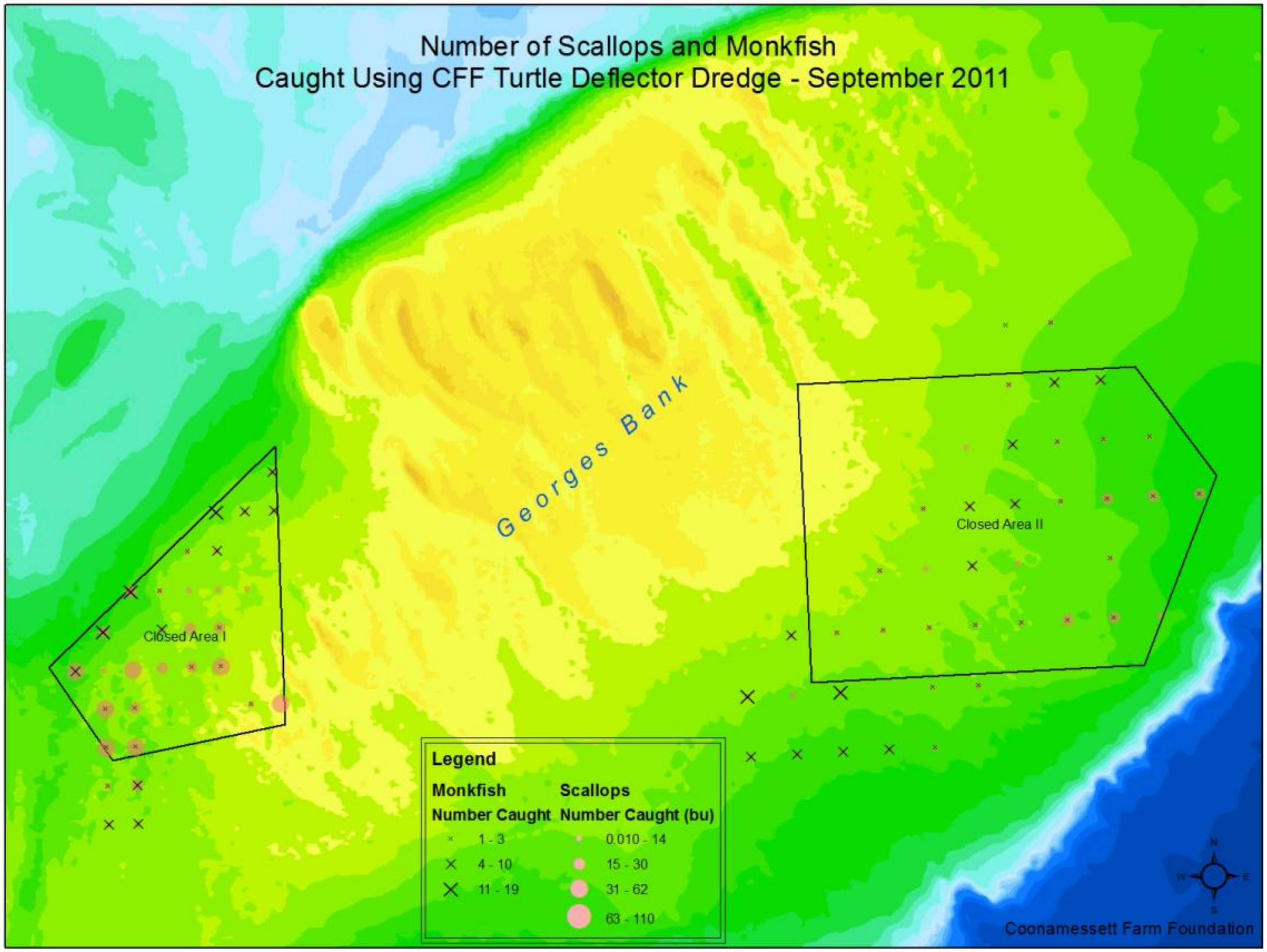


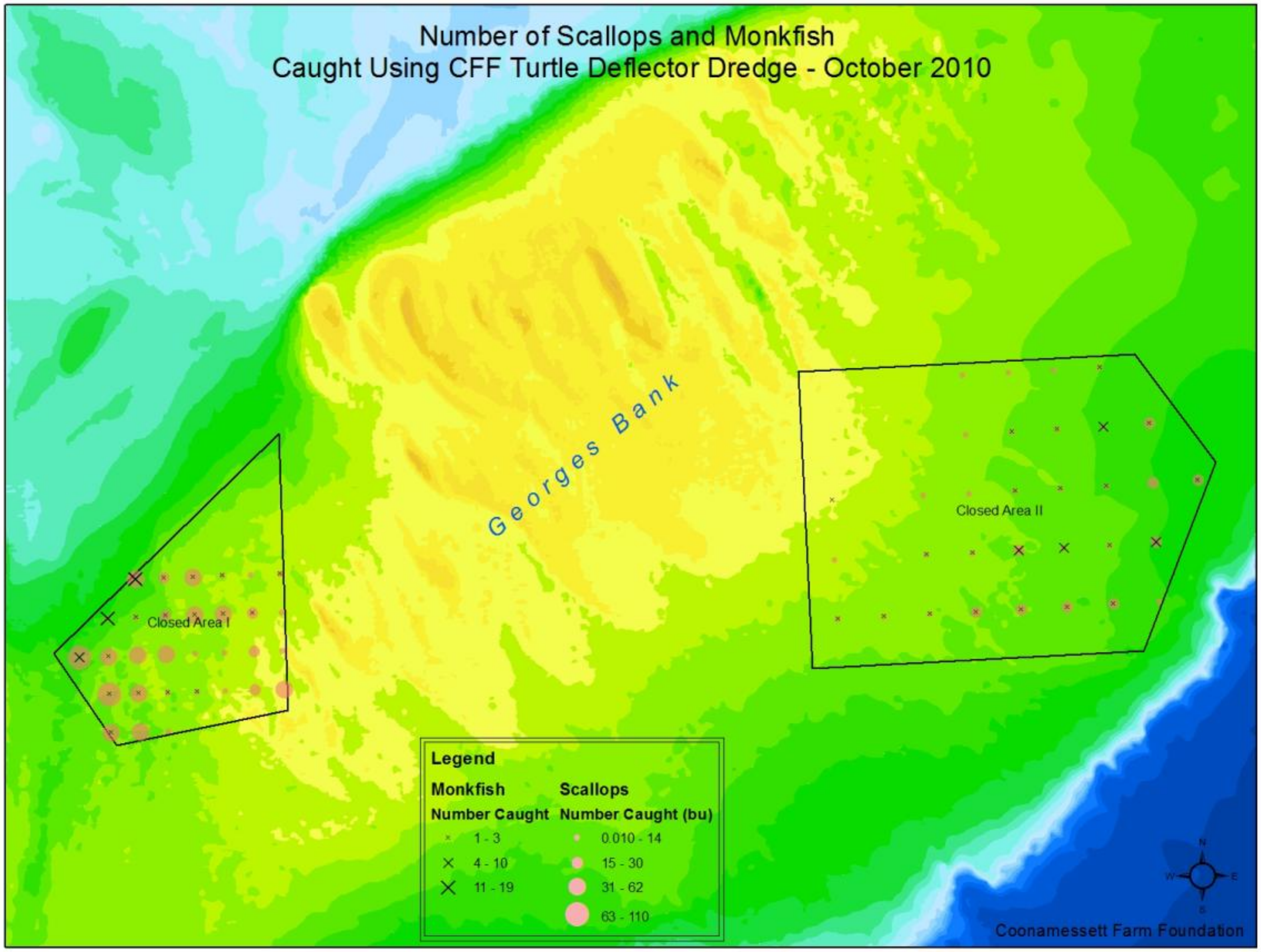
Number of Scallops and Monkfish
Caught Using CFF Turtle Deflector Dredge - May 2011
Georges Bank
Closed Area I
Closed Area II
Legend
Monkfish
Number Caught
1 - 3
4 - 10
11 - 19
Scallops
Number Caught (bu)
0.010 - 14
15 - 30
31 - 62
63 - 110
N
W
E
S
Coonamessett Farm Foundation


Number of Scallops and Monkfish
Caught Using CFF Turtle Deflector Dredge - June 2011
Georges Bank
Closed Area I
Closed Area II
Legend
Monkfish
Number Caught
1 - 3
4 - 10
11 - 19
Scallops
Number Caught (bu)
0.010 - 14
15 - 30
31 - 62
63 - 110
N
W
E
S
Coonamessett Farm Foundation

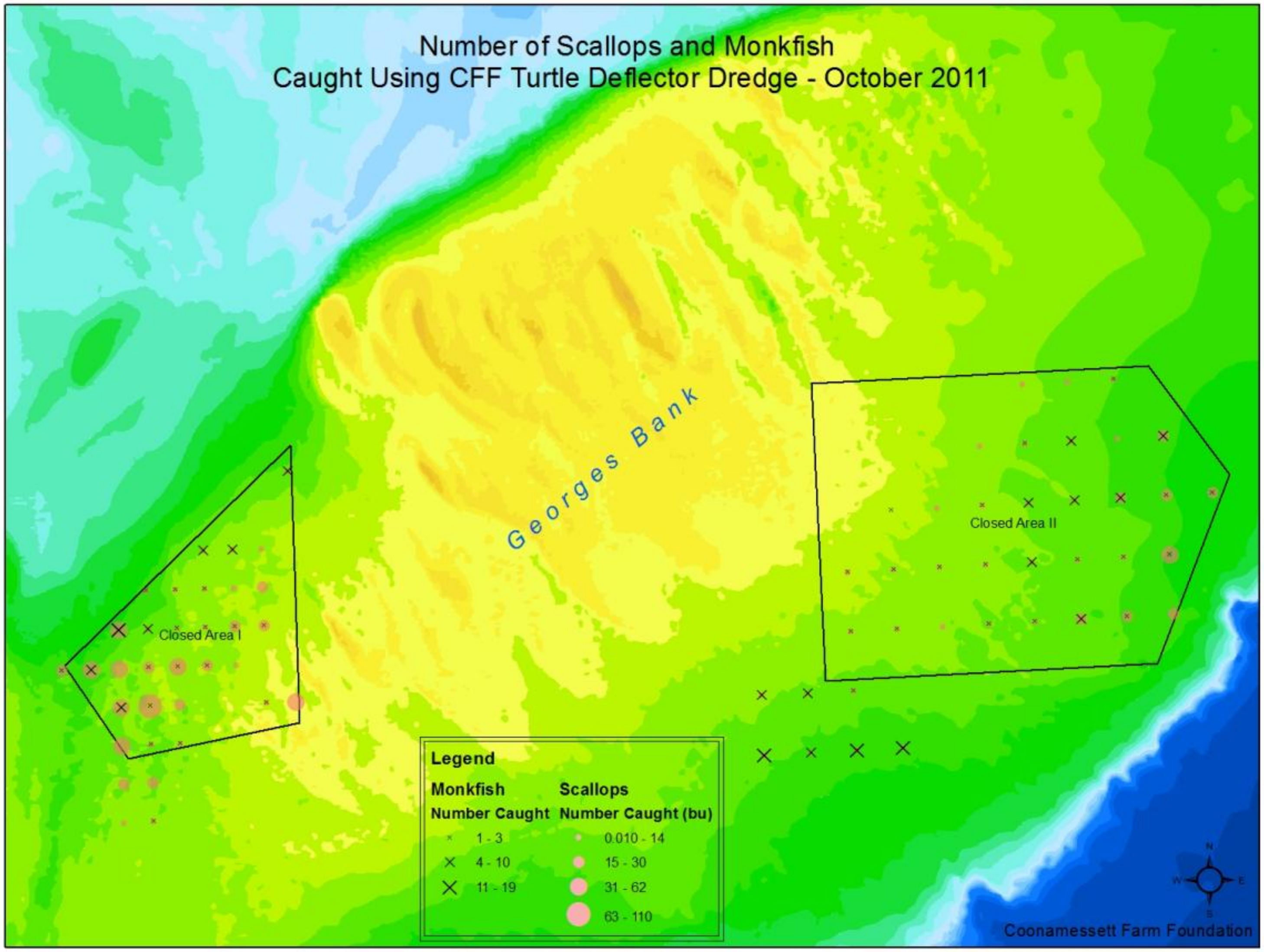

Number of Scallops and Monkfish
Caught Using CFF Turtle Deflector Dredge - July 2011
Georges Bank
Closed Area I
Closed Area II
Legend
Monkfish
NumberCaught
1 - 3
4 - 10
11 - 19
Scallops
NumberCaught (bu)
0.010 - 14
15 - 30
31 - 62
63 - 110
Coonamessett Farm Foundation

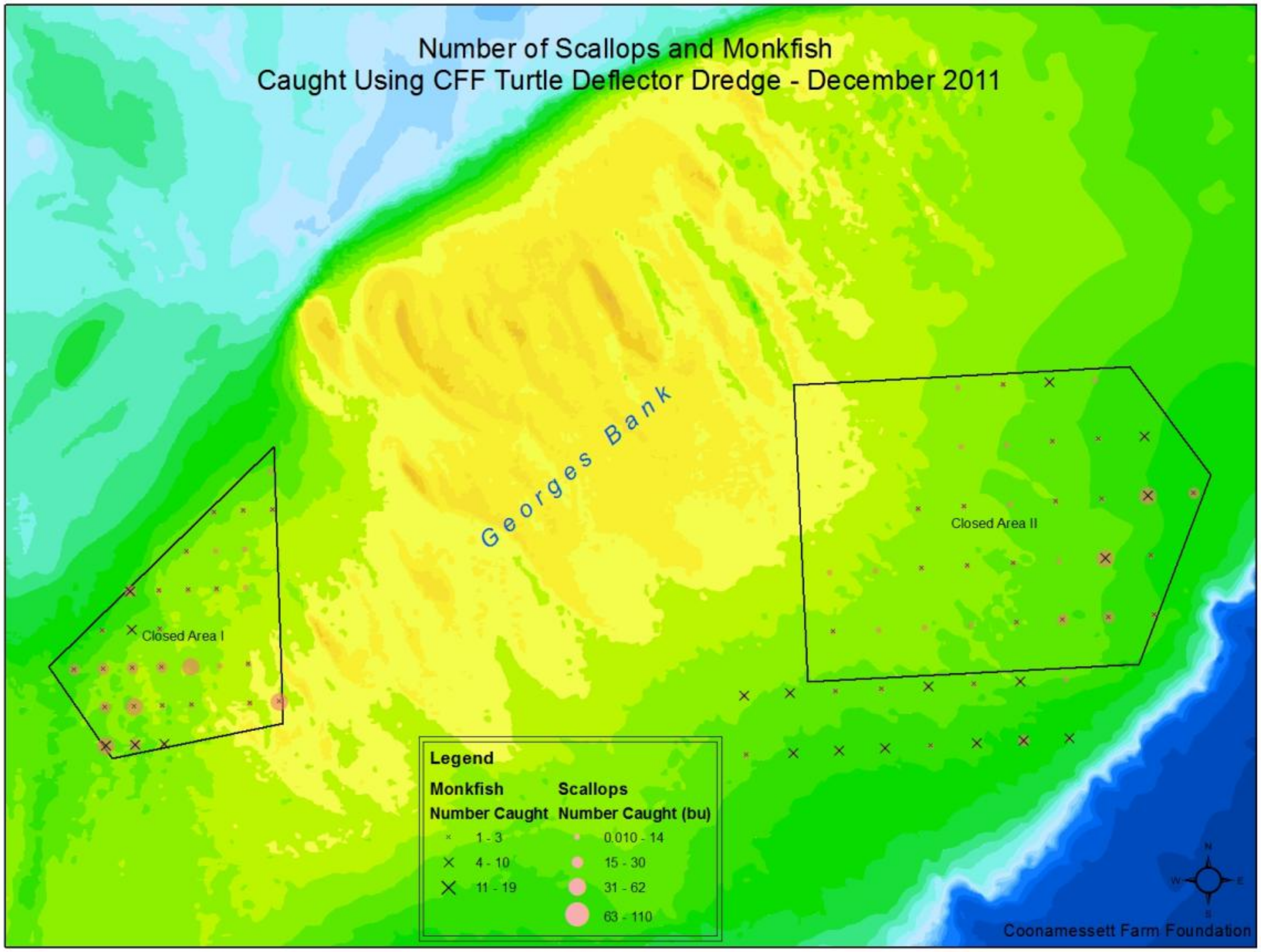

Number of Scallops and Monkfish
Caught Using CFF Turtle Deflector Dredge - August 2011
Georges Bank
Closed Area I
Closed Area II
Legend
Monkfish
Number Caught
1 - 3
4 - 10
11 - 19
Scallops
Number Caught (bu)
0.010 - 14
15 - 30
31 - 62
63 - 110
N
W
E
S
Coonamessett Farm Foundation


Number of Scallops and Monkfish
Caught Using CFF Turtle Deflector Dredge - September 2011
Georges Bank
Closed Area I
Closed Area II
Legend
Monkfish
Number Caught
1 - 3
4 - 10
11 - 19
Scallops
Number Caught (bu)
0.010 - 14
15 - 30
31 - 62
63 - 110
Coonamessett Farm Foundation

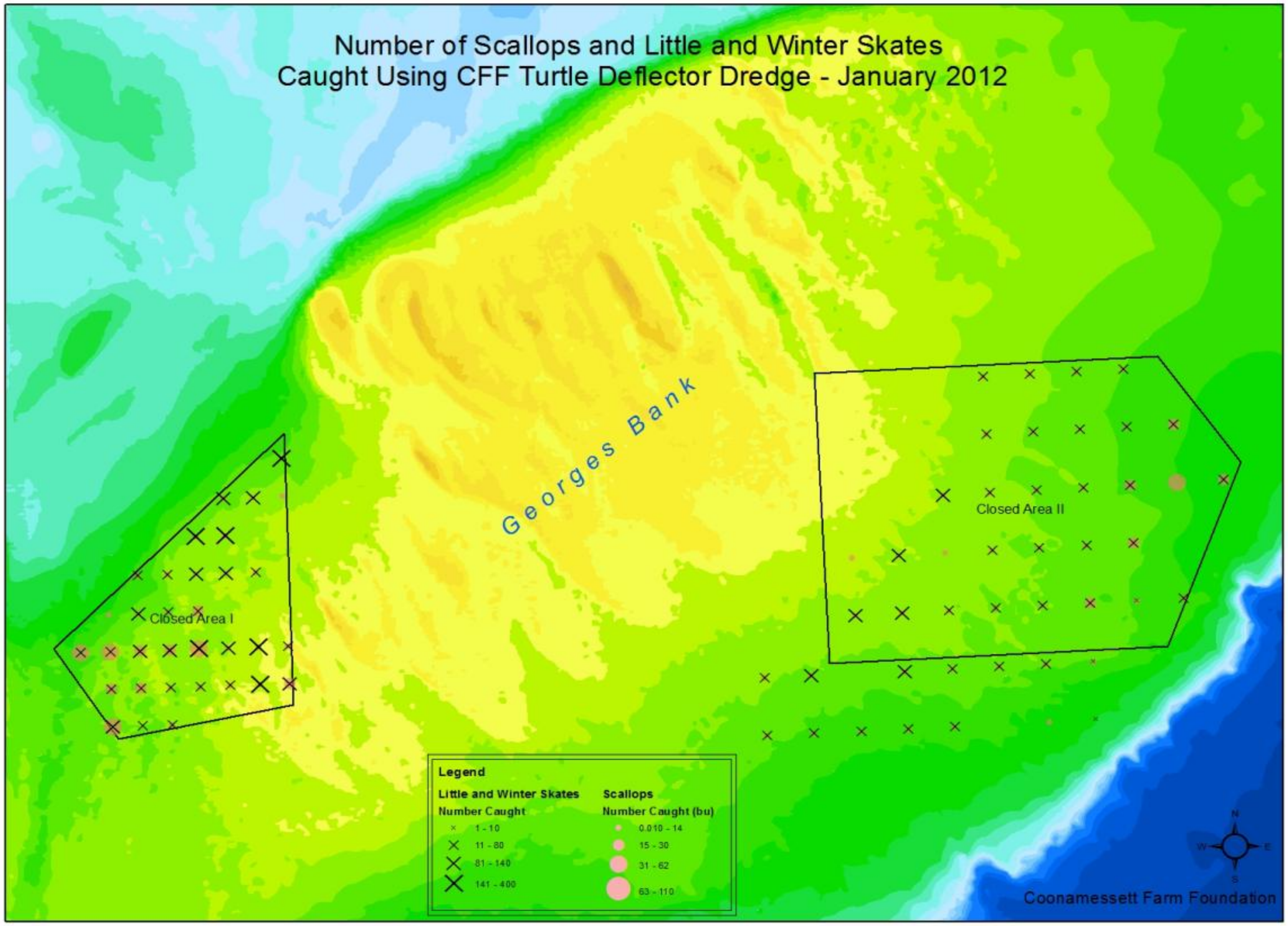


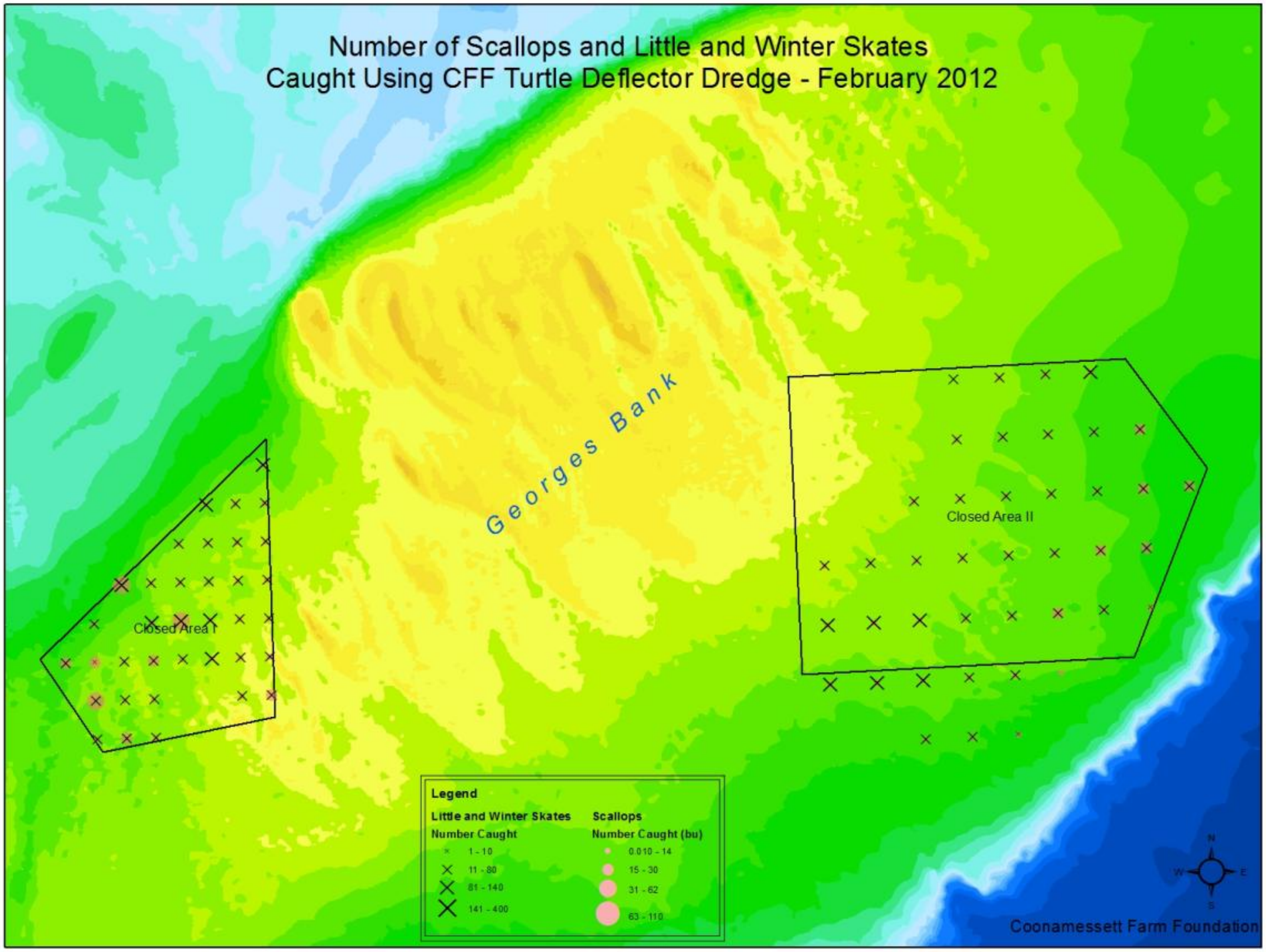
Number of Scallops and Monkfish
Caught Using CFF Turtle Deflector Dredge - October 2010
Georges Bank
Closed Area I
Closed Area II
Legend
Monkfish
Number Caught
1 - 3
4 - 10
11 - 19
Scallops
Number Caught (bu)
0.010 - 14
15 - 30
31 - 62
63 - 110
N
W
E
S
Coonamessett Farm Foundation


Number of Scallops and Monkfish
Caught Using CFF Turtle Deflector Dredge - October 2011
Georges Bank
Closed Area I
Closed Area II
Legend
Monkfish
Number Caught
1 - 3
4 - 10
11 - 19
Scallops
Number Caught (bu)
0.010 - 14
15 - 30
31 - 62
63 - 110
Coonamessett Farm Foundation

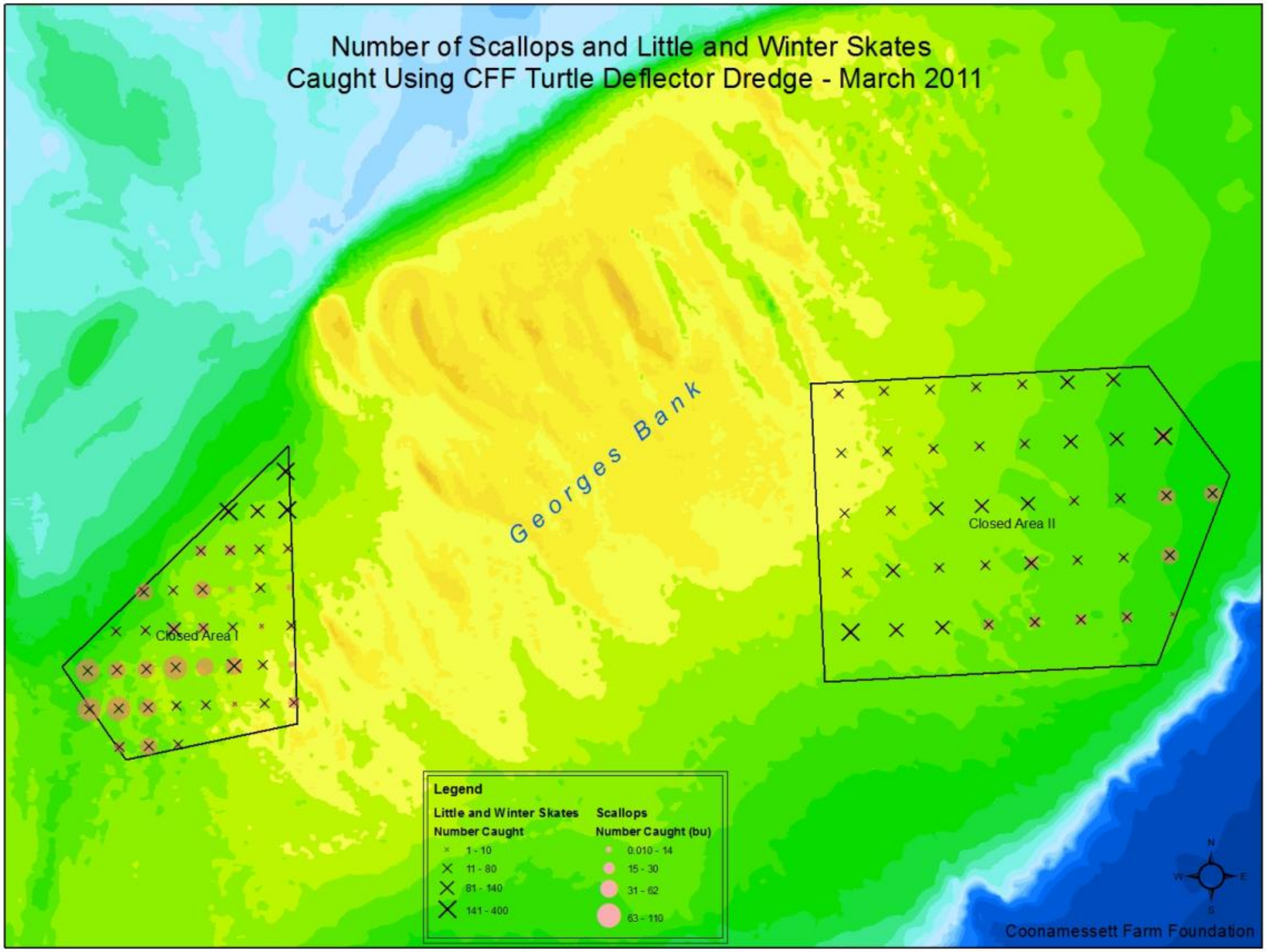

Number of Scallops and Monkfish
Caught Using CFF Turtle Deflector Dredge - December 2011
Georges Bank
Closed Area I
Closed Area II
Legend
Monkfish
Number Caught
1 - 3
4 - 10
11 - 19
Scallops
Number Caught (bu)
0.010 - 14
15 - 30
31 - 62
63 - 110
Coonamessett Farm Foundation

Scallops and Little and Winter Skates

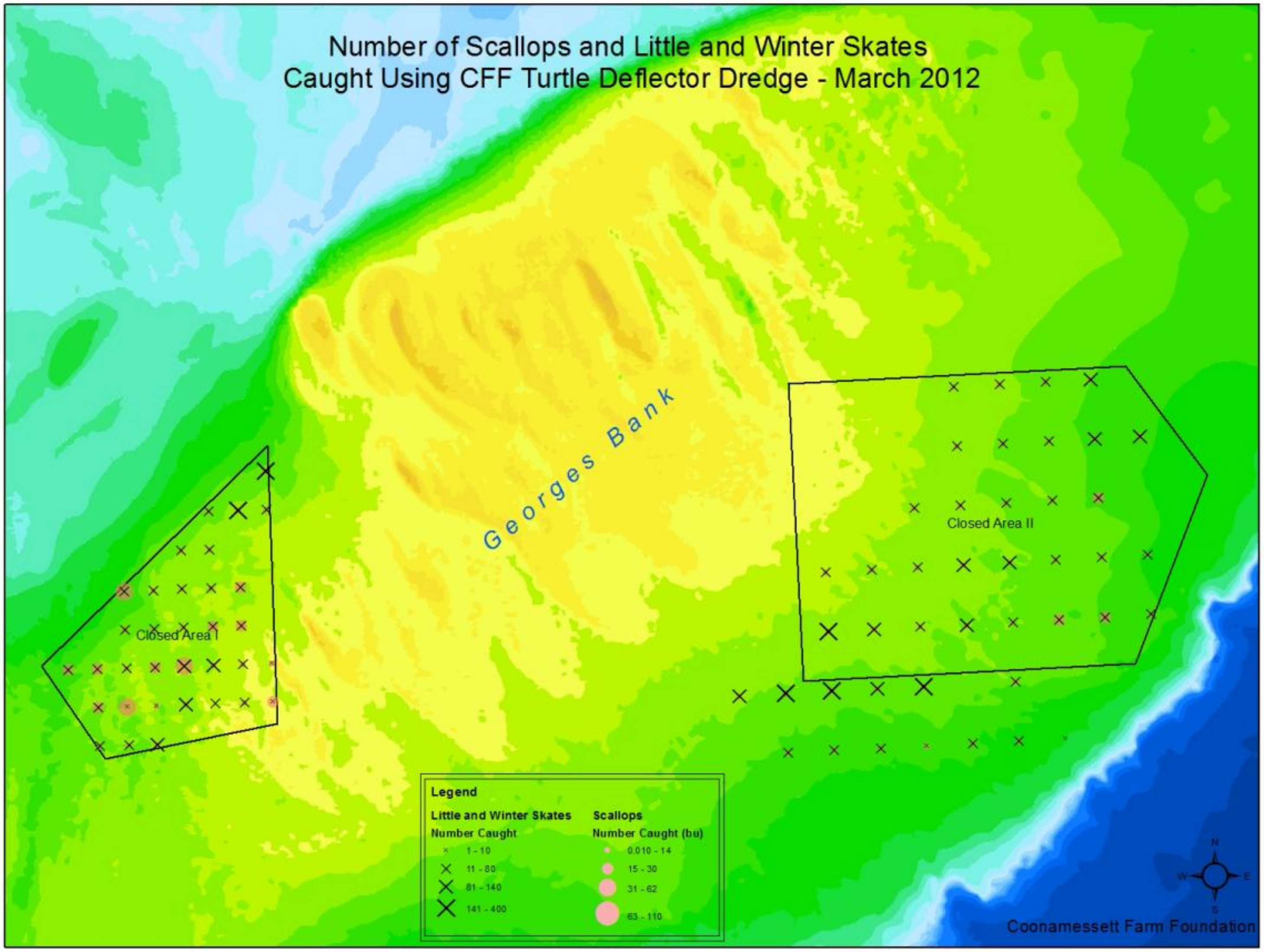




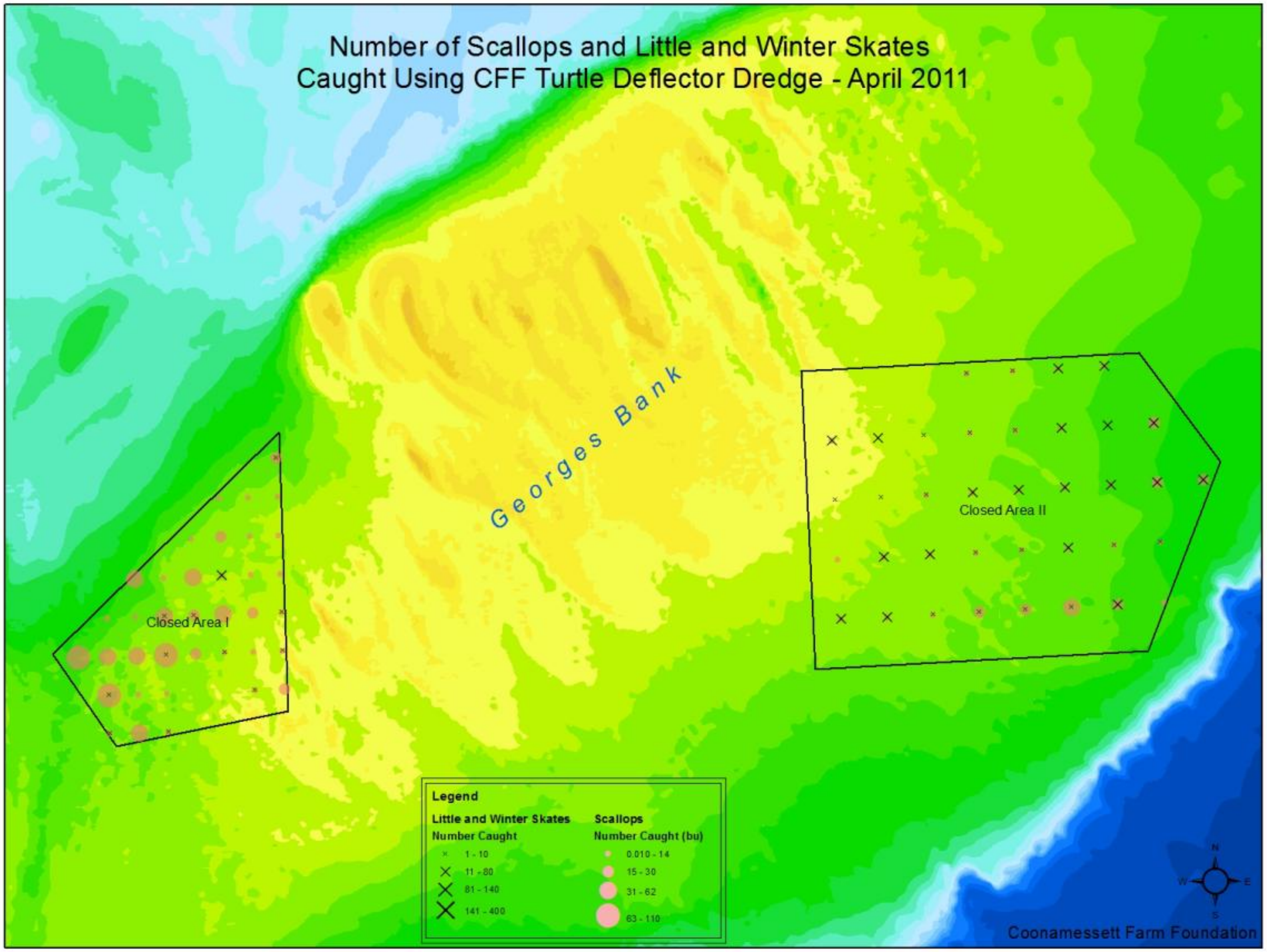
Number of Scallops and Little and Winter Skates
Caught Using CFF Turtle Deflector Dredge - February 2012
Georges Bank
Closed Area I
Closed Area II
Legend
Little and Winter Skates
Number Caught
1 - 10
11 - 80
81 - 140
141 - 400
Scallops
Number Caught (bu)
0.010 - 14
15 - 30
31 - 62
63 - 110
N
S
E
W
Coonamessett Farm Foundation

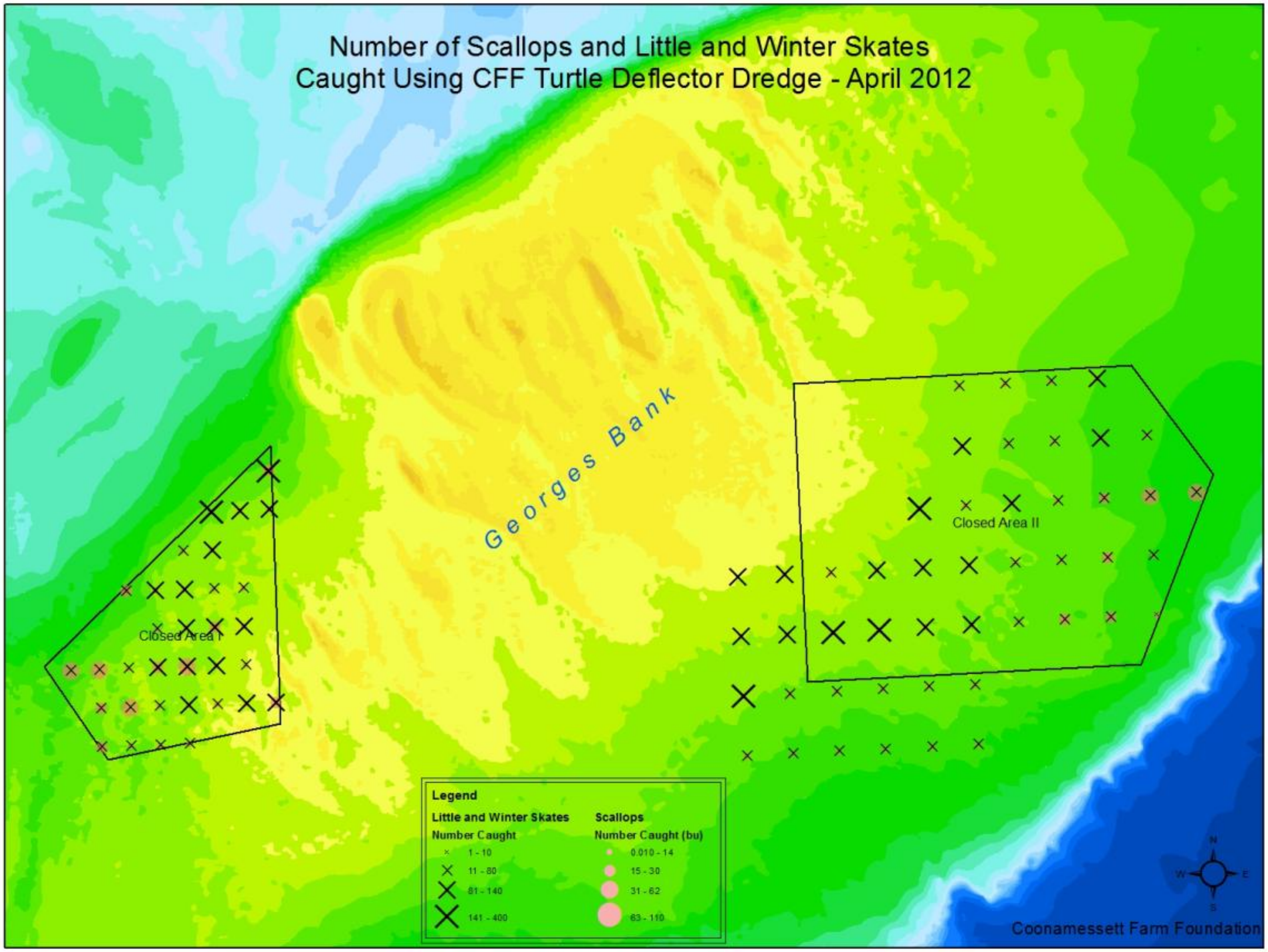


Number of Scallops and Little and Winter Skates
Caught Using CFF Turtle Deflector Dredge - March 2011
Georges Bank
Closed Area I
Closed Area II
Legend
Little and Winter Skates
Number Caught
1 - 10
11 - 80
81 - 140
141 - 400
Scallops
Number Caught (bu)
0.010 - 14
15 - 30
31 - 62
63 - 110
N
S
E
W
Coonamessett Farm Foundation

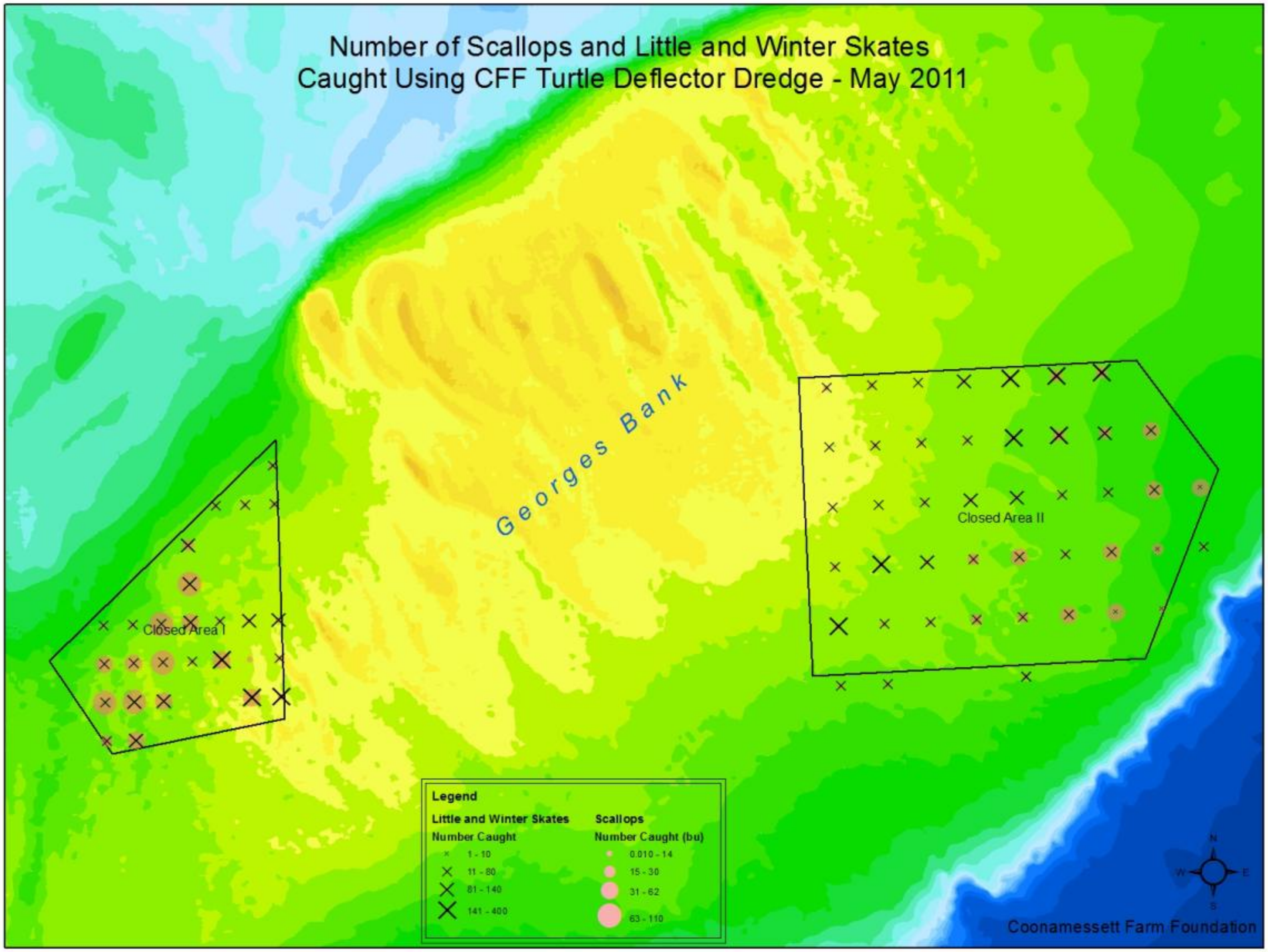


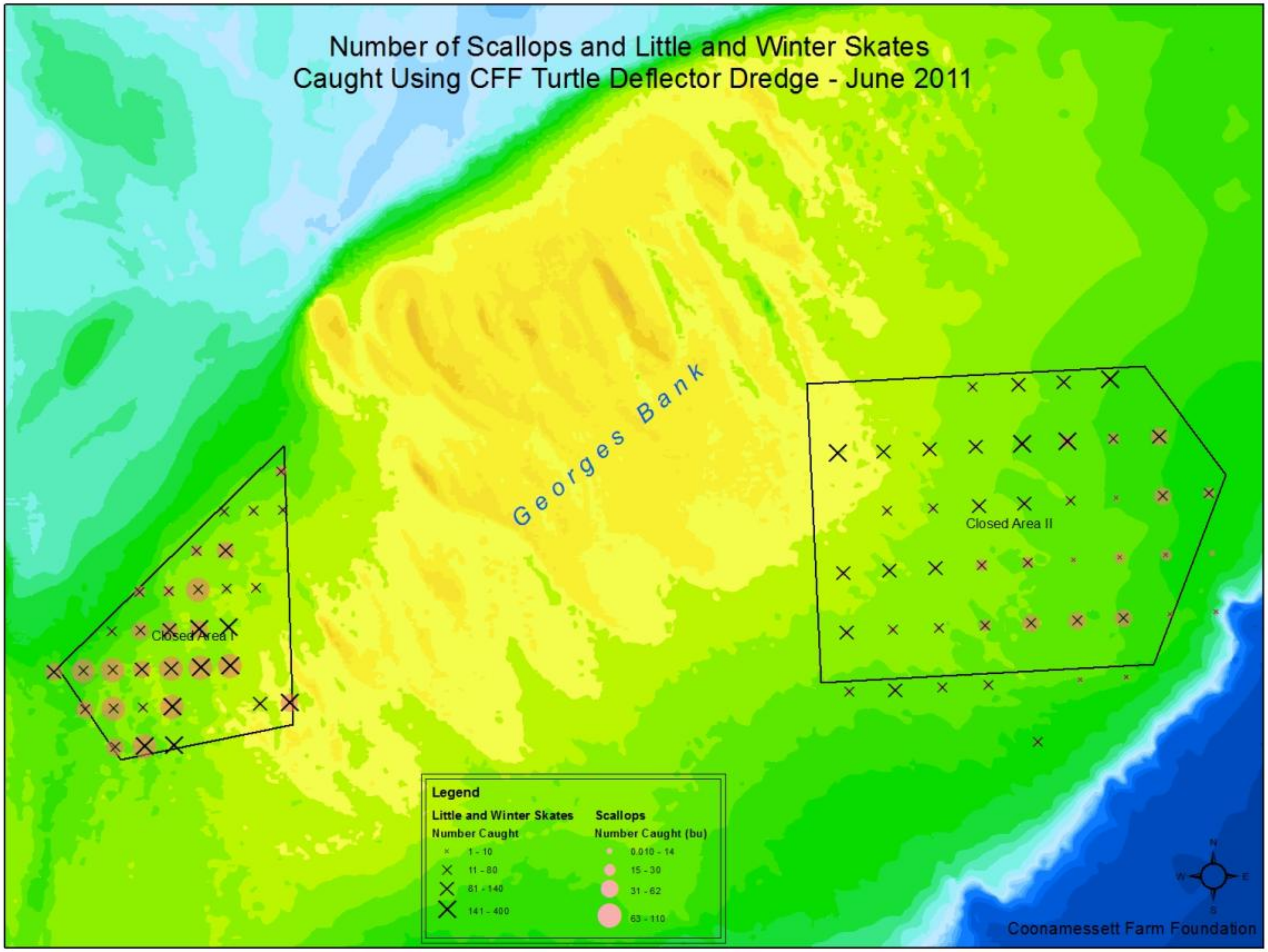
Number of Scallops and Little and Winter Skates
Caught Using CFF Turtle Deflector Dredge - March 2012
Georges Bank
Closed Area I
Closed Area II
Legend
Little and Winter Skates
Number Caught
1 - 10
11 - 80
81 - 140
141 - 400
Scallops
Number Caught (bu)
0.010 - 14
15 - 30
31 - 62
63 - 110
N
W
E
S
Coonamessett Farm Foundation


Number of Scallops and Little and Winter Skates
Caught Using CFF Turtle Deflector Dredge - April 2011
Georges Bank
Closed Area I
Closed Area II
Legend
Little and Winter Skates
Number Caught
1 - 10
11 - 80
81 - 140
141 - 400
Scallops
Number Caught (bu)
0.010 - 14
15 - 30
31 - 62
63 - 110
N
W
E
S
Coonamessett Farm Foundation

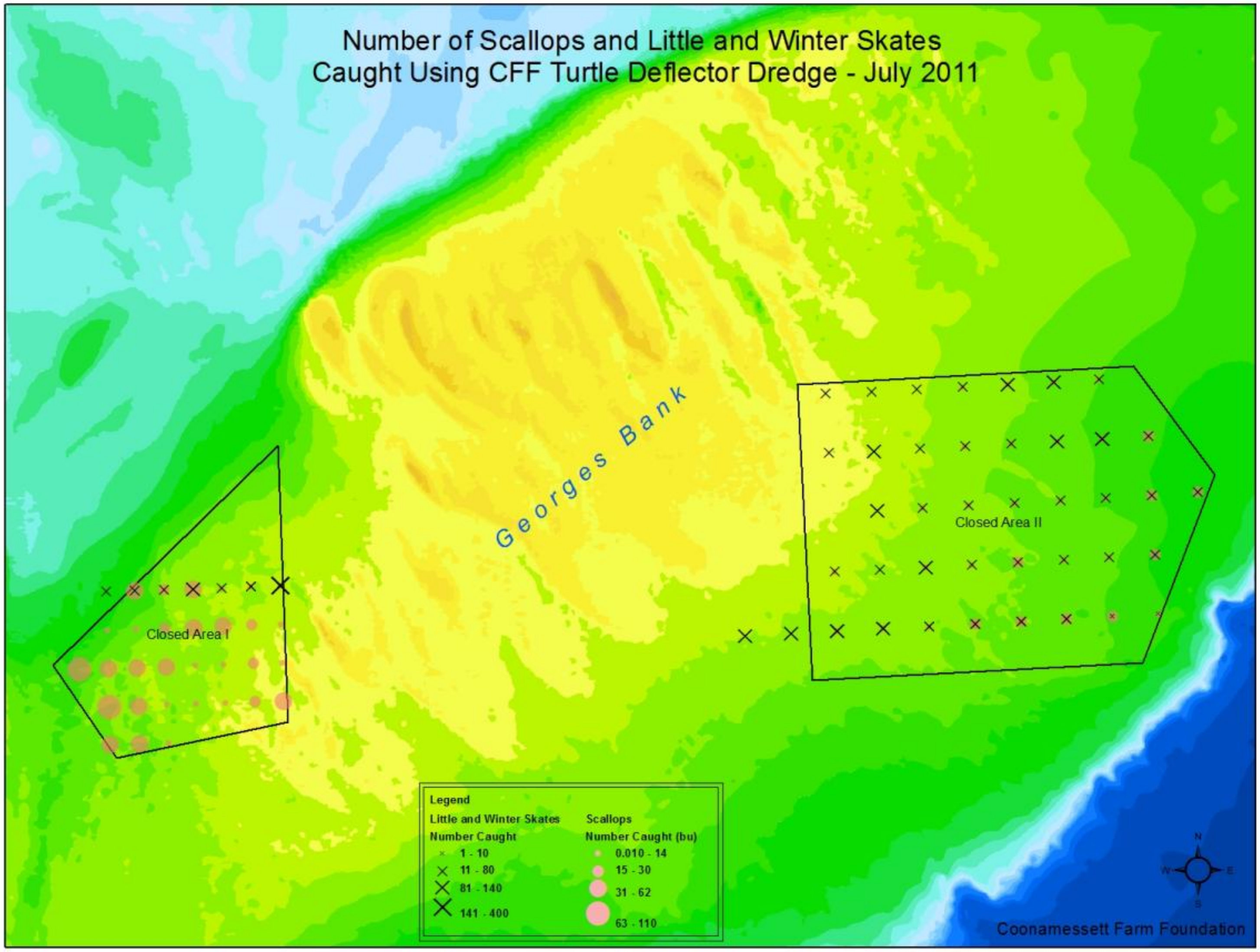


Number of Scallops and Little and Winter Skates
Caught Using CFF Turtle Deflector Dredge - April 2012
Georges Bank
Closed Area I
Closed Area II
Legend
Little and Winter Skates
Number Caught
1 - 10
11 - 80
81 - 140
141 - 400
Scallops
Number Caught (bu)
0.010 - 14
15 - 30
31 - 62
63 - 110
N
W
E
S
Coonamessett Farm Foundation

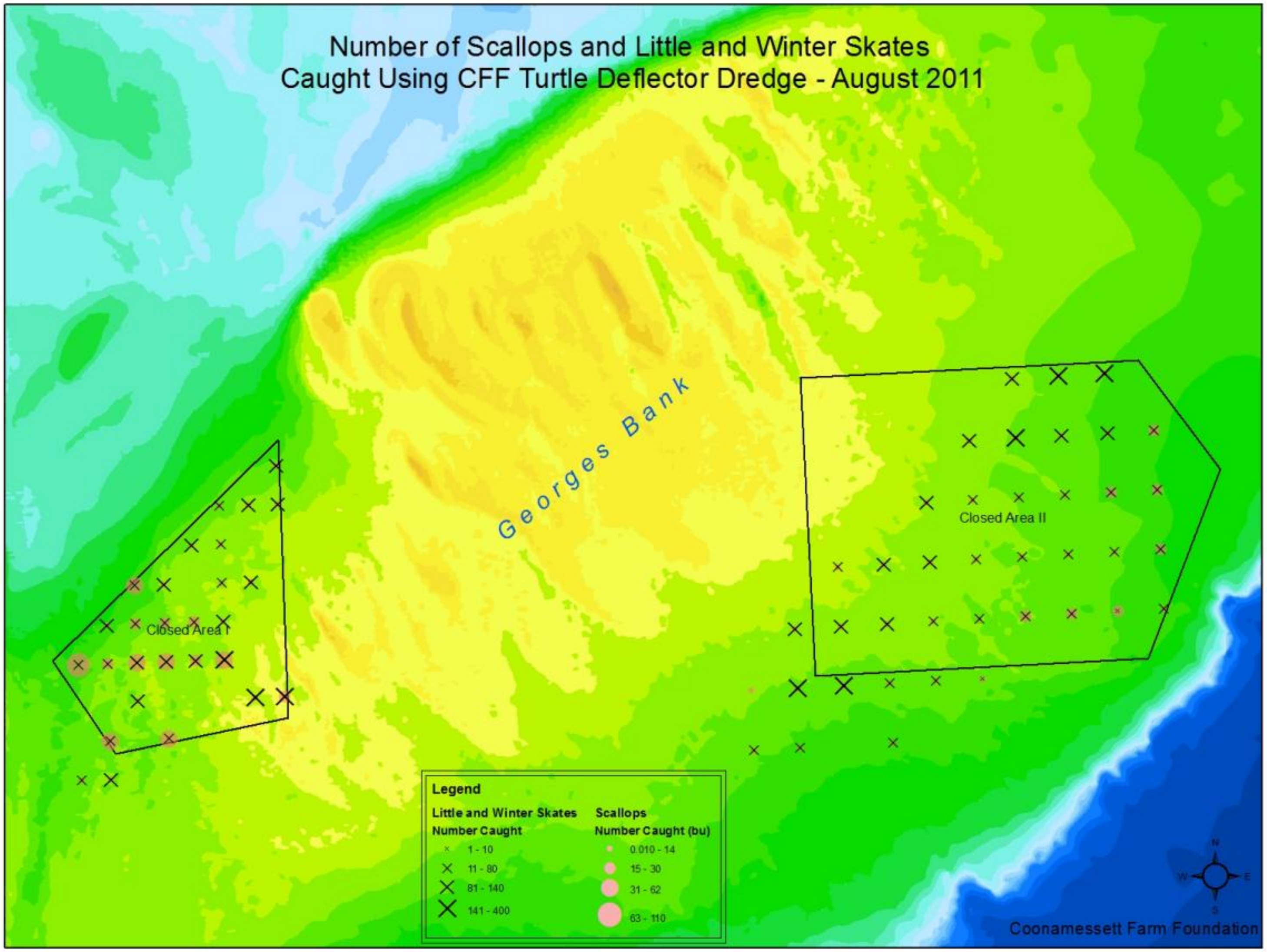

Number of Scallops and Little and Winter Skates
Caught Using CFF Turtle Deflector Dredge - May 2011
Georges Bank
Closed Area I
Closed Area II
Legend
Little and Winter Skates
Number Caught
1 - 10
11 - 80
81 - 140
141 - 400
Scallops
Number Caught (bu)
0.010 - 14
15 - 30
31 - 62
63 - 110
N
S
E
W
Coonamessett Farm Foundation



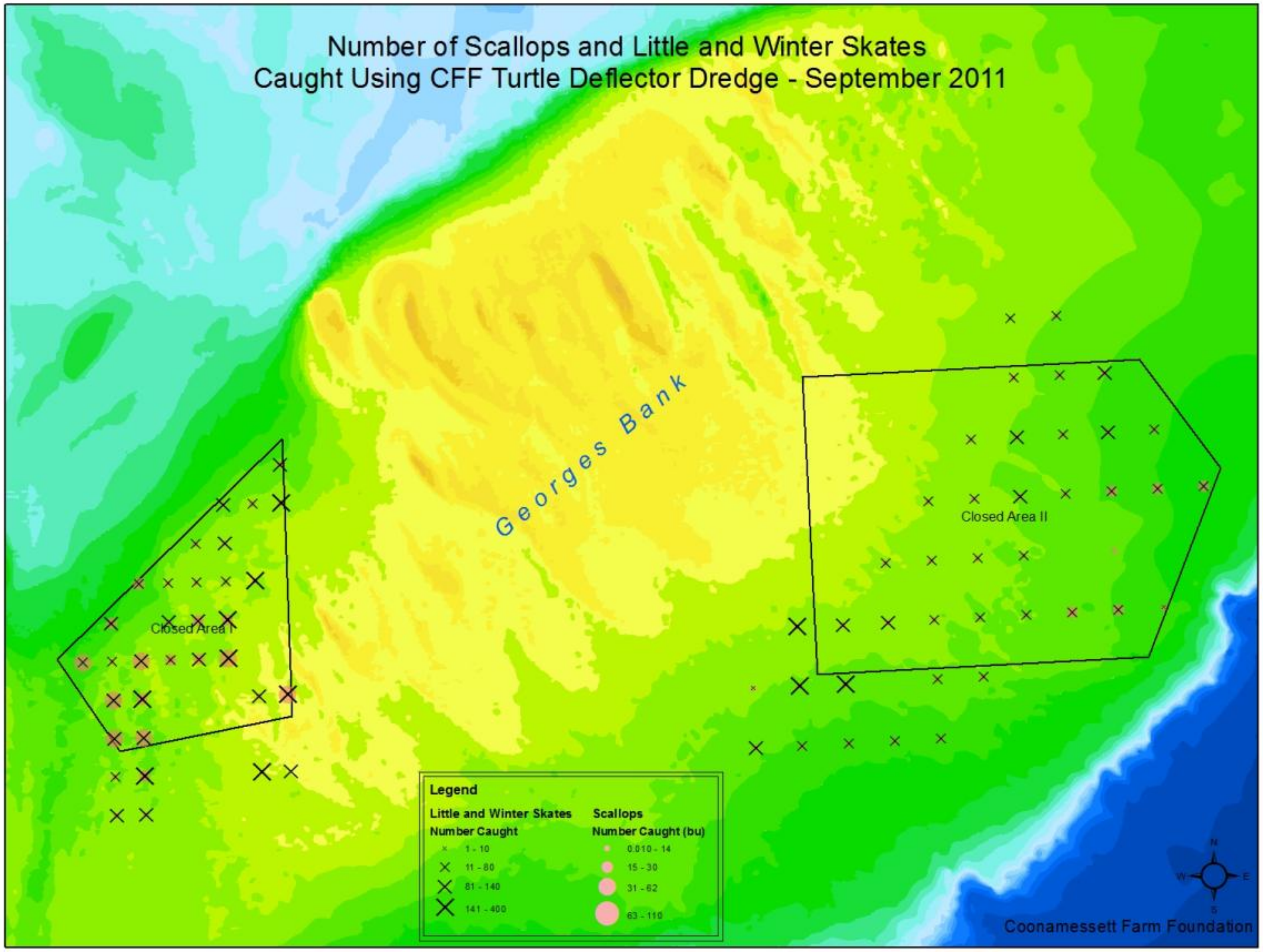
Number of Scallops and Little and Winter Skates
Caught Using CFF Turtle Deflector Dredge - June 2011
Georges Bank
Closed Area I
Closed Area II
Legend
Little and Winter Skates
Number Caught
1 - 10
11 - 80
81 - 140
141 - 400
Scallops
Number Caught (bu)
0.010 - 14
15 - 30
31 - 62
63 - 110
N
E
S
W
Coonamessett Farm Foundation



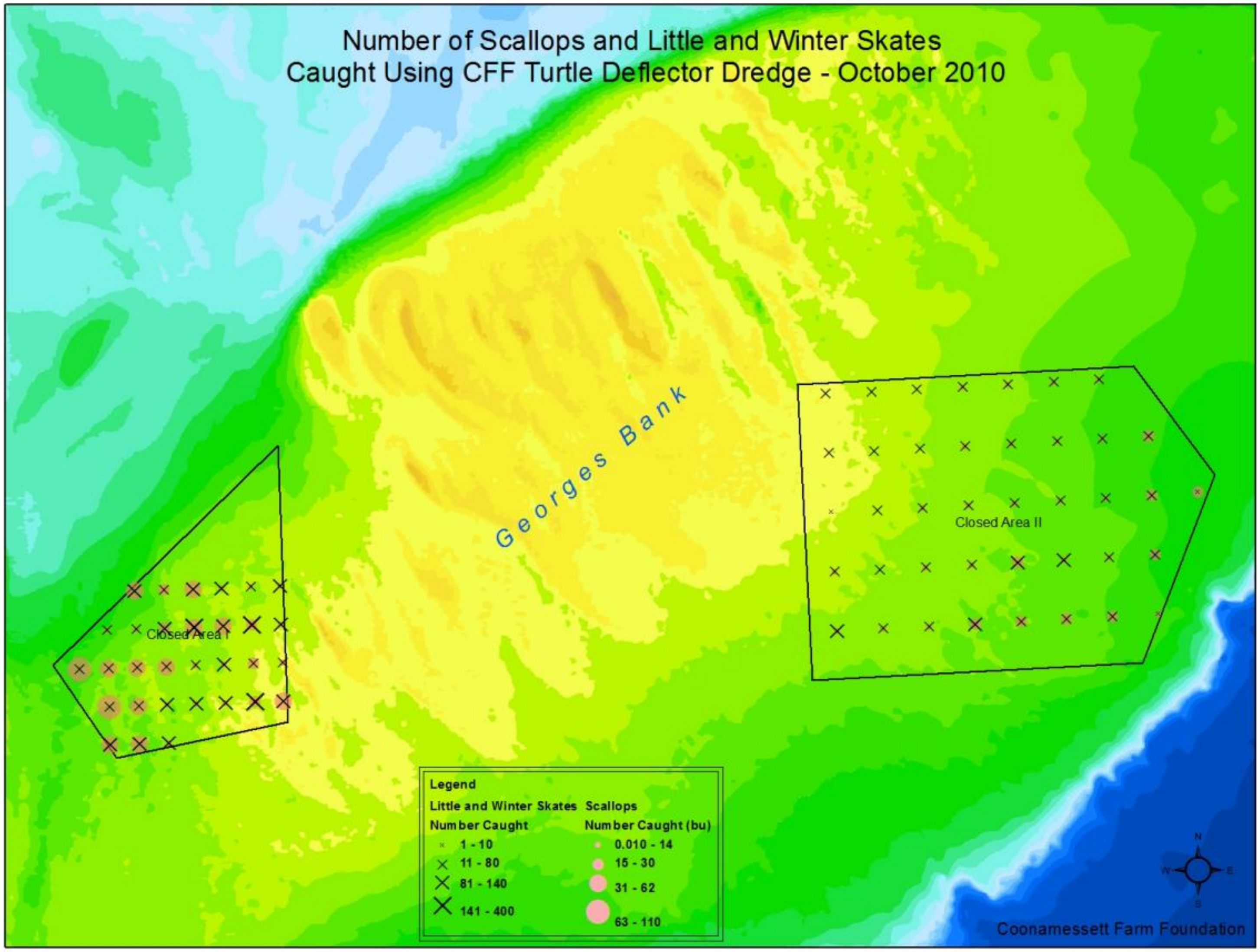
Number of Scallops and Little and Winter Skates
Caught Using CFF Turtle Deflector Dredge - July 2011
Georges Bank
Closed Area I
Closed Area II
Legend
Little and Winter Skates
Number Caught
1 - 10
11 - 80
81 - 140
141 - 400
Scallops
Number Caught (bu)
0.010 - 14
15 - 30
31 - 62
63 - 110
N
S
E
W
Coonamessett Farm Foundation

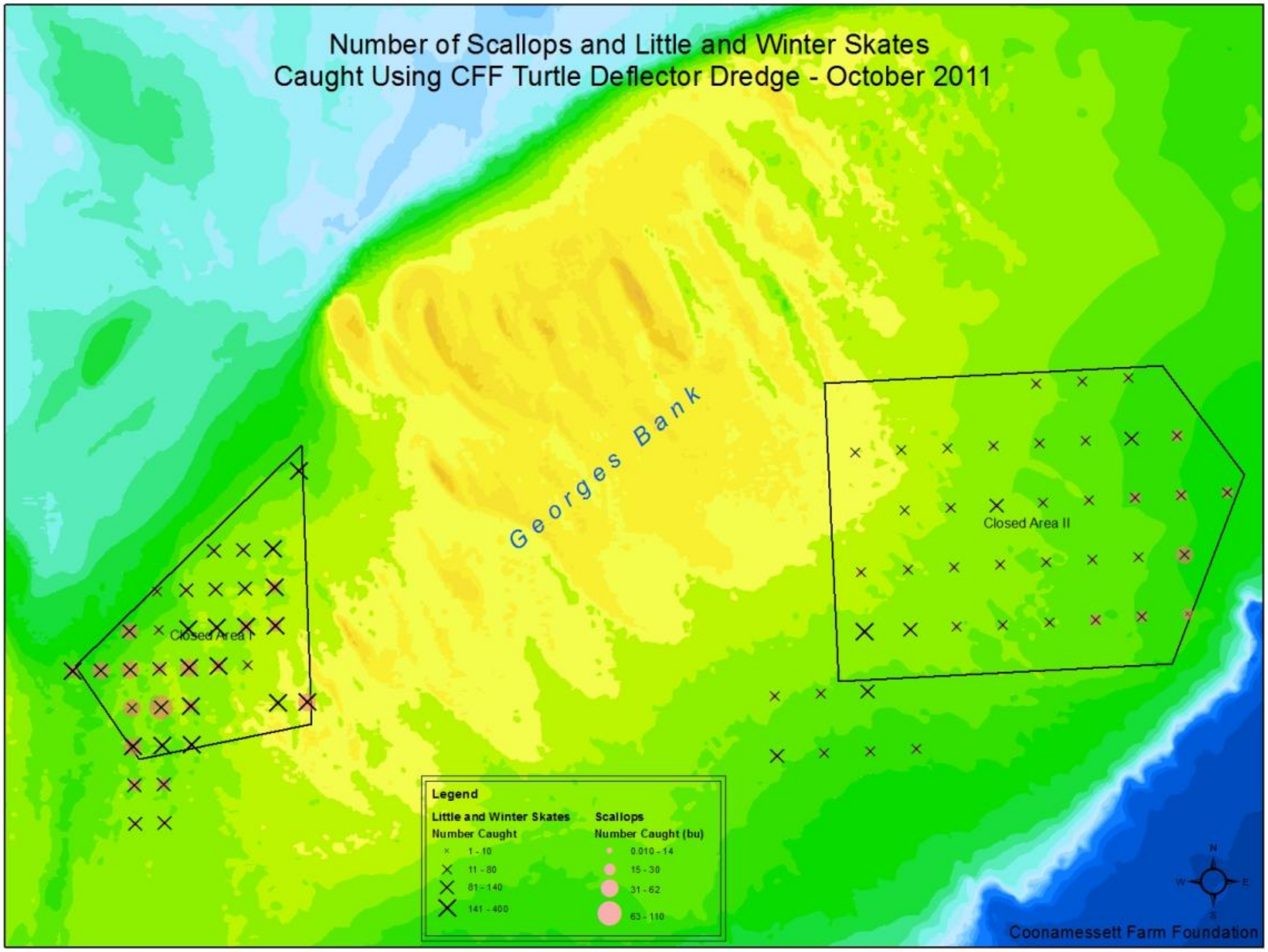


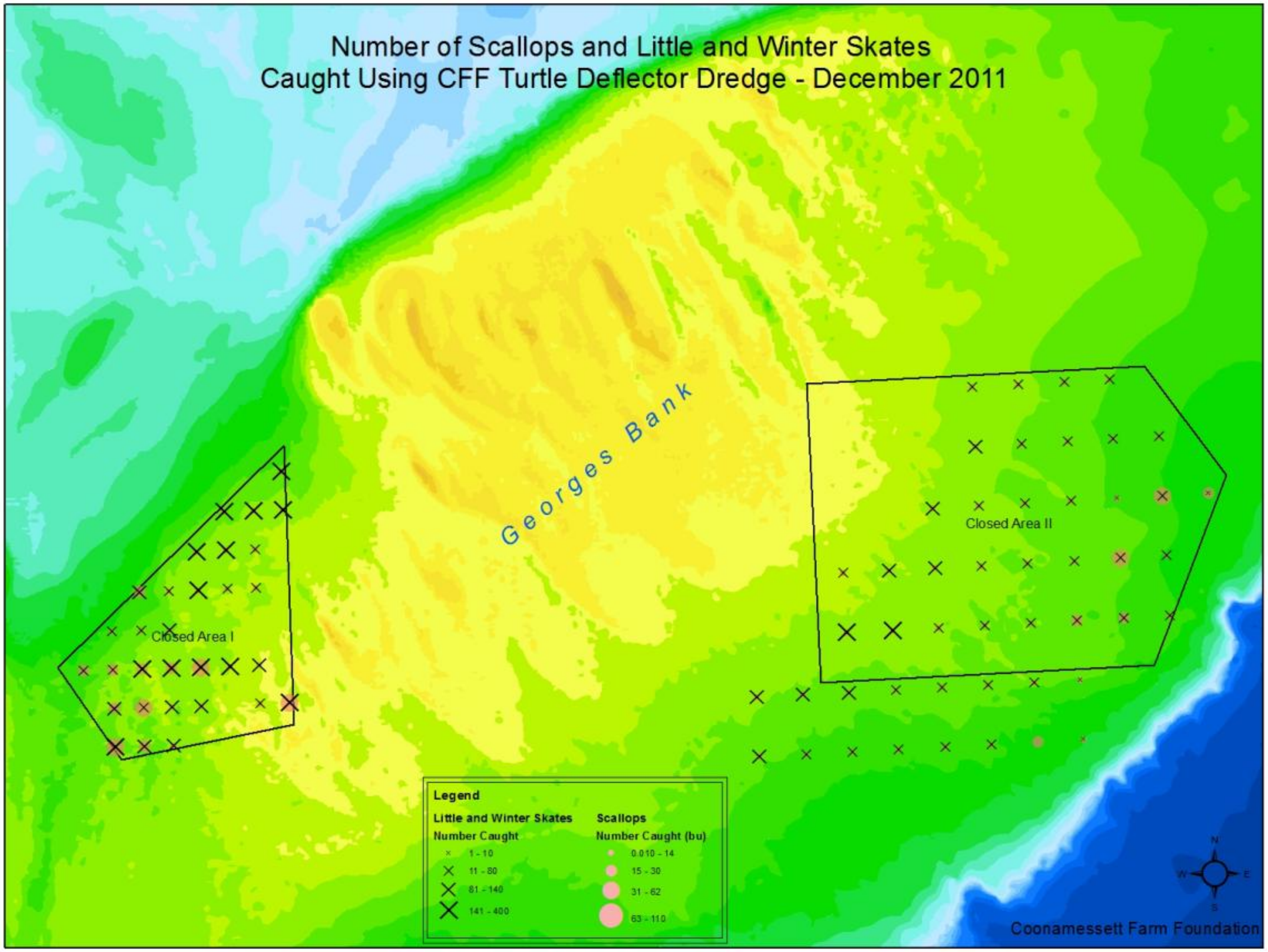
Number of Scallops and Little and Winter Skates
Caught Using CFF Turtle Deflector Dredge - August 2011
Georges Bank
Closed Area I
Closed Area II
Legend
Little and Winter Skates
Number Caught
1 - 10
11 - 80
81 - 140
141 - 400
Scallops
Number Caught (bu)
0.010 - 14
15 - 30
31 - 62
63 - 110
Coonamessett Farm Foundation



Number of Scallops and Little and Winter Skates
Caught Using CFF Turtle Deflector Dredge - September 2011
Georges Bank
Closed Area I
Closed Area II
Legend
Little and Winter Skates
Number Caught
1 - 10
11 - 80
81 - 140
141 - 400
Scallops
Number Caught (bu)
0.010 - 14
15 - 30
31 - 62
63 - 110
N
W
E
S
Coonamessett Farm Foundation

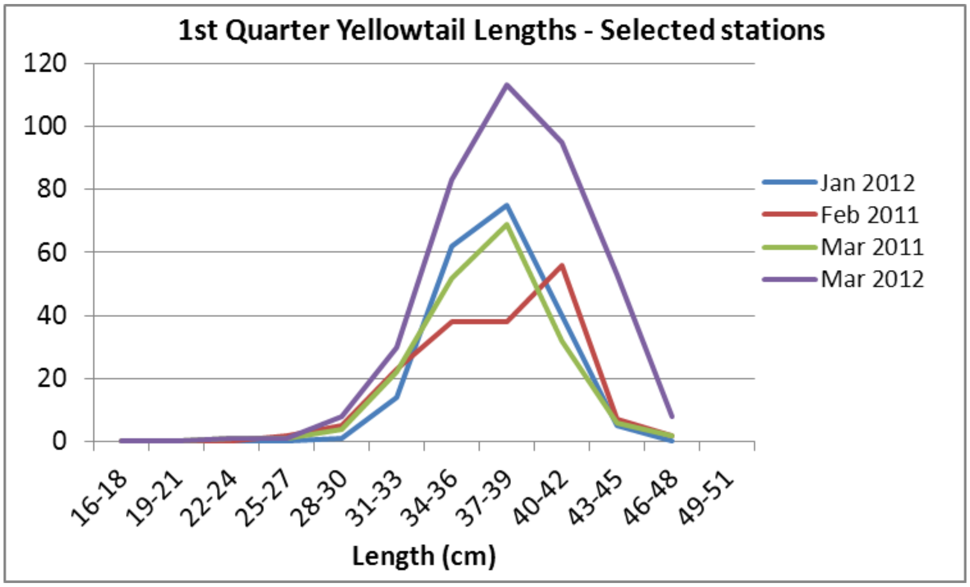

Number of Scallops and Little and Winter Skates
Caught Using CFF Turtle Deflector Dredge - October 2010
Georges Bank
Closed Area I
Closed Area II
Legend
Little and Winter Skates
Number Caught
1 - 10
11 - 80
81 - 140
141 - 400
Scallops
Number Caught (bu)
0.010 - 14
15 - 30
31 - 62
63 - 110
Coonamessett Farm Foundation

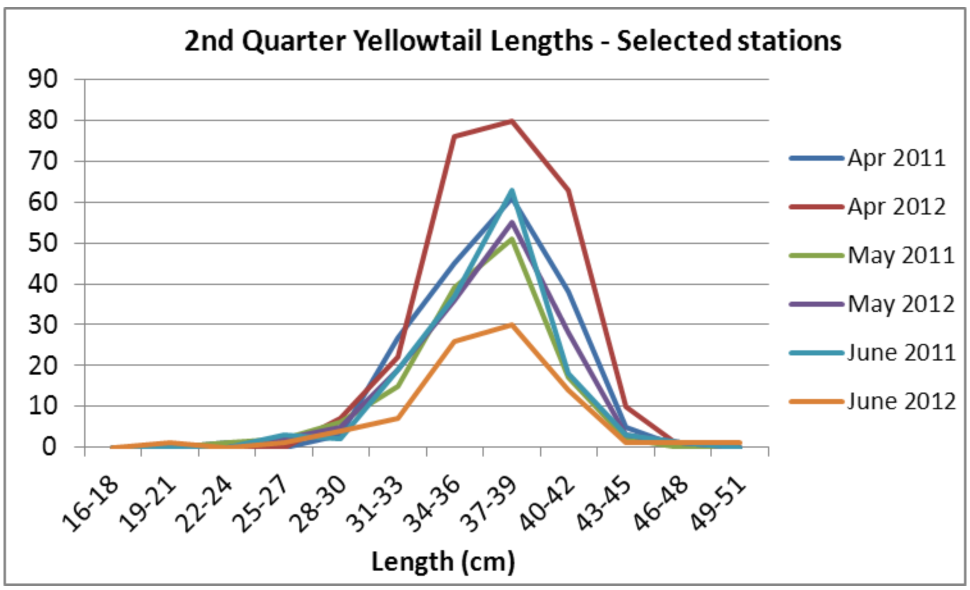

Number of Scallops and Little and Winter Skates
Caught Using CFF Turtle Deflector Dredge - October 2011
Georges Bank
Closed Area I
Closed Area II
Legend
Little and Winter Skates
Number Caught
1 - 10
11 - 80
81 - 140
141 - 400
Scallops
Number Caught (bu)
0.010 - 14
15 - 30
31 - 62
63 - 110
N
W
E
S
Coonamessett Farm Foundation

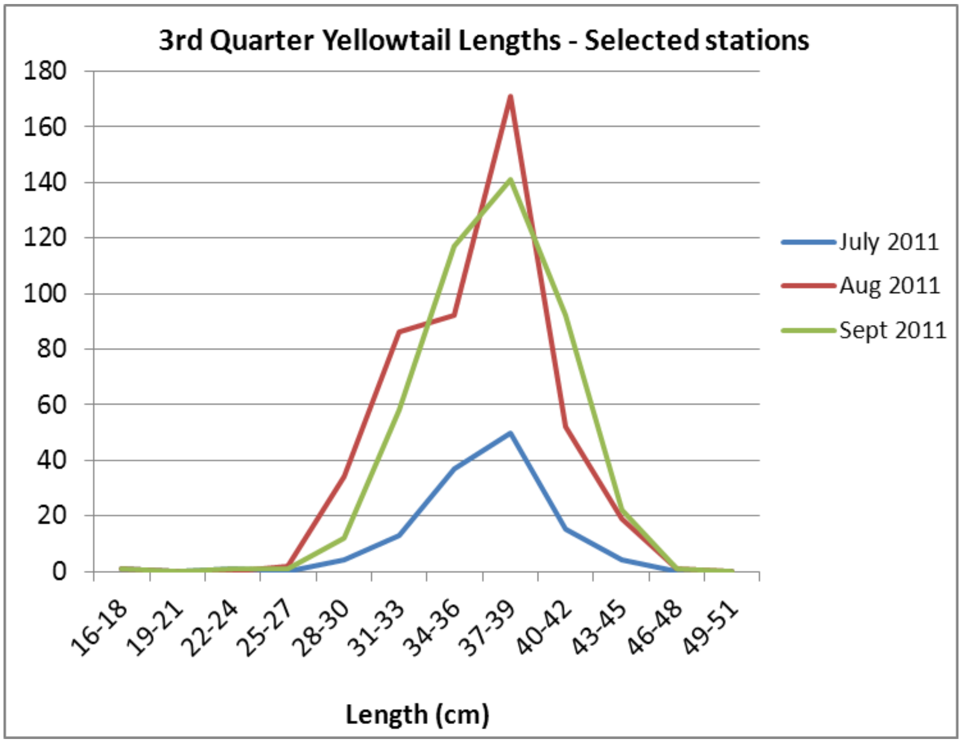


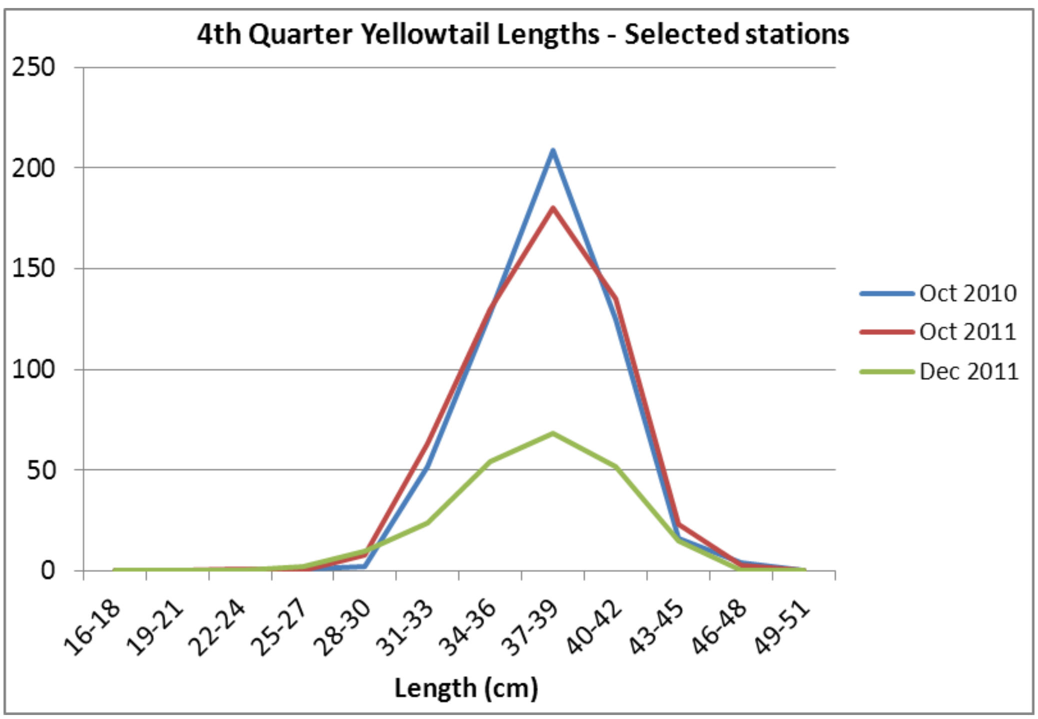
Number of Scallops and Little and Winter Skates
Caught Using CFF Turtle Deflector Dredge - December 2011
Georges Bank
Closed Area I
Closed Area II
Legend
Little and Winter Skates
Number Caught
1 - 10
11 - 80
81 - 140
141 - 400
Scallops
Number Caught (bu)
0.010 - 14
15 - 30
31 - 62
63 - 110
N
E
S
W
Coonamessett Farm Foundation

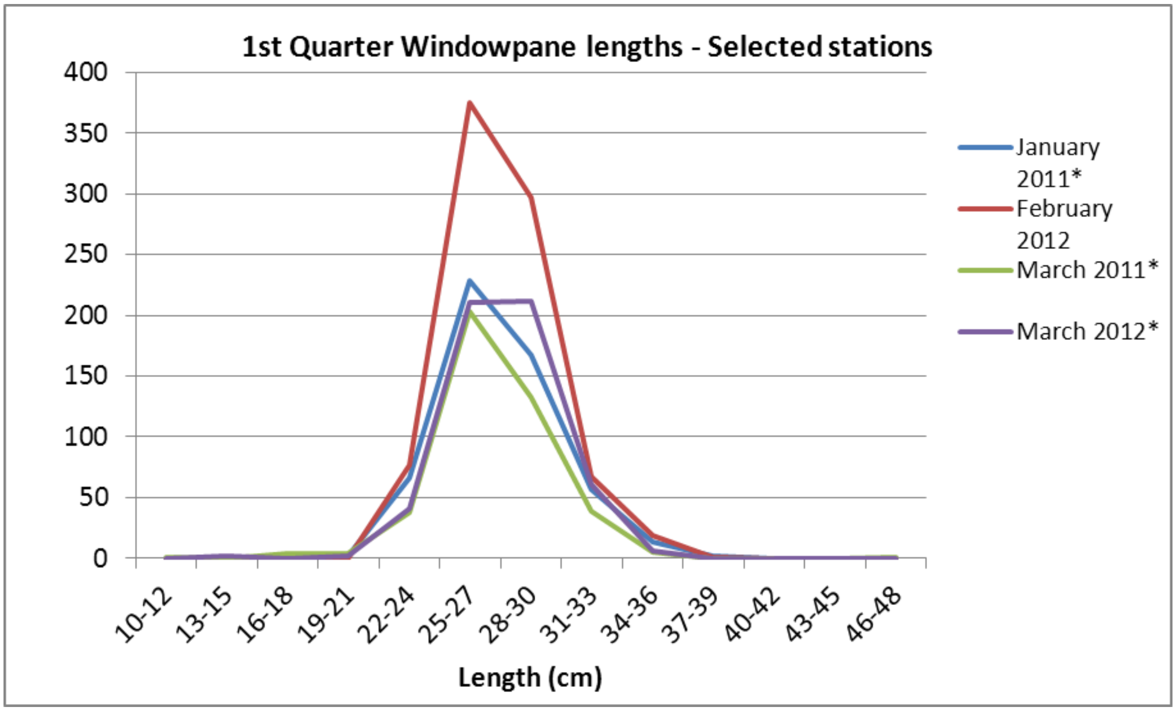
APPENDIX B: Bycatch species length frequency distributions

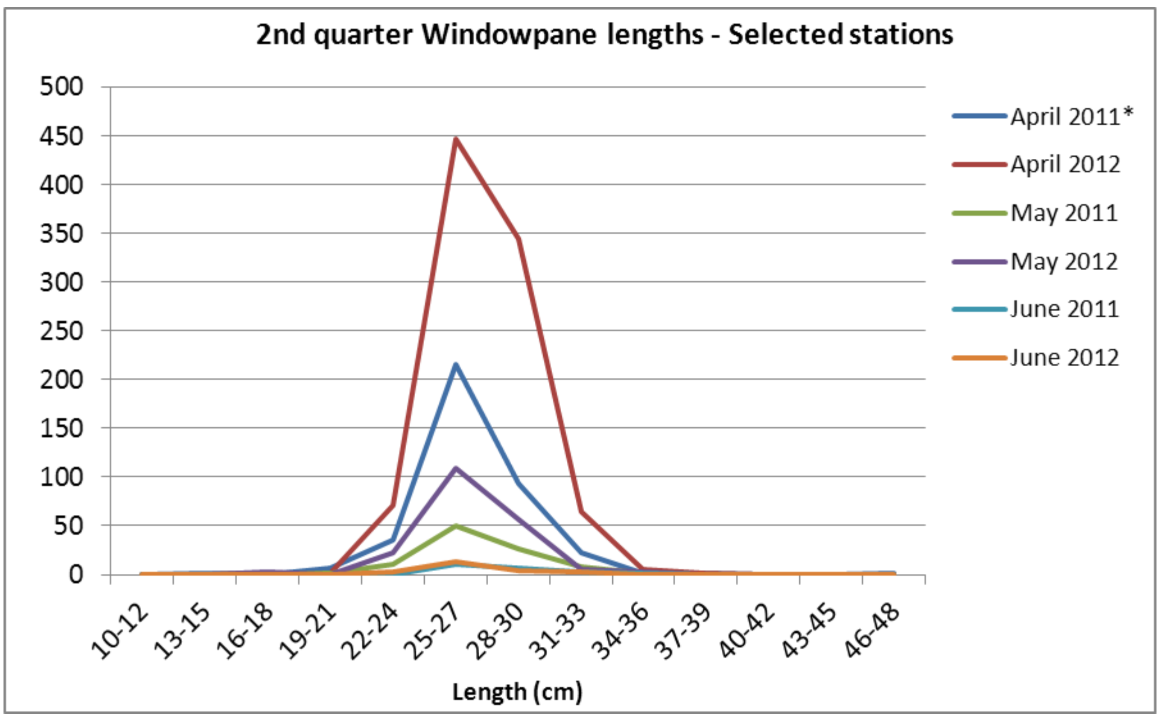


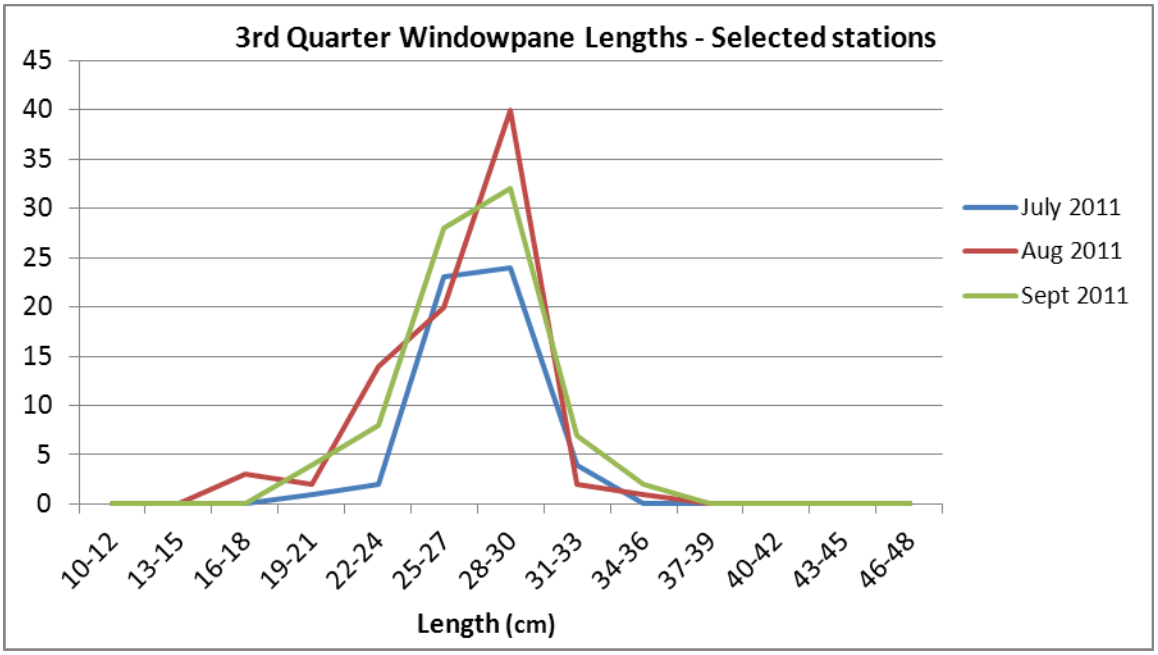


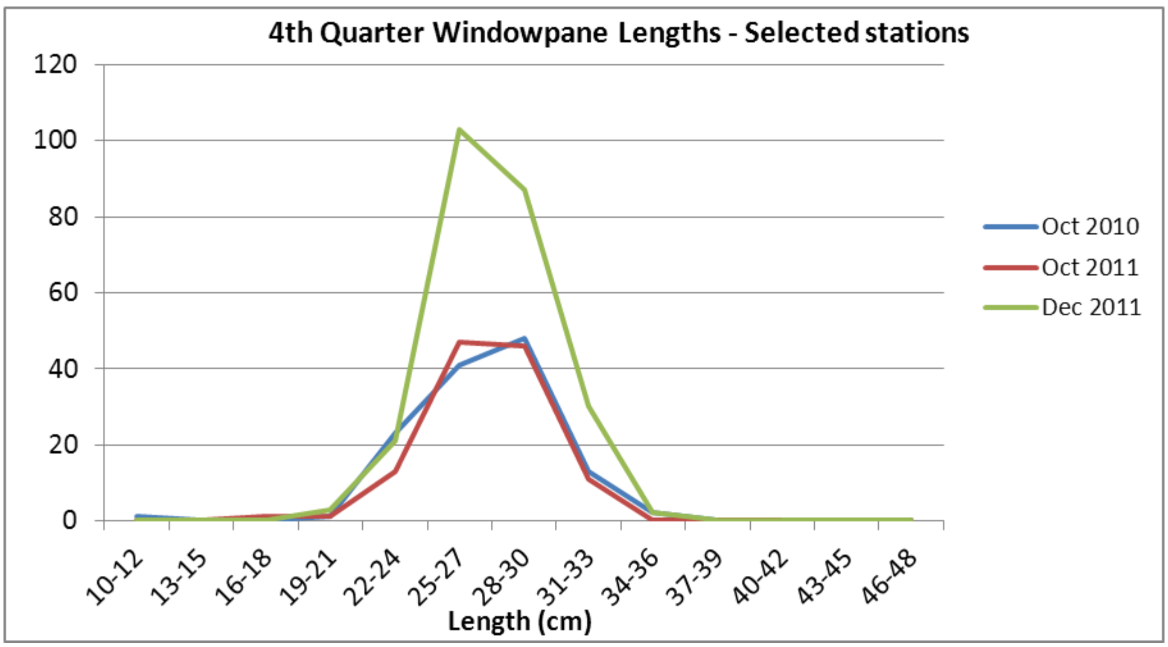

3rd Quarter Yellowtail Lengths - Selected stations
180
160
140
120
100
80
60
40
20
0
16-18
19-21
22-24
25-27
28-30
31-33
34-36
37-39
40-42
43-45
46-48
49-51
Length (cm)
July 2011
Aug 2011
Sept 2011

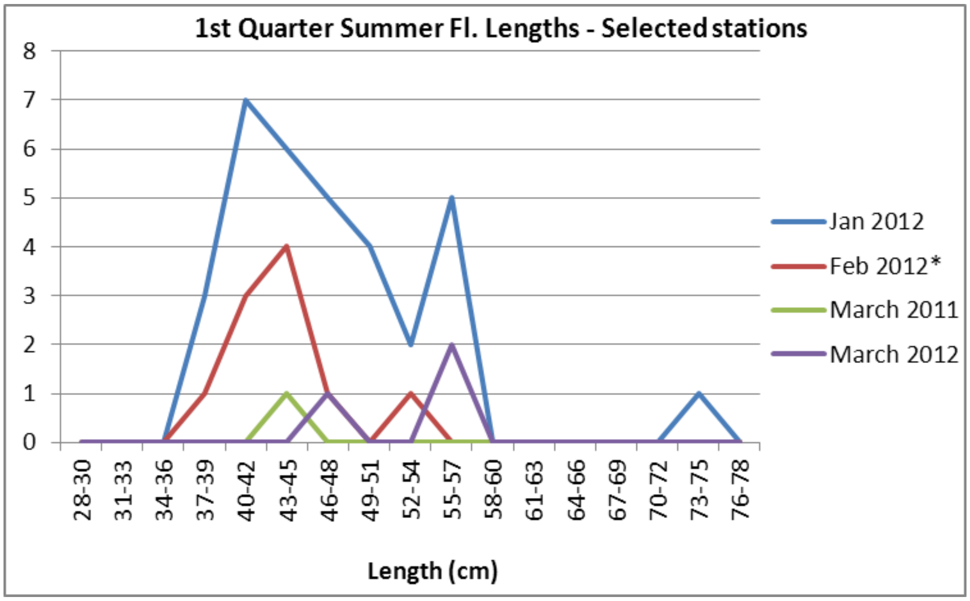

4th Quarter Yellowtail Lengths - Selected stations
250
200
150
100
50
0
16-18
19-21
22-24
25-27
28-30
31-33
34-36
37-39
40-42
43-45
46-48
49-51
Length (cm)
Oct 2010
Oct 2011
Dec 2011

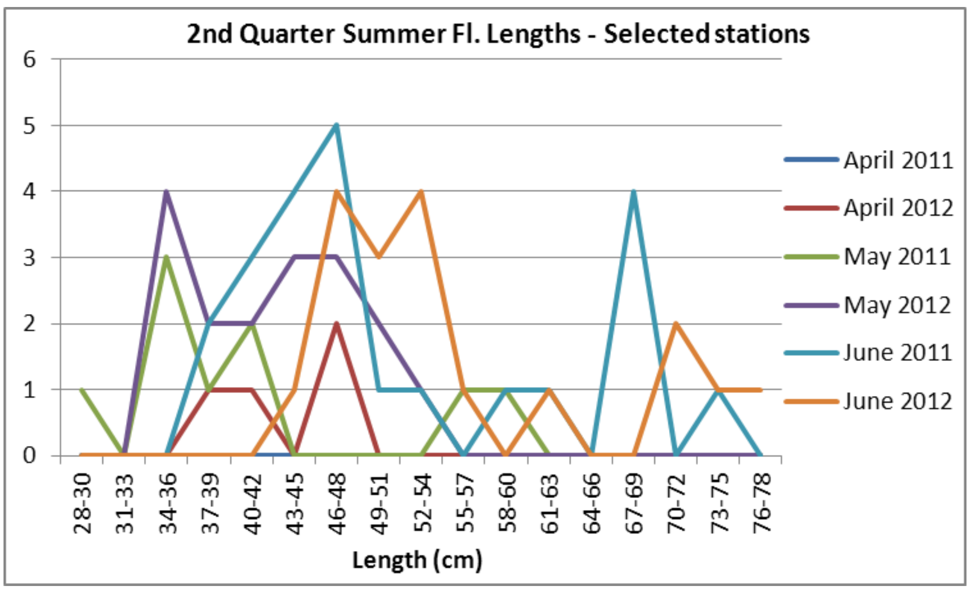

1st Quarter Windowpane lengths - Selected stations
400
350
300
250
200
150
100
50
0
10-12
13-15
16-18
19-21
22-24
25-27
28-30
31-33
34-36
37-39
40-42
43-45
46-48
Length (cm)
January 2011*
February 2012
March 2011*
March 2012*

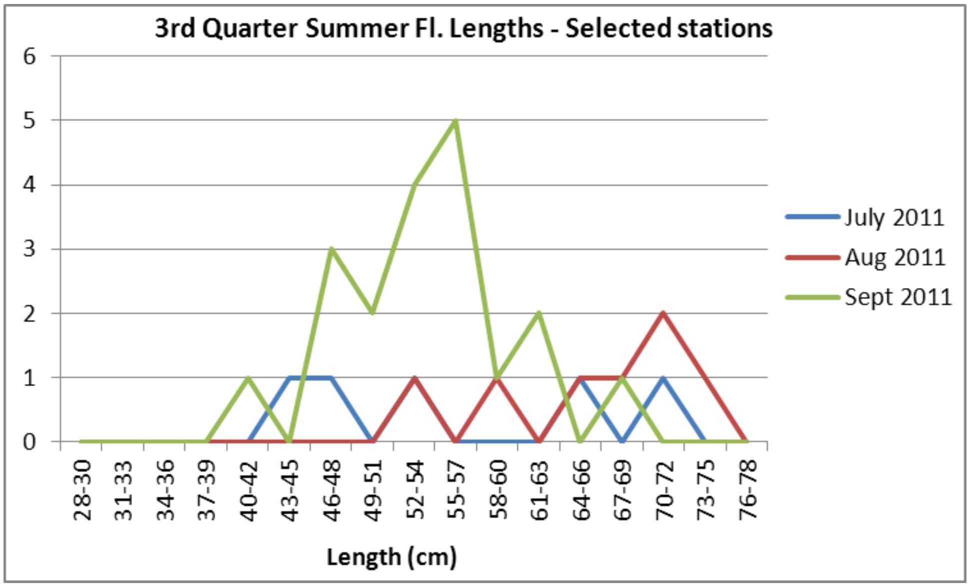

2nd quarter Windowpane lengths - Selected stations
500
450
400
350
300
250
200
150
100
50
0
10-12
13-15
16-18
19-21
22-24
25-27
28-30
31-33
34-36
37-39
40-42
43-45
46-48
Length (cm)
April 2011*
April 2012
May 2011
May 2012
June 2011
June 2012

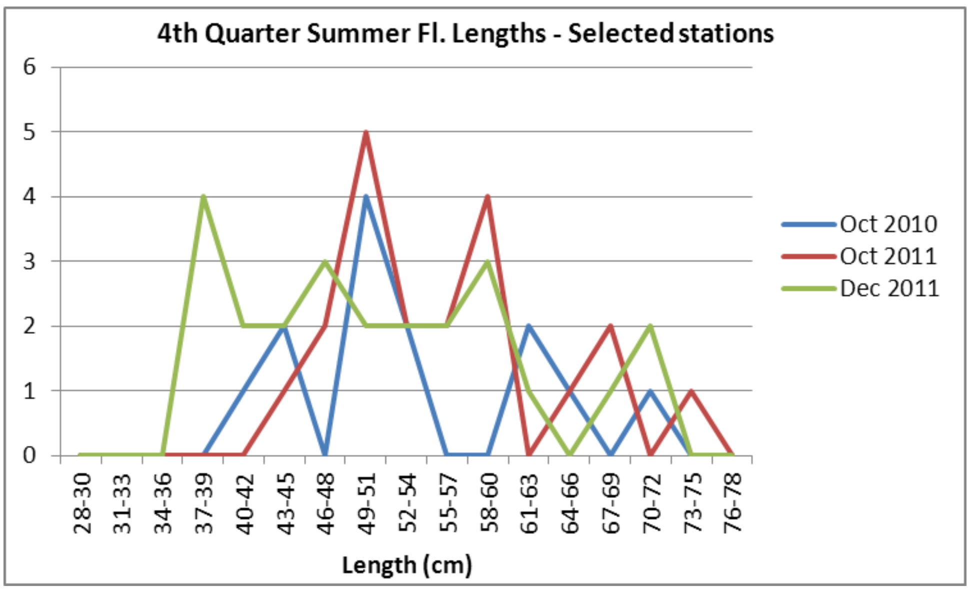

3rd Quarter Windowpane Lengths - Selected stations
45
40
35
30
25
20
15
10
5
0
10-12
13-15
16-18
19-21
22-24
25-27
28-30
31-33
34-36
37-39
40-42
43-45
46-48
Length (cm)
July 2011
Aug 2011
Sept 2011

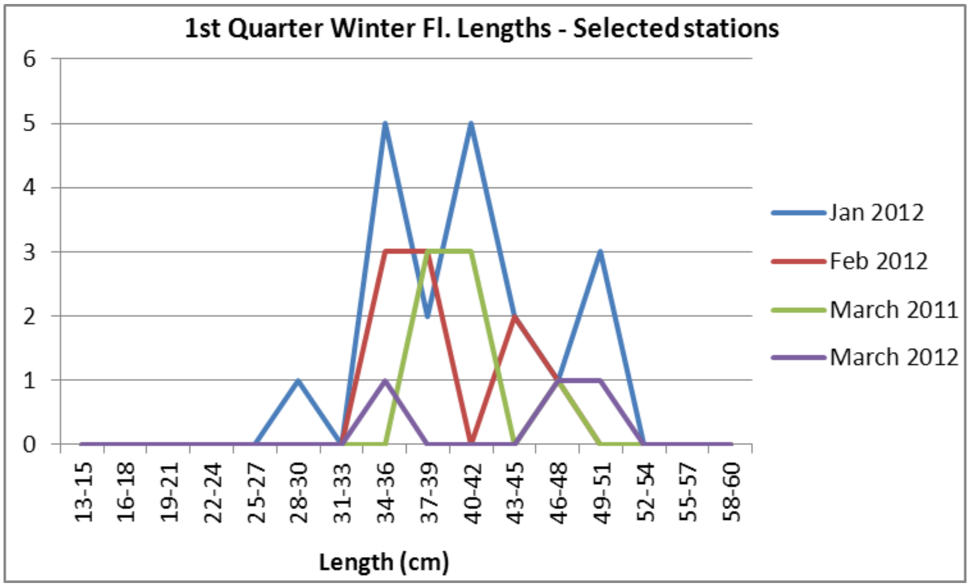

4th Quarter Windowpane Lengths - Selected stations
120
100
80
60
40
20
0
10-12
13-15
16-18
19-21
22-24
25-27
28-30
31-33
34-36
37-39
40-42
43-45
46-48
Length (cm)
Oct 2010
Oct 2011
Dec 2011

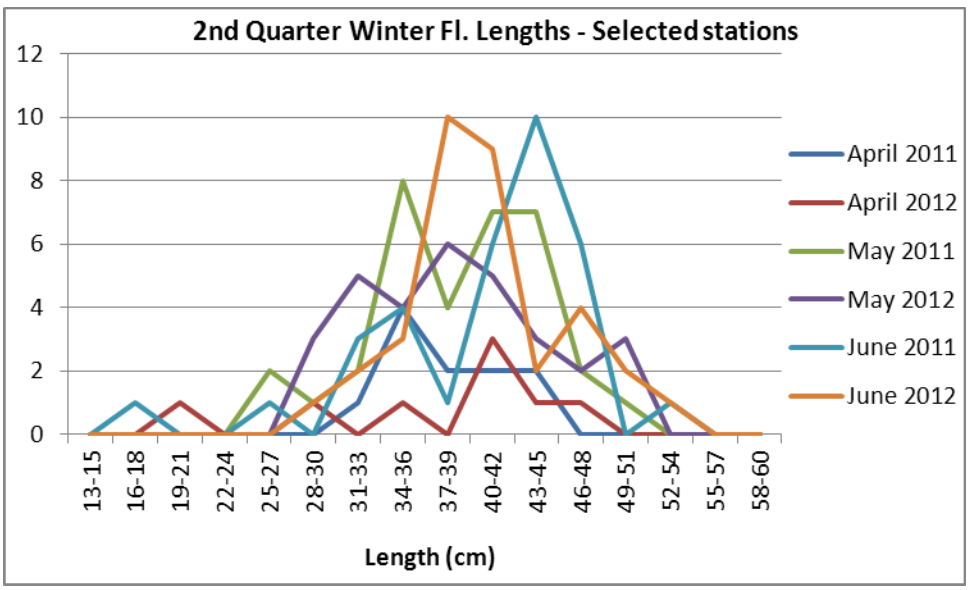

1st Quarter Summer Fl. Lengths - Selected stations
8
7
6
5
4
3
2
1
0
28-30
31-33
34-36
37-39
40-42
43-45
46-48
49-51
52-54
55-57
58-60
61-63
64-66
67-69
70-72
73-75
76-78
Length (cm)
Jan 2012
Feb 2012*
March 2011
March 2012

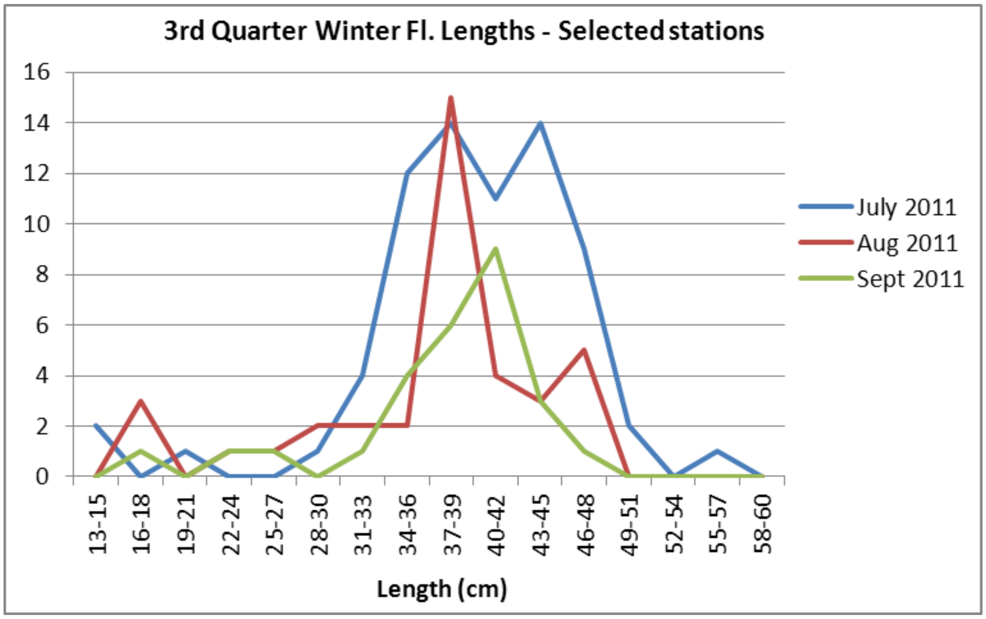

2nd Quarter Summer Fl. Lengths - Selected stations
6
5
4
3
2
1
0
28-30
31-33
34-36
37-39
40-42
43-45
46-48
49-51
52-54
55-57
58-60
61-63
64-66
67-69
70-72
73-75
76-78
Length (cm)
April 2011
April 2012
May 2011
May 2012
June 2011
June 2012

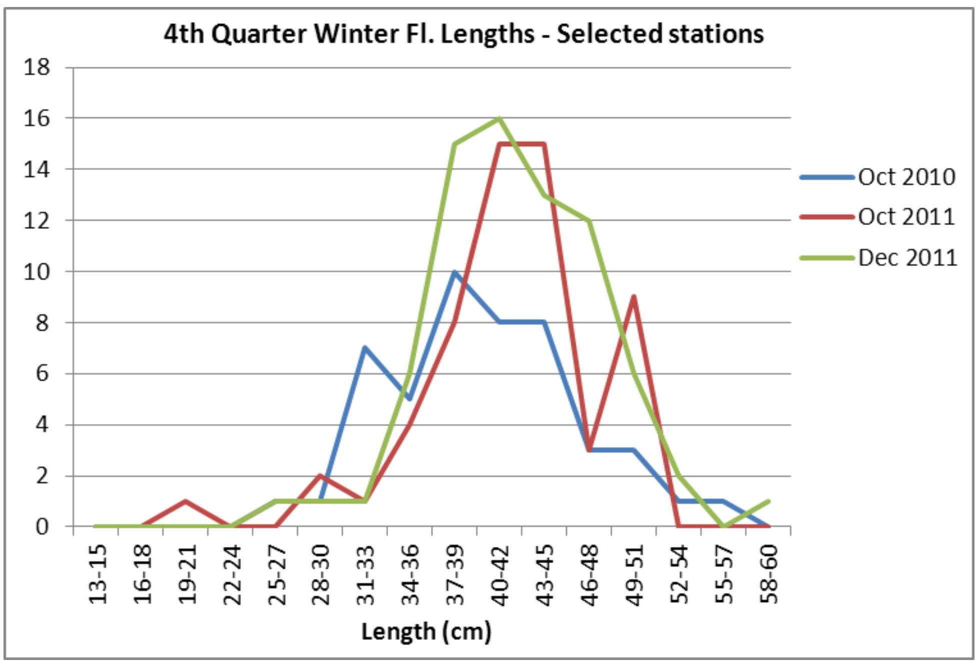

3rd Quarter Summer Fl. Lengths - Selected stations
6
5
4
3
2
1
0
28-30
31-33
34-36
37-39
40-42
43-45
46-48
49-51
52-54
55-57
58-60
61-63
64-66
67-69
70-72
73-75
76-78
Length (cm)
July 2011
Aug 2011
Sept 2011

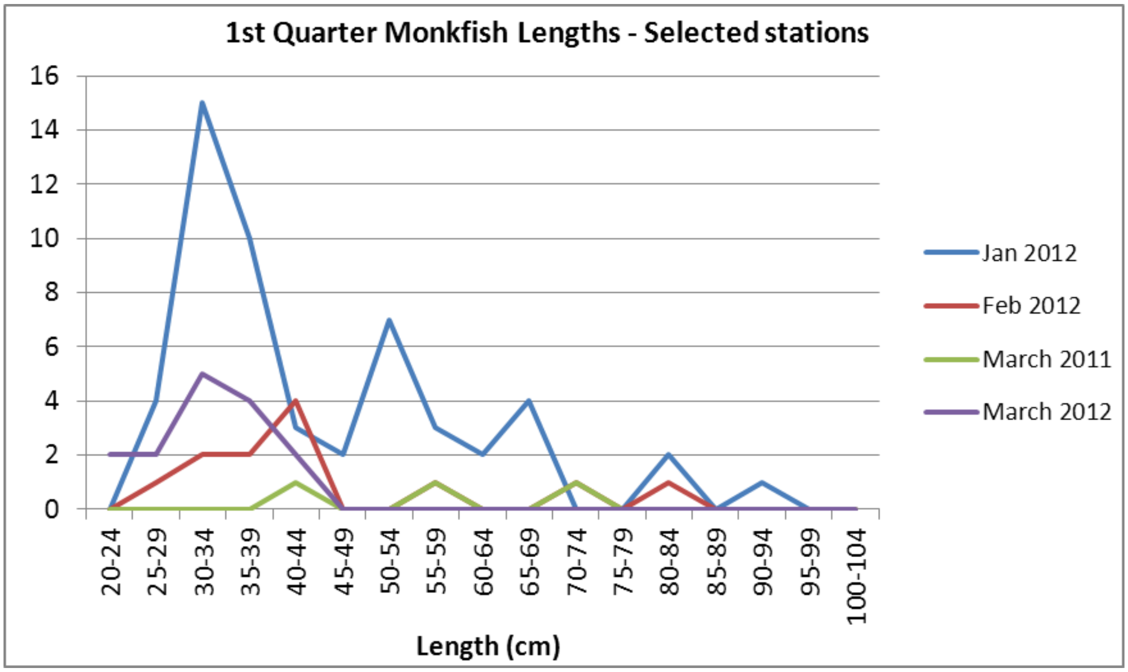

4th Quarter Summer Fl. Lengths - Selected stations
6
5
4
3
2
1
0
28-30
31-33
34-36
37-39
40-42
43-45
46-48
49-51
52-54
55-57
58-60
61-63
64-66
67-69
70-72
73-75
76-78
Length (cm)
Oct 2010
Oct 2011
Dec 2011

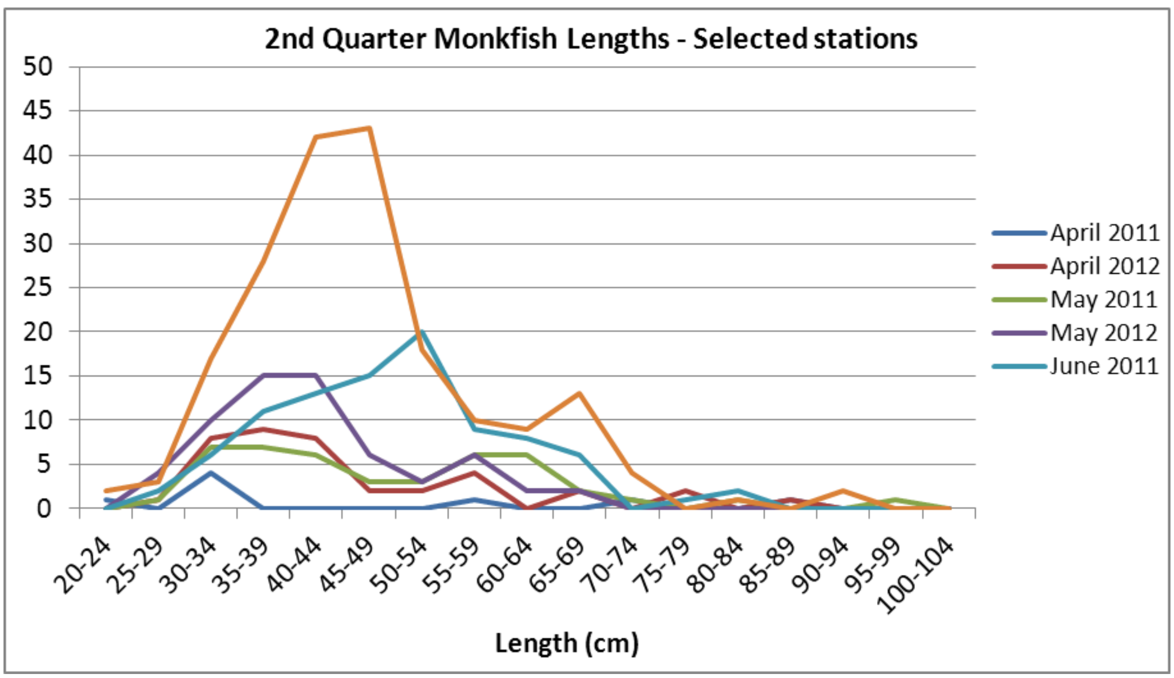

1st Quarter Winter Fl. Lengths - Selected stations
6
5
4
3
2
1
0
13-15
16-18
19-21
22-24
25-27
28-30
31-33
34-36
37-39
40-42
43-45
46-48
49-51
52-54
55-57
58-60
Length (cm)
Jan 2012
Feb 2012
March 2011
March 2012

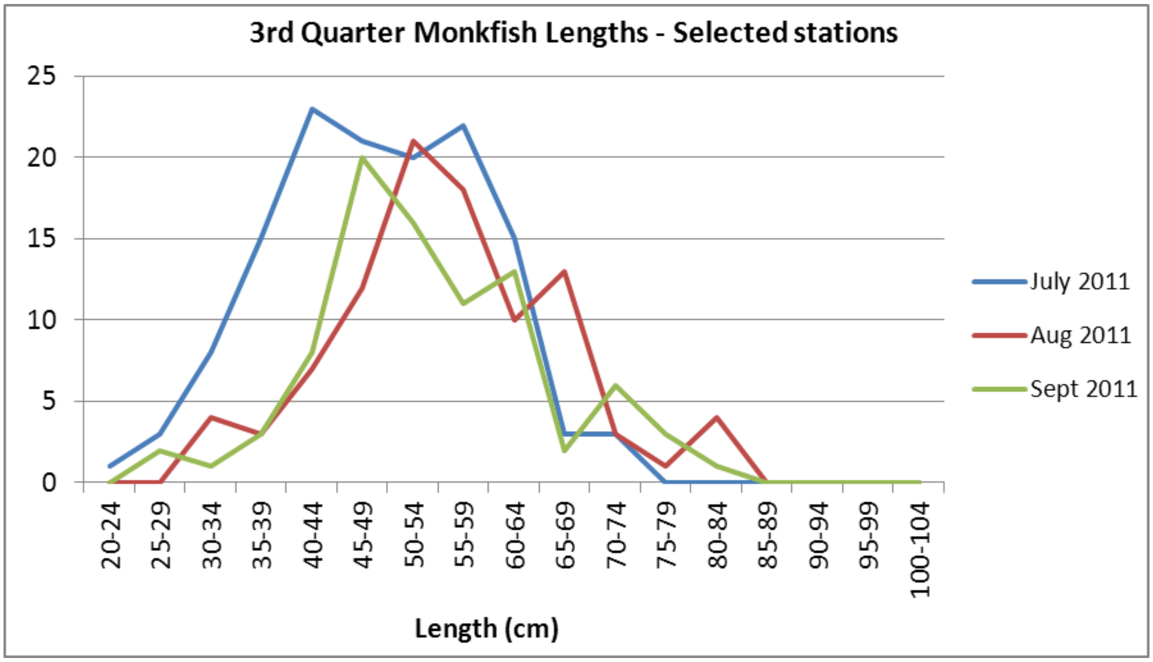

2nd Quarter Winter Fl. Lengths - Selected stations
12
10
8
6
4
2
0
13-15
16-18
19-21
22-24
25-27
28-30
31-33
34-36
37-39
40-42
43-45
46-48
49-51
52-54
55-57
58-60
Length (cm)
April 2011
April 2012
May 2011
May 2012
June 2011
June 2012

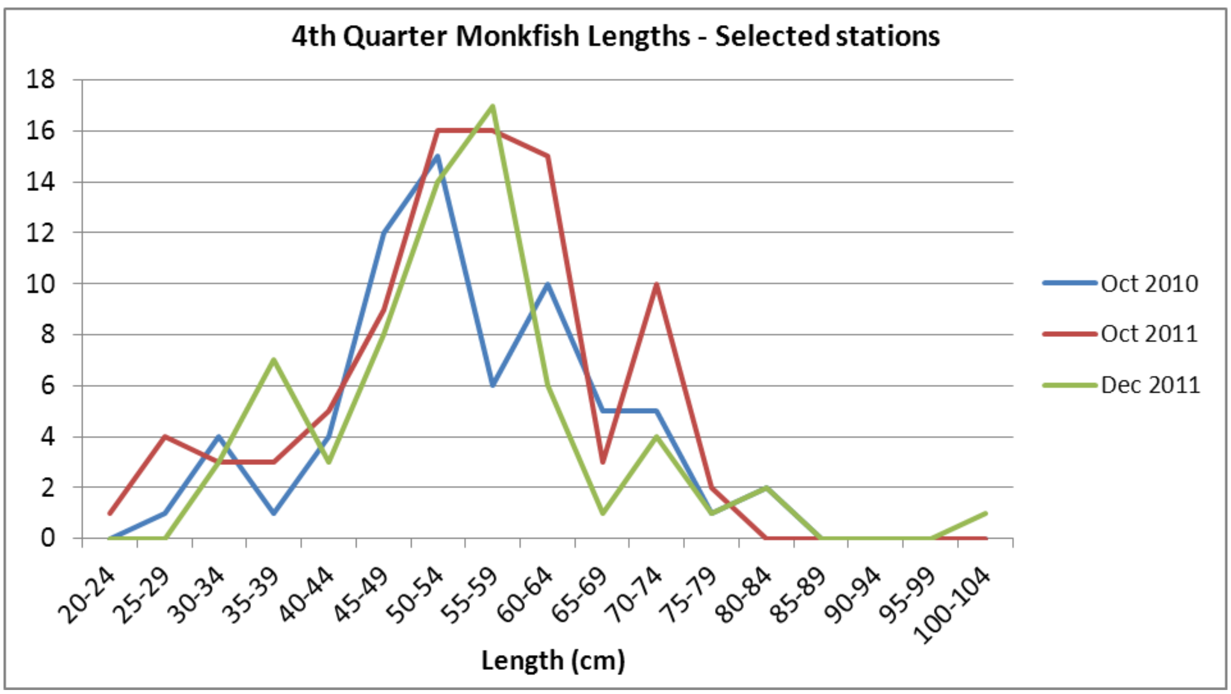

3rd Quarter Winter Fl. Lengths - Selected stations
16
14
12
10
8
6
4
2
0
13-15
16-18
19-21
22-24
25-27
28-30
31-33
34-36
37-39
40-42
43-45
46-48
49-51
52-54
55-57
58-60
Length (cm)
July 2011
Aug 2011
Sept 2011


4th Quarter Winter Fl. Lengths - Selected stations
18
16
14
12
10
8
6
4
2
0
13-15
16-18
19-21
22-24
25-27
28-30
31-33
34-36
37-39
40-42
43-45
46-48
49-51
52-54
55-57
58-60
Length (cm)
Oct 2010
Oct 2011
Dec 2011


1st Quarter Monkfish Lengths - Selected stations
16
14
12
10
8
6
4
2
0
20-24
25-29
30-34
35-39
40-44
45-49
50-54
55-59
60-64
65-69
70-74
75-79
80-84
85-89
90-94
95-99
100-104
Length (cm)
Jan 2012
Feb 2012
March 2011
March 2012


2nd Quarter Monkfish Lengths - Selected stations
50
45
40
35
30
25
20
15
10
5
0
20-24
25-29
30-34
35-39
40-44
45-49
50-54
55-59
60-64
65-69
70-74
75-79
80-84
85-89
90-94
95-99
100-104
Length (cm)
April 2011
April 2012
May 2011
May 2012
June 2011


3rd Quarter Monkfish Lengths - Selected stations
25
20
15
10
5
0
20-24
25-29
30-34
35-39
40-44
45-49
50-54
55-59
60-64
65-69
70-74
75-79
80-84
85-89
90-94
95-99
100-104
Length (cm)
July 2011
Aug 2011
Sept 2011


4th Quarter Monkfish Lengths - Selected stations
18
16
14
12
10
8
6
4
2
0
20-24
25-29
30-34
35-39
40-44
45-49
50-54
55-59
60-64
65-69
70-74
75-79
80-84
85-89
90-94
95-99
100-104
Length (cm)
Oct 2010
Oct 2011
Dec 2011

Windowpane Fl. Length Frequency (selected stations)

Length (cm)	Oct 2010	March 2011*	April 2011*	May 2011	June 2011	July 2011	Aug 2011	Sept 2011	Oct 2011	Dec 2011	Jan 2012*	Feb 2012	March 2012*	April 2012	May 2012	June 2012
10-12	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13-15	0	0	1	0	0	0	0	0	0	0	0	0	2	0	0	0
16-18	0	4	0	1	0	0	3	0	1	0	0	0	0	1	2	0
19-21	1	4	6	1	0	1	2	4	1	3	2	0	2	1	0	0
22-24	23	38	36	11	0	2	14	8	13	21	66	77	41	71	23	3
25-27	41	203	215	50	10	23	20	28	47	103	228	375	211	447	109	13
28-30	48	133	93	26	6	24	40	32	46	87	167	297	212	345	56	4
31-33	13	39	22	8	2	4	2	7	11	30	57	67	61	64	5	2
34-36	2	5	1	1	1	0	1	2	0	2	13	19	6	5	2	0
37-39	0	0	1	0	0	0	0	0	0	0	2	1	0	1	0	0
40-42	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
43-45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
46-48	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0

*not all fish measured

Yellowtail Fl. Length Frequency (selected stations)

Length (cm)	Oct 2010	March 2011	April 2011	May 2011	June 2011	July 2011	Aug 2011	Sept 2011	Oct 2011	Dec 2011	Jan 2012	Feb 2012	March 2012	April 2012	May 2012	June 2012
16-18	0	0	0	0	0	1	1	1	0	0	0	0	0	0	0	0
19-21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
22-24	0	1	1	1	0	1	0	1	1	0	0	0	1	0	0	0
25-27	1	1	0	2	3	0	2	1	0	2	0	2	1	0	2	1
28-30	2	4	3	6	2	4	34	12	8	10	1	5	8	7	5	4
31-33	52	22	27	15	19	13	86	58	63	24	14	23	30	22	19	7
34-36	128	52	45	39	37	37	92	117	130	54	62	38	83	76	36	26
37-39	209	69	61	51	63	50	171	141	180	68	75	38	113	80	55	30
40-42	125	32	38	17	18	15	52	92	135	52	40	56	95	63	28	14
43-45	16	6	5	2	3	4	19	22	23	15	5	7	53	10	3	1
46-48	4	2	0	0	1	0	1	1	3	0	0	2	8	0	1	1
49-51	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1

Monkfish Length Frequency (selected stations)

Length (cm)	Oct 2010	March 2011	April 2011	May 2011	June 2011	July 2011	Aug 2011	Sept 2011	Oct 2011	Dec 2011	Jan 2012	Feb 2012	March 2012	April 2012	May 2012	June 2012
20-24	0	0	1	0	0	1	0	0	1	0	0	0	2	0	0	2
25-29	1	0	0	1	2	3	0	2	4	0	4	1	2	1	4	3
30-34	4	0	4	7	6	8	4	1	3	3	15	2	5	8	10	17
35-39	1	0	0	7	11	15	3	3	3	7	10	2	4	9	15	28
40-44	4	1	0	6	13	23	7	8	5	3	3	4	2	8	15	42
45-49	12	0	0	3	15	21	12	20	9	8	2	0	0	2	6	43
50-54	15	0	0	3	20	20	21	16	16	14	7	0	0	2	3	18
55-59	6	1	1	6	9	22	18	11	16	17	3	1	0	4	6	10
60-64	10	0	0	6	8	15	10	13	15	6	2	0	0	0	2	9
65-69	5	0	0	2	6	3	13	2	3	1	4	0	0	2	2	13
70-74	5	1	1	1	0	3	3	6	10	4	0	1	0	0	0	4
75-79	1	0	0	0	1	0	1	3	2	1	0	0	0	2	0	0
80-84	2	0	0	1	2	0	4	1	0	2	2	1	0	0	0	1
85-89	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0
90-94	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	2
95-99	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
100-104	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0

Winter Fl. Length Frequency (selected stations)

Length (cm)	Oct 2010	March 2011	April 2011	May 2011	June 2011	July 2011	Aug 2011	Sept 2011	Oct 2011	Dec 2011	Jan 2012	Feb 2012	March 2012	April 2012	May 2012	June 2012
13-15	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0
16-18	0	0	0	0	1	0	3	1	0	0	0	0	0	0	0	0
19-21	0	0	0	0	0	1	0	0	1	0	0	0	0	1	0	0
22-24	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0
25-27	1	0	0	2	1	0	1	1	0	1	0	0	0	0	0	0
28-30	1	0	0	1	0	1	2	0	2	1	1	0	0	1	3	1
31-33	7	0	1	2	3	4	2	1	1	1	0	0	0	0	5	2
34-36	5	0	4	8	4	12	2	4	4	6	5	3	1	1	4	3
37-39	10	3	2	4	1	14	15	6	8	15	2	3	0	0	6	10
40-42	8	3	2	7	6	11	4	9	15	16	5	0	0	3	5	9
43-45	8	0	2	7	10	14	3	3	15	13	2	2	0	1	3	2
46-48	3	1	0	2	6	9	5	1	3	12	1	1	1	1	2	4
49-51	3	0	0	1	0	2	0	0	9	6	3	0	1	0	3	2
52-54	1	0	0	0	1	0	0	0	0	2	0	0	0	0	0	1
55-57	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
58-60	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0

Summer Fl. Length Frequency (selected stations)

Length (cm)	Oct 2010	March 2011	April 2011	May 2011	June 2011	July 2011	Aug 2011	Sept 2011	Oct 2011	Dec 2011	Jan 2012	Feb 2012*	March 2012	April 2012	May 2012	June 2012
28-30	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
31-33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
34-36	0	0	0	3	0	0	0	0	0	0	0	0	0	0	4	0
37-39	0	0	0	1	2	0	0	0	0	4	3	1	0	1	2	0
40-42	1	0	0	2	3	0	0	1	0	2	7	3	0	1	2	0
43-45	2	1	0	0	4	1	0	0	1	2	6	4	0	0	3	1
46-48	0	0	0	0	5	1	0	3	2	3	5	1	1	2	3	4
49-51	4	0	0	0	1	0	0	2	5	2	4	0	0	0	2	3
52-54	2	0	0	0	1	1	1	4	2	2	2	1	0	0	1	4
55-57	0	0	0	1	0	0	0	5	2	2	5	0	2	0	0	1
58-60	0	0	0	1	1	0	1	1	4	3	0	0	0	0	0	0
61-63	2	0	0	0	1	0	0	2	0	1	0	0	0	0	0	1
64-66	1	0	0	0	0	1	1	0	1	0	0	0	0	0	0	0
67-69	0	0	0	0	4	0	1	1	2	1	0	0	0	0	0	0
70-72	1	0	0	0	0	1	2	0	0	2	0	0	0	0	0	2
73-75	0	0	0	0	1	0	1	0	1	0	1	0	0	0	0	1
76-78	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1

*not all fish measured