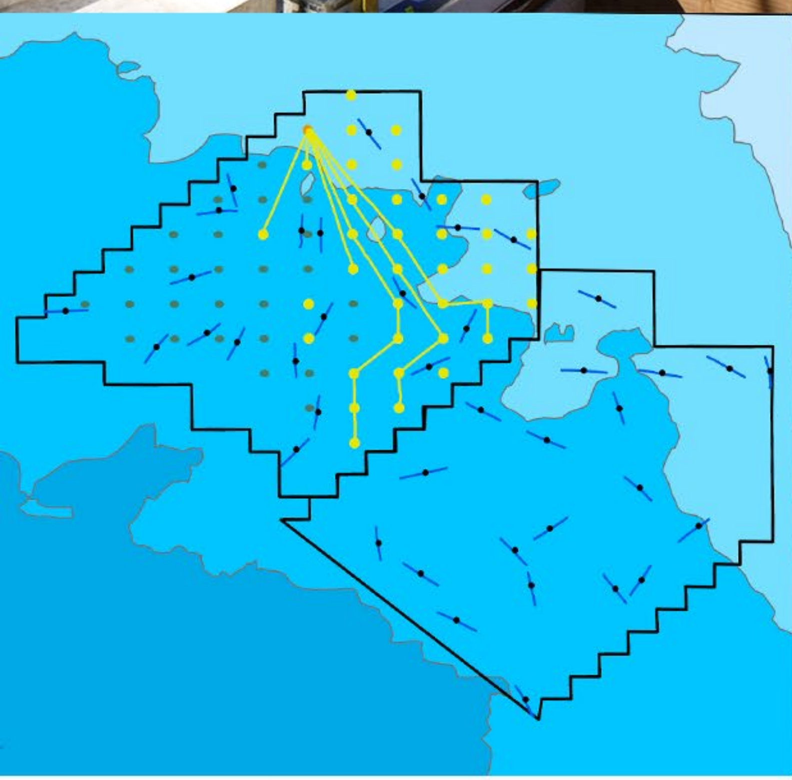
Vineyard Wind 1 Demersal Trawl Survey



Vineyard Wind 1 Study Area

Quarterly Report

Fall 2023 (October - December)

VINEYARD WIND 1 DEMERSAL TRAWL SURVEY

Fall 2023 Seasonal Report

Vineyard Wind 1 Study Area

February 2024

Prepared for Vineyard Wind 1 LLC

VINEYARD WIND

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Vineyard Wind 1 Demersal Trawl Survey Fall 2023 Seasonal Report

Vineyard Wind 1 Study Area

Progress Report #14

October 1 – December 31, 2023

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1. Introduction

In 2015, Vineyard Wind 1 LLC (Vineyard Wind) leased a 675 square kilometer (km^2) area for renewable energy development on the Outer Continental Shelf, Lease Area OCS-A 0501, which is located approximately 14 miles south of Martha's Vineyard off the south coast of Massachusetts. Vineyard Wind is conducting fisheries studies in a 306 km^2 area referred to as the "VW1 Study Area," which is the focus of this report. Fisheries studies were also conducted in Vineyard Wind shareholder company lease areas. This includes Lease Area OCS-A 0534 (the "534 Study Area") and Lease Area OCS-A 0522 (the "522 Study Area"); these studies were reported separately.[1]

The Bureau of Ocean Energy Management (BOEM) has statutory obligations under the National Environmental Policy Act to evaluate the environmental, social, and economic impacts of a potential project. Additionally, BOEM has statutory obligations under the Outer Continental Shelf Lands Act to ensure any on-lease activities "protect the environment, conserve natural resources, prevent interference with reasonable use of the U.S. Exclusive Economic Zone, and consider the use of the sea as a fishery."

To address the potential impacts, Vineyard Wind, in collaboration with the University of Massachusetts Dartmouth's School for Marine Science and Technology (SMAST), has developed a monitoring plan to assess the potential environmental impacts of the proposed development on marine fish and invertebrate communities. The impact of the development will be evaluated using the Before-After-Control-Impact (BACI) framework. This framework is commonly used to assess the environmental impact of an activity (i.e., wind farm development and operation). Under this framework, monitoring occurs prior to development (Before), and then during construction and operation (After). During these periods, changes in the ecosystem will be compared between the development site (Impact) and a control site (Control) to assess if there is any impact due to the development of wind farms. The control site will be in the general vicinity with similar characteristics to the study area (i.e., depth, habitat type, seabed characteristics, etc.). The goal of the monitoring plan is to assess the impact that wind farm construction and operation may have on the ecosystem within an ever-changing ocean.

[1] The Bureau of Ocean Energy Management (BOEM) segregated Lease Area OCS-A 0501 into two lease areas – OCS-A 0501 and OCS-A 0534 – in June 2021. The VW1 Study Area, which is located in the area designated as Lease Area OCS-A 0501, is referred to as the "501N Study Area" in SMAST fisheries survey reports compiled prior to the lease area segregation. Similarly, the 534 Study Area, which is designated as Lease Area OCS-A 0534, is referred to as the 501S Study Area in SMAST fisheries survey reports compiled prior to the lease area segregation.

The current monitoring plan incorporates multiple surveys utilizing a range of survey methods to assess different facets of the regional marine ecosystem. The trawl survey is one component of the overall survey plan. A demersal otter trawl, further referred to as a trawl, is a net that is towed behind a vessel along the seafloor and expanded horizontally by a pair of otter boards or trawl doors (Figure 1). Trawls tend to be relatively indiscriminate in the fish and invertebrates they collect; hence, bottom trawls are a generally accepted tool for assessing the biological communities along the seafloor and are widely used by institutions worldwide for ecosystem monitoring. Since they are actively towed behind a vessel, they are less biased by fish activity and behavior than passive fishing gear (i.e., gillnets, longlines, traps, etc.), which relies on animals moving to the gear. As such, state and federal fisheries management agencies heavily rely on trawl surveys to evaluate ecosystem changes and to assess the abundance of fishery resources. The current trawl survey closely emulates the Northeast Area Monitoring and Assessment Program (NEAMAP) survey protocol. In doing so, the goal was to ensure compatibility with other regional surveys, including the National Marine Fisheries Service annual spring and fall trawl surveys, the annual NEAMAP spring and fall trawl surveys, and state trawl surveys including the Massachusetts Division of Marine Fisheries trawl survey. The NEAMP survey protocol has also been adopted by trawl surveys conducted in other offshore wind development areas in the northeast US by other institutions. The bottom trawl survey is complemented by the drop camera survey and the lobster trap survey in the same area, also carried out by SMAST (reported separately).

The primary goal of this survey was to provide data related to fish abundance as represented by catch per unit effort (CPUE), distribution, and population structure in the VW1 Study Area and an adjacent area (Control Area). Offshore construction activities for the Vineyard Wind 1 project began in the spring of 2023. The data will serve to assess the impact that offshore construction activities have on fish communities. The reports for the first three years of pre-construction baseline monitoring from spring 2019 to summer 2022 have been submitted to the sponsoring organization. This progress report documents the survey methodology, survey effort, and data collected during the fall of 2023.

2. Methodology

The methodology for the survey was adapted from the Atlantic States Marine Fisheries Commission's NEAMAP nearshore trawl survey. Initiated in 2006, NEAMAP conducts annual spring and fall trawl surveys from Cape Hatteras to Cape Cod. The NEAMAP survey protocol has gone through extensive peer review and is currently implemented near Lease Area OCS-A 0501 using a commercial fishing vessel (Bonzek et al., 2008). The current NEAMAP protocol samples at a resolution of ~100 km^2, which is inadequate to provide scientific information related to potential changes on a smaller scale. Adapting existing methods with increased resolution (see Section 2.1) will enable the survey to fulfill the primary goal of evaluating the impact of wind farm development while improving the consistency between survey platforms. This should facilitate easier sharing and integration of the data with state and federal agencies and allow the data from this survey to be incorporated into existing datasets to enhance our understanding of the region's ecosystem dynamics. Additionally, the methodology is consistent with other ongoing surveys of nearby study areas (i.e., the 534 Study Area and 522 Study Area).

2.1 Survey Design

The current survey is designed to provide baseline data on catch rates, population structure, and community composition for a future environmental assessment using the BACI framework as recommended by BOEM (BOEM, 2013). Tow locations within the VW1 Study Area were selected using a spatially balanced sampling design. The current VW1 Study Area (total area: 265 km^2) was sub-divided into 20 sub-areas (each ~13.25 km^2), and one trawl tow was made in each of the 20 sub-areas. This was designed to ensure adequate spatial coverage throughout the VW1 Study Area. The starting location within each sub-area was randomly selected (Figure 2). Prior to the start of this survey, scour protection had been placed at all wind turbine locations. Scour protection consists of stone and rock material (~10 – 30 centimeter [cm] diameter) placed around the wind turbine's foundation to minimize the removal of sediment by hydrodynamic forces. The scour protection layer was ~50 meters (m) in diameter from the center of foundation, which makes the area untrawlable with demersal trawls. Additionally, the installation of several wind turbine foundations had begun. To address these untowable areas, alternative tow locations were created for each sub-area. If the primary tow location was located within an area with scour protection or a wind turbine foundation, the alternative tow location was used. Additionally, tow directions were selected to avoid towing the trawl across the scour protection.

An area located to the east of the VW1 Study Area was established as a control region, further referred to as the Control Area. The selected region has similar depth contours, bottom types, and benthic habitats to the VW1 Study Area. The Control Area (total area: 269.5 km^2) was sub-divided into 20 sub-areas (each ~13.5 km^2). An additional 20 tows, one per sub-area, were completed in the Control Area. The tow locations were selected in the same manner as the VW1 Study Area, using the spatially balanced sampling design.

The selection of 20 tows in each area was based on a preliminary power analysis conducted using catch data from a scoping survey (Stokesbury and Lowery, 2018). This information was updated based on catch data from the 2019/2020 and 2020/2021 survey years (Rillahan and He, 2020, Rillahan and He, 2021). The results of the updated power analysis indicated that several species, including little skate (*Leucoraja erinacea*), Atlantic longfin squid (*Dorytheuthis pealei*), silver hake (*Merluccius bilinearis*), and fourspot flounder (*Paralichthys oblongus*), had relatively low variability and therefore a high probability of detecting small to moderate effects (i.e., ~25% change) under the current monitoring effort. Many other common species observed, including winter skate (*Leucoraja ocellata*), red hake (*Urophycis chuss*), windowpane flounder (*Scophtalmus aquosus*), monkfish (*Lophius americanus*), summer flounder (*Paralichthys dentatus*), scup (*Stenotomus chrysops*), yellowtail flounder (*Pleironectes ferrugineus*), winter flounder (*Pleuronectes americanus*), and butterfish (*Peprilus triacanthus*), had higher variability (Coefficient of variation [CV]: 1.5 – 2.3). For these species, the current monitoring effort would have a high probability of detecting moderate effects (i.e., 30 – 50% change). For species exhibiting strong seasonality and high variability (CV: 2.5 – 4), large effects (i.e., 50 – 75% change) can be detected with a high probability under the current monitoring plan. For all species collected during the surveys, the current monitoring plan has the statistical power to detect a complete disappearance from either the VW1 Study Area or Control Area (i.e., 100% change). The updated power analysis showed that increasing the survey effort would only result in small improvements in the detectability of change.

Accounting for spatial and temporal variations in fish assemblages reduces the assumptions of the population dynamics while increasing the power to detect changes due to the impacting activities. When distributing the survey effort, randomly selecting multiple tow locations across the VW1 Study Area and Control Area accounts for spatial variations in fish populations. The distributed approach, applied here, assumes that the catch characteristics across each survey area represent the ecosystem. Additionally, surveying each site seasonally accounts for temporal variations in fish populations. This methodology is commonly referred to in the scientific literature as the "beyond-BACI" approach (Underwood, 1991).

The survey will have a sampling density of one station per 13.25 km^2 (3.86 square nautical miles [nmi^2]) in the VW1 Study Area and one station per 13.5 km^2 (3.94 nmi^2) in the Control Area. As previously mentioned, the NEAMAP nearshore survey samples at a density of one station per ~100 km^2 (30 nmi^2).

2.2 Trawl Net

To ensure standardization and compatibility between these surveys and ongoing regional surveys, and to take advantage of the well-established survey protocol, the otter trawl used in this survey has an identical design to the trawl used for the NEAMAP surveys, including otter boards, ground cables, and sweeps. This trawl was designed by the Mid-Atlantic and New England Fisheries Management Council's Trawl Advisory Panel (NTAP). As a result, the net design has been accepted by management authorities, the scientific community, and the commercial fishing industry in the region.

The survey trawl is a three-bridle, four-seam bottom trawl (Figure 3). This net style allows for a high vertical opening (~5 m) relative to the size of the net and consistent trawl geometry. These features make it suitable to sample a wide diversity of species with varying life history characteristics (i.e., demersal, pelagic, benthic, etc.). To effectively capture benthic organisms, a "flat sweep" was used (Figure 4). A "flat sweep" contains tightly packed rubber disks and lead weights, which ensures close contact with the substrate and minimizes the escape of fish under the net. This is permissible due to the soft bottom (i.e., sand, mud) in the survey areas. To ensure the retention of small individuals, a 1" mesh size knotless liner was used within a 12-cm diamond mesh codend. Thyboron Type IV 66" trawl doors were used to horizontally open the net. The trawl doors were connected to the trawl by a series of steel wire bridles (see Figures 5 and 6 for a diagram of the trawl's rigging during the surveys). For a detailed description of the trawl design, see Bonzek et al. (2008).

2.3 Trawl Geometry and Acoustic Monitoring Equipment

To ensure standardization between tows, the net geometry was required to be within pre-specified tolerances (±10%) for each of the geometry metrics (door spread, wing spread, and headline height). These metrics were developed by the NTAP and are part of the operational criteria in the NEAMAP survey protocol. Headline height was targeted to be between 5.0 and 5.5 m with acceptable deviations between 4.5 and 6.1 m. Wing spread was targeted between 13.0

and 14.0 m (acceptable range: 11.7 – 15.4 m). Door spread was targeted between 32.0 and 33.0 m (acceptable range: 28.8 – 37.4 m).

The Simrad PX net mensuration system (Kongsberg Group, Kongsberg, Norway) was used to monitor the net geometry (Figure 1). Two sensors were placed in the doors, one in each, to measure the distance between the doors, referred to as door spread. Two sensors placed on the center wingends measured the horizontal spread of the net, commonly referred to as the wing spread. A sensor with a sonar transducer was placed on the top of the net (headrope) to measure the vertical net opening, referred to as headline height. The headline sensor also measured bottom water temperature. To ensure the net was on the bottom a sensor was placed behind the footrope in the belly of the net. That sensor was equipped with a tilt sensor which reported the angle of the net belly. An angle around 0° indicated the net was on the seafloor. A towed hydrophone was placed over the side of the vessel to receive the acoustic signals from the net sensors. A processing unit, located in the wheelhouse and running the TV80 software, was used to monitor and log the data during tows (Figure 7).

2.4 Survey Operations

The survey was conducted on the F/V *Heather Lynn*, an 84' stern trawler operating out of Point Judith, Rhode Island between November 12 and 17, 2023. The F/V *Heather Lynn* is a commercial fishing vessel currently operating in the industry. One trip to the survey areas was made during which all planned tows were completed. As previously mentioned, this survey occurred during the Vineyard Wind 1 construction phase. Prior to this survey, all the scour protection had been deposited on the seafloor for the project's wind turbines and the electrical service platform had been installed. Thirty-four wind turbine foundations had been installed in Lease Area OCS-A 0501 using pile driving before this survey. Two wind turbines were installed during this survey. Additionally, 18 inter-array cables had been laid on the seafloor: sixteen were buried prior to the start of the survey while two were buried during the survey.

Surveys were alternated daily between the VW1 Study Area and Control Area. Tows were only conducted during daylight hours. All tows started at least 30 minutes after sunrise and ended 30 minutes before sunset. This was intended to reduce the variability commonly observed during crepuscular periods. Tow duration was 20 minutes at a target tow speed of 3.0 knots (range: 2.8 – 3.2 knots). Timing of the tow duration was initiated when the wire drums were locked and ended at the beginning of the haulback (i.e., net retrieval). The trawl was towed behind the fishing vessel from steel wires, commonly referred to as trawl warp. The trawl warp ratio (trawl warp: seafloor depth) was set to ~4:1. This decision was based on the net geometry data obtained from the 2019 surveys indicating that the 4:1 ratio constrained the horizontal spreading of the net to provide the desired headline height.

In addition to monitoring the net geometry to ensure acceptable performance (as described in Section 2.3 above), the following environmental and operational data were collected:

- Cloud cover (i.e., clear, partly cloudy, overcast, fog, etc.)
- Wind speed (Beaufort scale)
- Wind direction
- Sea state (Douglas Sea Scale)
- Start and end position (Latitude and Longitude)
- Start and end depth
- Tow speed
- Bottom temperature

Tow paths and tow speed were continuously logged using the OpenCPN charting software (opencpn.org) running on a computer with a USB GPS unit (GlobalSat BU-353-S4).

A CTD sonde (RBR Concerto[3], RBR LTD, Ottawa, Canada) was deployed off the side of the vessel at the conclusion of each tow. The CTD sonde was lowered to the seafloor at a rate of ~30 cm per second. Upon hitting the seafloor, the sonde was immediately retrieved. The CTD sonde recorded water column profiles of conductivity/salinity, temperature, and pressure/depth at a sampling rate of 8 Hertz.

2.5 Catch Processing

The catch from each tow was sorted by species. Aggregated weight from each species was weighed on a motion-compensated scale (M1100, Marel Corp., Gardabaer, Iceland). Individual fish length (to the nearest centimeter) and weight (to the nearest gram) were collected. Length data were collected using a digital measuring board (DCS-5, Big Fin Scientific LLC, Austin, Texas) and individual weights were measured using a motion-compensated digital scale (M1100, Marel Corp., Gardabaer, Iceland). An Android tablet (Samsung Active Tab 2) running DCSLinkStream (Big Fin Scientific LLC, Austin, Texas) served as the data collection platform.

Efforts were made to process all animals; however, during large catches sub-sampling was used for some abundant species. Only one sub-sampling strategy was employed over the duration of the survey: straight sub-sampling by weight.

Straight sub-sampling by weight: When catch diversity was relatively low (5 to 10 species), straight sub-sampling was used. In this method, the catch was sorted by species. An aggregated species weight was measured and then a sub-sample (50 – 100 individuals) was collected for individual length and weight measurements. The ratio of the sub-sample weight to the total species weight was then used to extrapolate the length-frequency estimates. This was the predominant sub-sampling strategy.

Lengths were collected during every tow. Individual fish weights were collected during every tow for low abundance species (<20 individuals/tow) or during alternating tows for abundant species (>20 individuals/tow). The result from each tow was a measurement of aggregated weight, length-frequency curves, and length-weight curves for each species except crabs, lobsters, and some non-commercial species. For these species, aggregated weight and counts were collected. Any observation of squid eggs was documented. All survey data were uploaded and stored in a Microsoft Access database.

3. Results

3.1 Operational Data, Environmental Data, and Trawl Performance

Twenty tows were successfully completed in both the VW1 Study Area and the Control Area (Figure 2, Table 1). Operational parameters were similar between these two survey areas (Table 2). Tow durations averaged 20.0 ± 0.1 minutes (mean ± one standard deviation) in the VW1 Study Area and 20.0 ± 0.1 minutes in the Control Area. Tow distances averaged 0.96 ± 0.02 nautical miles (nmi) in the VW1 Study Area giving an average tow speed of 2.9 ± 0.1 knots. Similarly, tow distance averaged 0.96 ± 0.05 nmi in the Control Area giving an average tow speed of 2.9 ± 0.1 knots.

The trawl geometry data indicated that the trawl took about two to three minutes to open and stabilize. Once open, readings were stable throughout the duration of the tow. Door spread averaged 34.0 ± 1.0 m (range: 31.7 – 35.5 m) for tows in the VW1 Study Area and 34.1 ± 1.3 (range: 30.9 – 35.8 m) in the Control Area. Wing spread averaged 13.7 ± 0.6 m for tows in the

VW1 Study Area (range: 12.8 – 14.8 m) and 13.7 ± 0.7 m for tows in the Control Area (range: 12.1 – 14.7 m). Headline height averaged 5.4 ± 0.2 m for tows in the VW1 Study Area (range: 5.0 – 5.7 m) and 5.5 ± 0.3 m for tows in the Control Area (range: 5.2 – 6.0 m). All tows were in the acceptable range for all trawl geometry parameters.

The seafloor in both areas follows a northeast-to-southwest depth gradient with the shallowest tow along the northeastern edge (~33 m). Depth increased to a maximum of 50 m along the southwestern boundary. Bottom water temperature was consistent across depths and survey areas. Bottom water temperature varied from 13.3 – 13.8°C [56 – 57°F]. No thermocline was observed in the in the VW1 Study Area (Figure 8) or the Control Area (Figure 9).

3.2 Catch Data

3.2.1 VW1 Study Area

In the VW1 Study Area, a total of 33 species were caught over the duration of the survey (Table 3). Catch volume ranged from 27.0 to 2,398.4 kilograms per tow (kg/tow) with an average of 495.7 kg/tow. The majority of the catch was primarily comprised of a small subset of the observed species. The five most abundant species (scup, butterfish, little skate, silver hake, and Atlantic longfin squid) accounted for 94.4% of the total catch weight. Data collected from this area included the catch of both adults and juveniles of most species observed.

Scup was the most abundant species, accounting for 61.3% of the total catch weight. Individuals ranged in length from 6 to 31 cm in length with a unimodal size distribution consisting of a peak at 19 cm (Figure 10). Scup were observed in 19 of the 20 tows at an average catch rate of 302.3 ± 104.4 kg/tow (mean ± Standard Error of the Mean [SEM], range: 0 – 1,991.1 kg/tow). Scup were primarily caught in the southern half of the VW1 Study Area (Figure 11).

Butterfish was the second most abundant species, accounting for 19.5% of the total catch weight. Individuals ranged in length from 5 to 17 cm in length with a bimodal size distribution consisting of a small peak at 8 cm and a larger peak at 14 cm (Figure 12). Butterfish were observed in all 20 tows at an average catch rate of 97.1 ± 34.3 kg/tow (range: 0.5 – 586.5 kg/tow). Similar to scup, butterfish were primarily caught in the southern half of the VW1 Study Area (Figure 13).

Little skate was the third most abundant species observed, accounting for 5.9% of the total catch weight. Individuals ranged in length from 12 to 34 cm (disk width) with a unimodal size distribution consisting of a peak at 26 cm (Figure 14). Little skate were observed in all 20 tows with an average catch rate of 29.8 ± 6.2 kg/tow (range: 1.8 – 116.5 kg/tow). The catch of little skate was relatively uniform across the VW1 Study Area (Figure 15).

Silver hake, a commercially important species also commonly referred to as whiting, was a frequently observed species in the VW1 Study Area. Silver hake was the fourth most abundant species, accounting for 4.4% of the total catch weight. Individuals ranged in length from 8 to 48 cm with a unimodal distribution consisting of a peak at 24 cm (Figure 16). Silver hake were observed in 18 of the 20 tows at an average catch rate of 21.6 ± 7.0 kg/tow (range: 0 – 92.7 kg/tow). Higher catch rates were observed in the southern half of the VW1 Study Area (Figure 17). Low catch rates were observed in the northern half of the VW1 Study Area.

Atlantic longfin squid is a commercially important species commonly referred to as loligo squid. Atlantic longfin squid was the fifth most abundant species, accounting for 3.4% of the total catch weight. Atlantic longfin squid ranged in length from 2 to 25 cm (mantle length) with a unimodal size distribution peaking at 5 cm (Figure 18). Atlantic longfin squid were observed in all 20 tows at an average catch rate of 17.3 ± 1.7 kg/tow (range: 4.7 – 29.9 kg/tow). Atlantic longfin squid were caught throughout the VW1 Study Area with catch rates increasing from south to north (Figure 19). No squid “mops” were observed during this survey.

Winter skate was frequently observed in the VW1 Study Area. Individuals ranged in length from 13 to 54 cm (disk width) with a wide size distribution (Figure 20). Winter skate were observed in 15 of the 20 tows. Catch rates averaged 5.0 ± 1.9 kg/tow (range: 0 – 37.8 kg/tow). Winter skate were distributed throughout the VW1 Study Area with higher catches observed in the southern half of the development area (Figure 21).

Spiny dogfish (*Squalus acanthias*) were frequently observed in the VW1 Study Area. Individuals ranged in length from 32 to 88 cm with a broad size distribution (Figure 22). Spiny dogfish were observed in 18 of the 20 tows. Catch rates averaged 4.7 ± 1.1 kg/tow (range: 0 – 21.8 kg/tow). Spiny dogfish were observed throughout the VW1 Study Area (Figure 23).

Windowpane flounder is a federally regulated flatfish species found in the VW1 Study Area. Individuals ranged in length from 18 to 29 cm with a unimodal size distribution peaking at 22 cm (Figure 24). Windowpane flounder were observed in 19 of the 20 tows at an average catch rate of 3.6 ± 0.7 kg/tow (range: 0 – 11.7 kg/tow). Windowpane flounder were observed to be dispersed across the VW1 Study Area (Figure 25).

Black sea bass (*Centropristis striata*) is a commercially important species commonly observed in the VW1 Study Area. Black sea bass ranged in length from 16 to 40 cm with a wide size distribution (Figure 26). Black sea bass were observed in 16 of the 20 tows at an average catch rate of 2.5 ± 0.6 kg/tow (range: 0 – 9.3 kg/tow). Black sea bass were observed to be dispersed across the VW1 Study Area (Figure 27).

Summer flounder is a commercially important flatfish species commonly referred to as fluke. Summer flounder were commonly caught in the VW1 Study Area. Summer flounder ranged in length from 10 to 63 cm with a broad size distribution (Figure 28). Summer flounder were observed in 11 of the 20 tows at an average catch rate of 1.4 ± 0.5 kg/tow (range: 0 – 8.7 kg/tow). Summer flounder were caught sporadically around the VW1 Study Area (Figure 29).

Less common recreational and commercial species observed included 54 individuals of weakfish (*Cynoscion regalis*, size: 31 – 39 cm), 23 individuals of bluefish (*Pomatomus saltatrix*, size: 23 – 52 cm), seven individuals of winter flounder (size: 23 – 35 cm), four individuals of yellowtail flounder (size: 26 – 27 cm), two individuals of northern kingfish (*Menticirrhus saxatilis*, size: 91 cm), one individual monkfish (size: 74 cm), one individual Atlantic sea scallop (*Placopecten magellanicus*), and one individual American lobster (*Homarus americanus*).

One dusky shark (*Carcharhinus obscurus*) was caught. The shark was estimated to be ~1 m long (fork length). The animal was immediately returned to the sea and was observed to swim away.

3.2.2 Control Area

In the Control Area, a total of 31 species were caught over the duration of the survey (Table 4). Catch volume ranged from 6.2 to 1,060.3 kg/tow with an average of 487.9 kg/tow. The majority of the catch was primarily comprised of a small subset of the observed species. The five most abundant species (scup, little skate, silver hake, butterfish, and Atlantic longfin squid) accounted for 92.7% of the total catch weight. Data collected from this area included the catch of both adults and juveniles of most species observed.

Scup was the most abundant species, accounting for 73.9% of the total catch weight. Individuals ranged in length from 2 to 30 cm with a unimodal size distribution consisting of a peak at 19 cm (Figure 10). Scup were observed in all 20 tows at an average catch rate of 358.9 ± 61.5 kg/tow (range: 0.7 – 901.1 kg/tow). Scup were caught throughout the Control Area (Figure 11).

Little skate was the second most abundant species observed, accounting for 7.1% of the total catch weight. Individuals ranged in length from 14 to 35 cm (disk width) with a unimodal size distribution consisting of a peak a 25 cm (Figure 14). Little skate were observed in 19 of the 20 tows with an average catch rate of 35.1 ± 7.5 kg/tow (range: 0 – 122.9 kg/tow). The catch of little skate was relatively uniform across the Control Area (Figure 15).

Silver hake was the third most abundant species, accounting for 6.0% of the total catch weight. Individuals ranged in length from 7 to 34 cm with a unimodal distribution consisting of a peak at 24 cm (Figure 16). Silver hake were observed in 19 of the 20 tows at an average catch rate of 29.3 ± 7.5 kg/tow (range: 0 – 103.4 kg/tow). The catch of silver hake was dispersed across the Control Area (Figure 17).

Butterfish was the fourth most abundant species, accounting for 4.2% of the total catch weight. Individuals ranged in length from 5 to 18 cm in length with a bimodal size distribution consisting of a small peak at 7 cm and a larger peak at 14 cm (Figure 12). Butterfish were observed in all 20 tows at an average catch rate of 21.2 ± 5.6 kg/tow (range: 0.8 – 95.0 kg/tow). Butterfish were dispersed across the Control Area (Figure 13).

Atlantic longfin squid was the fifth most abundant species, accounting for 1.5% of the total catch weight. Atlantic longfin squid ranged in length from 2 to 28 cm (mantle length) with a broad size distribution (Figure 18). Atlantic longfin squid were observed in all 20 tows at an average catch rate of 7.3 ± 2.3 kg/tow (range: 0.6 – 37.3 kg/tow). Atlantic longfin squid were caught throughout the Control Area with the highest catch rates observed in the northern half of the study area (Figure 19). No squid "mops" were observed during this survey.

Windowpane flounder were commonly found in the Control Area. Individuals ranged in length from 16 to 31 cm with a unimodal size distribution peaking at 22 cm (Figure 24). Windowpane flounder were observed in all 20 tows at an average catch rate of 7.2 ± 1.8 kg/tow (range: 0.3 – 28.2 kg/tow). Windowpane flounder were observed to be dispersed across the Control Area with higher catches observed in the northern half of the study area (Figure 25).

Winter skate was frequently observed in the Control Area. Individuals ranged in length from 19 to 52 cm (disk width) with a wide size distribution (Figure 20). Winter skate were observed in 15 of the 20 tows. Catch rates averaged 6.6 ± 1.7 kg/tow (range: 0 – 34.0 kg/tow). Winter skate were distributed throughout the Control Area (Figure 21).

Spiny dogfish were frequently observed in the Control Area. Individuals ranged in length from 49 to 96 cm with a broad size distribution (Figure 22). Spiny dogfish were observed in 13 of the 20 tows. Catch rates averaged 5.2 ± 1.6 kg/tow (range: 0 – 20.4 kg/tow). Spiny dogfish were observed throughout the Control Area with the majority of the catch occurring in the southern half of the Control Area (Figure 23).

Black sea bass were commonly observed in the Control Area. Black sea bass ranged in length from 14 to 42 cm with a wide size distribution (Figure 26). Black sea bass were observed in 18 of the 20 tows at an average catch rate of 2.1 ± 0.4 kg/tow (range: 0 – 7.4 kg/tow). Black sea bass were observed to be dispersed across the Control Area (Figure 27).

Summer flounder were commonly caught in the Control Area. Summer flounder ranged in length from 28 to 60 cm with a broad size distribution (Figure 28). Summer flounder were observed in 10 of the 20 tows at an average catch rate of 1.2 ± 0.4 kg/tow (range: 0 – 5.1 kg/tow). Summer flounder were caught sporadically around the Control Area (Figure 29).

Less common recreational and commercial species observed included 70 individuals of weakfish (size: 28 – 42 cm), five individuals of winter flounder (size: 26 – 41 cm), four individuals of bluefish (size: 39 – 71 cm), one individual northern kingfish, one individual monkfish (size: 48 cm), and one individual Atlantic sea scallop.

4. Acknowledgements

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Table 1: Operational and environmental conditions for each survey tow.

Tow Number	Tow Area	Date	Sky Condition	Wind State (Knots)	Wind Direction	Sea State (m.)	Start Time	Start Latitude	Start Longitude	Start Depth (fm)	End Time	End Latitude	End Longitude	End Depth (fm)	Bottom Temp. (°C)	Trawl Warp (fm)
1	VW1	11/13/2023	Clear	3-6	N	0.1-0.5	6:44	N 41° 05.898	W 70° 31.458	23	7:04	N 41° 04.992	W 70° 31.181	23	13.7	100
2	VW1	11/13/2023	Clear	3-6	N	0.1-0.5	7:54	N 41° 04.847	W 70° 30.174	23	8:14	N 41° 04.745	W 70° 32.337	24	13.7	100
3	VW1	11/13/2023	Partly Cloudy	3-6	N	0.1-0.5	8:54	N 41° 04.667	W 70° 28.685	22	9:14	N 41° 03.705	W 70° 28.644	23	13.8	100
4	VW1	11/13/2023	Partly Cloudy	3-6	N	0.1-0.5	9:50	N 41° 03.941	W 70° 29.499	24	10:10	N 41° 04.767	W 70° 29.231	23	13.8	100
5	VW1	11/13/2023	Partly Cloudy	3-6	N	0.1-0.5	10:47	N 41° 02.966	W 70° 26.514	22	11:07	N 41° 02.119	W 70° 25.850	22	13.8	100
6	VW1	11/13/2023	Partly Cloudy	3-6	N	0.1-0.5	11:48	N 41° 02.071	W 70° 24.083	22	12:08	N 41° 01.150	W 70° 24.519	22	13.8	100
7	VW1	11/13/2023	Partly Cloudy	3-6	N	0.1-0.5	12:56	N 41° 00.684	W 70° 24.867	22	13:16	N 41° 00.199	W 70° 25.951	22	13.8	100
8	Control	11/13/2023	Partly Cloudy	3-6	N	0.1-0.5	14:02	N 40° 59.386	W 70° 24.304	22	14:22	N 40.° 58.903	W 70° 23.317	21	13.8	100
9	Control	11/13/2023	Partly Cloudy	3-6	N	0.1-0.5	14:38	N 40° 58.581	W 70° 22.531	22	14:58	N 40° 58.133	W 70° 21.401	23	13.8	100
10	Control	11/13/2023	Partly Cloudy	3-6	N	0.1-0.5	15:27	N 40° 57.511	W 70° 24.848	23	15:47	N 40° 57.202	W 70° 26.273	24	13.8	100
11	Control	11/14/2023	Mostly Cloudy	3-6	N	0.1-0.5	6:45	N 40° 55.783	W 70° 26.949	25	7:05	N 40° 54.851	W 70° 26.804	26	13.8	100
12	Control	11/14/2023	Mostly Cloudy	3-6	N	0.1-0.5	7:54	N 40° 54.751	W 70° 26.128	25	8:14	N 40° 54.131	W 70° 25.095	26	13.7	100
13	Control	11/14/2023	Mostly Cloudy	3-6	N	0.1-0.5	8:56	N 40° 53.346	W 70° 25.077	27	9:16	N 40° 52.837	W 70° 23.962	26	13.7	120
14	Control	11/14/2023	Mostly Cloudy	3-6	N	0.1-0.5	10:02	N 40° 51.247	W 70° 22.768	27	10:22	N 40° 50.390	W 70° 22.245	27	13.6	120
15	Control	11/14/2023	Mostly Cloudy	3-6	N	0.1-0.5	11:07	N 40° 53.595	W 70° 22.227	25	11:27	N 40° 54.532	W 70° 22.454	24	13.7	100
16	Control	11/14/2023	Partly Cloudy	7-10	N	0.1-0.5	12:11	N 40° 54.753	W 70° 22.499	23	13:31	N 40° 55.505	W 70° 23.278	23	13.7	100
17	Control	11/14/2023	Partly Cloudy	11-15	N	0.5-1.25	13:20	N 40° 55.494	W 70° 22.689	23	13:40	N 40° 56.119	W 70° 21.314	23	13.7	100
18	Control	11/14/2023	Mostly Cloudy	11-15	N	0.5-1.25	14:18	N 40° 54.482	W 70° 20.200	23	14:38	N 40° 53.687	W 70° 19.541	23	13.6	100
19	Control	11/14/2023	Mostly Cloudy	16-20	N	0.5-1.25	15:16	N 40° 53.917	W 70° 19.407	23	15:36	N 40° 54.766	W 70° 18.827	22	13.5	100
20	Control	11/14/2023	Mostly Cloudy	16-20	N	0.5-1.25	15:57	N 40° 55.483	W 70° 17.981	22	16:17	N 40° 56.123	W 70° 17.116	21	13.6	100
21	VW1	11/15/2023	Partly Cloudy	3-6	N	0.1-0.5	6:40	N 41° 01.902	W 70° 36.836	25	7:00	N 41° 01.947	W 70° 35.539	24	13.6	100
22	VW1	11/15/2023	Partly Cloudy	3-6	N	0.1-0.5	7:51	N 41° 02.734	W 70° 33.086	26	8:11	N 41° 03.088	W 70° 31.916	25	13.6	100
23	VW1	11/15/2023	Clear	3-6	N	0.1-0.5	9:07	N 41° 01.269	W 70° 33.177	26	9:27	N 41° 00.456	W 70° 33.830	25	13.6	100
24	VW1	11/15/2023	Clear	3-6	N	0.1-0.5	10:09	N 41° 00.973	W 70° 32.564	26	10:29	N 41° 01.594	W 70° 31.634	25		120
25	VW1	11/15/2023	Clear	0-3	N	0.1-0.5	11:52	N 41° 01.467	W 70° 30.918	26	12:12	N 41° 00.572	W 70° 31.389	26	13.6	100
26	VW1	11/15/2023	Clear	3-6	N	0.1-0.5	13:07	N 41° 00.093	W 70° 29.360	25	13:27	N 41° 01.049	W 70° 29.417	24	13.5	100
27	VW1	11/15/2023	Clear	3-6	N	0.1-0.5	14:12	N 41° 01.329	W 70° 28.804	23	14:32	N 41° 02.147	W 70° 28.322	22	13.6	100
28	VW1	11/15/2023	Clear	7-10	N	0.1-0.5	15:05	N 40° 59.548	W 70° 28.678	24	15:25	N 40° 58.592	W 70° 28.809	24	13.6	100
29	VW1	11/15/2023	Clear	11-15	N	0.1-0.5	15:39	N 40° 58.288	W 70° 28.988	24	15:59	N 40° 57.527	W 70° 29.774	25	13.6	100
30	Control	11/16/2023	Mostly Cloudy	16-20	W	1.25-2.5	6:38	N 40° 56.649	W 70° 18.832	21	6:58	N 40° 57.306	W 70° 19.620	23	13.5	100
31	Control	11/16/2023	Partly Cloudy	16-20	W	1.25-2.5	7:39	N 40° 58.848	W 70° 19.667	23	7:59	N 40° 59.729	W 70° 19.984	23	13.6	100
32	Control	11/16/2023	Clear	16-20	W	1.25-2.5	8:37	N 41° 00.369	W 70° 21.500	21	8:57	N 41° 00.314	W 70° 20.181	22	13.5	100
33	Control	11/16/2023	Clear	11-15	W	1.25-2.5	9:19	N 41° 00.394	W 70° 19.227	21	9:39	N 41° 00.216	W 70° 17.964	22	13.6	100
34	Control	11/16/2023	Clear	11-15	W	1.25-2.5	10:09	N 41° 00.802	W 70° 17.209	20	10:29	N 41° 00.226	W 70° 16.096	20	13.6	95
35	Control	11/16/2023	Clear	11-15	W	1.25-2.5	10:49	N 40° 59.918	W 70° 15.363	18	11:09	N 41° 00.809	W 70° 15.507	19	13.5	95
36	Control	11/16/2023	Clear	11-15	W	1.25-2.5	11:53	N 41° 02.195	W 70° 19.960	21	12:13	N 41° 02.647	W 70° 21.037	22	13.6	100
37	VW1	11/16/2023	Clear	11-15	W	1.25-2.5	12:39	N 41° 03.855	W 70° 22.490	22	12:59	N 41° 04.386	W 70° 23.537	22	13.5	100
38	VW1	11/16/2023	Clear	11-15	W	1.25-2.5	13:18	N 41° 04.414	W 70° 24.029	22	13:38	N 41° 04.465	W 70° 25.257	22	13.5	100
39	VW1	11/16/2023	Clear	11-15	W	1.25-2.5	13:54	N 41° 04.951	W 70° 25.459	22	14:14	N 41° 05.818	W 70° 25.998	21		100
40	VW1	11/16/2023	Clear	11-15	W	0.5-1.25	14:50	N 41° 06.695	W 70° 26.953	21	15:10	N 41° 07.517	W 70° 27.604	22	13.5	100

Table 2: Tow parameters for each survey tow.

Tow Number	Tow Area	Tow Duration (min)	Tow Distance (nmi)	Tow Speed (knots)	Start Depth (fm)	Bottom Temp. (^{0}C)	Trawl Warp (fm)	Headline Height (m)	Wing Spread (m)	Spread Door (m)
1	VW1	20.1	0.94	2.8	23	13.7	100	5.5		
2	VW1	20.0	0.90	2.7	23	13.7	100	5.4	13.4	
3	VW1	19.9	0.98	3.0	22	13.8	100	5.4	13.4	34.5
4	VW1	20.0	0.94	2.8	24	13.8	100	5.5	13.2	33.8
5	VW1	20.0	1.01	3.0	22	13.8	100	5.5	13.3	33.6
6	VW1	20.0	0.99	3.0	22	13.8	100	5.5	12.9	32.6
7	VW1	20.2	0.96	2.9	22	13.8	100	5.7	12.8	31.7
8	Control	19.8	0.91	2.8	22	13.8	100	5.4	13.2	33.7
9	Control	20.0	0.96	2.9	22	13.8	100	5.3	13.5	35.0
10	Control	20.2	1.09	3.2	23	13.8	100	5.3	14.1	34.5
11	Control	20.0	0.95	2.8	25	13.8	100	5.3	14.0	34.4
12	Control	20.0	1.01	3.0	25	13.7	100	5.2	14.0	34.5
13	Control	20.0	1.00	3.0	27	13.7	120	5.4	13.8	34.2
14	Control	20.0	0.97	2.9	27	13.6	120	5.4	14.2	34.5
15	Control	20.3	0.96	2.8	25	13.7	100	5.2	14.4	35.2
16	Control	20.1	0.96	2.9	23	13.7	100	5.3	13.6	34.3
17	Control	20.1	0.95	2.9	23	13.7	100	5.2	14.5	35.2
18	Control	20.0	0.95	2.9	23	13.6	100	5.3	14.1	34.0
19	Control	20.0	0.96	2.9	23	13.5	100	5.3	14.7	35.4
20	Control	20.1	0.93	2.8	22	13.6	100	5.2		35.8
21	VW1	20.3	0.97	2.9	25	13.6	100	5.2		35.2
22	VW1	20.0	0.96	2.9	26	13.6	100	5.3		34.1
23	VW1	20.1	0.96	2.9	26	13.6	100	5.6	14.6	34.7
24	VW1	20.0	0.96	2.9	26		120	5.2	14.1	32.0
25	VW1	20.0	0.97	2.9	26	13.6	100	5.3	14.8	34.1
26	VW1	20.0	0.97	2.9	25	13.5	100	5.4		34.6
27	VW1	20.0	0.97	2.9	23	13.6	100	5.3		34.8
28	VW1	20.0	0.97	2.9	24	13.6	100	5.3		34.1
29	VW1	20.0	0.98	2.9	24	13.6	100	5.5		33.5
30	Control	20.2	0.90	2.7	21	13.5	100	5.8	12.9	33.4
31	Control	20.0	0.92	2.8	23	13.6	100	5.6	13.6	34.0
32	Control	20.0	1.01	3.0	21	13.5	100	5.9	13.7	32.2
33	Control	20.0	0.98	2.9	21	13.6	100	6.0	12.3	31.6
34	Control	20.1	1.02	3.1	20	13.6	95	6.0	12.1	30.9
35	Control	19.9	0.90	2.7	18	13.5	95	5.5	13.1	33.7
36	Control	20.0	0.94	2.8	21	13.6	100	5.9	13.7	35.7
37	VW1	20.0	0.95	2.9	22	13.5	100	5.2	13.9	35.5
38	VW1	20.0	0.94	2.8	22	13.5	100	5.4	13.7	34.2
39	VW1	20.0	0.97	2.9	22		100	5.0	14.0	34.6
40	VW1	20.1	0.96	2.9	21	13.5	100	5.4	14.0	34.5
Summary Statistics										
Control	Minimum	19.8	0.90	2.7	18.0	13.5	95	5.2	12.1	30.9
	Maximum	20.3	1.09	3.2	27.0	13.8	120	6.0	14.7	35.8
	Average	20.0	0.96	2.9	22.8	13.6	102	5.5	13.7	34.1
	St. Dev	0.1	0.05	0.1	2.2	0.1	6.5	0.3	0.7	1.3
VW1	Minimum	19.9	0.90	2.7	21.0	13.5	100	5.0	12.8	31.7
	Maximum	20.3	1.01	3.0	26.0	13.8	120	5.7	14.8	35.5
	Average	20.0	0.96	2.9	23.5	13.7	101	5.4	13.7	34.0
	St. Dev.	0.1	0.02	0.1	1.7	0.1	4.5	0.2	0.6	1.0

Table 3: Total and average catch weights from 20 tows within the VW1 Study Area.

Species Name	Scientific Name	Total Weight (kg)	Catch/Tow (kg)		% of Total Catch	Tows with Species Present
			Mean	SEM*		
Scup	*Stenotomus chrysops*	5986.3	302.3	104.4	61.3	19
Butterfish	*Peprilus triacanthus*	1902.0	97.1	34.3	19.5	20
Skate, Little	*Leucoraja erinacea*	572.1	29.8	6.2	5.9	20
Hake, Silver (Whiting)	*Merluccius bilinearis*	432.4	21.6	7.0	4.4	18
Squid, Atlantic Longfin	*Dorytheuthis pealei*	330.5	17.3	1.7	3.4	20
Skate, Winter	*Leucoraja ocellata*	96.8	5.0	1.9	1.0	15
Dogfish, Spiny	*Squalus acanthias*	92.1	4.7	1.1	0.9	18
Flounder, Windowpane	*Scophtalmus aquosus*	69.0	3.6	0.7	0.7	19
Hake, Spotted	*Urophycis regia*	68.3	3.4	1.1	0.7	16
Sea Robin, Northern	*Prionotus carolinus*	49.7	2.5	1.1	0.5	15
Black Sea bass	*Centropristis striata*	49.6	2.5	0.6	0.5	16
Bluefish	*Pomatomus saltatrix*	37.0	1.9	0.6	0.4	10
Flounder, Summer (Fluke)	*Paralichthys dentatus*	26.6	1.4	0.5	0.3	11
Weakfish	*Cynoscion regalis*	23.6	1.2	0.6	0.2	6
Flounder, Fourspot	*Paralichthys oblongus*	9.2	0.5	0.1	0.1	14
Monkfish	*Lophius americanus*	6.4	0.4	0.4	0.1	1
Kingfish, Northern	*Menticirrhus saxatilis*	3.4	0.2	0.1	0.03	2
Shark, Dusky	*Carcharhinus obscurus*	3.4	0.2	0.2	0.03	1
Flounder, Winter	*Pleuronectes americanus*	1.9	0.1	0.0	0.02	4
Lobster, American	*Homarus americanus*	1.0	0.1	0.1	0.01	1
Sea Robin, Striped	*Prionotus evolans*	1.0	0.1	0.04	0.01	2
Atlantic cutlassfish	*Trichiurus lepturus*	0.9	0.04	0.03	0.01	2
Dogfish, Smooth	*Mustelus canis*	0.7	0.04	0.03	0.01	2
Flounder, Yellowtail	*Pleuronectes ferrugineus*	0.7	0.04	0.02	0.01	3
Sculpin, Longhorn	*Myoxocephalus octodecimspinosus*	0.5	0.03	0.03	0.01	1
Flounder, Gulfstream	*Citharichthys arctifrons*	0.4	0.02	0.01	0.004	2
Hake, Red	*Urophycis chuss*	0.3	0.02	0.01	0.003	2
Mackerel, Atlantic	*Scomber scombrus*	0.2	0.01	0.01	0.002	2
Herring, Atlantic	*Clupea harengus*	0.2	0.01	0.01	0.002	2
Filefish	*Monacanthidae*	0.2	0.01	0.01	0.002	2
Sea Scallop, Atlantic	*Placopecten magellanicus*	0.1	0.01	0.01	0.001	1
Lizardfish	*Synodontidae*	0.1	0.01	0.01	0.001	1
Goatfish, Northern	*Mullus auratus*	0.1	0.01	0.01	0.001	1
Total		9766.7				

*SEM - Standard Error of the Mean

Table 4: Total and average catch weights from 20 tows within the Control Area.

Species Name	Scientific Name	Total Weight (kg)	Catch/Tow (kg)		% of Total Catch	Tows with Species Present
			Mean	SEM*		
Scup	*Stenotomus chrysops*	7115.3	358.9	61.5	73.9	20
Skate, Little	*Leucoraja erinacea*	687.2	35.1	7.5	7.1	19
Hake, Silver (Whiting)	*Merluccius bilinearis*	574.8	29.3	7.5	6.0	19
Butterfish	*Peprilus triacanthus*	405.9	21.2	5.6	4.2	20
Squid, Atlantic Longfin	*Dorytheuthis pealei*	140.3	7.3	2.3	1.5	20
Hake, Spotted	*Urophycis regia*	137.6	7.1	2.0	1.4	18
Flounder, Windowpane	*Scophtalmus aquosus*	134.0	7.2	1.8	1.4	20
Skate, Winter	*Leucoraja ocellata*	130.2	6.6	1.7	1.4	15
Dogfish, Spiny	*Squalus acanthias*	103.0	5.2	1.6	1.1	13
Black Sea bass	*Centropristis striata*	41.5	2.1	0.4	0.4	18
Sea Robin, Northern	*Prionotus carolinus*	37.0	1.8	0.9	0.4	15
Weakfish	*Cynoscion regalis*	33.2	1.7	0.4	0.3	13
Hake, Red	*Urophycis chuss*	26.9	1.3	1.0	0.3	6
Flounder, Summer (Fluke)	*Paralichthys dentatus*	22.3	1.2	0.4	0.2	10
Flounder, Fourspot	*Paralichthys oblongus*	13.9	0.7	0.1	0.1	17
Bluefish	*Pomatomus saltatrix*	8.6	0.5	0.3	0.1	4
Flounder, Winter	*Pleuronectes americanus*	3.8	0.2	0.1	0.04	5
Sea Robin, Striped	*Prionotus evolans*	3.1	0.1	0.1	0.03	2
Monkfish	*Lophius americanus*	3.1	0.2	0.2	0.03	1
Dogfish, Smooth	*Mustelus canis*	1.6	0.1	0.1	0.02	2
Herring, Atlantic	*Clupea harengus*	0.4	0.02	0.02	0.004	1
Shad, American	*Alosa sapidissima*	0.4	0.02	0.02	0.004	1
Sculpin, Longhorn	*Myoxocephalus octodecimspinosus*	0.4	0.02	0.02	0.004	1
Menhaden, Atlantic	*Brevoortia tyrannus*	0.3	0.02	0.02	0.003	1
Kingfish, Northern	*Menticirrhus saxatilis*	0.3	0.01	0.01	0.003	1
Atlantic cutlassfish	*Trichiurus lepturus*	0.3	0.02	0.02	0.003	1
Mackerel, Atlantic	*Scomber scombrus*	0.2	0.01	0.01	0.002	1
Filefish	*Monacanthidae*	0.2	0.01	0.01	0.002	2
Sea Scallop, Atlantic	*Placopecten magellanicus*	0.1	0.01	0.01	0.001	1
Flounder, Gulfstream	*Citharichthys arctifrons*	0.1	0.01	0.01	0.001	1
Crab, Rock	*Cancer irroratus*	0.1	0.01	0.01	0.001	1
Total		9626.0				

*SEM - Standard Error of the Mean

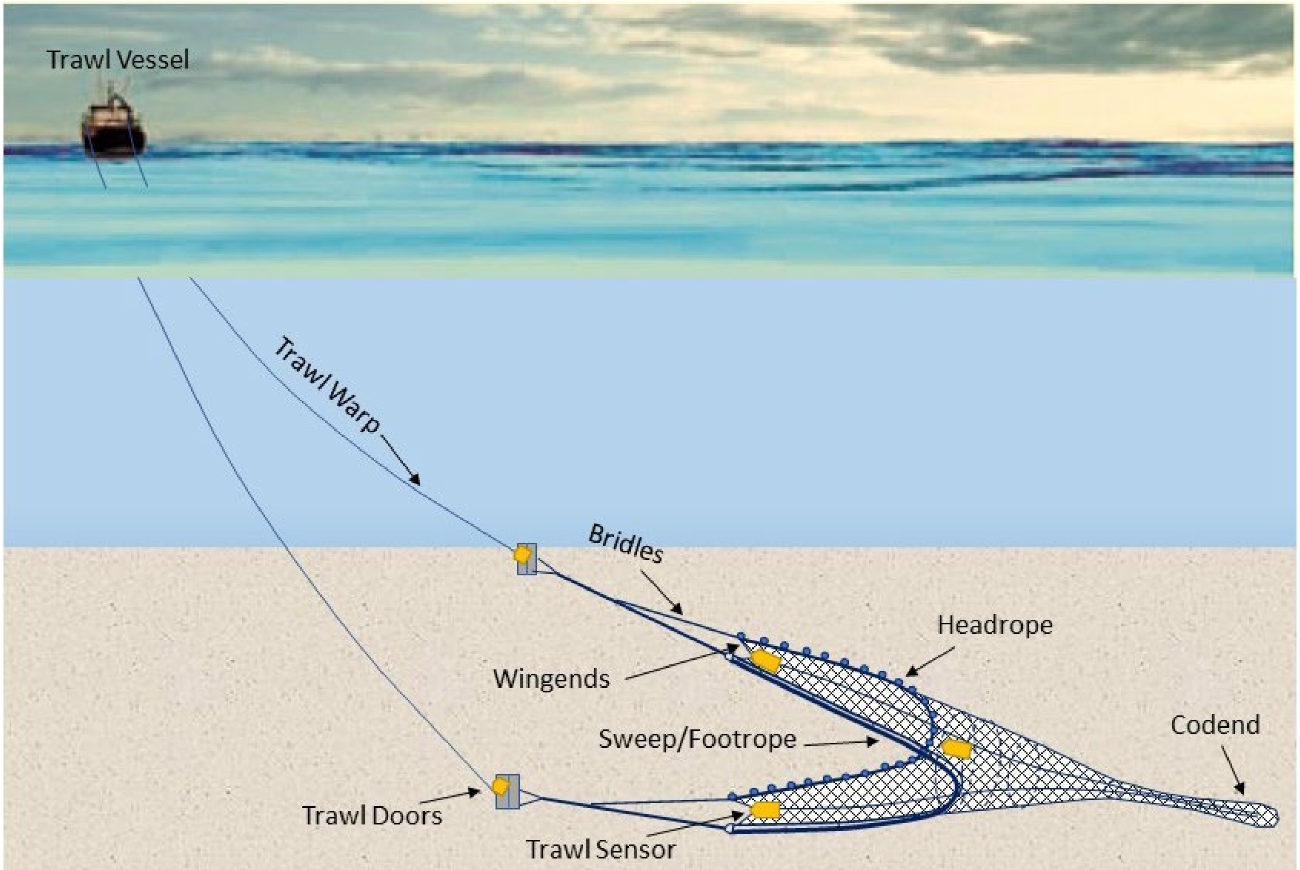


Figure 1: General schematic (not to scale) of a demersal otter trawl. Yellow rectangles indicate Simrad PX trawl geometry sensors.

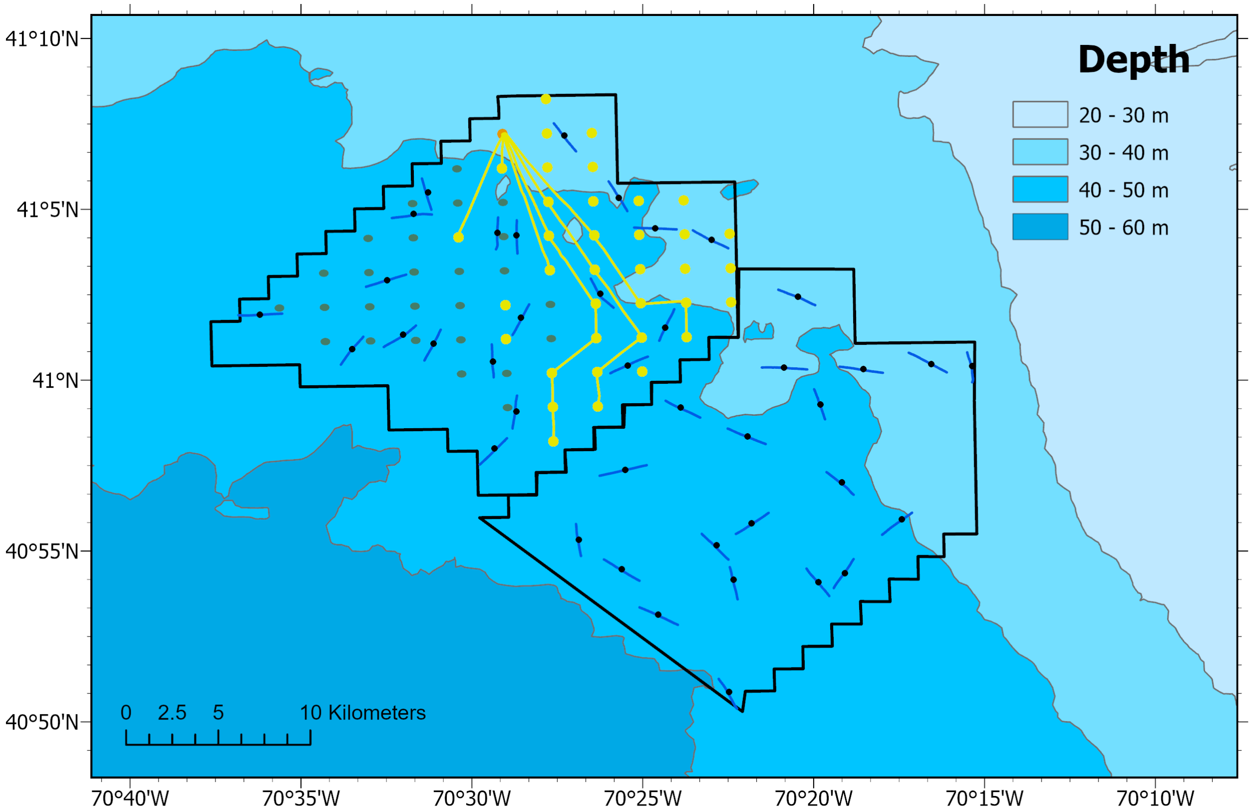


Figure 2: Tow locations (black dots) and trawl tracks (blue lines) from the VW1 Study Area (left) and the Control Area (right). Prior to the start of the survey, scour protection (gray dots) had been installed in all wind turbine locations. The electrical service platform (orange dot) in addition to select wind turbine foundations (yellow dots) and inter-array cables (yellow lines) had been installed.

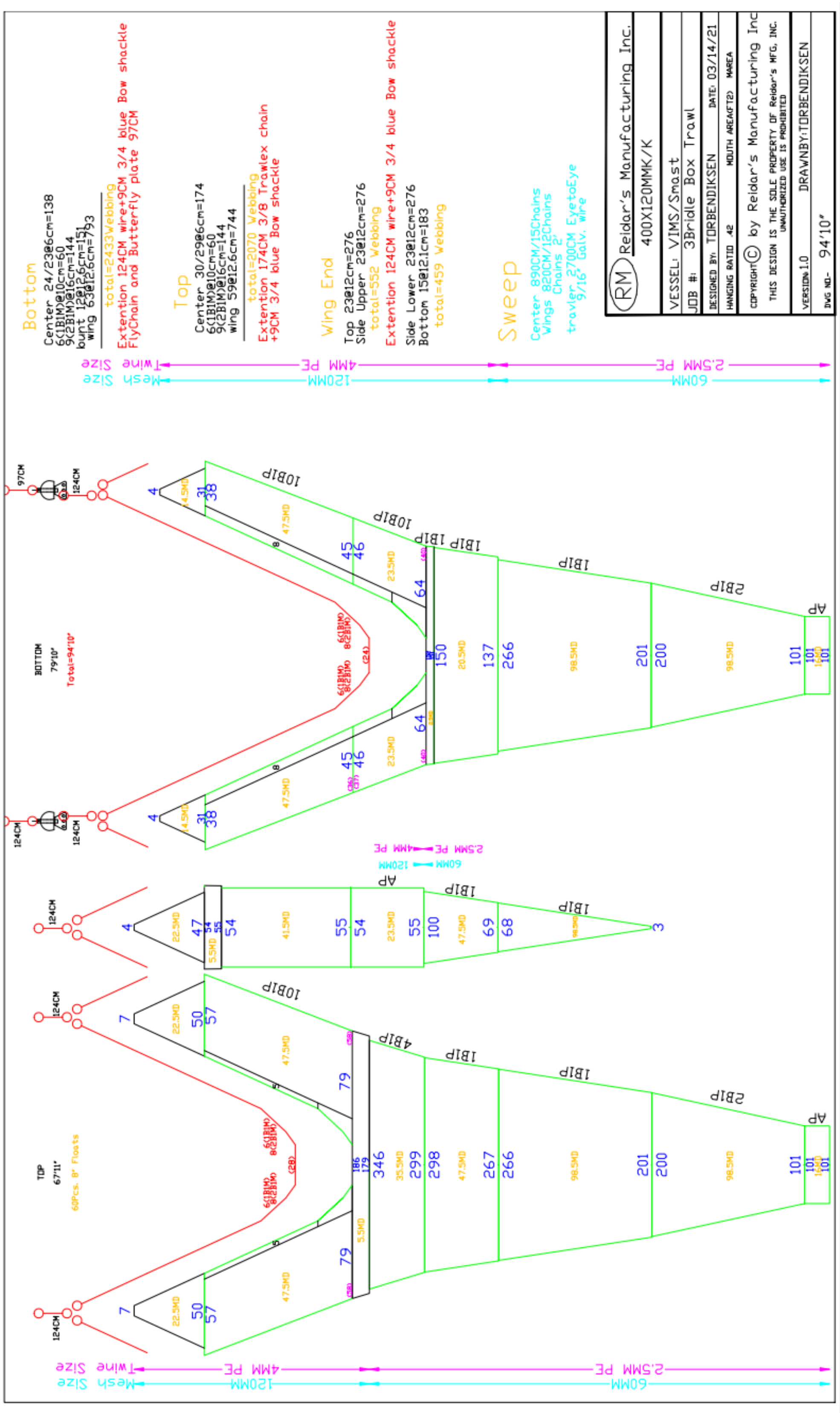


Figure 3: Schematic net plan for the NEAMAP trawl (Courtesy of Reidar's Manufacturing Inc.).

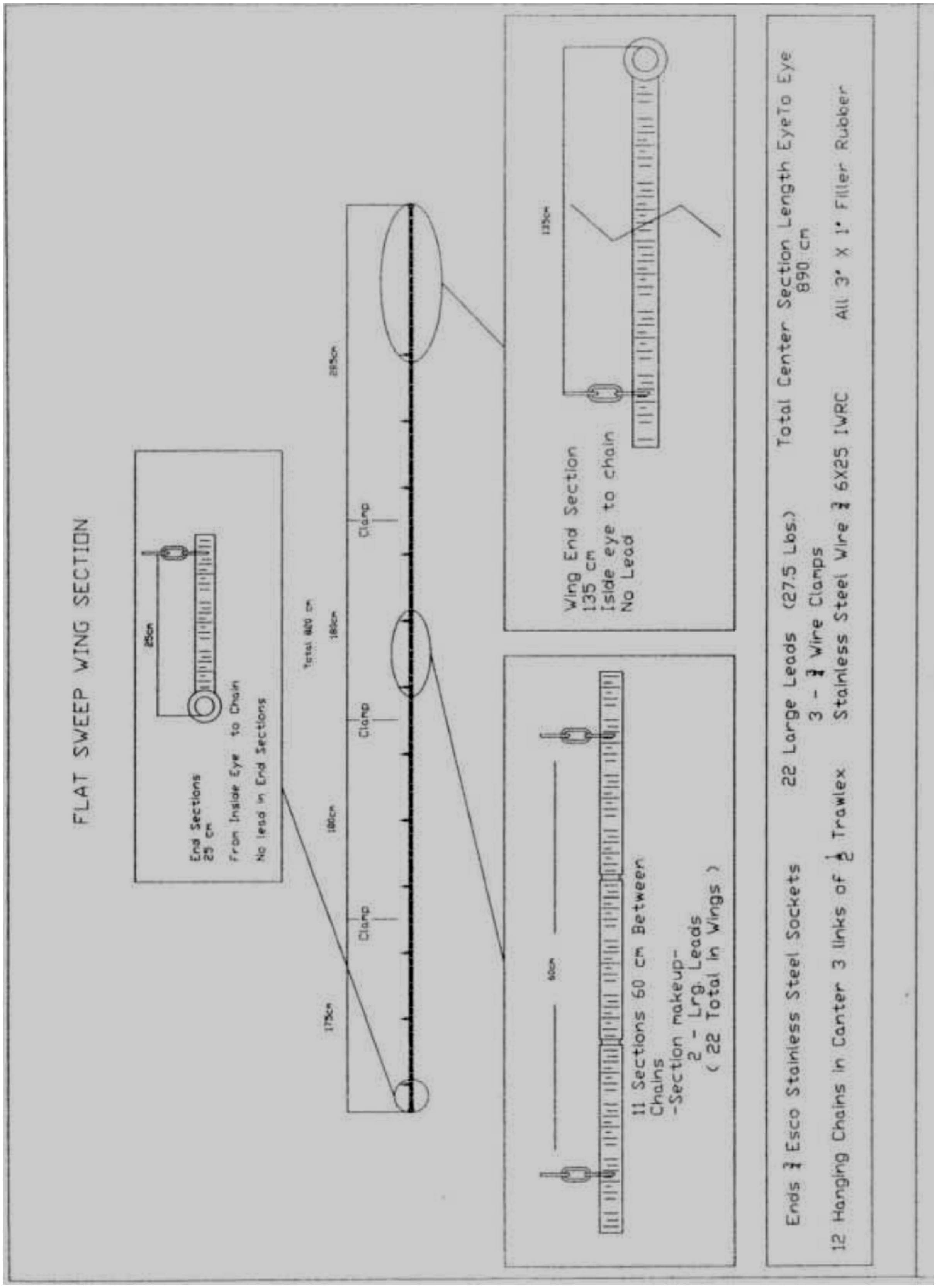


Figure 4: Sweep diagram for the survey trawl (Bonzek et al., 2008).

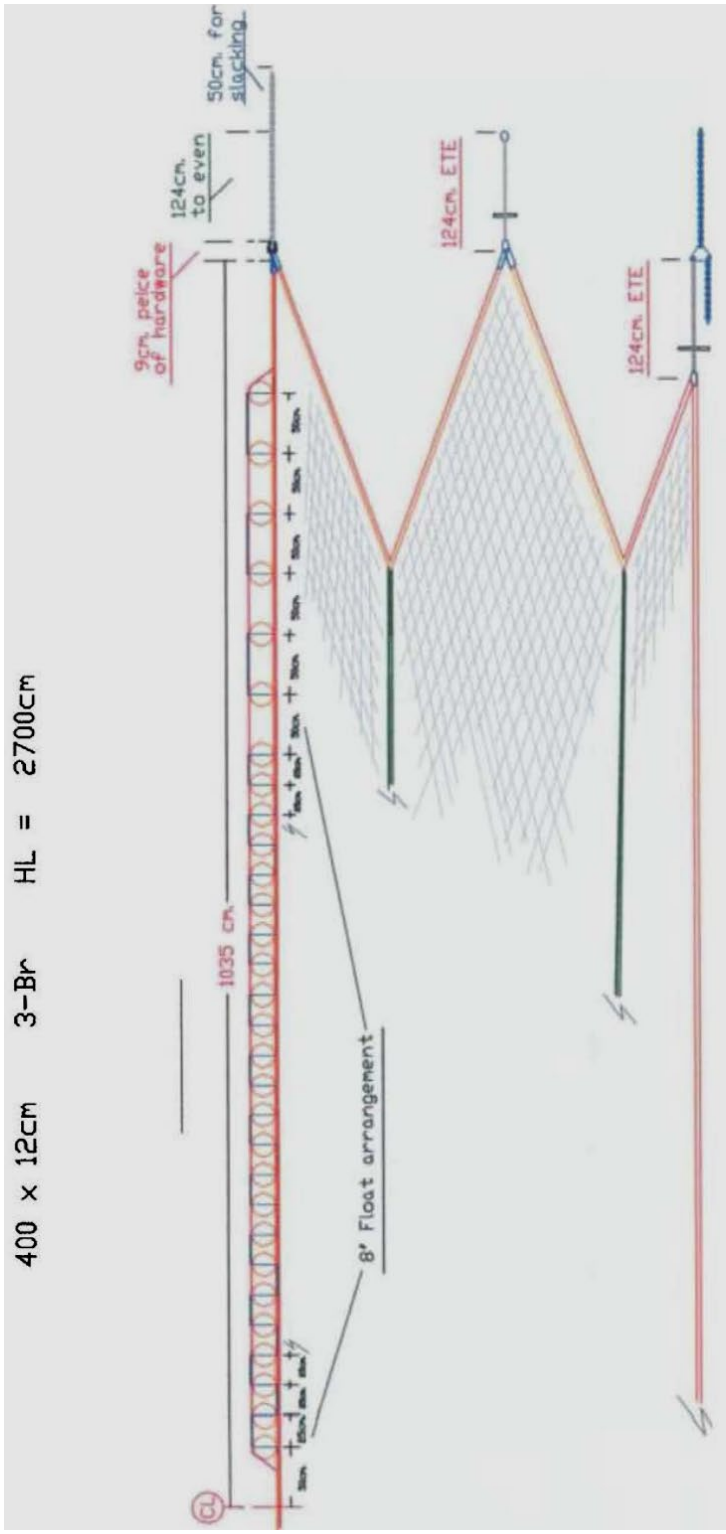


Figure 5: Headrope and rigging plan for the survey trawl (Bonzek et al., 2008).

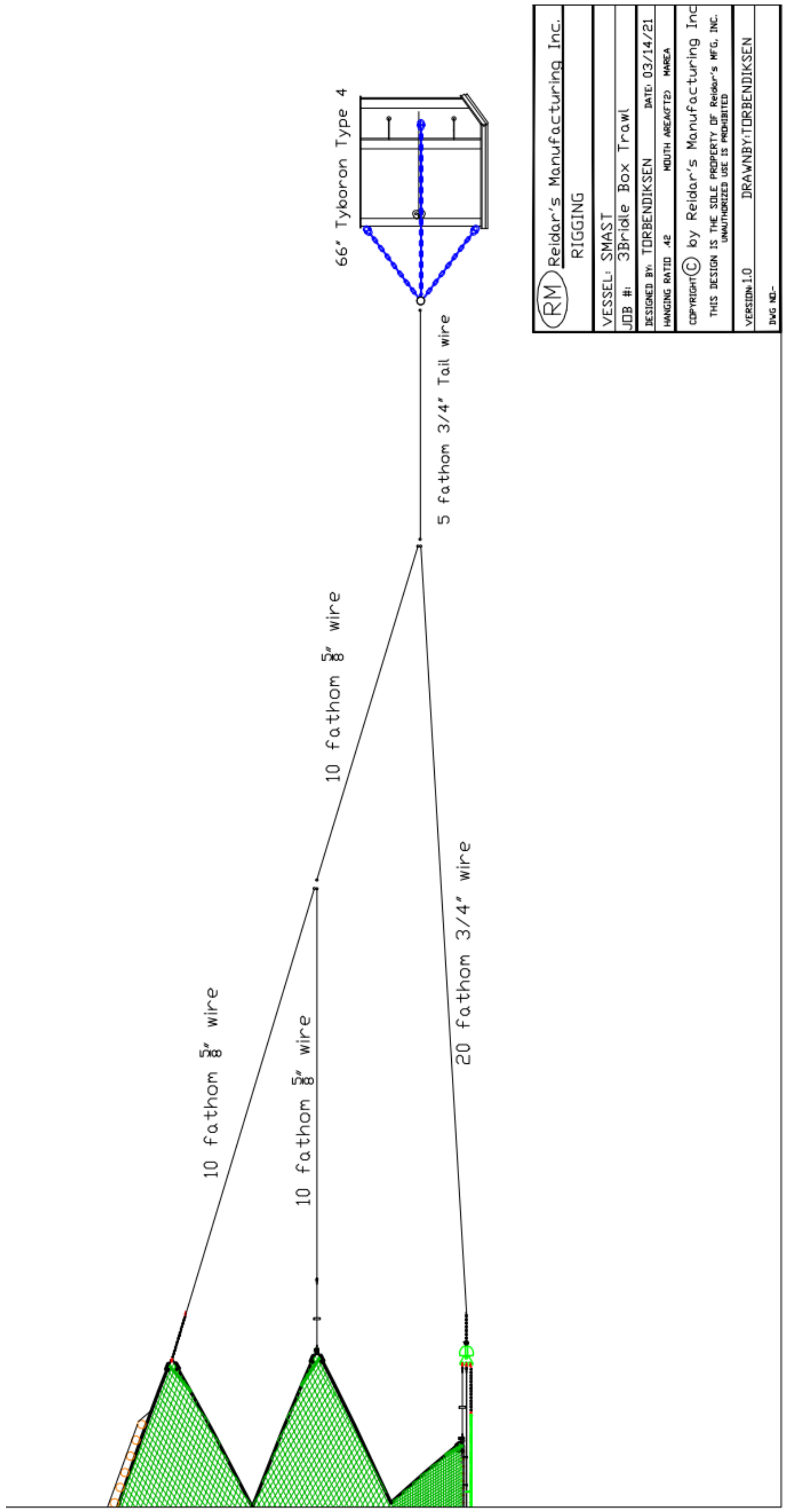


Figure 6: Bridle and door rigging schematic for the survey trawl (Courtesy of Reidar's Manufacturing Inc.).

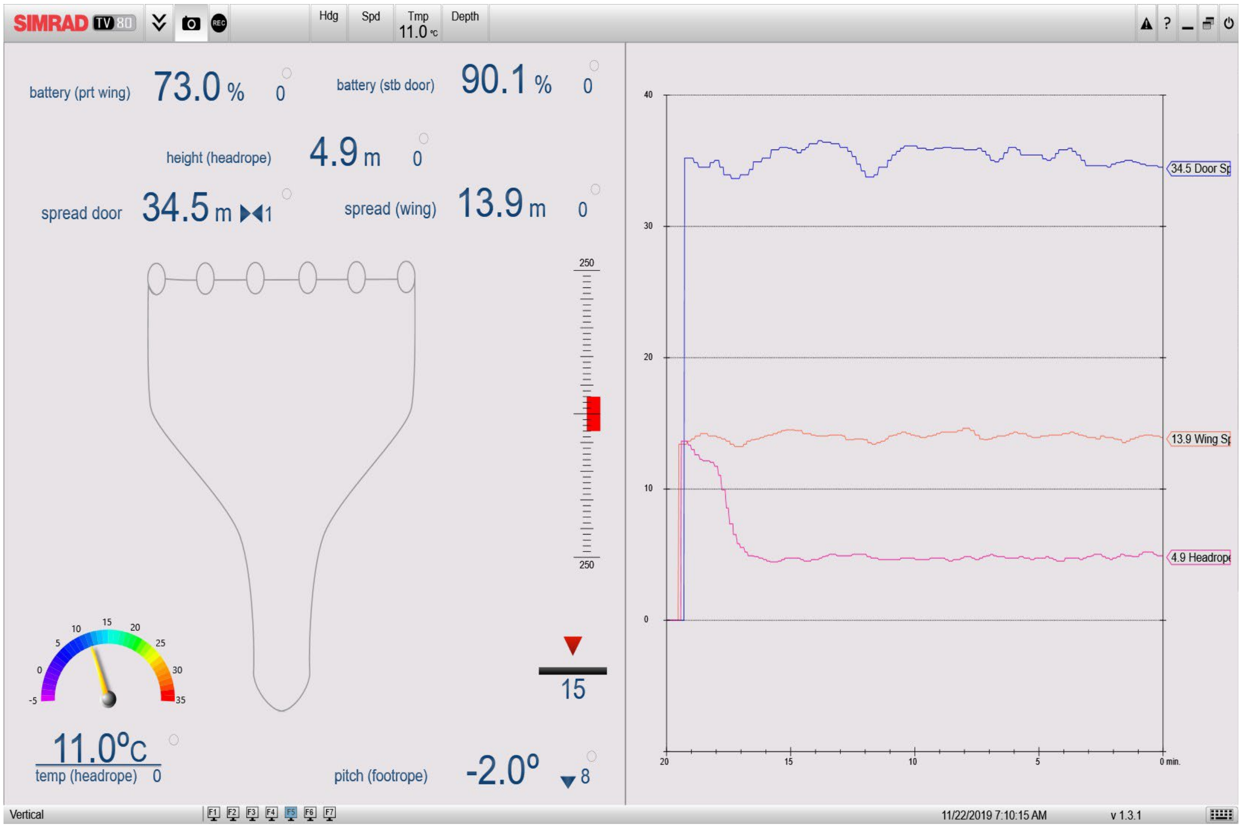


Figure 7: Screenshot of the SIMRAD TV80 software monitoring the trawl parameters.

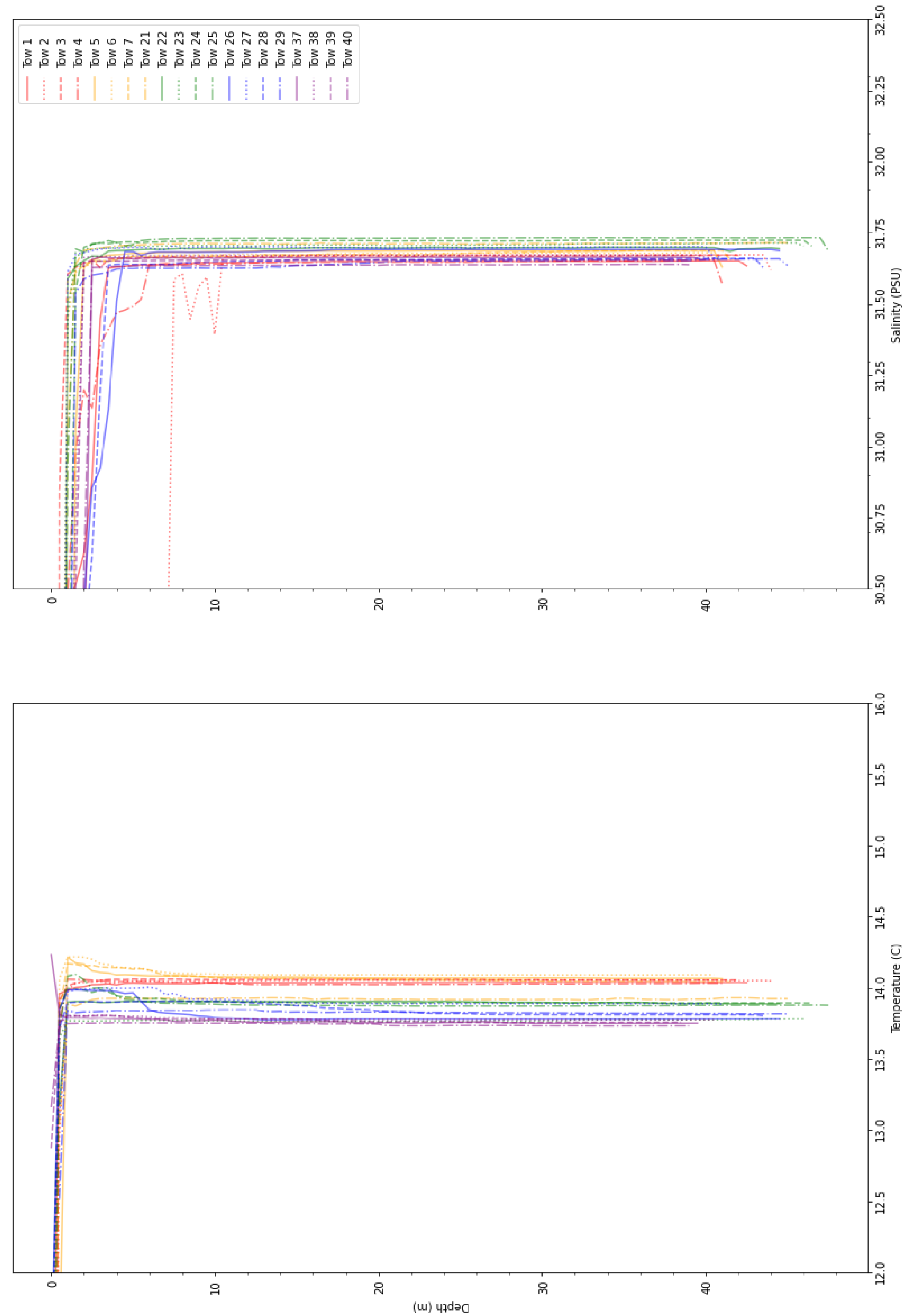
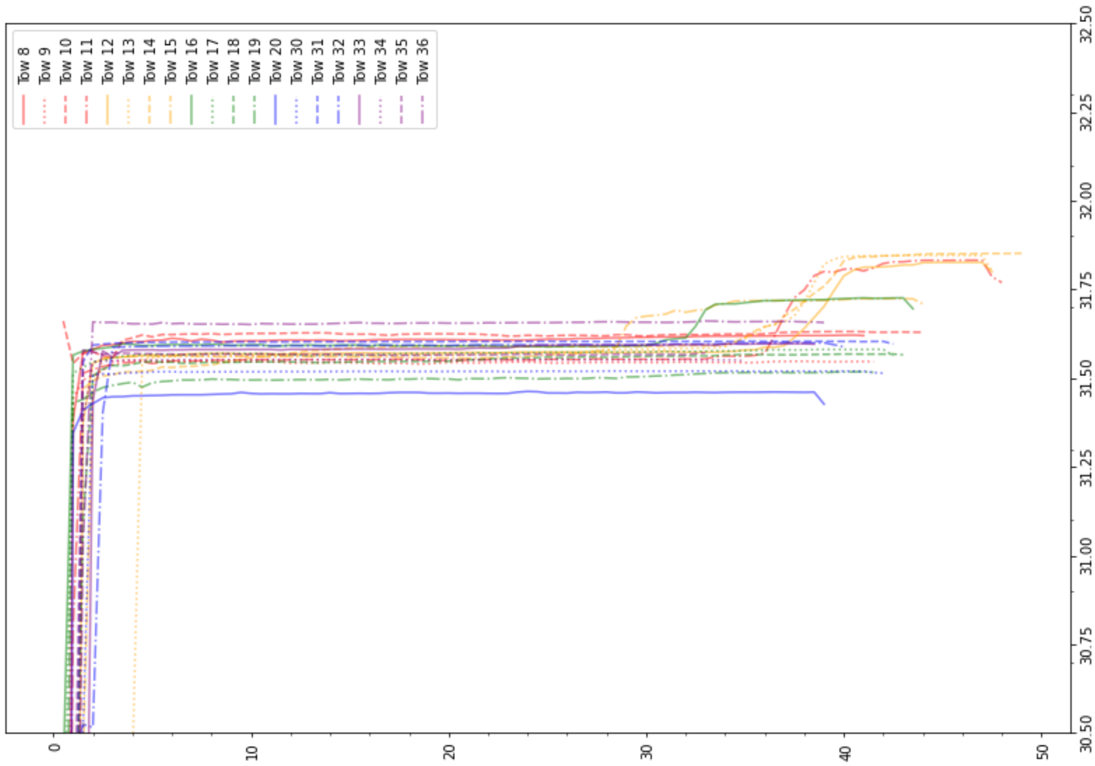


Figure 8: CTD sonde downcast profiles from the VW1 Study Area.



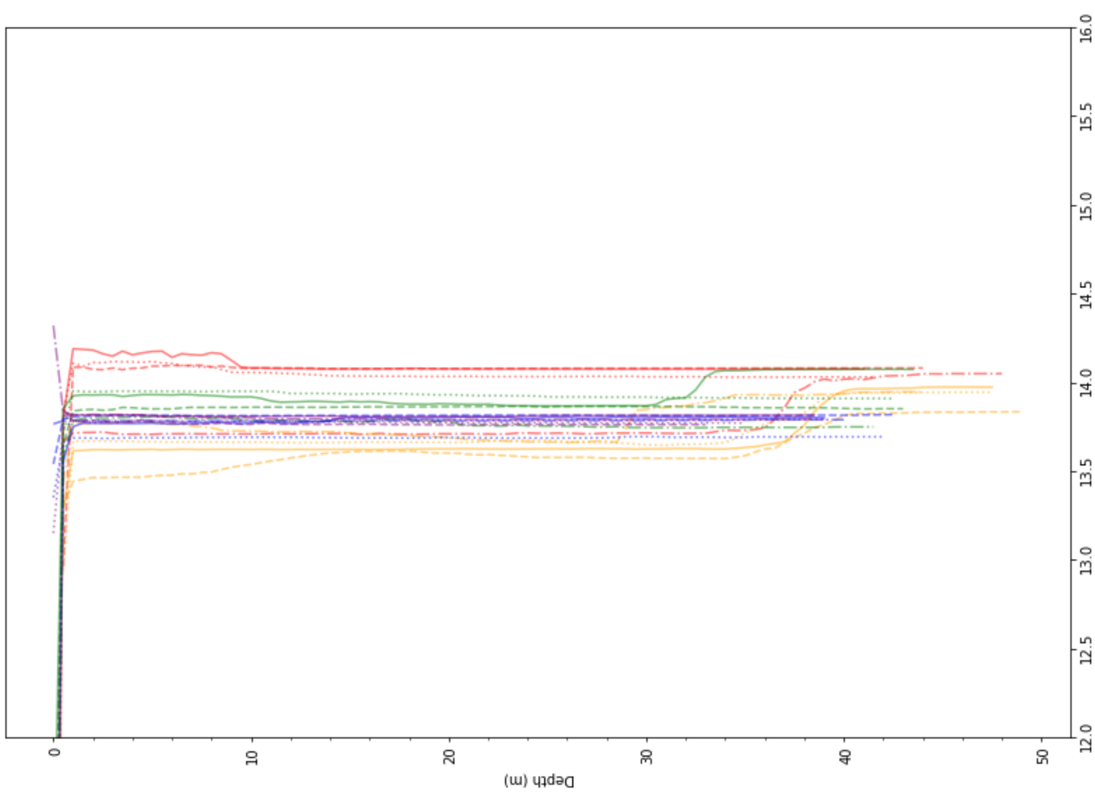
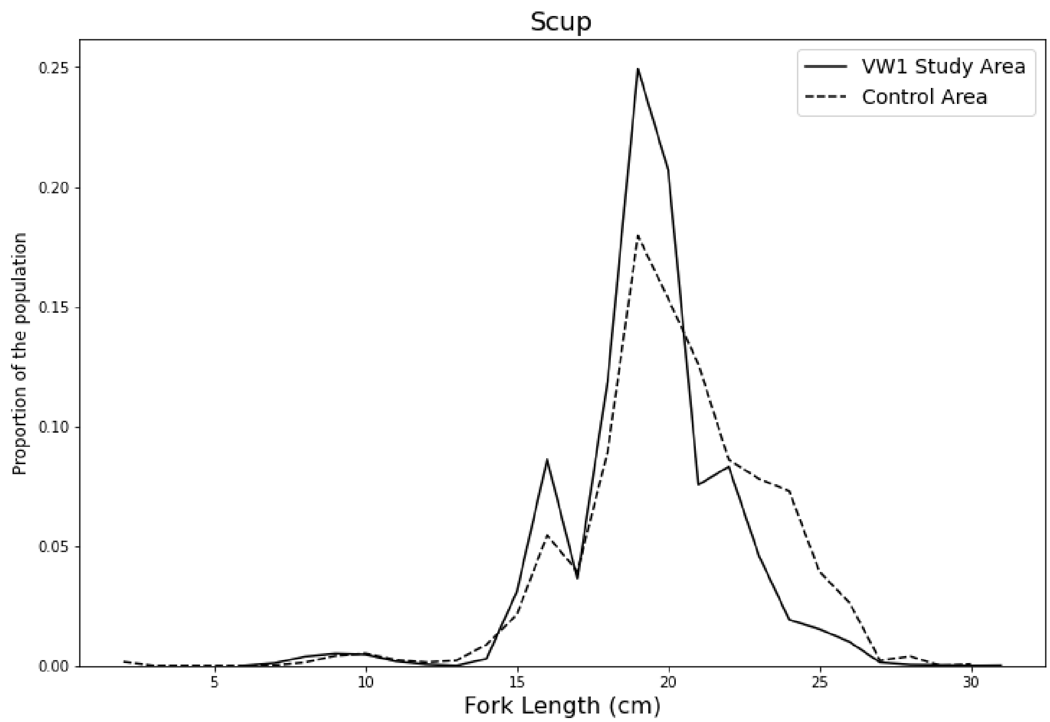


Figure 9: CTD sonde downcast profiles from the Control Area.



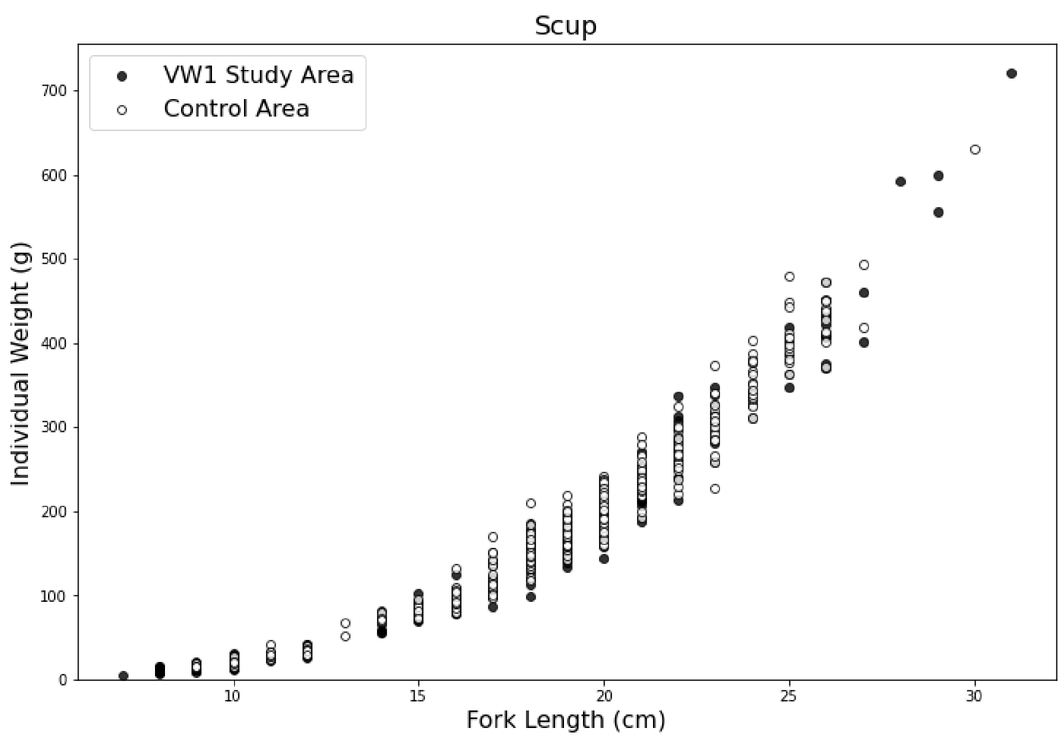


Figure 10: Population structure of scup in the VW1 Study Area and Control Area as determined by the length-frequency data (top) and length-weight relationships (bottom).

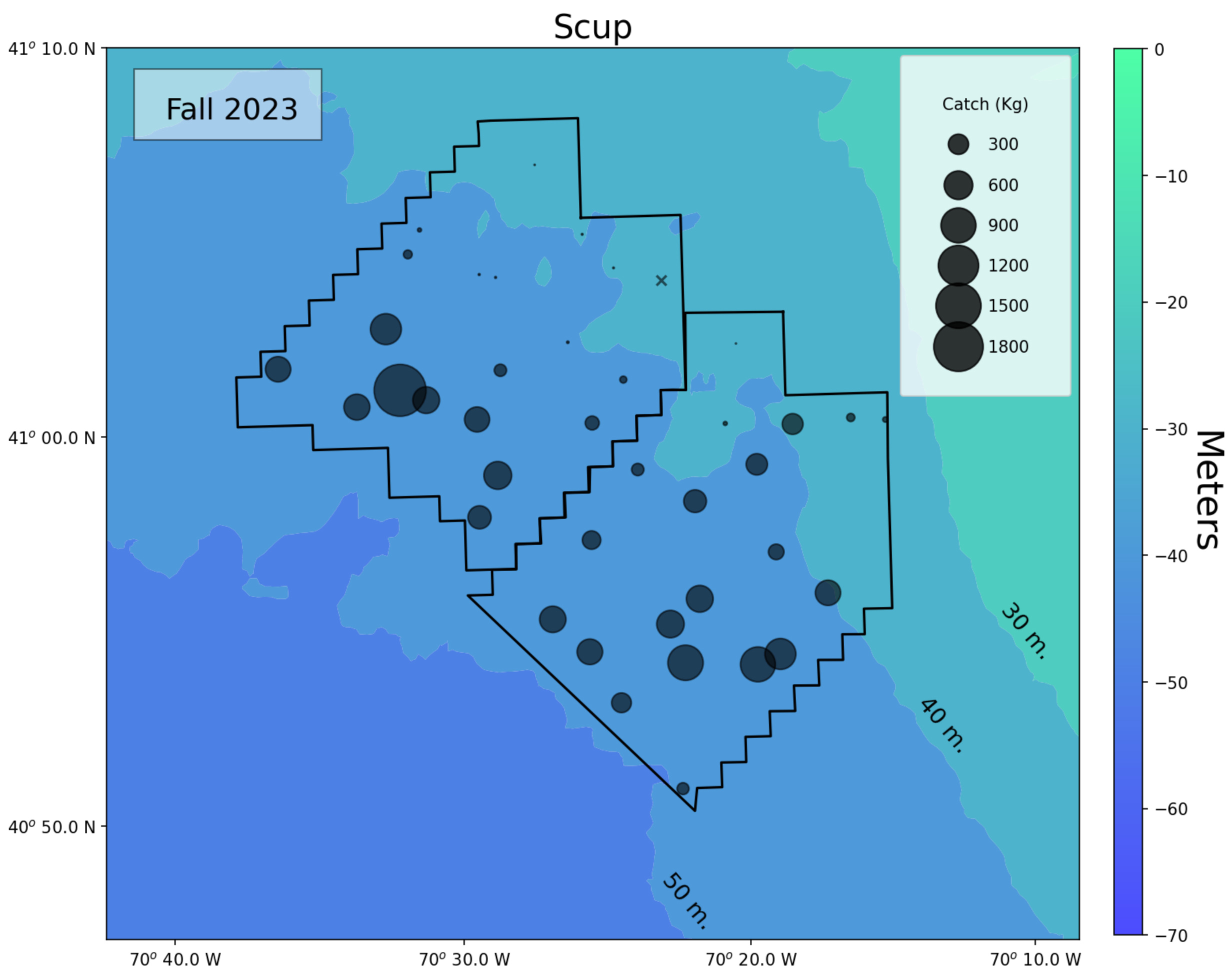
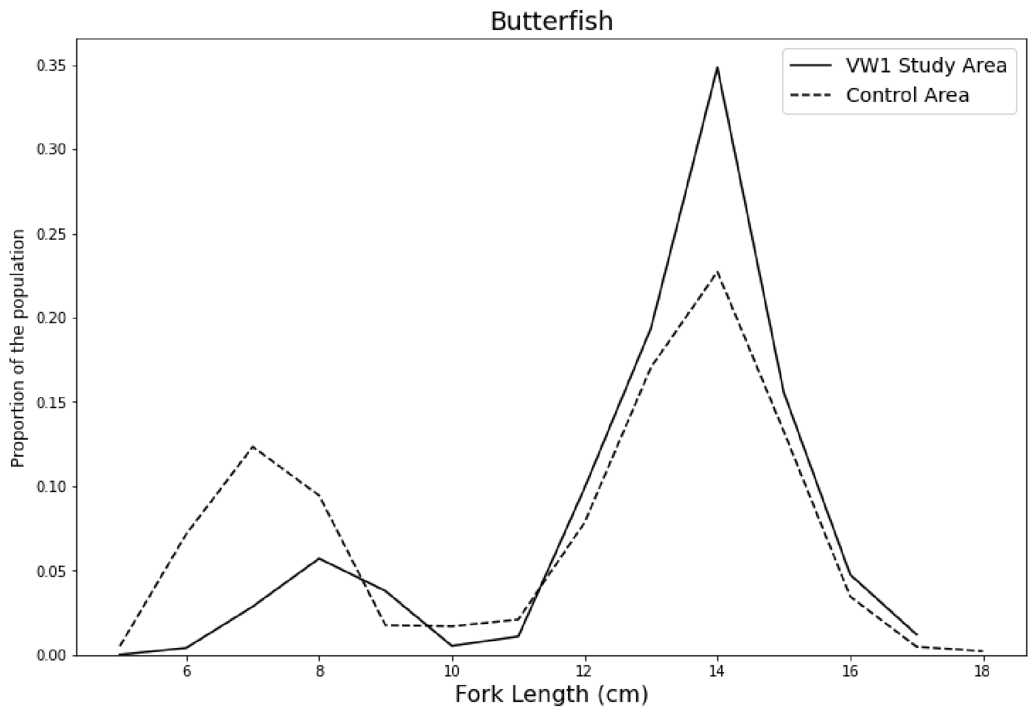


Figure 11: Distribution of the catch of scup in the VW1 Study Area (left) and Control Area (right). Tows with zero catch are denoted with an x.



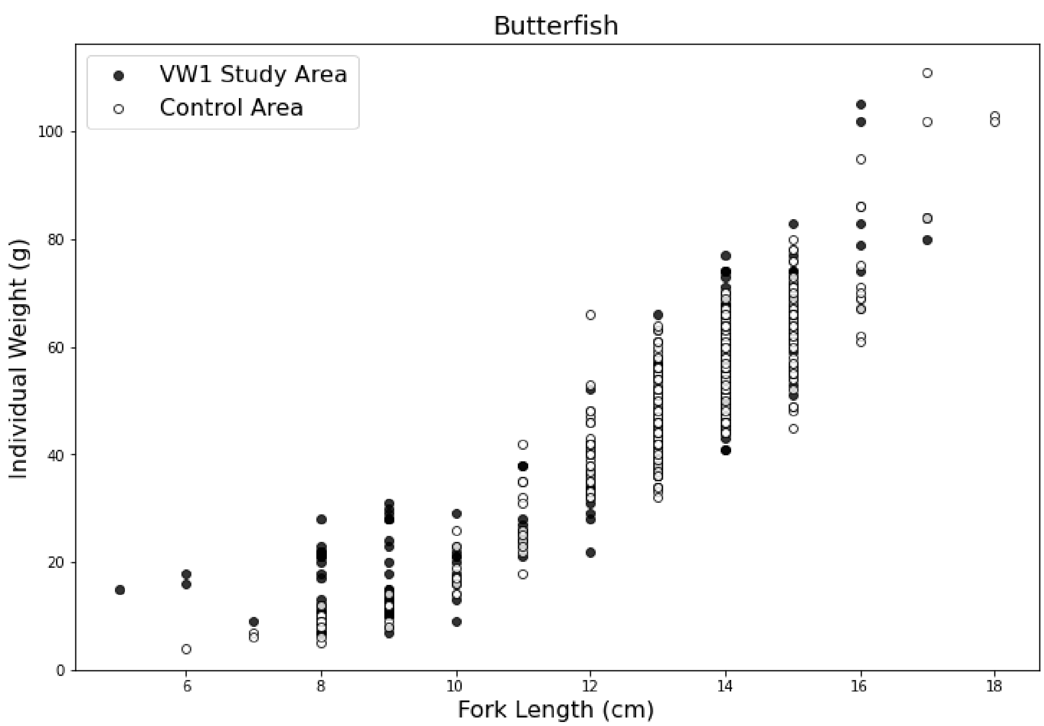


Figure 12: Population structure of butterfish in the VW1 Study Area and Control Area as determined by the length-frequency data (top) and length-weight relationships (bottom).

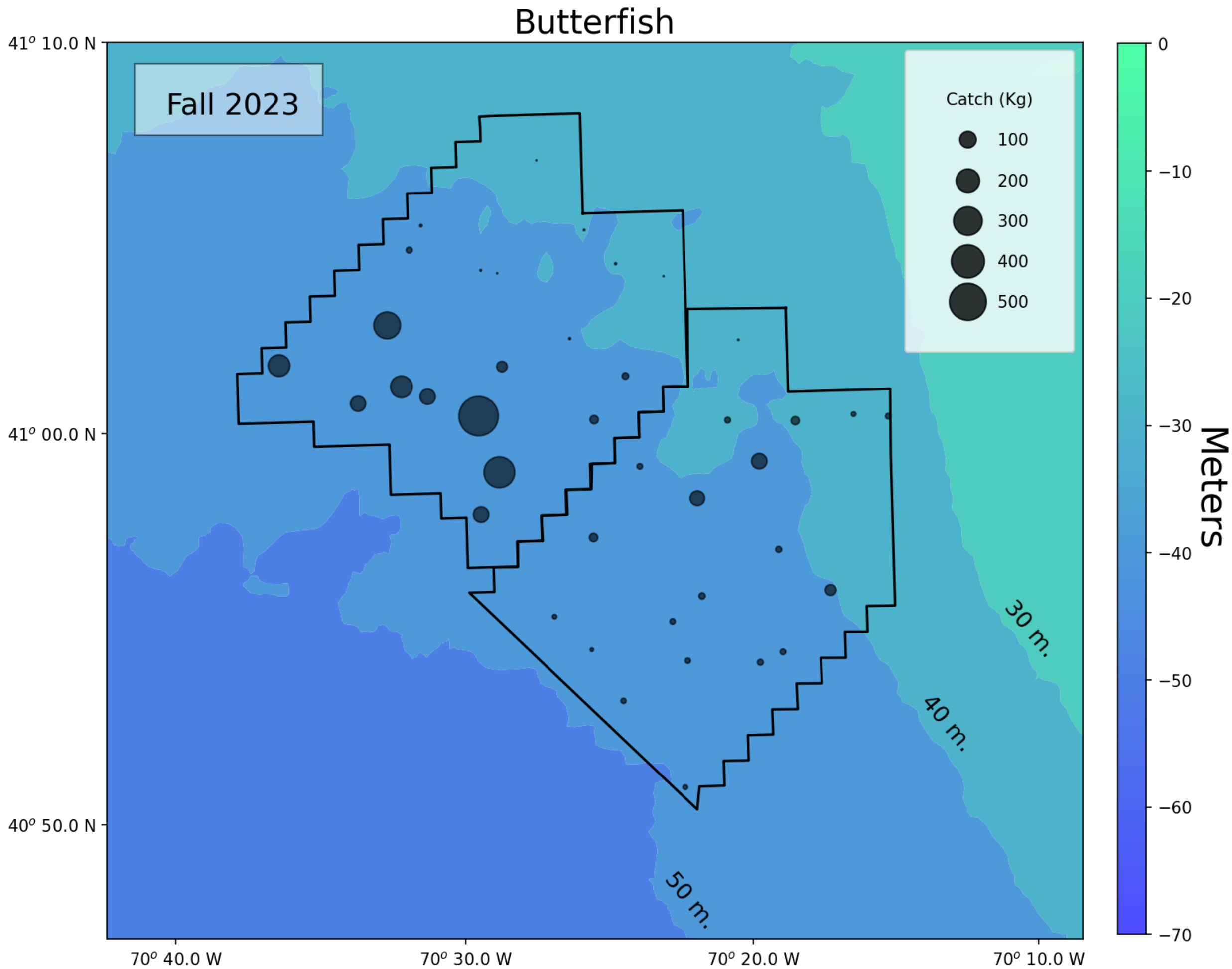
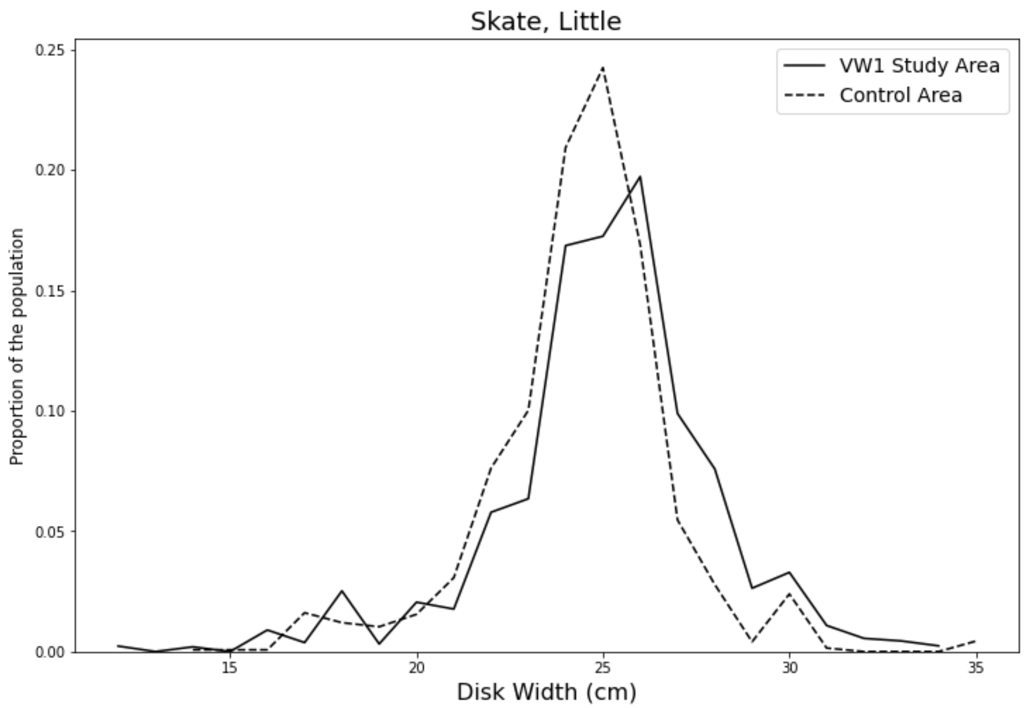


Figure 13: Distribution of the catch of butterfish in the VW1 Study Area (left) and Control Area (right).



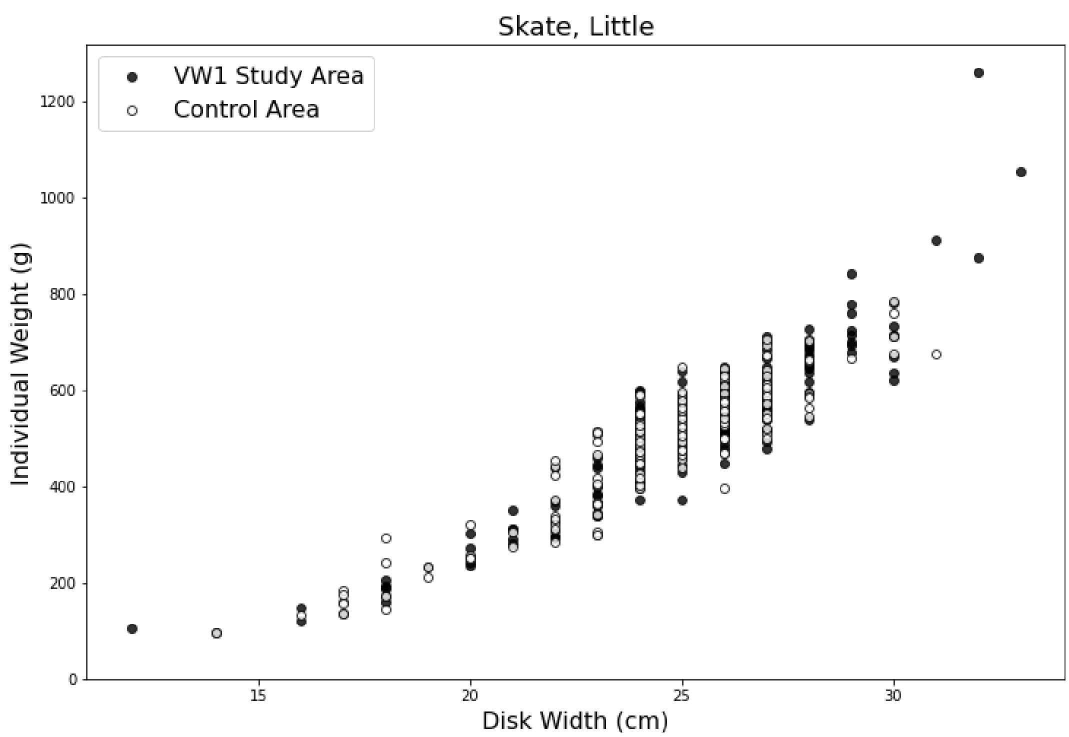


Figure 14: Population structure of little skate in the VW1 Study Area and Control Area as determined by the length-frequency data (top) and length-weight relationships (bottom).

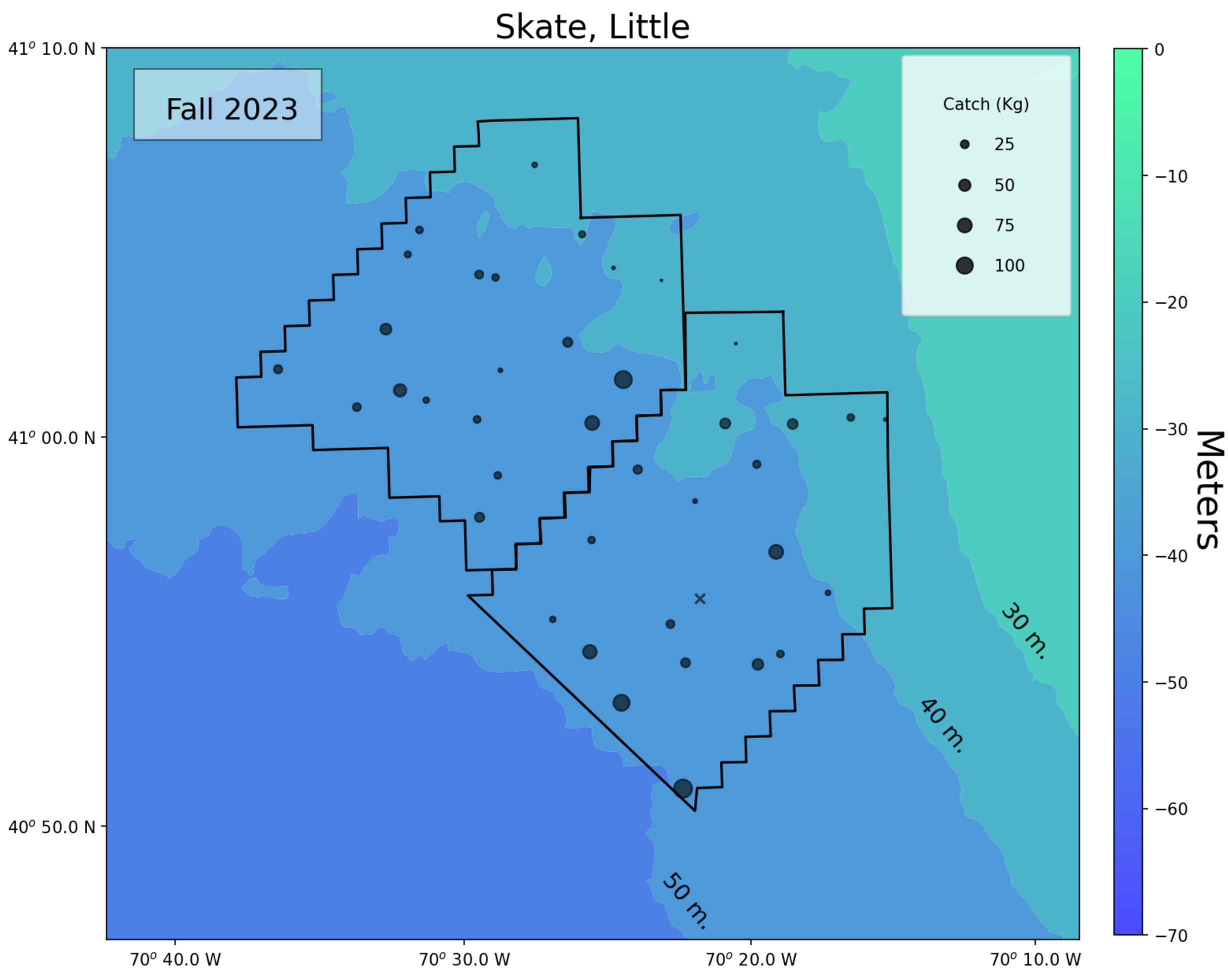
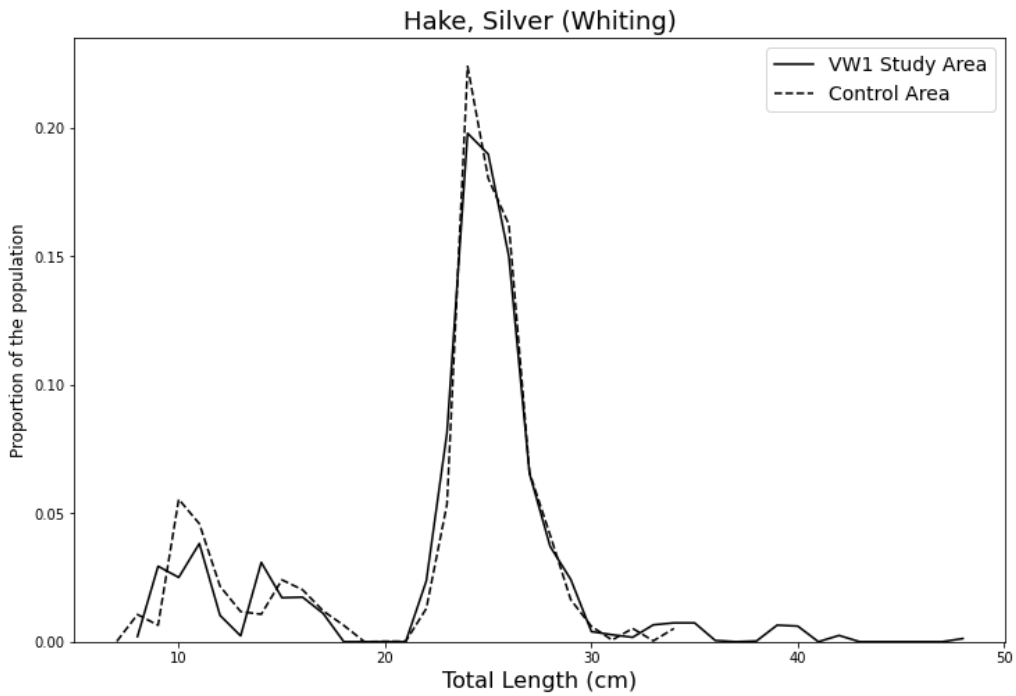


Figure 15: Distribution of the catch of little skate in the VW1 Study Area (left) and Control Area (right). Tows with zero catch are denoted with an x.



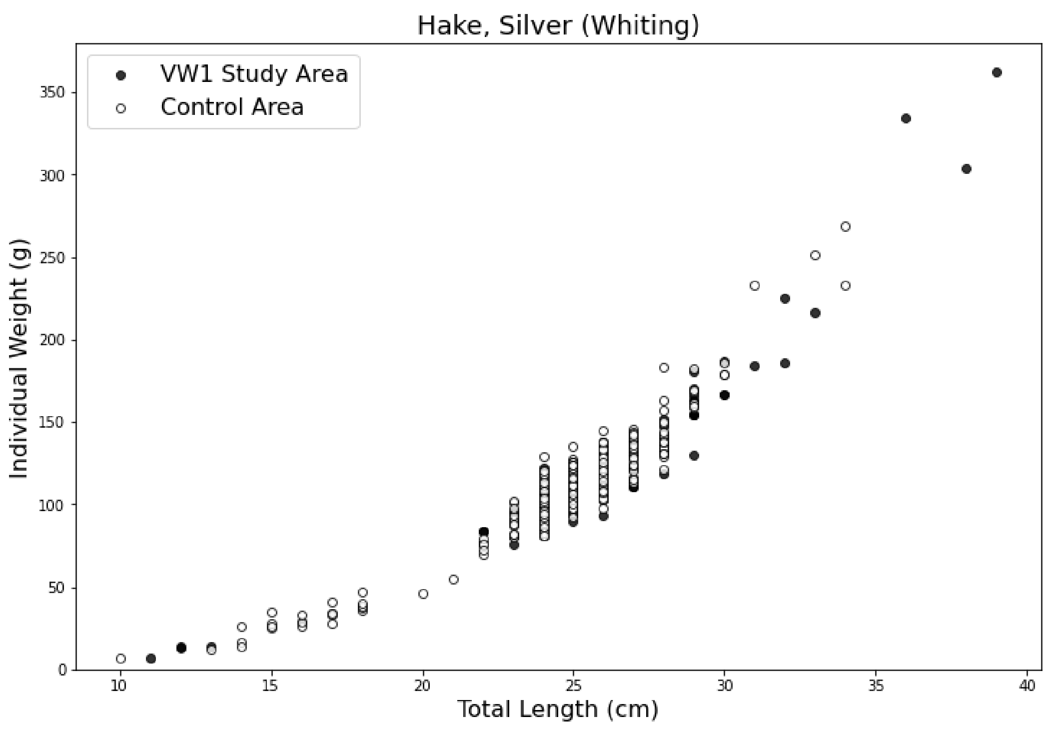


Figure 16: Population structure of silver hake in the VW1 Study Area and Control Area as determined by the length-frequency data (top) and length-weight relationships (bottom).

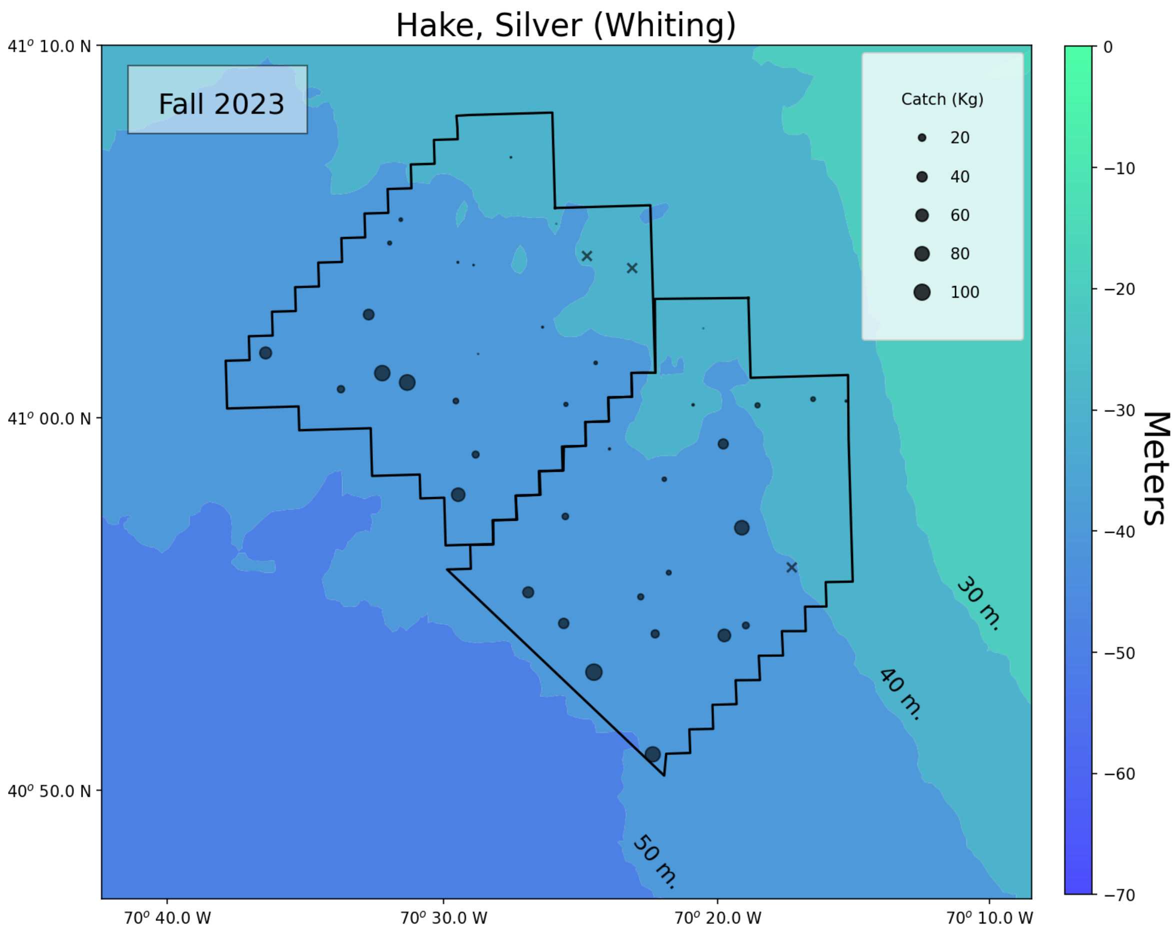
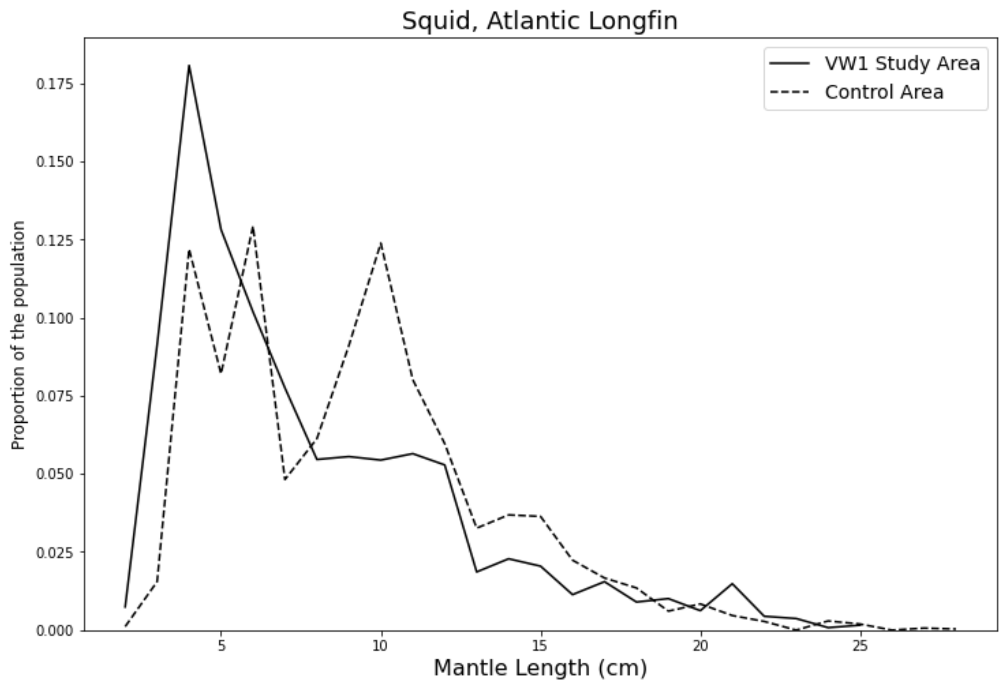


Figure 17: Distribution of the catch of silver hake in the VW1 Study Area (left) and Control Area (right). Tows with zero catch are denoted with an x.



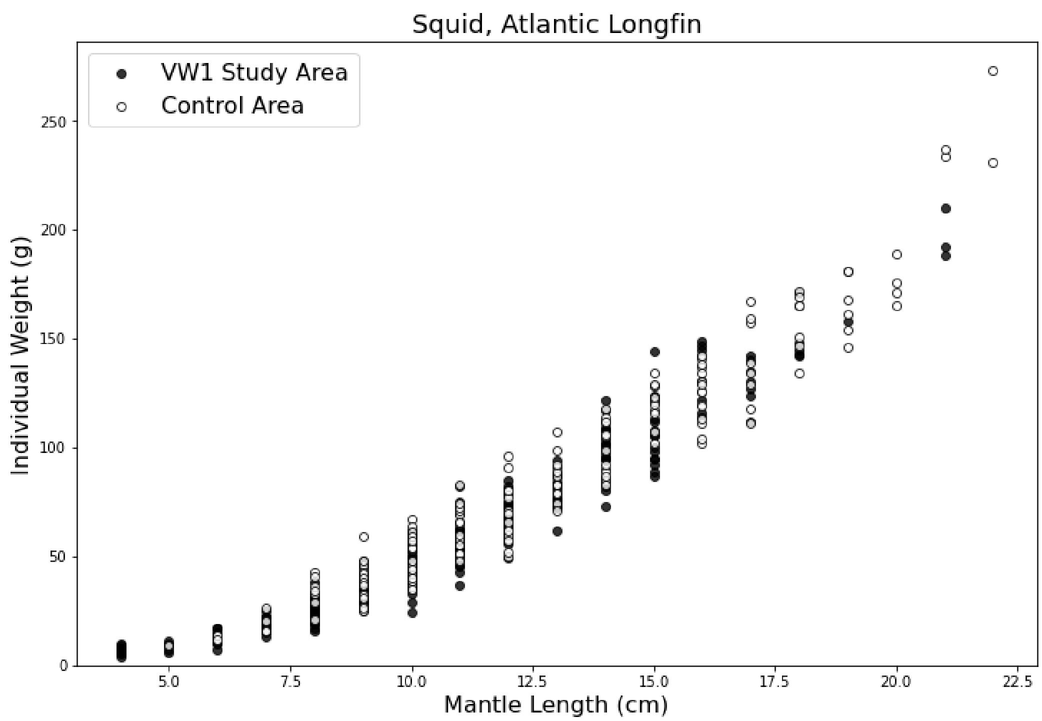


Figure 18: Population structure of Atlantic longfin squid in the VW1 Study Area and Control Area as determined by the length-frequency data (top) and length-weight relationships (bottom).

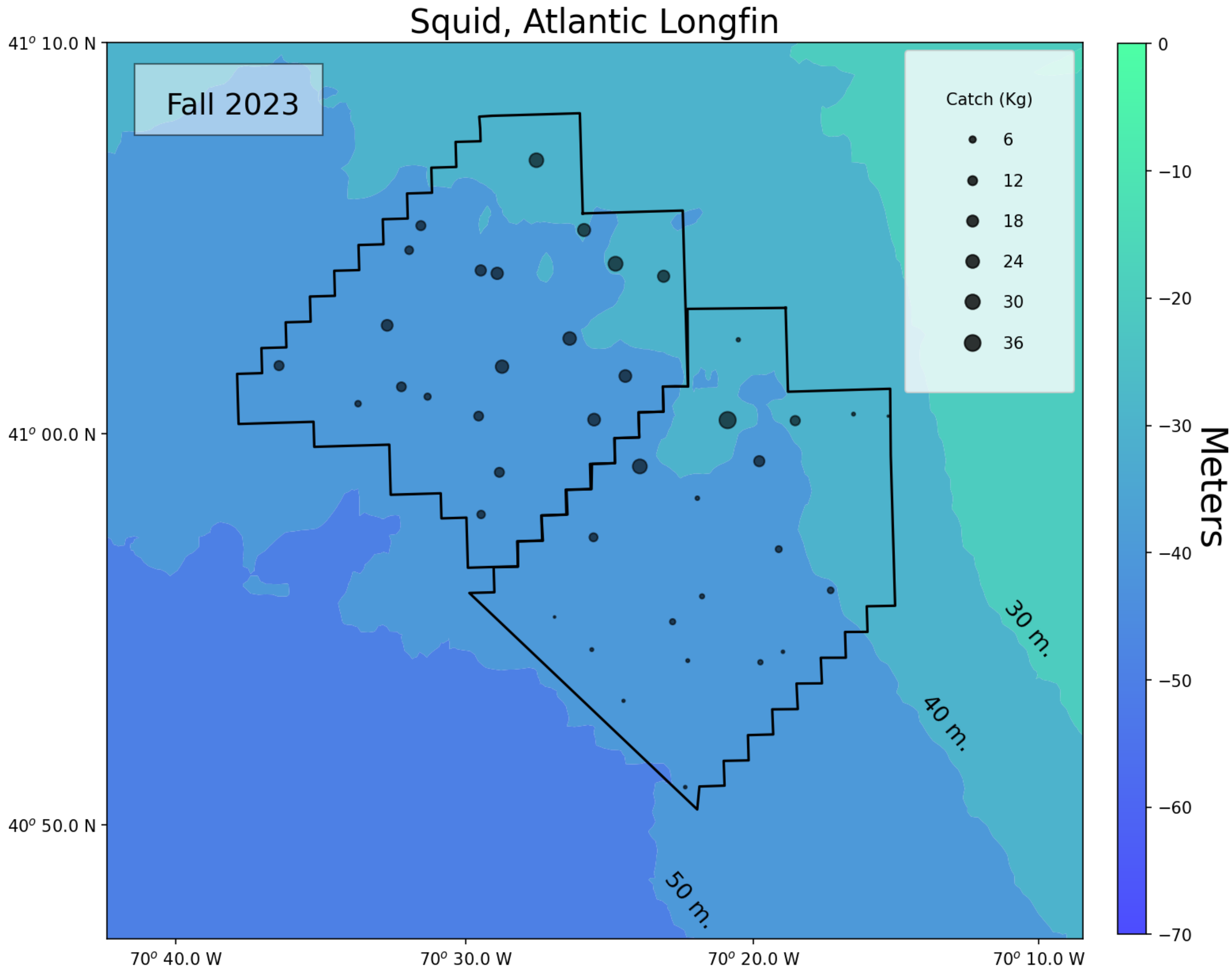
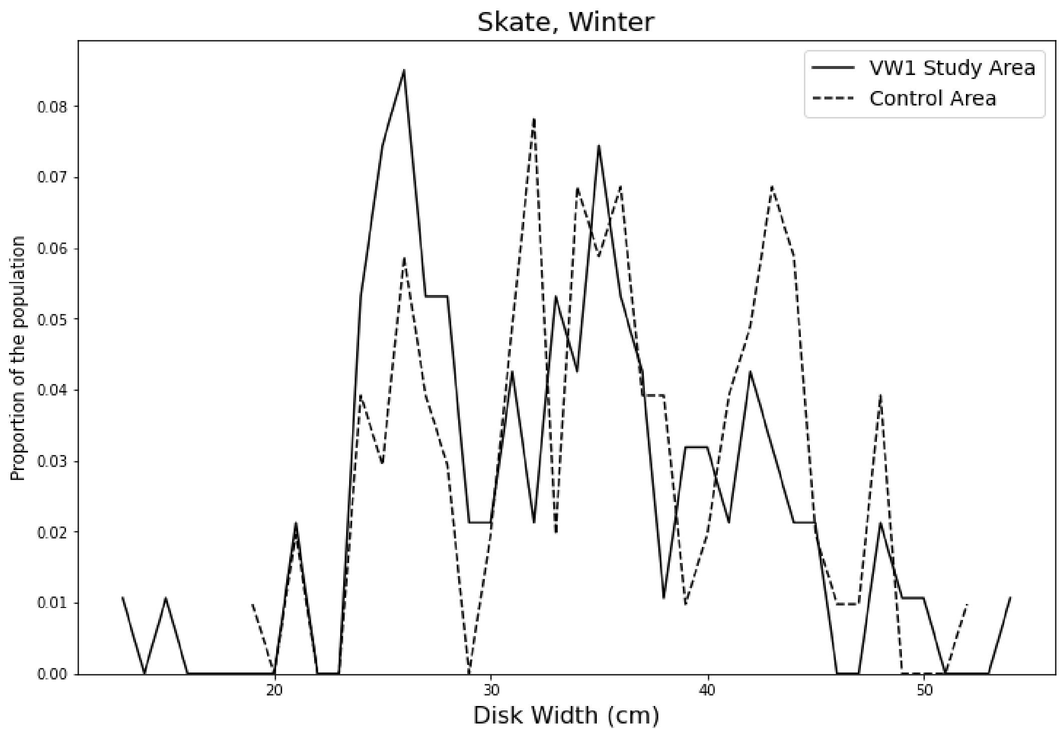


Figure 19: Distribution of the catch of Atlantic longfin squid in the VW1 Study Area (left) and Control Area (right).



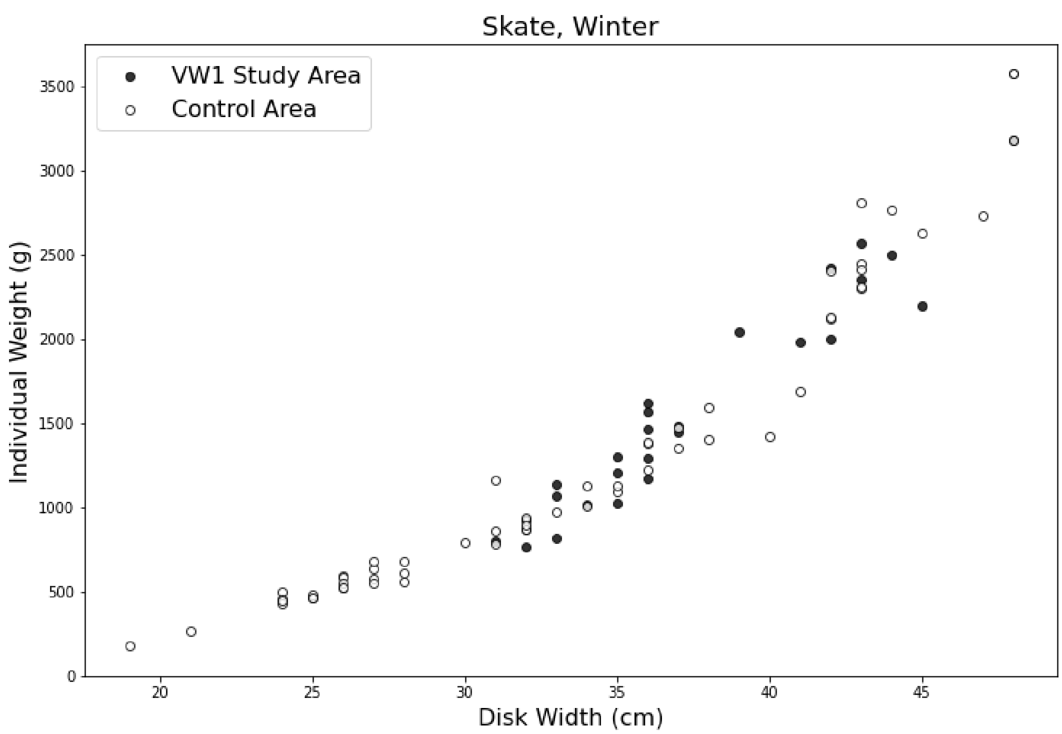


Figure 20: Population structure of winter skate in the VW1 Study Area and Control Area as determined by the length-frequency data (top) and length-weight relationships (bottom).

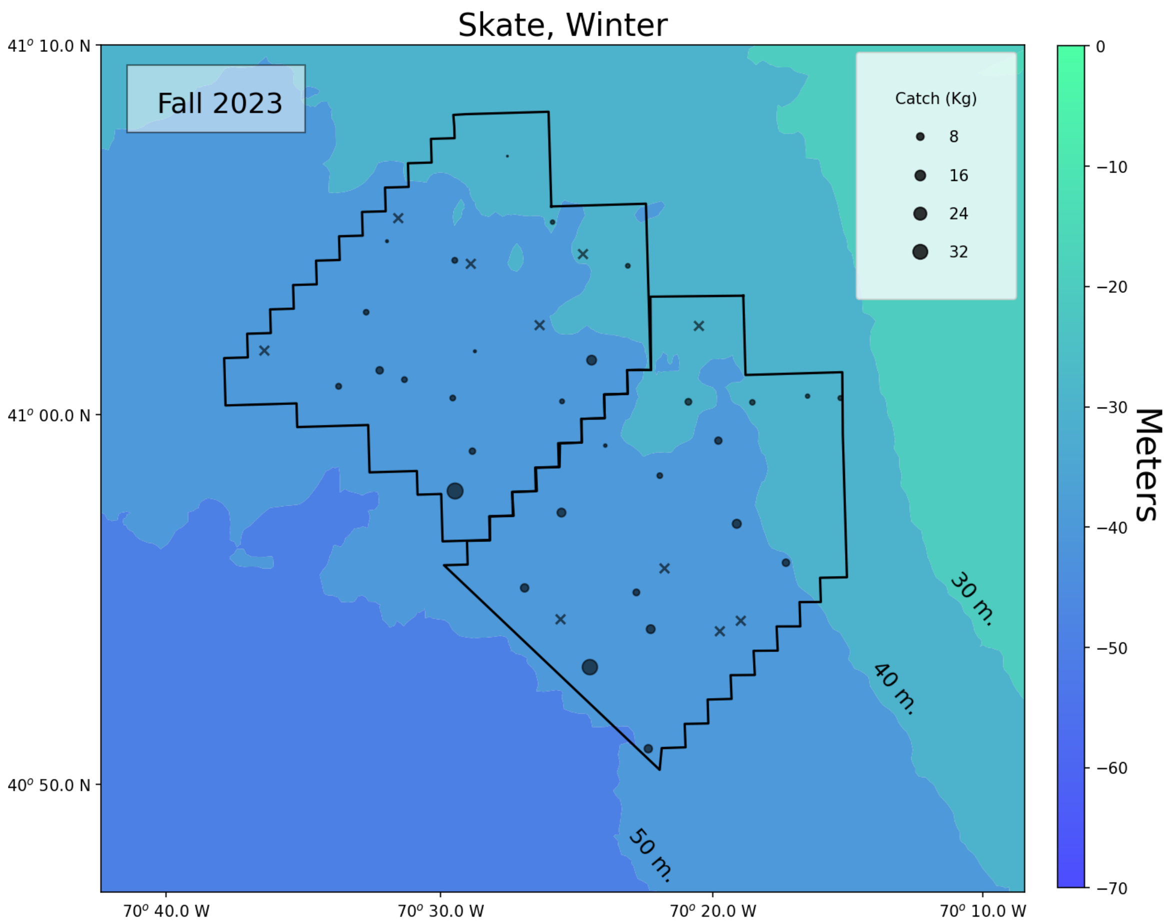
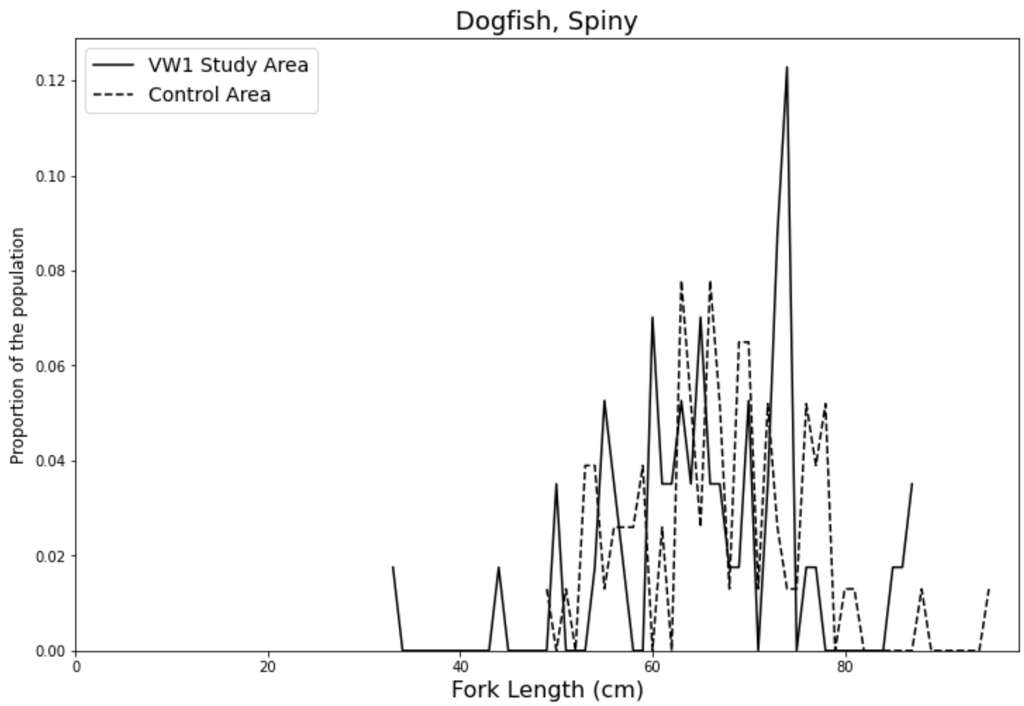


Figure 21: Distribution of the catch of winter skate in the VW1 Study Area (left) and Control Area (right). Tows with zero catch are denoted with an x.



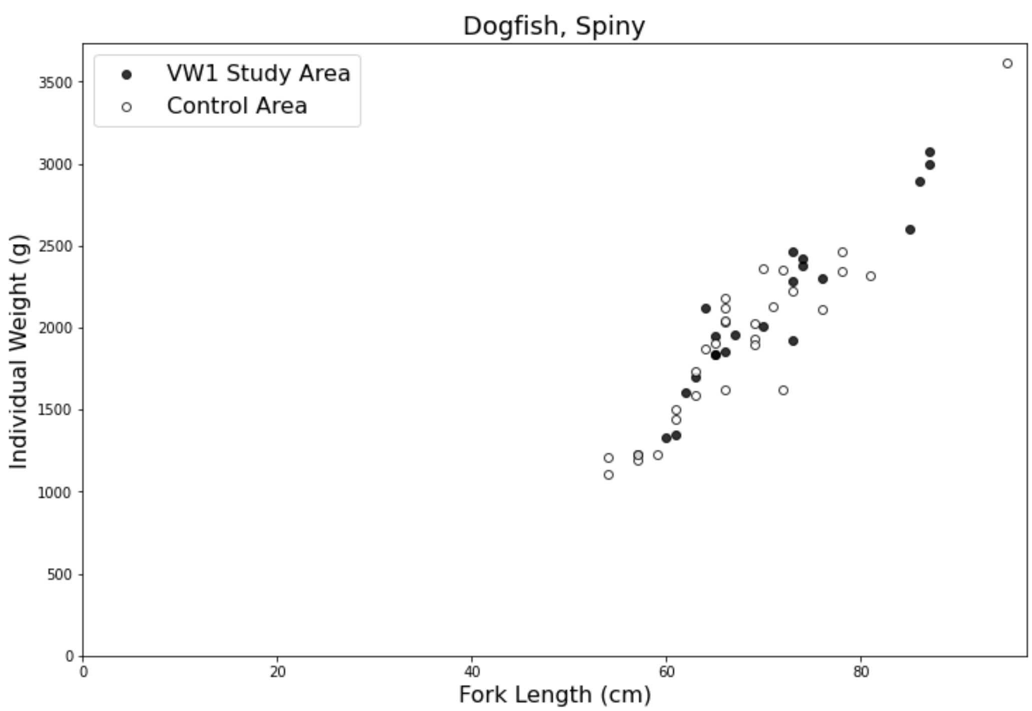


Figure 22: Population structure of spiny dogfish in the VW1 Study Area and Control Area as determined by the length-frequency data (top) and length-weight relationships (bottom).

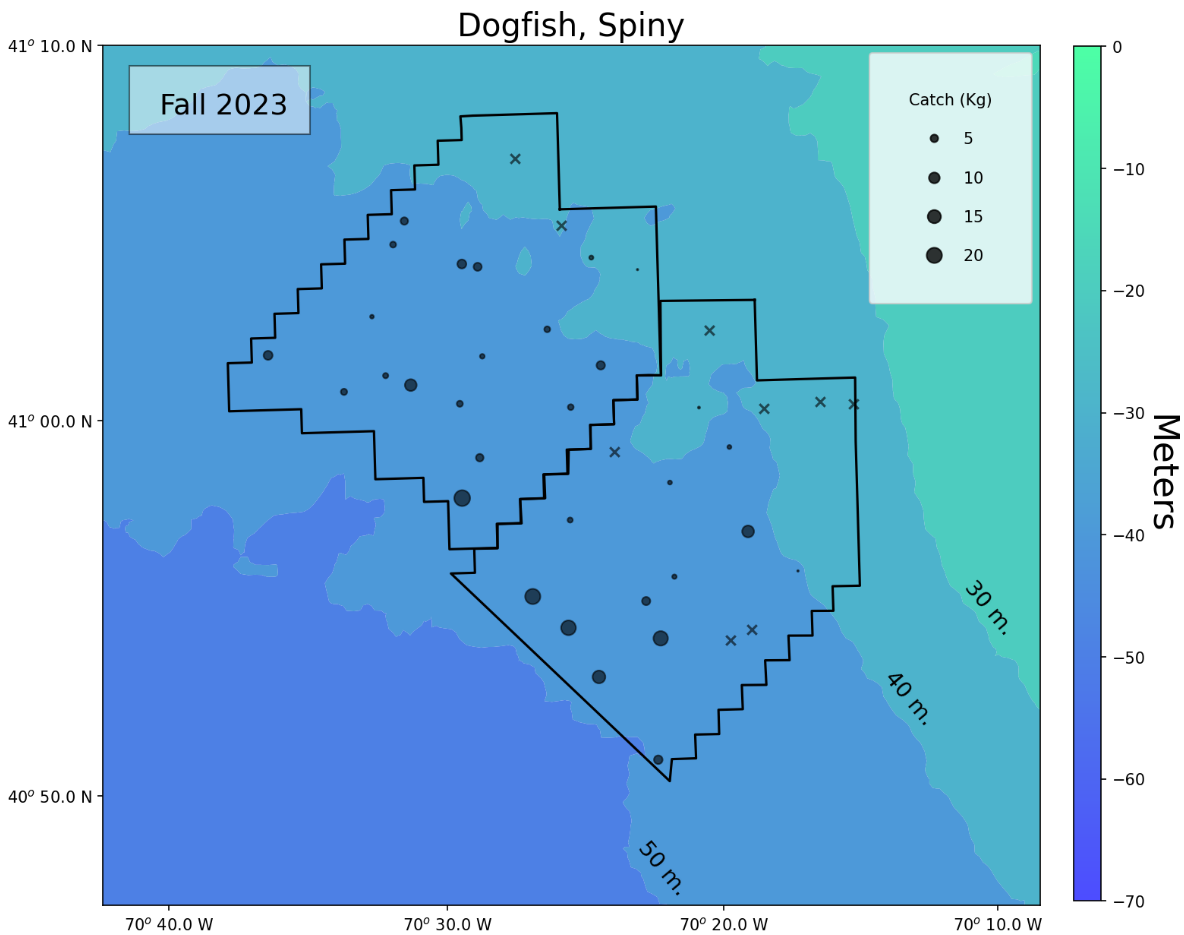
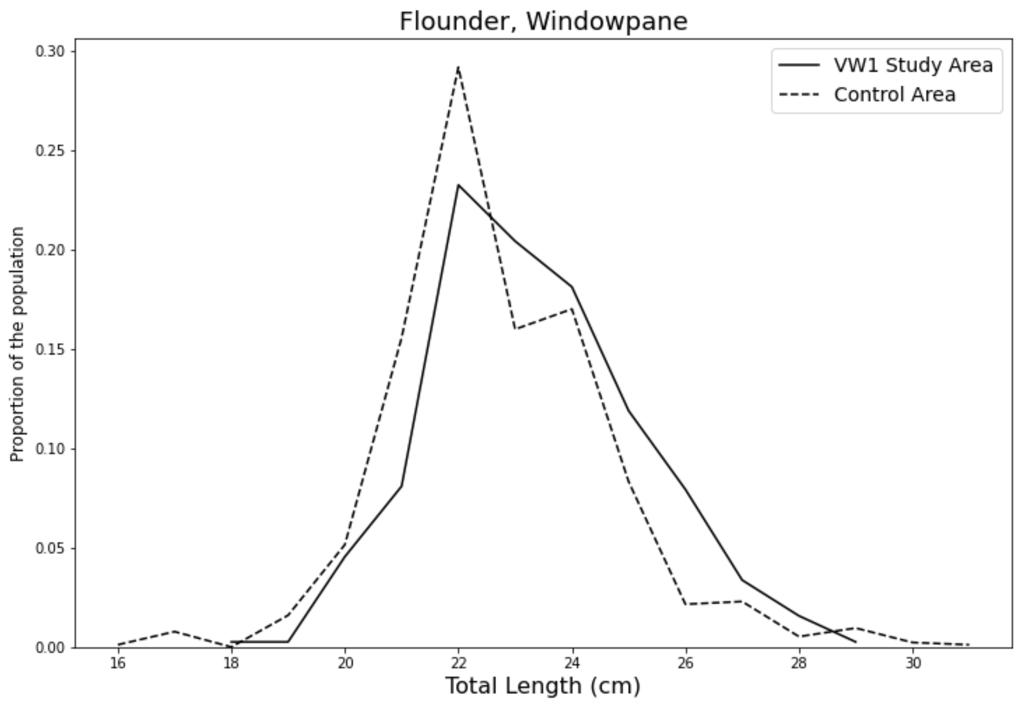


Figure 23: Distribution of the catch of spiny dogfish in the VW1 Study Area (left) and Control Area (right). Tows with zero catch are denoted with an x.



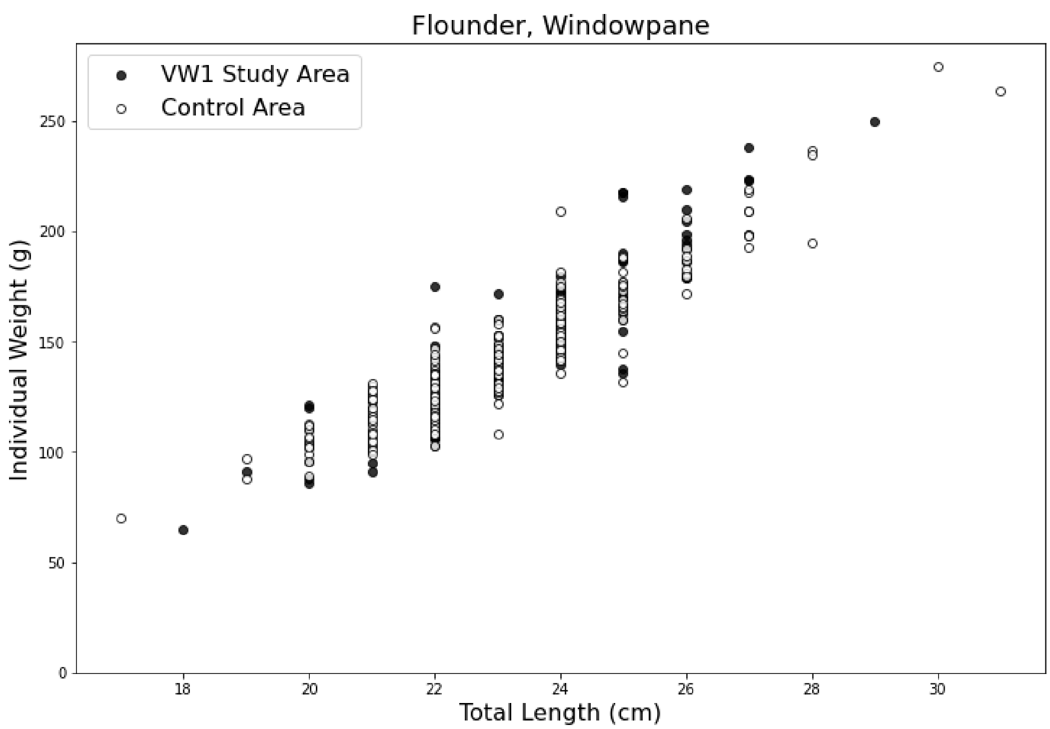


Figure 24: Population structure of windowpane flounder in the VW1 Study Area and Control Area as determined by the length-frequency data (top) and length-weight relationships (bottom).

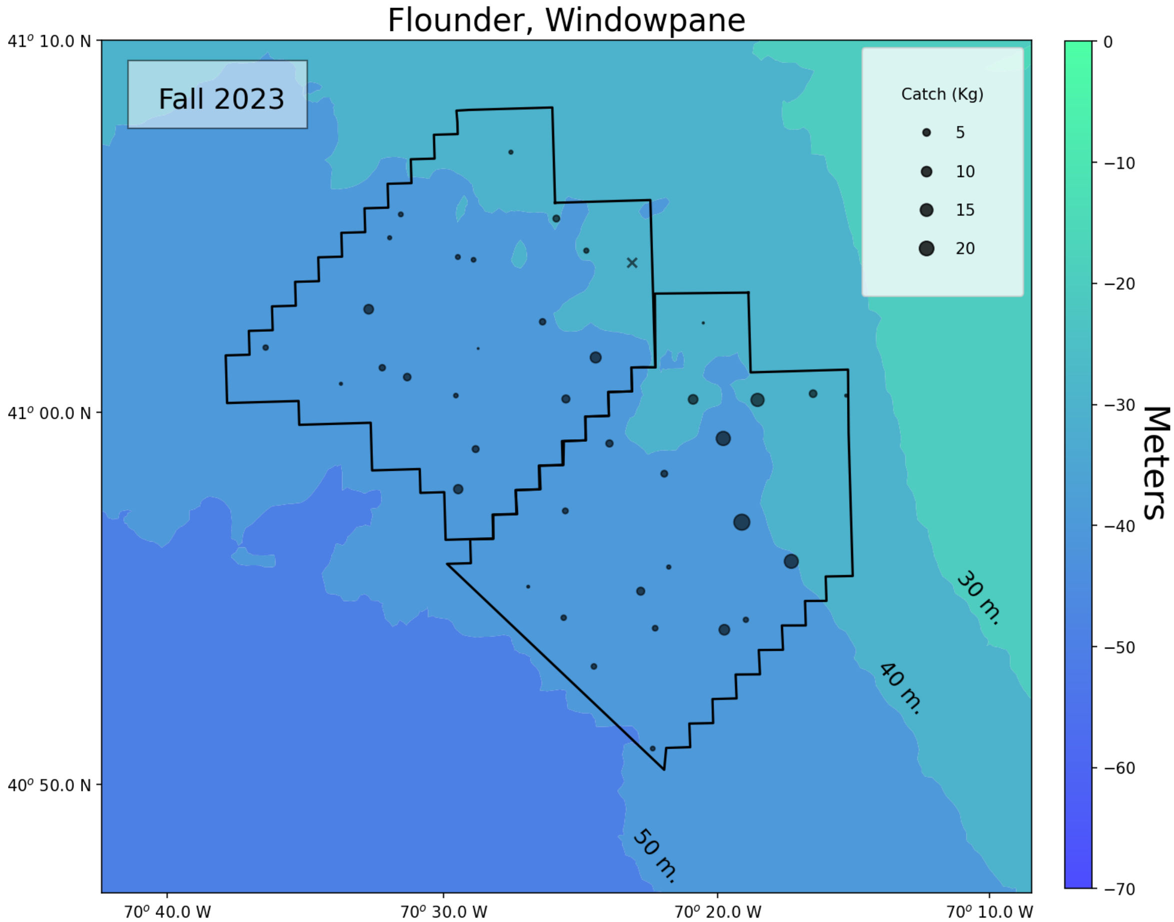
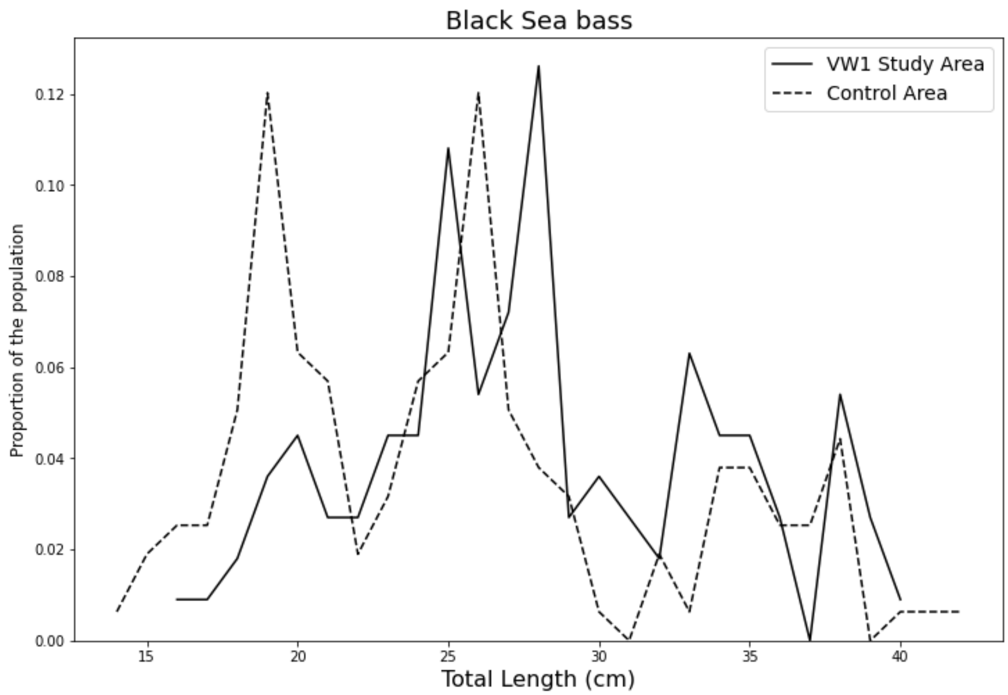


Figure 25: Distribution of the catch of windowpane flounder in the VW1 Study Area (left) and Control Area (right). Tows with zero catch are denoted with an x.



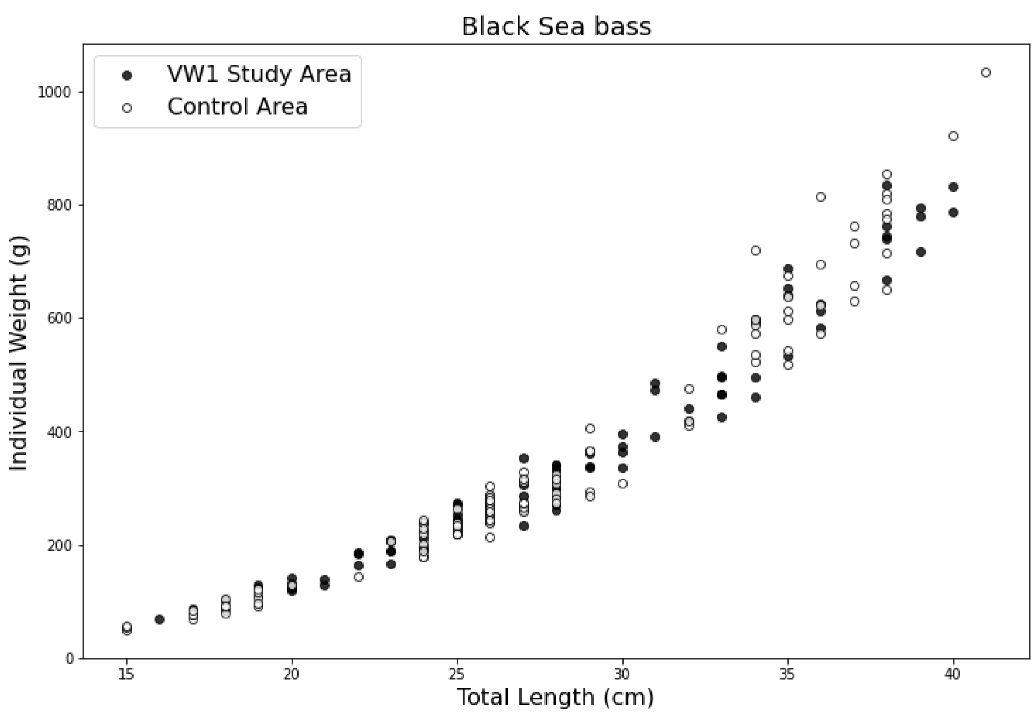


Figure 26: Population structure of black sea bass in the VW1 Study Area and Control Area as determined by the length-frequency data (top) and length-weight relationships (bottom).

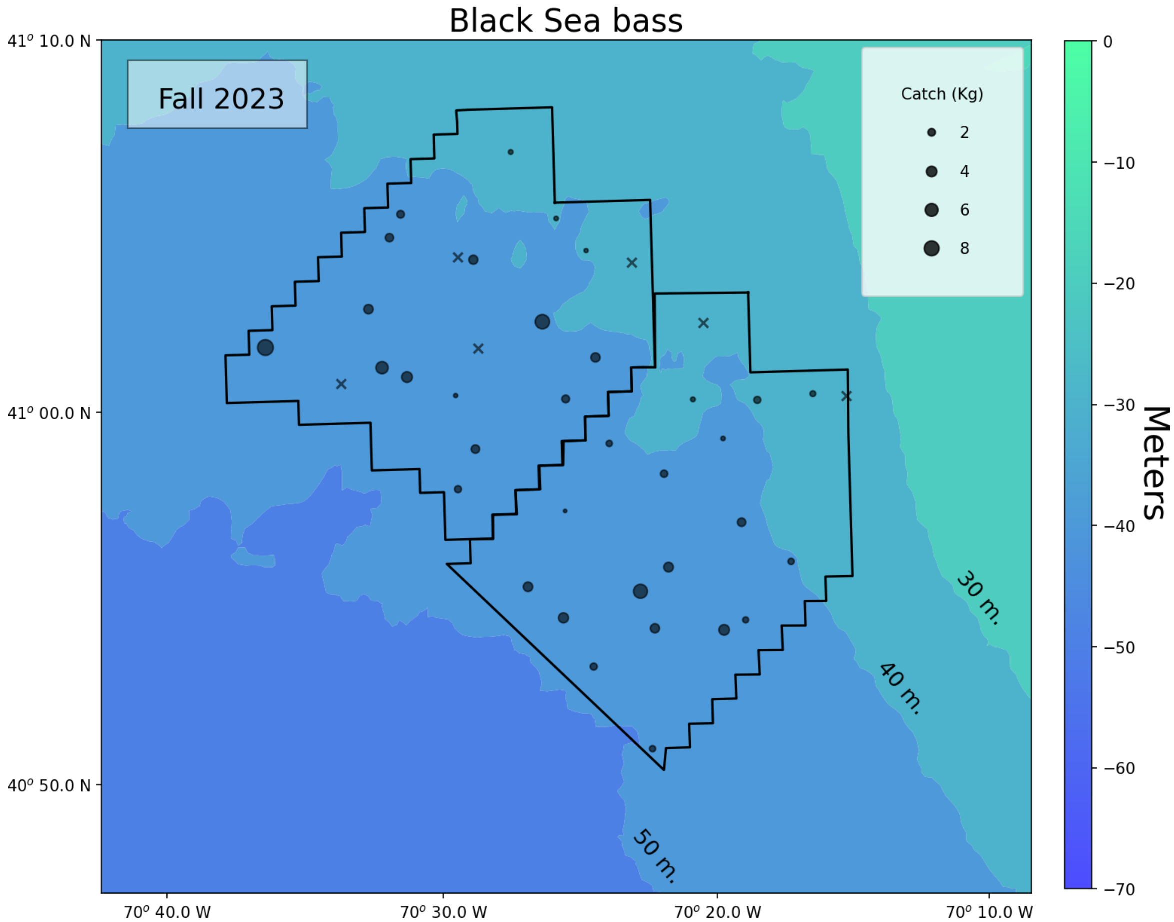
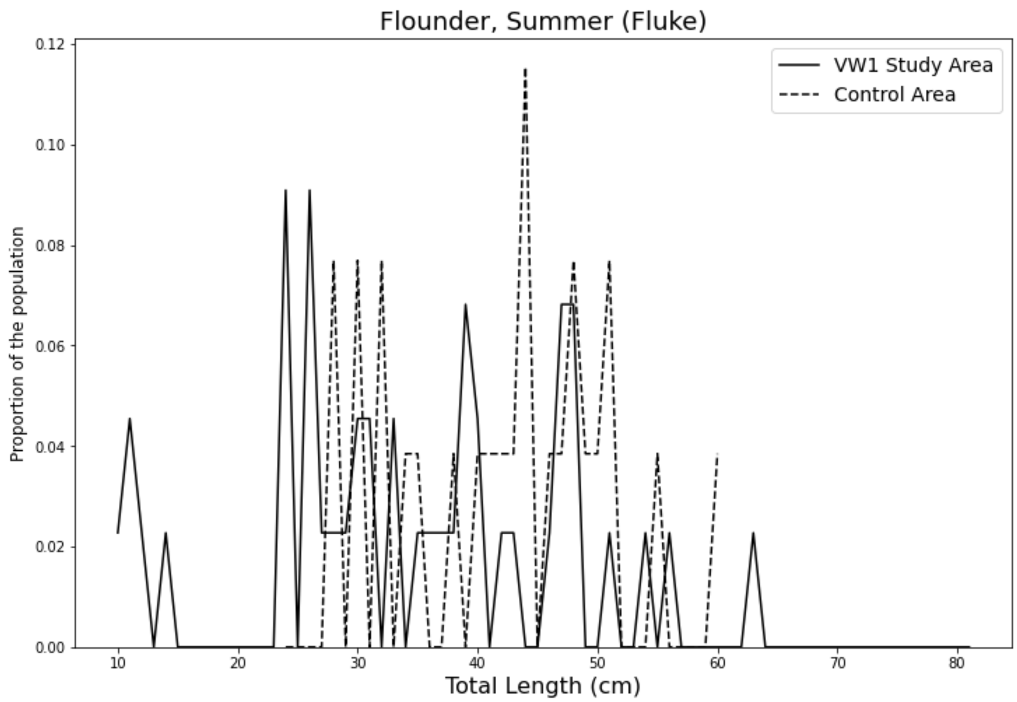


Figure 27: Distribution of the catch of black sea bass in the VW1 Study Area (left) and Control Area (right). Tows with zero catch are denoted with an x.



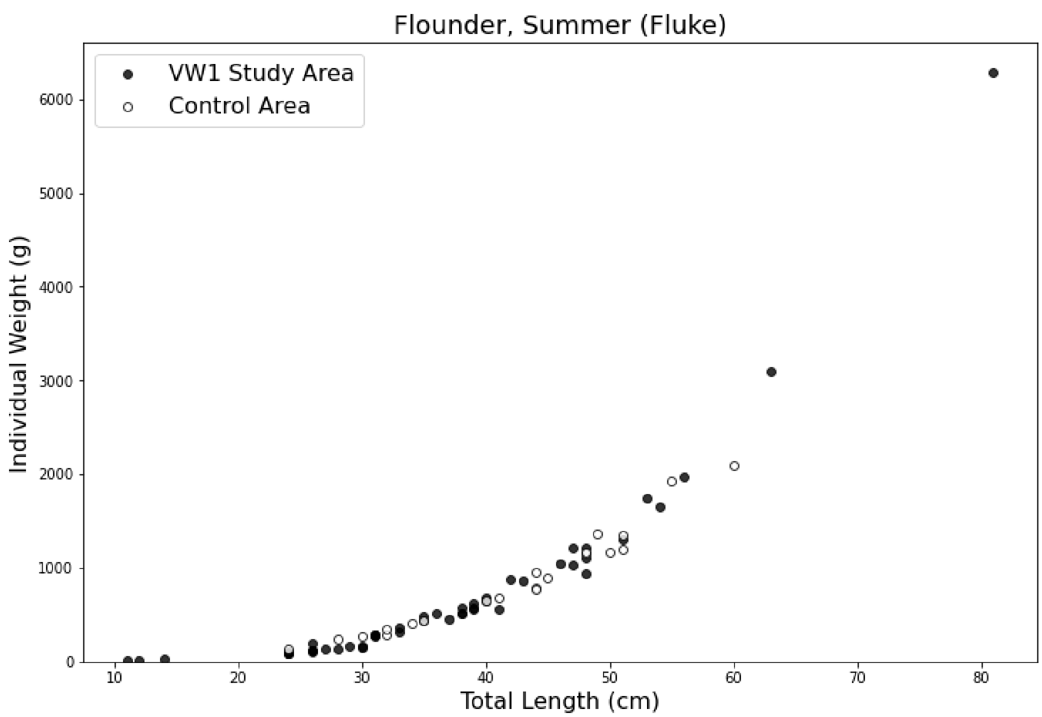


Figure 28: Population structure of summer flounder in the VW1 Study Area and Control Area as determined by the length-frequency data (top) and length-weight relationships (bottom).

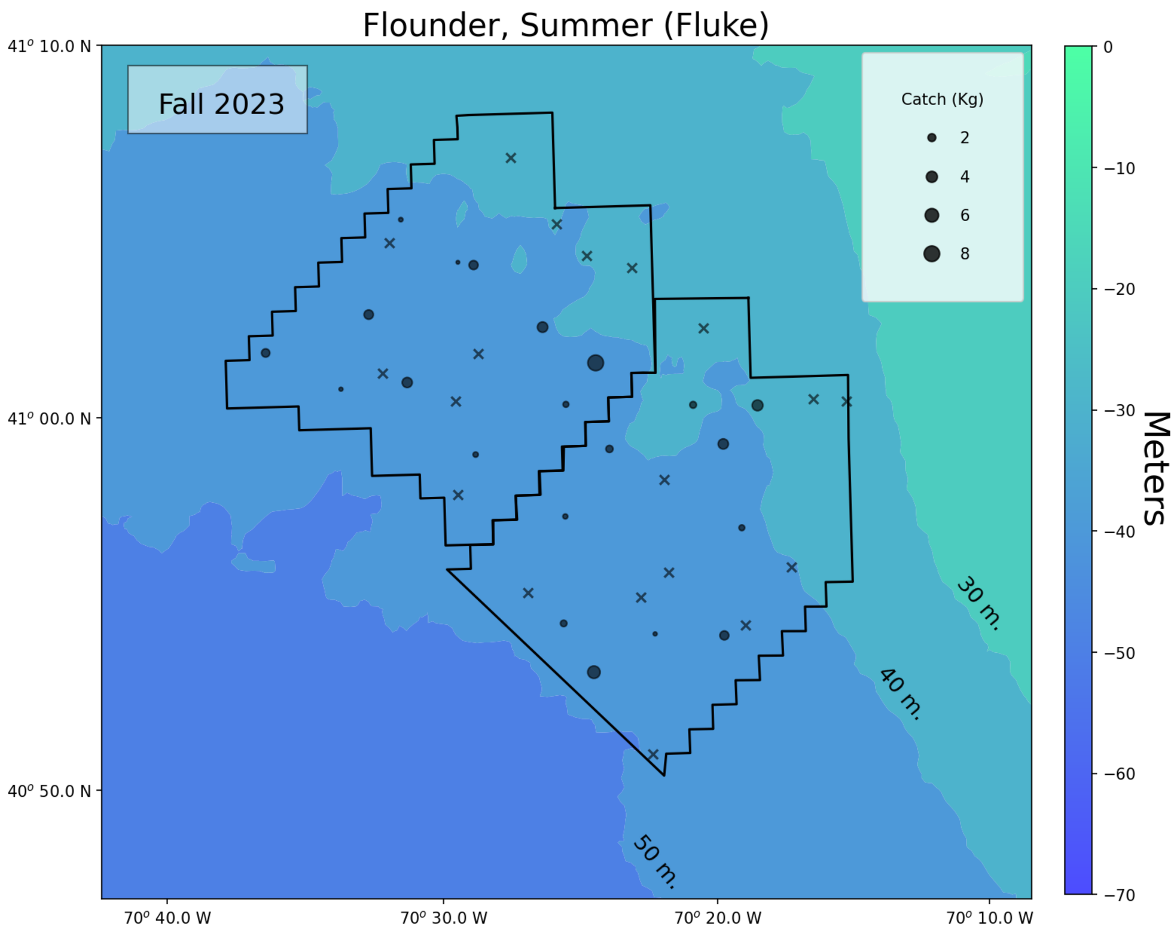


Figure 29: Distribution of the catch of summer flounder in the VW1 Study Area (left) and Control Area (right). Tows with zero catch are denoted with an x.