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DATE 9/28/05

Haskin Shellfish Research Laboratory

Institute of Marine and Coastal Sciences – New Jersey Agricultural Experiment Station
Rutgers, The State University of New Jersey

Reply to: Eleanor A. Bochenek
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TO: Joyce Lacerda
Grants and Management

From: Eleanor Bochenek EB
Marine Scientist

SUBJECT: ~~Semi-annual~~ Final Progress Report 03-RSA-003

DATE: March 22, 2005

We are pleased to submit the final report for our project entitled "Development of a Supplemental Finfish Survey Targeting Mid-Atlantic Migratory Species (03-RSA-003). Cruises were completed in January, March, May, and November 2004. Attached is the report for the November 2004 cruise. Data files from all cruises have been sent to Joan Palmer (NEFSC) for incorporation into the NMFS database.

The following cruise reports have been released:

1. HSRL. 2004a. Supplemental Finfish Survey Targeting Mid-Atlantic Migratory Species. January 2004 Cruise Report. Haskin Shellfish Research Laboratory, Rutgers University, 126 pp.
2. HSRL. 2004b. Supplemental Finfish Survey Targeting Mid-Atlantic Migratory Species. March 2004 Cruise Report. Haskin Shellfish Research Laboratory, Rutgers University, 129 pp.
3. HSRL. 2004c. Supplemental Finfish Survey Targeting Mid-Atlantic Migratory Species. May 2004 Cruise Report. Haskin Shellfish Research Laboratory, Rutgers University, 129 pp.
4. HSRL. 2004d. Supplemental Finfish Survey Targeting Mid-Atlantic Migratory Species. November 2004 Cruise Report. Haskin Shellfish Research Laboratory, Rutgers University, 133 pp.

cc. E. Powell
D. Cohen

Haskin Shellfish Research Laboratory

Institute of Marine and Coastal Sciences – New Jersey Agricultural Experiment Station
Rutgers, The State University of New Jersey

TO: Joyce Lacerda
Grants and Management

FROM: Eleanor Bochenek E.B
Marine Scientist

SUBJECT: Supplemental Finfish Survey 2004 (03-RSA-003)
Final abstract and expenditures

DATE: March 22, 2005

Supplemental Finfish Survey Targeting Mid-Atlantic Migratory Species Abstract

The supplemental finfish survey is a cooperative research program among the National Fisheries Institute-Scientific Monitoring Program (NFI-SMC), Rutgers University, Haskin Shellfish Research Laboratory (HSRL), and the National Marine Fisheries Service, Northeast Fisheries Science Center (NMFS-NEFSC). The program was funded by CMER and the MAFMC Research Set-Aside Program in 2003 and is funded by the MAFMC Research Set-Aside Program in 2004.

The main objectives of this project are: 1). to evaluate how fall downcoast and spring upcoast seasonal migration of fish in the Mid-Atlantic influences stock abundance estimates obtained from the winter and spring NMFS-NEFSC surveys and 2). to determine the extent to which migration offshore to depths beyond the limits of the winter and spring NEFSC-NMFS surveys influences abundance estimates. Many species move inshore and upcoast during the spring as the water warms and then move downcoast and offshore in the fall as the water cools. Some of these fish may seasonally move offshore beyond the range of present-day surveys. The NEFSC finfish surveys utilize a stratified random sampling design. Due to the scale of patchiness during migration, insufficient sampling density may occur in some strata in some years, and some groups of fish may avoid sampling. The cooperative supplemental finfish survey is designed to:

1. Monitor fish migration during the fall, winter, and spring.
2. Provide information that can be used to evaluate how year-to-year variation in migratory behavior can affect yearly changes in the NMFS survey abundance estimates.

3. Provide information as to the fraction of the stock offshore of the NMFS surveyed area.

Field efforts occurred in January, March, May, and November 2004. All data have been successfully entered into the NMFS-NEFSC survey database. Retrospective and planning meetings have bounded each cruise. Science personnel have consistently included representatives from HSRL and NMFS-NEFSC. The boat used for the January, March, and May cruises was the F/V Jason & Danielle out of Montauk, NY. The F/V Luke & Sarah out of Pt. Judith, RI assisted with the November cruise. A work plan for 2005, agreed upon by an informal committee of representatives from HSRL, NMFS-NEFSC, the MAFMC, NFI-SMC, and interested fishermen includes cruises in January, March, May, and November 2005.

The following cruise reports have been released.

1. HSRL. 2004a. Supplemental Finfish Survey Targeting Mid-Atlantic Migratory Species. January 2004 Cruise Report. Haskin Shellfish Research Laboratory, Rutgers University, 126 pp.
2. HSRL. 2004b. Supplemental Finfish Survey Targeting Mid-Atlantic Migratory Species. March 2004 Cruise Report. Haskin Shellfish Research Laboratory, Rutgers University, 129 pp.
3. HSRL. 2004c. Supplemental Finfish Survey Targeting Mid-Atlantic Migratory Species. May 2004 Cruise Report. Haskin Shellfish Research Laboratory, Rutgers University, 129 pp.
4. HSRL. 2004d. Supplemental Finfish Survey Targeting Mid-Atlantic Migratory Species. November 2004 Cruise Report. Haskin Shellfish Research Laboratory, Rutgers University, 133 pp.

Project Expenditures

Expenditures were as follows for the supplemental finfish survey research set-aside project:

1. Vessel costs: $181,600
2. Non-vessel costs: $157,172.16
3. Overhead costs: $9,859

Total cost: $348,631.16

By agreement with NMFS, the $53,058.52 in remaining funds from the 2003 auction were used for the January 2004 mission, with the intent of trying to complete four full cruise transects in 2004.

Supplemental Finfish Survey Targeting Mid-Atlantic Migratory Species

November 2004 Cruise Report

Funded by the
MAFMC Research Set-Aside Program

National Fisheries Institute – Scientific Monitoring Committee
and
Haskin Shellfish Research Laboratory – Rutgers, The State University of New Jersey

November 2004 Supplemental Survey Cruise Report

The goals of the supplemental survey program are 1) to track the seasonal movements of selected fish species, particularly the fall offshore and downcoast migration coincident with declining temperatures and the spring upcoast and onshore migration that occurs as the water warms, and 2) to extend the supplemental survey beyond the domain of present-day NMFS-NEFSC surveys. As a consequence, the survey design includes spatial and temporal components, and sampling intensity is increased between 150 and 250 fm.

History

To date, six Suplemental Finfish Surveys have been completed. The first sampling effort took place on the *F/V Jason & Danielle* from March 8-12, 2003. A total of 20 tows were made along the Hudson and Baltimore Canyon transects during the March survey and 26 tows during the week of May 25-31, 2003, thereby establishing the first May survey. In 2004, the survey was expanded with field programs in January and November, as well as March and May. Sampling occurred on Baltimore and Hudson Canyon transects during the weeks of January 24-February 2, March 4-17, May 19-23, and November 15-21. In addition, a transect near Poor Man's Canyon was sampled during the March 2004 survey. During the Summer of 2004, the *F/V Jason & Danielle* was sold and converted to a scallop dredge vessel and the survey was conducted on the *F/V Luke & Sarah* using exactly the same gear and sampling protocols. Data collected during the 2003-2004 surveys have been sent to the NMFS-NEFSC survey database. Cruise reports, documenting the results of each completed survey, were distributed to NFMS, NFI-SMC, and other interested parties after each sampling effort.

Organization of stations and target species

Stations are organized into cross-shelf transects oriented perpendicular to the average trend of the depth contours. The November survey sampled two fixed transects: oriented just east of Hudson Canyon (72°W) and just north of Baltimore Canyon (38°20′ N) (Figures 1 & 2). Stations were distributed by depth along each transect. Fixed stations were located at 40, 50, 60, 80, 100, 125, 150, 200, 225, and 250 fm along the Hudson Canyon transect. Fixed stations on the Baltimore Canyon transect were located at 40, 50, 60, 80, 100, 125, 150, 200, and 225 fm. The 250 fm station was not occupied on the Baltimore Canyon transect due to the steep depth gradient in the area. At each target depth, the amount of wire let out is held constant.

An additional five adaptive stations at Hudson Canyon and four along Baltimore Canyon transect were sited in an unbiased way while at sea based on the catches of target species at the fixed stations. Target species were summer flounder, scup, black sea bass, monkfish, spiny dogfish, silver+offshore hake, and *Loligo* squid. To create adaptive stations, fixed stations providing the highest overall ranking based on the catch of target species were identified. Adaptive stations were placed one-half depth increment between fixed station pairs that had the highest combined station ranks based on the sum of the target species ranks at each station until all five adaptive stations were allocated. An example in the form of an Excel spreadsheet is presented as Figure 3.

Hudson Canyon

Fixed Stations, November Positions

	Starting Position		Ending Position		Depth		
Station #	Latitude	Longitude	Latitude	Longitude	Average	(Target)	Wire Out (fm)
1	39° 55.292′	72° 21.125′	39° 54.563′	72° 22.094′	42 fm	(40 fm)	150
2	39° 47.890′	72° 10.590′	39° 47.880′	72° 12.012′	51 fm	(50 fm)	150
3	39° 45.700′	72° 7.879′	39° 45.430′	72° 8.980′	61 fm	(60 fm)	175
4	39° 35.897′	71° 56.252′	39° 36.841′	71° 56.017′	249 fm	(250 fm)	500
5	39° 37.030′	71° 56.540′	39° 37.940′	71° 56.360′	224 fm	(225 fm)	475
6	39° 37.790′	71° 57.040′	39° 38.640′	71° 56.540′	199 fm	(200 fm)	450
7	39° 39.112′	71° 58.479′	39° 39.890′	71° 57.900′	149 fm	(150 fm)	350
8	39° 41.180′	72° 4.140′	39° 42.089′	72° 3.434′	80 fm	(80 fm)	250
9	39° 40.024′	72° 1.033′	39° 40.660′	72° 0.200′	100 fm	(100 fm)	300
10	39° 38.760′	71° 59.810′	39° 37.840′	72° 0.610′	123 fm	(125 fm)	350

Adaptive Stations, November Positions

	Starting Position		Ending Position		Depth		
Station #	Latitude	Longitude	Latitude	Longitude	Average	(Target)	Wire Out (fm)
11	39° 40.450′	71° 59.910′	39° 41.060′	71° 59.102′	111 fm	(112.5 fm)	325
25	39° 39.312′	72° 2.537′	39° 40.160′	72° 2.090′	91 fm	(90 fm)	275
26	39° 40.850′	72° 7.410′	39° 41.640′	72° 6.450′	70 fm	(70 fm)	225
27	39° 46.460′	72° 7.570′	39° 46.170′	72° 8.790′	55 fm	(55 fm)	150
28	39° 53.030′	72° 16.920′	39° 53.070′	72° 15.680′	45 fm	(45 fm)	150

Baltimore Canyon

Fixed Stations, November Positions

	Starting Position		Ending Position		Depth		
Station #	Latitude	Longitude	Latitude	Longitude	Average	(Target)	Wire Out (fm)
12	38° 22.914′	73° 47.586′	38° 22.300′	73° 48.480′	40 fm	(40 fm)	150
13	38° 22.370′	73° 44.400′	38° 23.010′	73° 43.480′	50 fm	(50 fm)	150
14	38° 22.790′	73° 40.280′	38° 22.250′	73° 41.330′	60 fm	(60 fm)	175
15	38° 17.310′	73° 38.350′	38° 16.450′	73° 9.090′	80 fm	(80 fm)	250
16	38° 16.880′	73° 30.040′	38° 17.660′	73° 37.240′	99 fm	(100 fm)	300
17	38° 16.850′	73° 37.320′	38° 15.920′	73° 37.970′	121 fm	(125 fm)	325
18	38° 16.160′	73° 37.540′	38° 17.030′	73° 37.170′	145 fm	(150 fm)	375
19	38° 15.730′	73° 36.600′	38° 16.690′	73° 36.840′	203 fm	(200 fm)	450
20	38° 16.370′	73° 36.600′	38° 15.420′	73° 36.590′	194 fm	(225 fm)	475

Adaptive Stations, November Positions

	Starting Position		Ending Position		Depth		
Station #	Latitude	Longitude	Latitude	Longitude	Average	(Target)	Wire Out (fm)
21	38° 16.368′	73° 37.234′	38° 17.090′	73° 36.660′	169 fm	(175 fm)	425
22	38° 17.260′	73° 37.300′	38° 16.480′	73° 38.080′	112 fm	(112.5 fm)	325
23	38° 15.820′	73° 38.071′	38° 16.500′	73° 37.520′	132 fm	(137 fm)	375
24	38° 16.470′	73° 38.510′	38° 15.630′	73° 39.100′	90 fm	(90 fm)	275

Station Sampling Protocol

Beginning in May, 2004, tow lengths were reduced to a fixed distance of 1 nautical mile, in order to minimize sub-sampling and reduce on-deck processing time. On Hudson and Baltimore Canyon transects, tows were made at the fixed and adaptive stations according to the locations of tows from the May 2004 survey. If chosen adaptive stations were not sampled in May, tows were made according to the tow starting locations from previous surveys. These new beginning and ending positions will be used in the future should adaptive stations be chosen at those depths.

Tow speed was maintained near 3 knots. Tows were oriented along-slope to the extent possible, unless local conditions dictated a different approach. To minimize diel variability, stations in water depths $\leq$150 fm were sampled during daylight hours only. DGPS position was logged to 0.01′ latitude and longitude every 1 minute during the tow. Depth, GMT, and GPS position were logged manually every 5 minutes by the captain. Depth and bottom water temperature were logged remotely at 1-minute intervals using a Vemco sensor attached to the top of the net just behind the headrope.

Vessel and Gear Information

The November survey was conducted onboard the *F/V Luke & Sarah* because the former survey vessel, the *F/V Jason & Danielle*, was sold and converted to a scallop vessel. The *F/V Luke & Sarah* is 120′ in length with a 1500 HP engine. To minimize variability among surveys, the former Captain of the *F/V Jason & Danielle* operated the vessel during survey mode and the fishing gear from the previous surveys was retained and utilized during the November sampling effort. The target species included a combination of groundfish and other species. To permit efficient capture of groundfish while also maintaining a reasonable degree of catchability for other species such as scup, a 4-seam box net with a standard 6-cm codend (liner) was used. The fishing circle of the net is 506 meshes of 6″ mesh. The extension of the net is 3″ mesh knot to knot, 100 meshes long, and 225 meshes around. Gearwork & Marine Supply, Inc., which built the original codends, constructed two new codends for the sole purpose of the survey, built to the same specifications as those used during previous surveys. The codend is made of 6.5″ mesh knot to knot, 100 meshes long, 70 meshes around, and is lined with a 6-cm mesh liner. The chaffing gear is a mat made of 6″ mesh covering 2/3 of the bottom of the codend. The doors are 104″ Thyboron with a spoiler. Each door weighs 1,640 pounds. The footrope is constructed from 114′ 6.5″ × 1/2″ stainless steel wire wrapped with #12 polyester with two wire extensions of 6′ 5.16″ eye to eye joined with two 3/4″ bow shackles for an overall length of 127′ 11″. The headrope is 117′ 11.52″ overall length, including the extensions. There are 92 8″ hi-impact floats hung in groups of 6 on 5/8″ poly plus, grouped closely together in the center with a set of 6 on each wing. The traveler is made of 1/2″ stainless steel wire banded with 1/2″ stainless steel bands to the footrope. The overall length is 119′, with the stainless steel bands spaced at 1′ 11″ intervals. The sweep is made up of 5/8″ stainless steel wire with 84 1.4 pound leads in the center section and 3 link 1/2″ trix drop chains at 1′ 11″ intervals throughout. The sweep is in three sections joined with 1/2″ hanging locks and 2′ 6″ of 1/2″ trix chains on each wing end. Each wing is 46′ 6.84″ eye to eye and the bosom is 29′ 2.28″ eye to eye. The sweep is covered with 3″ rubber cookies.

Sample Processing Protocol

Sample processing protocol followed standard NMFS survey methods. Each tow was sorted to species and catch weights were obtained for each species. Target species for length measurements included: summer flounder, scup, black sea bass, monkfish, spiny dogfish, smooth dogfish, skates, yellowtail flounder, winter flounder, bluefish, American lobster, silver/offshore hake, *Illex* and *Loligo* squid. Priority species were then measured. The goal for each priority species was 100 length measurements for each tow. If fewer than 100 individuals were caught, all of the

individuals were measured. Each priority species was then divided into size classes and the first 3 individuals measured in each size class were weighed. Beginning in January, 2004, spiny dogfish were separated by sex prior to analysis. Neither yellowtail flounder nor winter flounder were caught in any of the tows. Personnel availability limited the amount of biological sampling done during the November survey.

Species	# Length Measurements	# Weight Measurements	# Samples Taken/Type
Silver hake	2167	182	
Loligo squid	2003	173	
Illex squid	1147	212	
Male spiny dogfish	855	137	
Monkfish	815	307	
Offshore hake	632	126	
Scup	405	47	
Female spiny dogfish	367	116	
Summer flounder	288	121	18/Scales
Rosette skate	254	61	
Bluefish	176	127	
Smooth Dogfish	131	91	
American lobster	53	53	
Thorny skate	29	19	
Winter skate	12	12	
Clearnose skate	7	7	
Black sea bass	6	5	
Smooth skate	4	4	

Results

A total of 28 tows were made during the November 2004 survey. Fifteen tows were taken along the Hudson Canyon transect and 13 along the Baltimore Canyon transect. Table 1 presents the basic tow information for each station. Average depth was calculated as the average of all the depths recorded by the Vemco minilogger during the tow. Due to the rapidly changing depth contours in Baltimore Canyon, it was difficult to maintain a constant depth in the deep-water stations. Nevertheless, the average tow depths were relatively close to the target depths for all tows (Table 1).

Depth range is the difference between the deepest and shallowest depth recorded during each tow. Scope was calculated by dividing the amount of tow wire out (m) by the average depth (m) of each tow, and normally fell between 2.2 and 3.4 (Table 1). Tow time (h) is the duration of each tow and speed (km/h) is the distance traveled divided by the duration of each tow. Distance (km) was calculated using

1-minute DGPS positions after establishing the beginning and ending positions of each tow using the Vemco minilogger depth record.

Tow distance was approximately 1.6 to 2.2 km and with one exception, tow speed varied by no more than 10% from the mean of 4.9 km/hr. Swept area (km^2) was calculated by multiplying the average door spread (m) by the distance traveled for each tow (km), and normally fell between 0.11 and 0.15 km^2 (Table 1).

Swath area measures the relative importance of each sampled depth according to its contribution to total distance along the transect set perpendicular to the depth contour. Figure 4 shows an example of how the distance along the transect was allocated to each tow for the calculation of swath area. The calculation projects the swept area of the tow had the net been towed along the main axis of the transect for the distance allocated to each sample depth. This distance is established by the midpoints between perpendiculars dropped to the transect line from the midpoints of each tow.

Table 2 lists the total catch, in kilograms, for each species caught on the survey. A line indicates the species whose total catch was greater than 1% of the total catch of all species. Table 3 lists the number of tows and the percentage of the total tows in which each species was caught.

Figures 5a-25a depict, by transect, the swept area catch (kg/km^2) for most species whose total catch was greater than 1% of the total catch of all species as well as other commercially-important species. Figures 5b-25b depict, by transect, the projected catch of each species for a distance along the transect represented by each tow swath. Figures 26a-43a represent the cumulative size-frequency distributions obtained by first normalizing each tow's data to swept area and then summing across all tows in each transect. Figures 26b-43b show the cumulative size-frequency distributions, corrected first to swept area as before, but then normalized to swath distance along the transect, and finally summed across all tows in each transect. Figures 44-56 are the cumulative size-frequencies, by tow, for each measured species with greater than 20 individuals measured per tow. Figures 57-72 show the relationship between length and weight per species by tow for each transect.

Figures 73a and 73b show the relationship between selected measures of sampling performance between the May and November 2004 surveys and a comparison of bottom temperature data between the January and November 2004 surveys. Overall, little variation in tow depth and scope occurred between the two surveys (Figure 73a). Depth range was more variable and increased with increasing target depth (Figure 73a & 74). Scope varied consistently with depth as expected (Figure 74). The two surveys resulted in a similar distribution between tow times, tow distances, and tow speeds. Swept areas varied slightly more during the November

survey than during the May effort, but overall, sampling performance on the *F/V Luke & Sarah* remained consistent with the *F/V Jason & Danielle*. Bottom temperatures tended to be warmer during the November 2004 survey when compared with bottom temperatures during the January 2004 survey (Figure73a).

Figures 75a-h compare the 20th, 50th, and 80th percentiles of depth distribution of species based on kg caught at each depth for each species in March and May 2003 and January, March, May, and November 2004. To calculate the percentiles, swath area catch (Figures 5b-25b) was cumulated from the shallowest to the deepest station on each transect. The 20th percentile, for example, is the depth where the cumulative catch curve reached 20% of the total catch. As examples, the figures for *Loligo* squid and butterfish indicate that the populations moved to shallower depths from March 2003 through January 2004 on the Hudson Canyon transect. In March of 2004, the distributions of both species appear to have shifted into deeper water on both Hudson and Baltimore Canyon transects and in May, the fish appear to have moved inshore again. In November, *Loligo* squid and butterfish continue migrating inshore to 100-125 m on the Hudson Canyon transect, whereas, near Baltimore Canyon, both species move offshore into approximately 150-175 m depths. Near Hudson Canyon, male and female spiny dogfish appear to follow similar distribution patterns. From January to March, the population shifts offshore to depths of 350 m and then migrate inshore in May, where they remain at a depth of 100 m. On the Baltimore Canyon transect, an entirely different migration pattern is observed. Female and male spiny dogfish move inshore from January to March and then migrate to depths around 225 m. In November 2004, the female population appears to shift inshore to shallower depths of 100-125 m whereas, males move further offshore into depths of 275-325 m. In contrast, the distribution of little skate remained relatively constant over the same time period at depths of 70-100 m.

Acknowledgements

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Table 1. Results of data recorded for each tow in November 2004. Transect 1 = Hudson Canyon Transect; Transect 2= Baltimore Canyon Transect. Target depth represents the depths at which the fixed positions were chosen before the cruise. Tow depth represents the actual depth at which each tow was made, calculated as the average of the depths recorded every minute during the tow.

Transect	Tow	Date	Tow Begin Time (Military)	Target Depth m	Tow Depth m	Depth Range m	Scope m	Swept Area km²	Swath Area km²	Bottom Temperature F	Tow Time h	Tow Speed km/h	Tow Distance km
1	1	11/16/04	15:26	73.15	81.62	6.60	3.36	0.12	248.96	56.91	0.37	5.23	1.92
1	2	11/16/04	18:00	91.44	95.80	16.60	2.86	0.13	506.21	54.64	0.42	5.33	2.22
1	3	11/16/04	20:09	109.73	116.08	6.60	2.76	0.15	276.01	54.89	0.42	5.42	2.26
1	4	11/16/04	23:36	457.20	454.41	39.80	2.01	0.11	62.26	42.00	0.35	4.43	1.55
1	5	11/17/04	00:50	411.48	412.27	16.60	2.11	0.12	104.20	42.96	0.35	5.28	1.85
1	6	11/17/04	02:05	365.76	373.62	13.30	2.20	0.14	159.35	44.97	0.40	4.82	1.93
1	7	11/17/04	11:45	274.32	267.54	10.90	2.39	0.12	109.41	50.69	0.37	4.73	1.73
1	8	11/17/04	17:06	146.30	143.97	10.90	3.18	0.14	233.11	54.28	0.40	4.85	1.94
1	9	11/17/04	18:24	182.88	179.76	7.30	3.05	0.13	57.28	53.94	0.42	4.12	1.72
1	10	11/17/04	19:42	228.60	222.76	7.30	2.87	0.15	113.91	52.55	0.40	4.63	1.85
1	11	11/17/04	21:36	204.83	199.58	7.30	2.98	0.14	118.89	53.40	0.43	4.20	1.82
2	12	11/18/04	11:33	73.15	79.28	13.30	3.46	0.11	149.23	60.55	0.37	4.94	1.82
2	13	11/18/04	12:45	91.44	99.19	3.30	2.77	0.10	243.38	60.46	0.37	4.92	1.81
2	14	11/18/04	13:56	109.73	115.92	3.30	2.76	0.13	408.14	60.44	0.37	5.33	1.96
2	15	11/18/04	15:29	146.30	154.73	6.60	2.95	0.14	324.77	59.45	0.40	4.90	1.96
2	16	11/18/04	16:41	182.88	188.34	13.30	2.91	0.14	17.32	55.39	0.40	5.00	2.00
2	17	11/18/04	19:15	228.60	236.86	13.30	2.51	0.13	16.97	52.39	0.35	5.37	1.88
2	18	11/18/04	21:07	274.32	267.63	49.80	2.56	0.14	21.06	51.14	0.43	4.62	2.00
2	19	11/19/04	01:26	365.76	355.48	63.10	2.32	0.17	51.17	45.87	0.45	5.10	2.30
2	20	11/19/04	02:50	411.48	383.10	99.60	2.27	0.12	33.92	44.72	0.35	4.65	1.63
2	21	11/19/04	11:28	320.04	324.43	106.30	2.40	0.13	33.41	48.75	0.38	4.66	1.78
2	22	11/19/04	13:35	204.83	213.63	13.30	2.78	0.14	30.78	54.23	0.40	4.63	1.85
2	23	11/19/04	16:24	250.55	242.22	19.90	2.83	0.12	6.22	53.62	0.37	5.02	1.84
2	24	11/19/04	17:25	164.59	172.64	20.00	2.91	0.14	30.68	56.60	0.42	4.57	1.91
1	25	11/20/04	12:50	164.59	172.33	10.00	2.92	0.13	172.59	54.47	0.37	4.93	1.81
1	26	11/20/04	14:38	128.02	135.49	6.60	3.04	0.15	344.18	54.08	0.42	5.21	2.17
1	27	11/20/04	17:05	100.58	109.88	6.70	2.50	0.11	173.65	53.32	0.35	5.19	1.82
1	28	11/20/04	19:25	82.30	88.81	9.90	3.09	0.12	617.67	58.82	0.38	4.92	1.88

Table 2. Total catch in kg for each species caught during the November 2004 survey. Species above the line represent those species whose total catch was greater than 1% of the total catch of all species.

Species	Total Catch (kg)
Silver Hake	10013.069
Spotted Hake	6439.755
Loligo Squid	6392.241
Monkfish	1744.258
Male Spiny Dogfish	1597.924
Deepsea Red Crab	1400.462
Offshore Hake	799.792
Fourspot Flounder	732.234
Female Spiny Dogfish	717.606
Red Hake	646.265
Butterfish	501.129
Smooth Dogfish	463.231
Illex Squid	401.624
Bluefish	391.219
Summer Flounder	375.942
Little Skate	363.468
Rock Crab	274.442
Witch Flounder	264.154
Anemone, Unk.	222.923
Rosette Skate	184.676
Buckler Dory	169.004
Jonah Crab	132.141
Chain Dogfish	130.843
Sea Potato	124.139
Starfish, Unk.	98.080
Blackbelly Rosefish	88.033
Sea Scallop	87.779
Scup	36.351
American Lobster	35.739
Tilefish	26.767
Hickory Shad	26.576
Shrimp, Unk.	25.002
Gulfstream Flounder	24.222
Atlantic Torpedo Ray	21.033
Thorny Skate	19.260
White Hake	18.420
Northern Sea Robin	17.899
Striped Sea Robin	16.411
Shell, Unk.	15.690
Longfin Hake	15.268
Clearnose Skate	11.399
Gladiator Box Crab	8.088
Sea Pen	8.060
Spider Crab, Unk.	7.915
Armored Sea Robin	7.058
Beardfish	5.407
Weakfish	4.944
Marlinspike Grenadier	4.858
Anchovy, Unk.	4.672
Winter Skate	4.536
Conger Eel	4.536
Longnose Greeneye	3.506
Longnose Grenadier	3.415
Galatheid, Unk.	3.257
Blackfin Goosefish	3.116
Vinciguerria Spp.	2.372
Hermit Crab, Unk.	2.200
Atlantic Mackerel	2.087
Spotfin Dragonet	1.978
Batfish, Unk.	1.810
Slender Snipe Eel	1.583
Smooth Skate	1.542
Bathyal Swimming Crab	1.375
Atlantic Herring	1.297
White Barracudina	0.726
Streamer Bass	0.694
Jellyfish, Unk.	0.653
Fish, Unk.	0.526
Blue Hake	0.490
Frostfish	0.467
Ocean Pout	0.372
Squid, Unk.	0.349
Alewife	0.313
Haddock	0.268
Fourbeard Rockling	0.213
Keelcheek Bass	0.168
Shortnose Greeneye	0.163
Slope Hatchetfish	0.159
Longhorn Sculpin	0.127
Sea Urchin, Unk.	0.118
Octopus, Unk.	0.118
Tonguefish	0.095
Crab, Unk.	0.095
Sponge, Unk.	0.077
Fawn Cusk Eel	0.068
Black Sea Bass	0.059
Mantis Shrimp	0.054
Roughy, Unk.	0.050
Sea Raven	0.032
Rough Scad	0.027
Spotted Tinselfish	0.018
Redeye Gaper	0.018
Flounder, Unk.	0.004

Table 3. Number and percentage of tows in which each species was caught during November 2004.

Species	# Times Caught	Percentage
Jonah Crab	27	96
Monkfish	26	93
Illex Squid	26	93
Silver Hake	25	89
Spotted Hake	24	86
Loligo Squid	23	82
Fourspot Flounder	23	82
Rock Crab	22	79
Gulfstream Flounder	21	75
Chain Dogfish	20	71
Red Hake	19	68
Female Spiny Dogfish	18	64
American Lobster	18	64
Bluefish	17	61
Starfish, Unk.	17	61
Rosette Skate	16	57
Male Spiny Dogfish	15	54
Summer Flounder	15	54
Smooth Dogfish	15	54
Butterfish	15	54
Galatheid, Unk.	15	54
Witch Flounder	14	50
Buckler Dory	13	46
Blackbelly Rosefish	13	46
Anemone, Unk.	12	43
Beardfish	12	43
Armored Sea Robin	12	43
Offshore Hake	11	39
Shrimp, Unk.	11	39
Spider Crab, Unk.	11	39
Hickory shad	10	36
Marlinspike Grenadier	10	36
Anchovy, Unk.	10	36
Gladiator Box Crab	9	32
Scup	8	29
Deepsea Red Crab	8	29
Fish, Unk.	8	29
Longnose Grenadier	8	29
Clearnose Skate	7	25
Little Skate	7	25
Longnose Greeneye	7	25
Sea Potato	7	25
Shortnose Greeneye	7	25
Atlantic Mackerel	7	25
Sea Scallop	6	21
Sea Pen	6	21
Slender Snipe Eel	6	21
Shell, Unk.	5	18
Striped Sea Robin	5	18
Tilefish	5	18
Spotfin Dragonet	5	18
Weakfish	4	14
Winter Skate	4	14
Four Beard Rockling	4	14
Blue Hake	4	14
White Hake	4	14
Thorny Skate	4	14
Vinciguerria Spp.	4	14
White Barracudina	4	14
Longfin Hake	4	14
Batfish, Unk.	4	14
Northern Sea Robin	4	14
Hermit Crab, Unk.	4	14
Black Sea Bass	3	11
Slope Hatchetfish	3	11
Smooth Skate	3	11
Tonguefish	3	11
Bathyal Swimming Cra	3	11
Conger Eel	3	11
Streamer Bass	3	11
Atlantic Torpedo Ray	3	11
Crab, Unk.	3	11
Atlantic Herring	2	7
Mantis Shrimp	2	7
Alewife	2	7
Fawn Cusk Eel	2	7
Jellyfish, Unk.	2	7
Blackfin Goosefish	2	7
Octopus, Unk.	2	7
Ocean Pout	1	4
Sea Raven	1	4
Frostfish	1	4
Flounder, Unk.	1	4
Haddock	1	4
Spotted Tinselfish	1	4
Sponge, Unk.	1	4
Sea Urchin, Unk.	1	4
Keelcheek Bass	1	4
Roughy, Unk.	1	4
Redeye Gaper	1	4
Squid, Unk.	1	4
Longhorn Sculpin	1	4
Rough Scad	1	4

Figure 1. Location of tows made along the Hudson Canyon Transect in November 2004. Fixed tows are marked with triangles as the tow begin point and circles as the tow end point. Adaptive tows are marked with stars as the beginning and ending points.

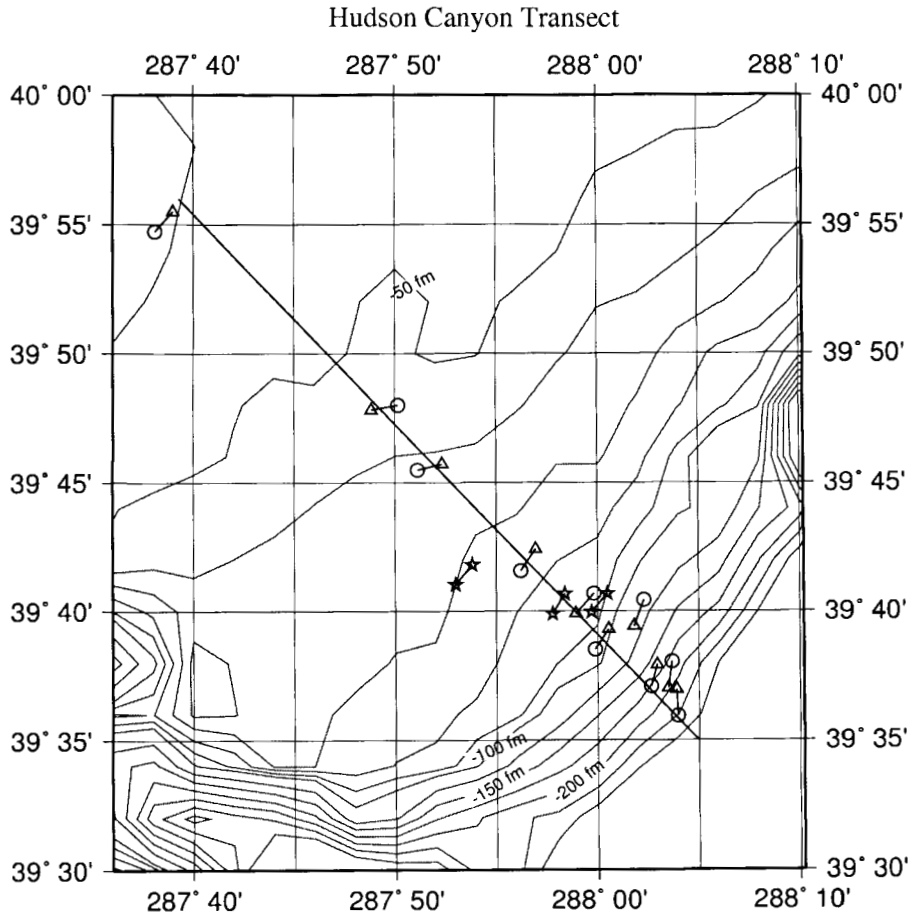


Figure 2. Location of tows made along the Baltimore Canyon Transect in November 2004. Fixed tows are marked with triangles as the tow begin point and circles as the tow end point.

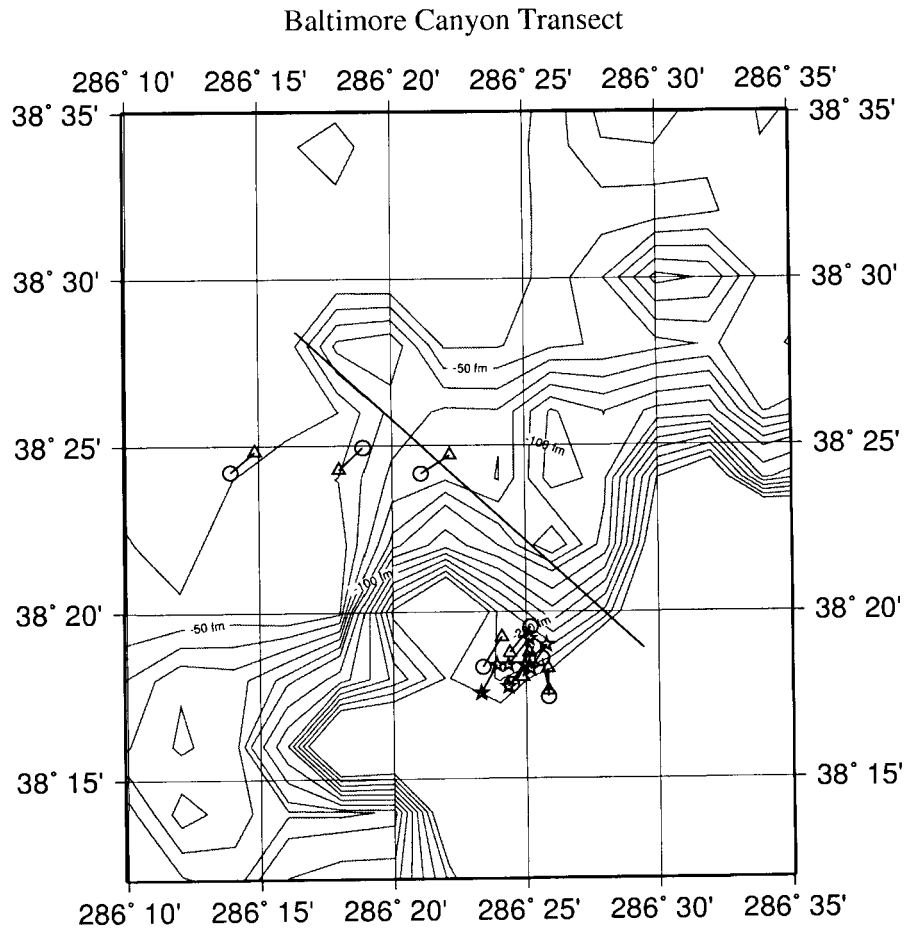


Figure 3. Selection of adaptive tows on Hudson Canyon transect for the November 2004 survey. The stations are ranked according to catches of target species. The ranks are summed (Sum column in lower left table). Potential intermediate stations are established between each of the fixed stations (upper right table). The five to be sampled are identified by the five lowest scores (average sum of ranks between adjacent fixed stations) in the Sum column (*** in lower right table).

Catch (kg) for All Fixed Stations of the Hudson Transect

Fixed Station Depth (fm)	Monkfish	Scup	Black Sea Bass	Loligo Squid	Silver + Offshore Hake	Summer Flounder	Spiny Dogfish
40	6.35	2.76	0.03	42.10	40.40	19.30	172.02
50	1.97	1.18	0.00	128.76	32.71	41.20	178.85
60	24.60	0.00	0.00	138.00	200.80	10.90	585.10
80	11.30	0.00	0.00	2.45	473.00	9.82	143.26
100	24.92	0.00	0.00	3.98	652.20	4.05	32.53
125	34.95	0.00	0.00	0.31	685.40	0.00	14.33
150	7.16	0.00	0.00	0.00	255.70	0.00	18.03
200	50.82	0.00	0.00	0.00	226.10	0.00	0.00
225	29.70	0.00	0.00	0.00	25.33	0.00	0.00
250	3.60	0.00	0.00	2.44	8.52	0.00	0.00

Potential Adaptive Stations at Intermediate Depths:

Depth (fm)
45
55
70
90
112.5
137.5
175
212.5
237.5

Rank of Catch by Species

Fixed Station Depth (fm)	Monkfish	Scup	Black Sea Bass	Loligo Squid	Silver + Offshore Hake	Summer Flounder	Spiny Dogfish	Sum
40	8	1	1	3	7	2	3	25
50	10	2	2	2	8	1	2	27
60	5	3	2	1	6	3	1	21
80	6	3	2	5	3	4	4	27
100	4	3	2	4	2	5	5	25
125	2	3	2	6	1	6	7	27
150	7	3	2	7	4	6	6	35
200	1	3	2	7	5	6	8	32
225	3	3	2	7	9	6	8	38
250	9	3	2	7	10	6	8	45

Integrating Ranks Between Stations

Intermediate Depth (fm)	Avg. Sum of Ranks	
45	26	***
55	24	***
70	24	***
90	26	***
112.5	26	***
137.5	31	
175	33.5	
212.5	35	
237.5	41.5	

Figure 4. Swath distance for tows 1, 2, and 3, taken near a transect, showing the distance allotted to each tow had it actually been taken along the transect.

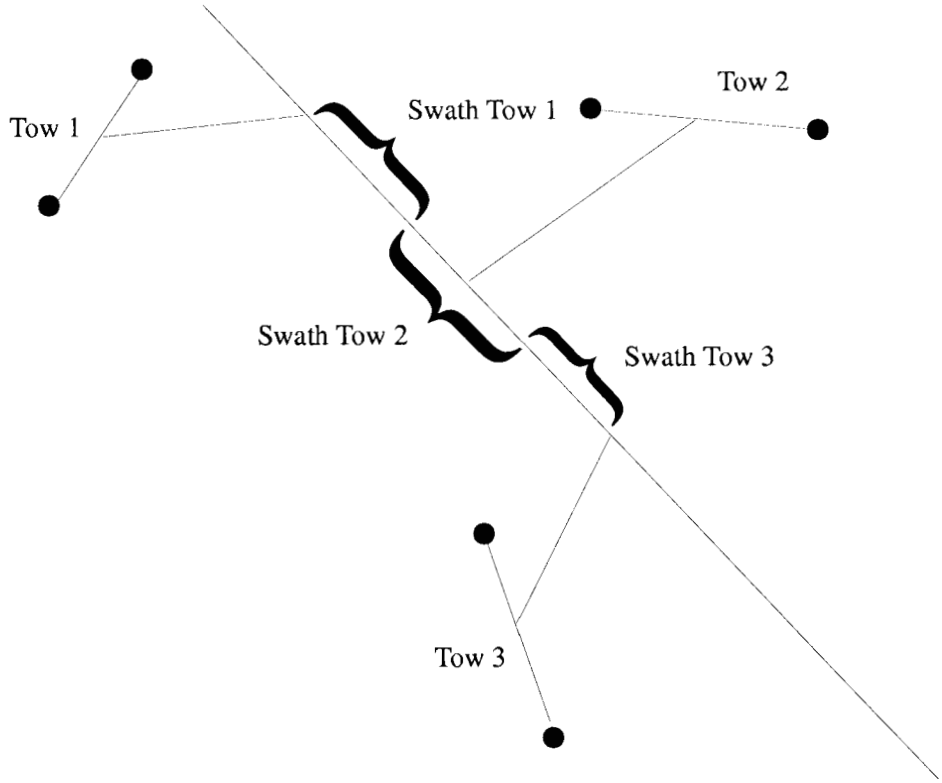


Figure 5a. Catches of American lobster in each tow along the two transects. Catch is recorded in kg caught/swept area (km^2). Depth is the average depth at which each tow was made (in meters). Tow numbers indicate the sampling sequence during the cruise. Tows are ordered shallowest to deepest along the x-axis.

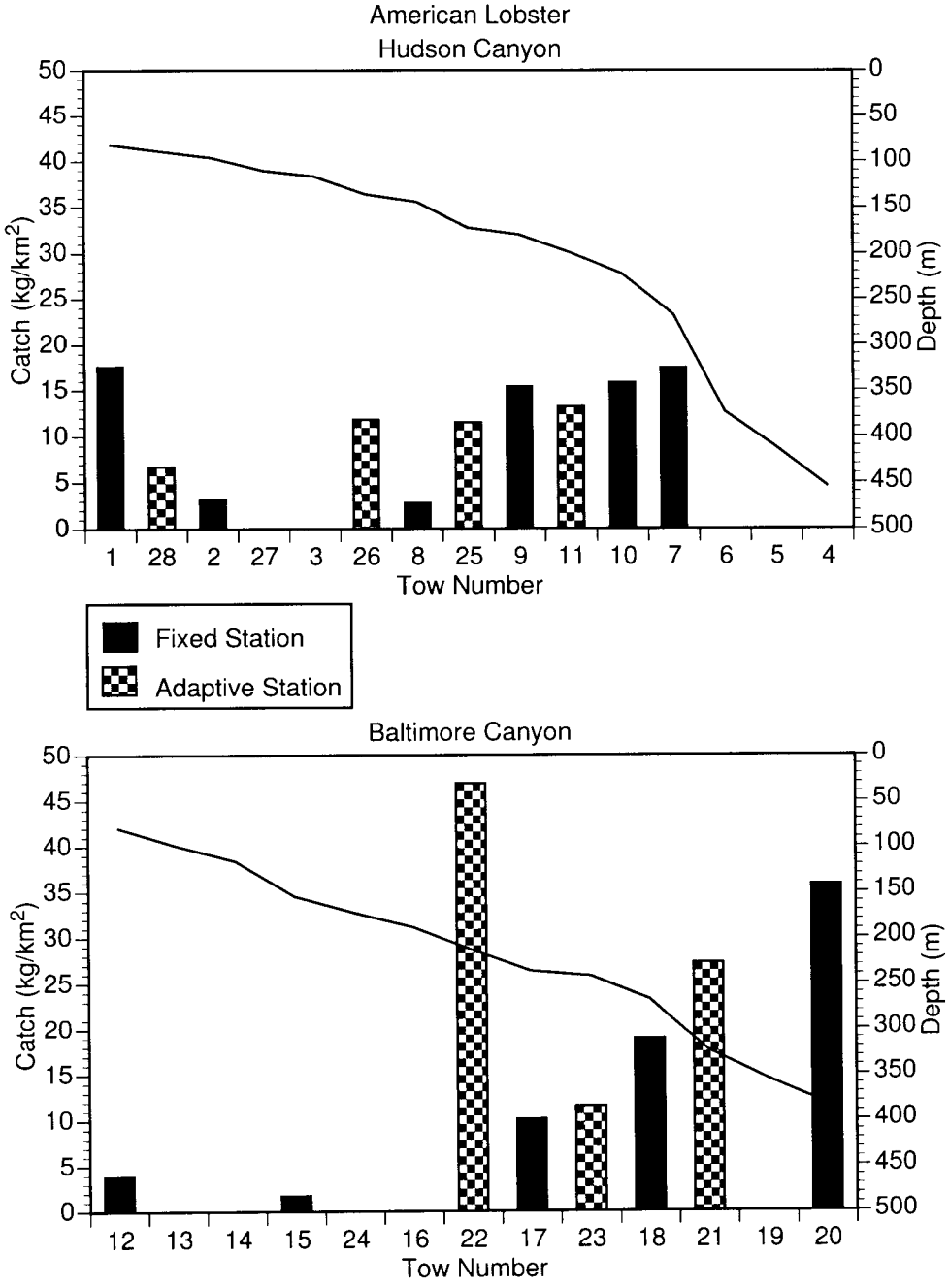


Figure 5b. Projected abundance of American lobster along the transect with each tow representing the projected abundance for the distance along the transect. Tow numbers indicate the sampling sequence during the cruise. Tows are ordered shallowest to deepest along the x-axis.

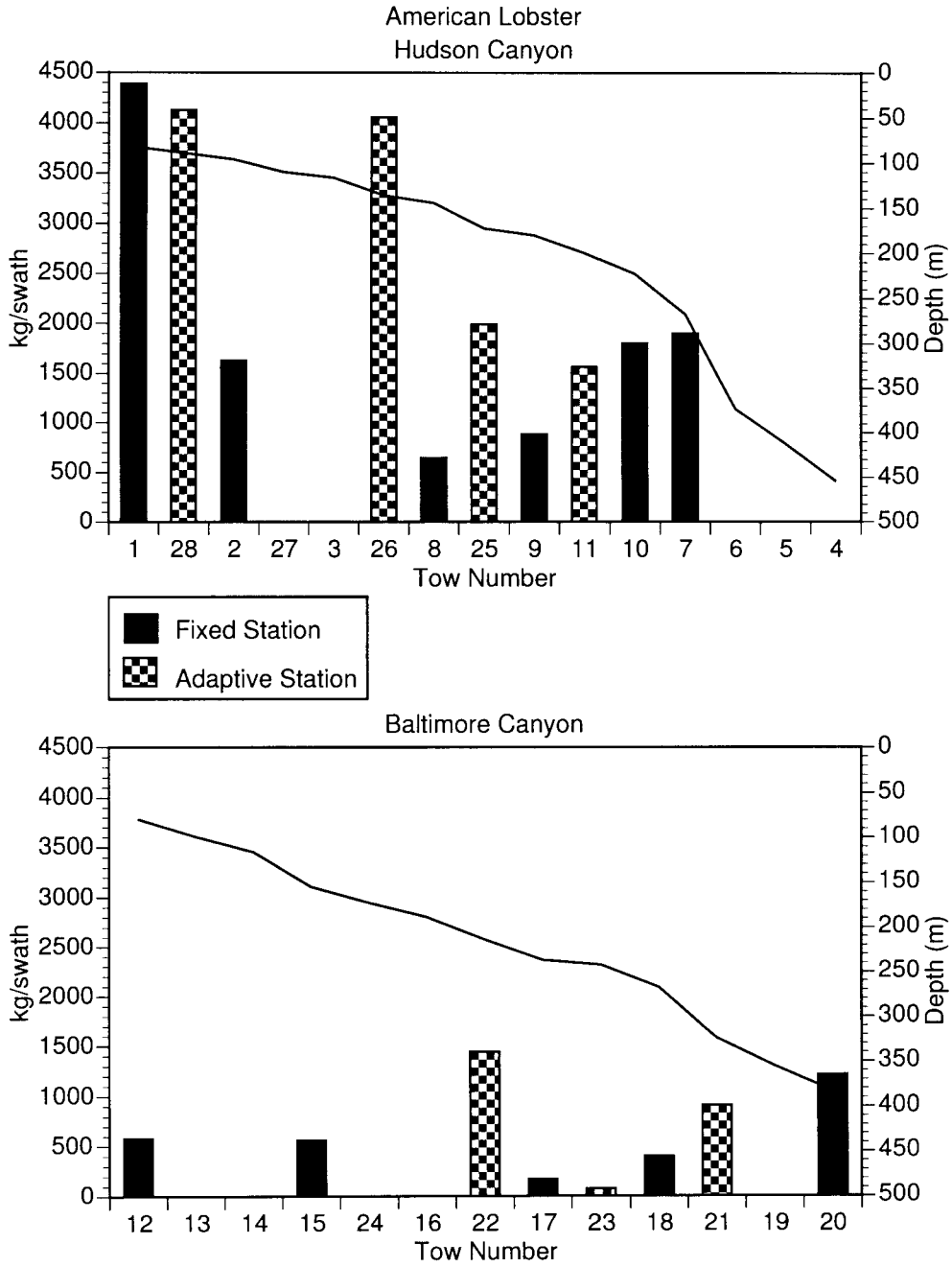


Figure 6a. Catches of black sea bass in each tow along the two transects. Catch is recorded in kg caught/swept area (km^2). Depth is the average depth at which each tow was made (in meters). Tow numbers indicate the sampling sequence during the cruise. Tows are ordered shallowest to deepest along the x-axis.

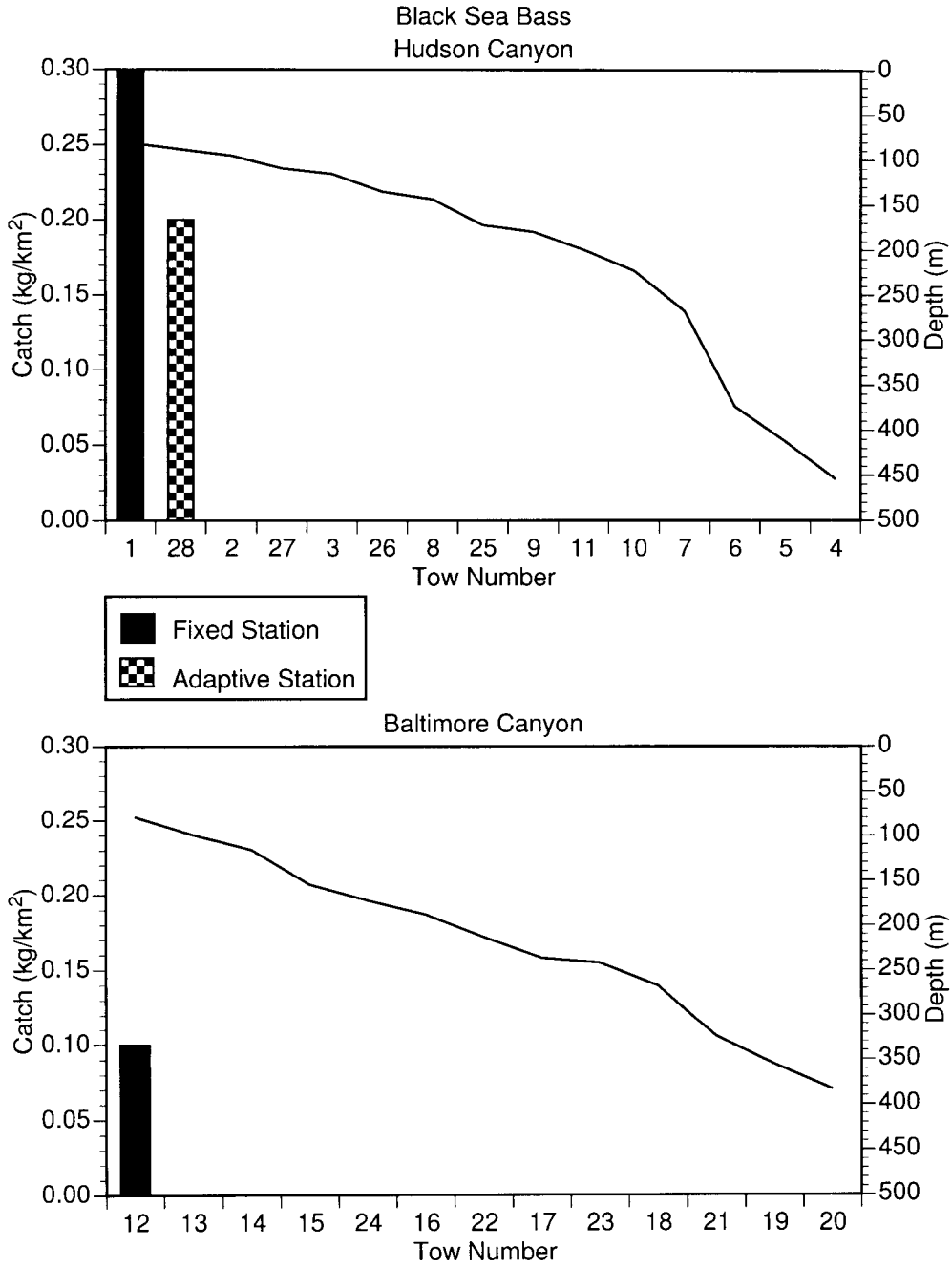


Figure 6b. Projected abundance of black sea bass along the transect with each tow representing the projected abundance for the distance along the transect. Tow numbers indicate the sampling sequence during the cruise. Tows are ordered shallowest to deepest along the x-axis.

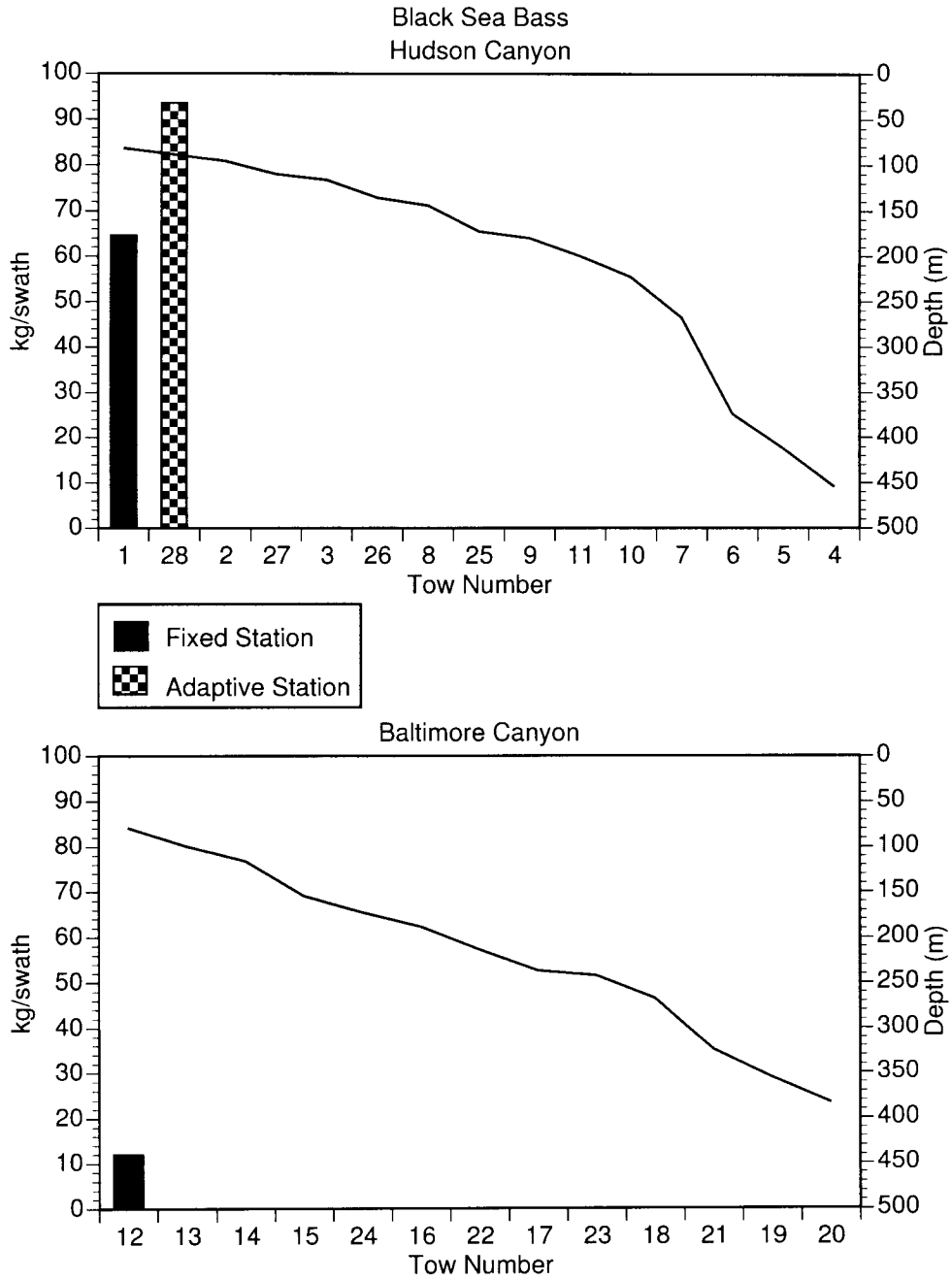


Figure 7a. Catches of bluefish in each tow along the two transects. Catch is recorded in kg caught/swept area (km^2). Depth is the average depth at which each tow was made (in meters). Tow numbers indicate the sampling sequence during the cruise. Tows are ordered shallowest to deepest along the x-axis.

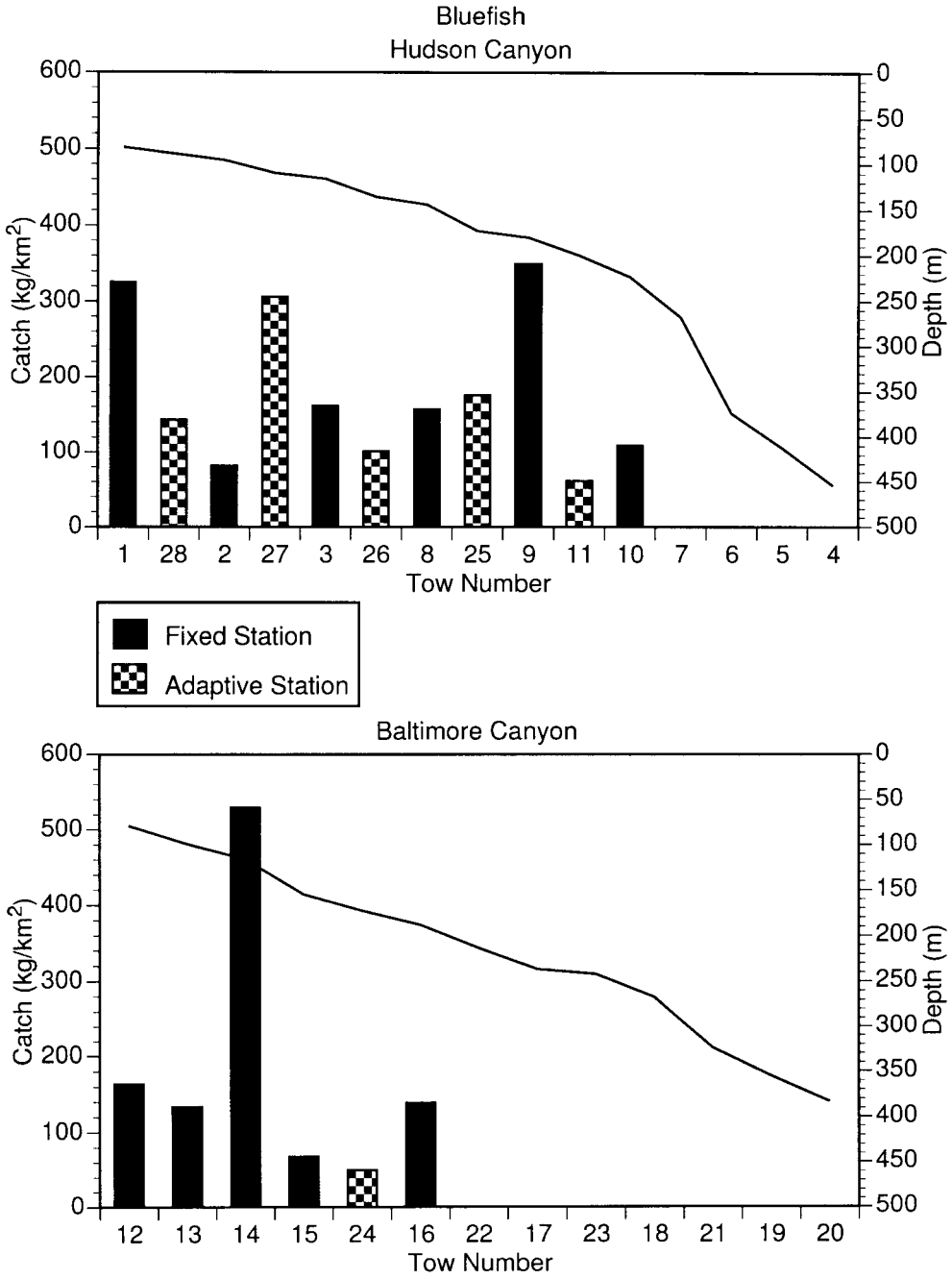


Figure 7b. Projected abundance of bluefish along the transect with each tow representing the projected abundance for the distance along the transect. Tow numbers indicate the sampling sequence during the cruise. Tows are ordered shallowest to deepest along the x-axis.

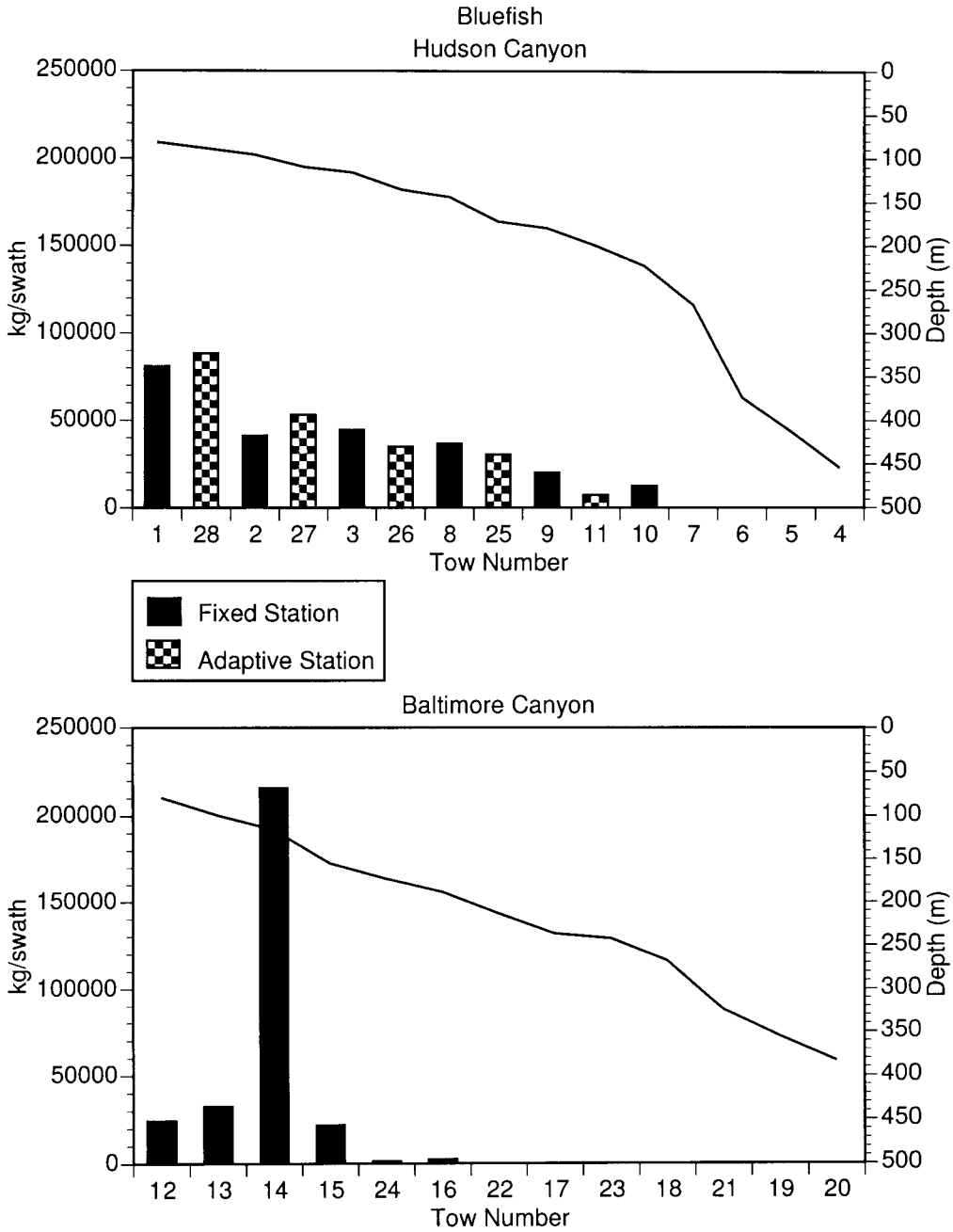


Figure 8a. Catches of butterfish in each tow along the two transects. Catch is recorded in kg caught/swept area (km²). Depth is the average depth at which each tow was made (in meters). Tow numbers indicate the sampling sequence during the cruise. Tows are ordered shallowest to deepest along the x-axis.

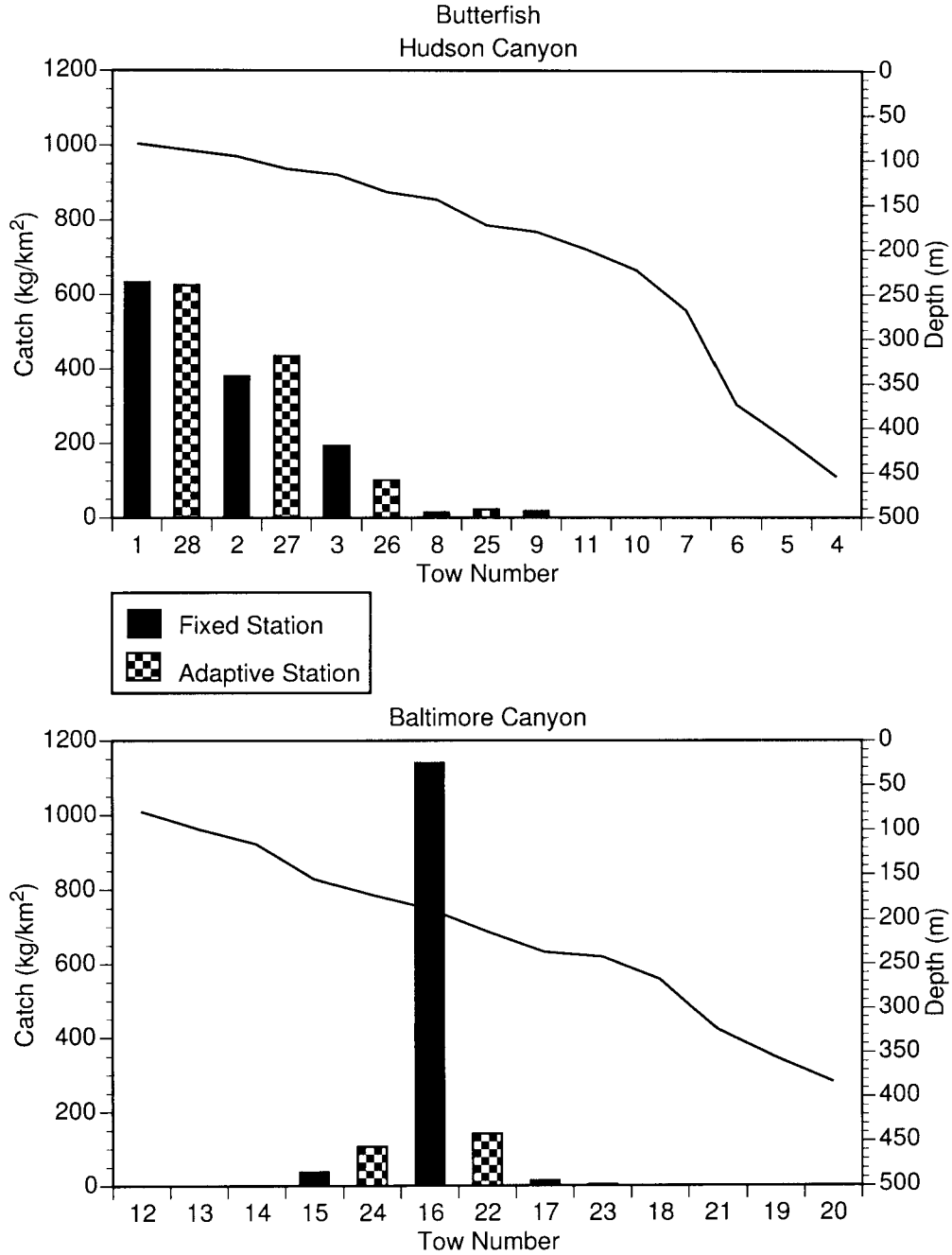


Figure 8b. Projected abundance of butterfish along the transect with each tow representing the projected abundance for the distance along the transect. Tow numbers indicate the sampling sequence during the cruise. Tows are ordered shallowest to deepest along the x-axis.

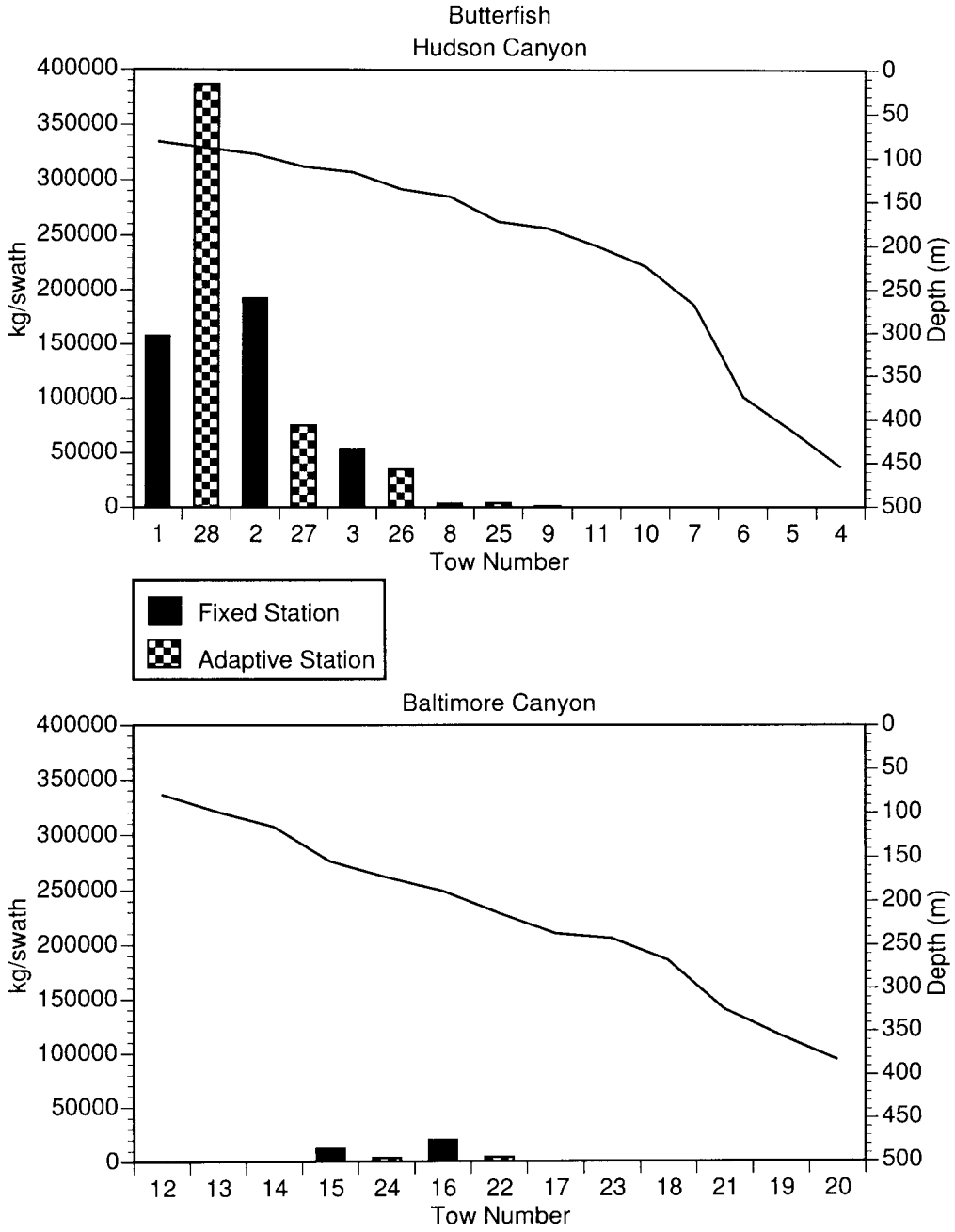


Figure 9a. Catches of deepsea red crab in each tow along the two transects. Catch is recorded in kg caught/swept area (km^2). Depth is the average depth at which each tow was made (in meters). Tow numbers indicate the sampling sequence during the cruise. Tows are ordered shallowest to deepest along the x-axis.

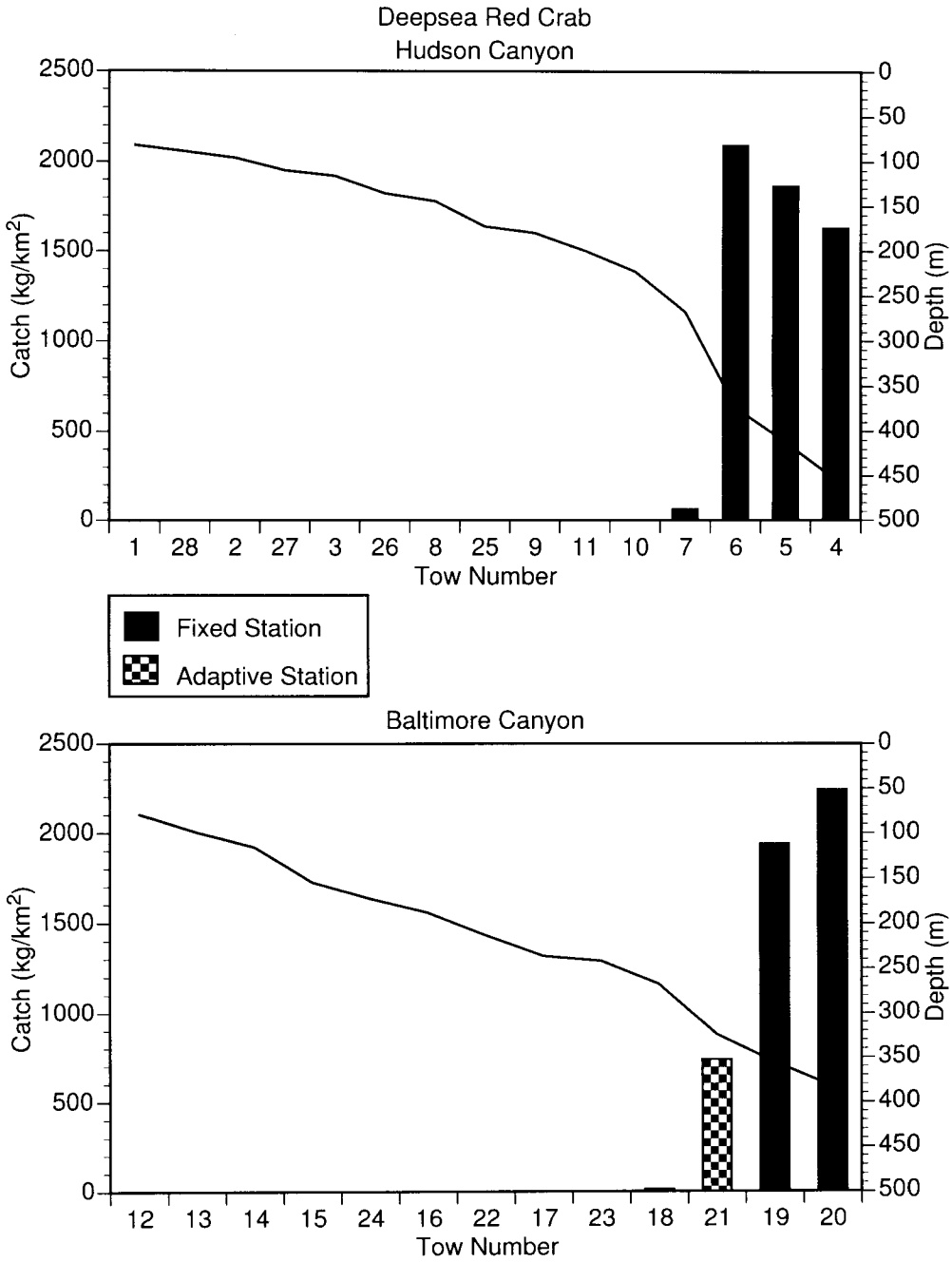


Figure 9b. Projected abundance of deepsea red crab along the transect with each tow representing the projected abundance for the distance along the transect. Tow numbers indicate the sampling sequence during the cruise. Tows are ordered shallowest to deepest along the x-axis.

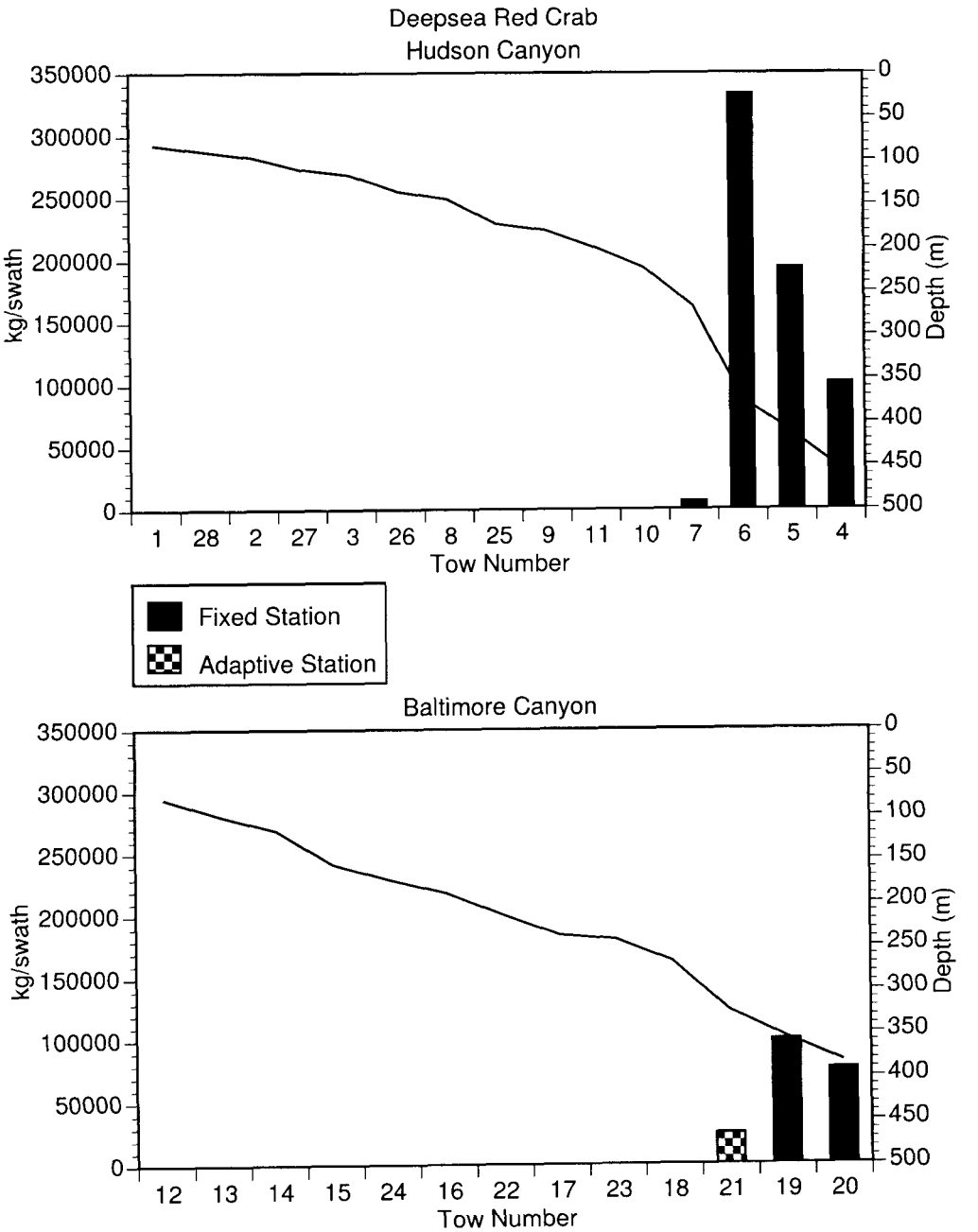


Figure 10a. Catches of fourspot flounder in each tow along the two transects. Catch is recorded in kg caught/swept area (km^2). Depth is the average depth at which each tow was made (in meters). Tow numbers indicate the sampling sequence during the cruise. Tows are ordered shallowest to deepest along the x-axis.

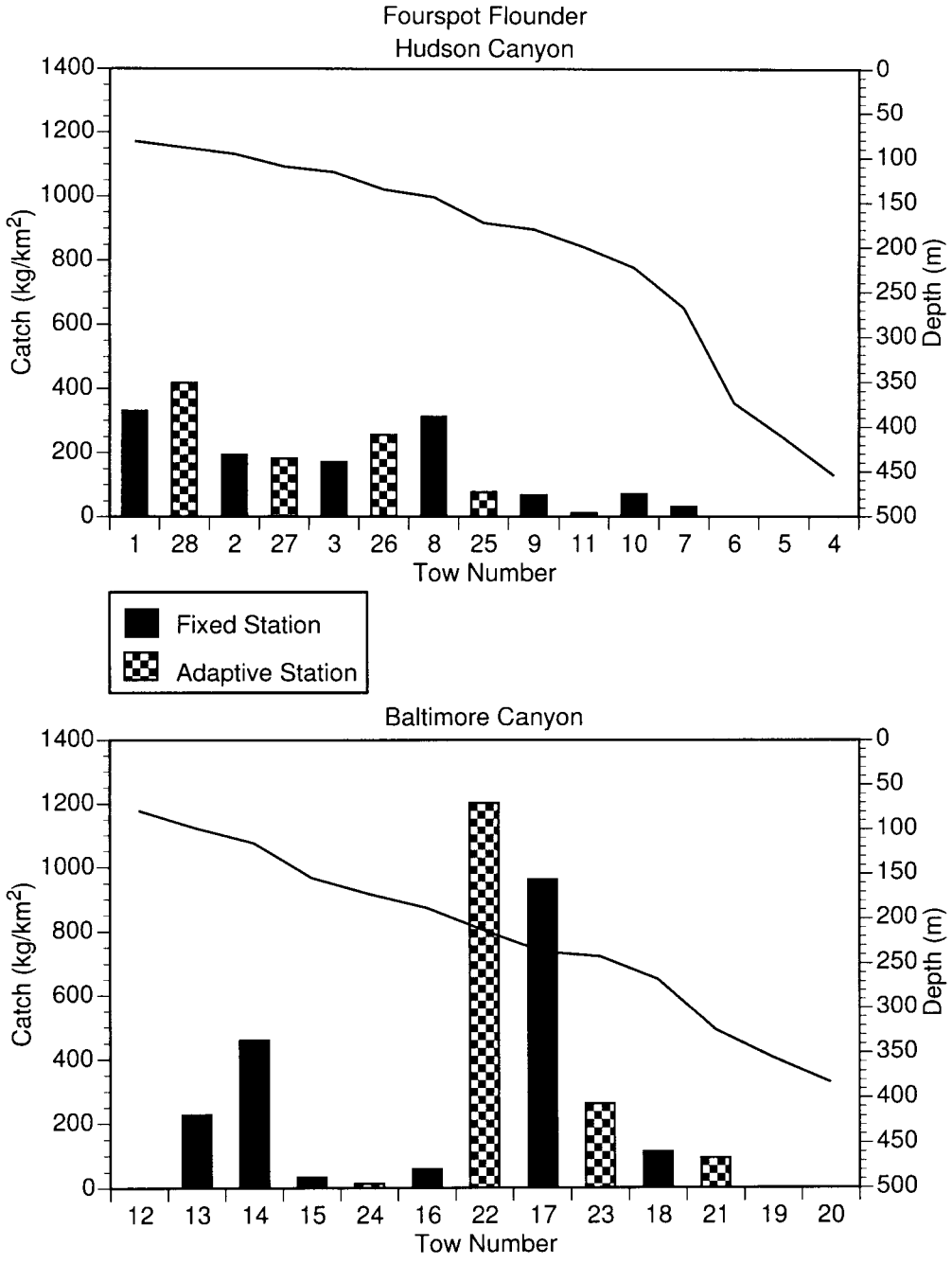


Figure 10b. Projected abundance of fourspot flounder along the transect with each tow representing the projected abundance for the distance along the transect. Tow numbers indicate the sampling sequence during the cruise. Tows are ordered shallowest to deepest along the x-axis.

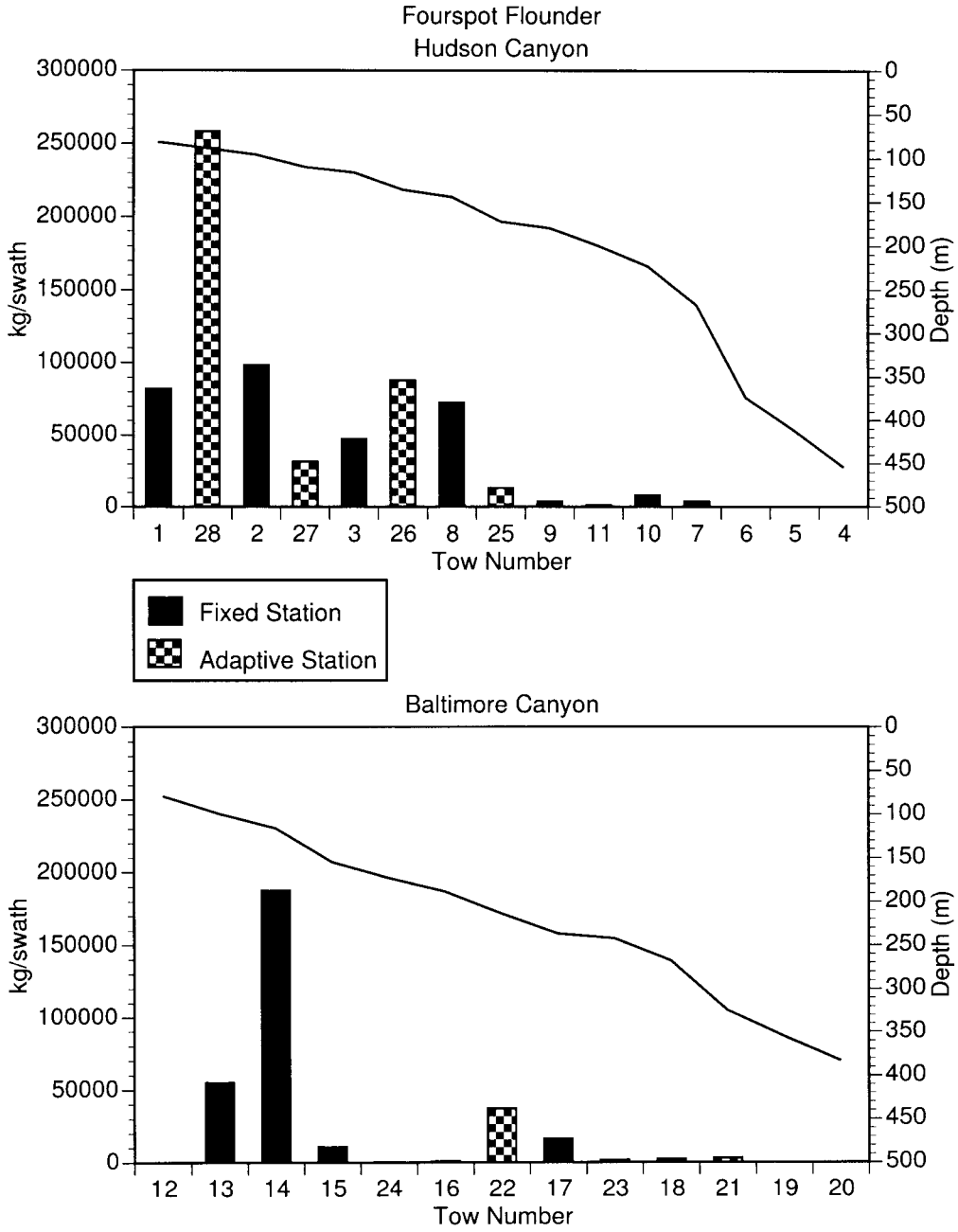


Figure 11a. Catches of *Illex* squid in each tow along the two transects. Catch is recorded in kg caught/swept area (km^2). Depth is the average depth at which each tow was made (in meters). Tow numbers indicate the sampling sequence during the cruise. Tows are ordered shallowest to deepest along the x-axis.

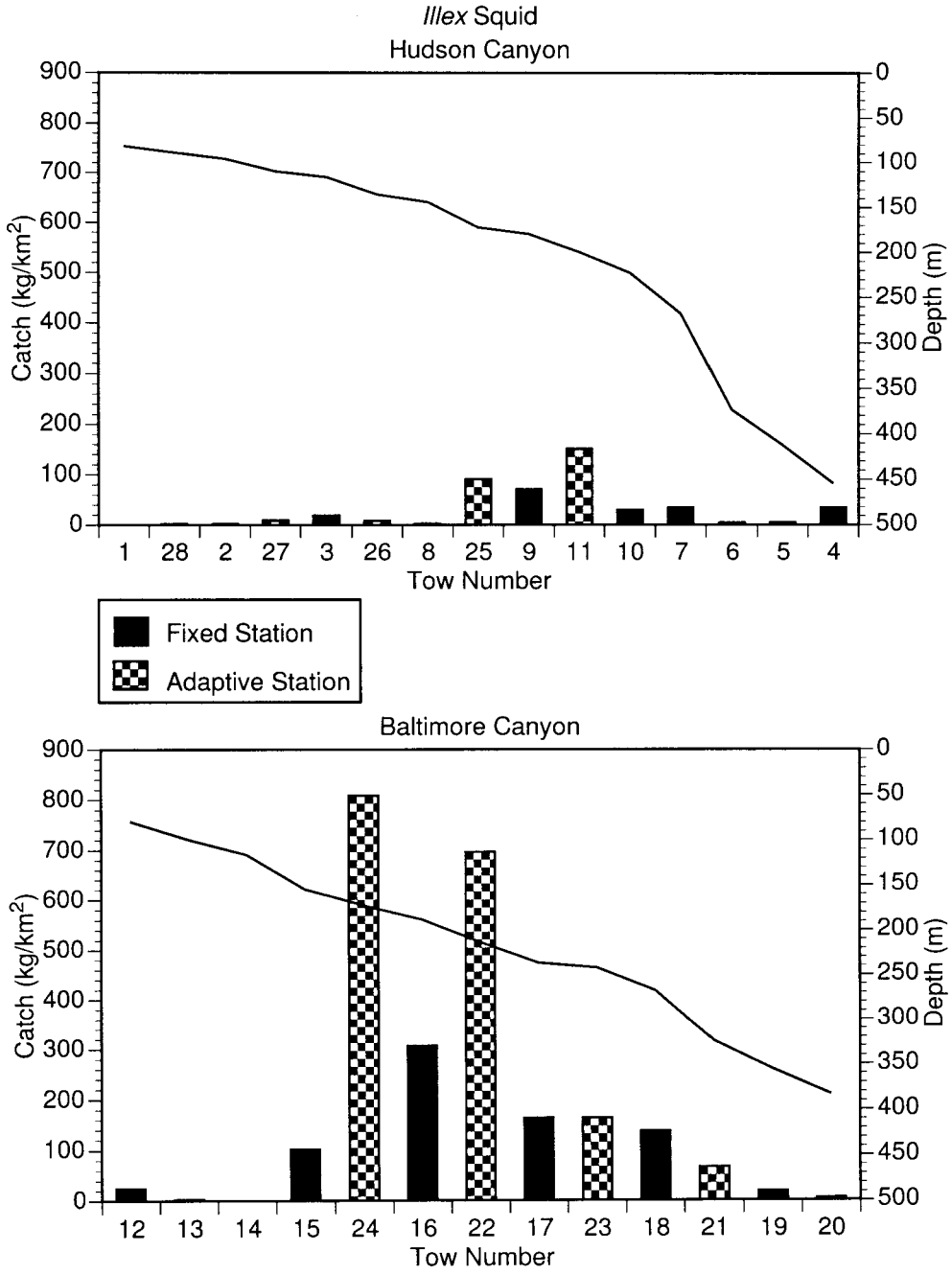


Figure 11b. Projected abundance of *Illex* squid along the transect with each tow representing the projected abundance for the distance along the transect. Tow numbers indicate the sampling sequence during the cruise. Tows are ordered shallowest to deepest along the x-axis.

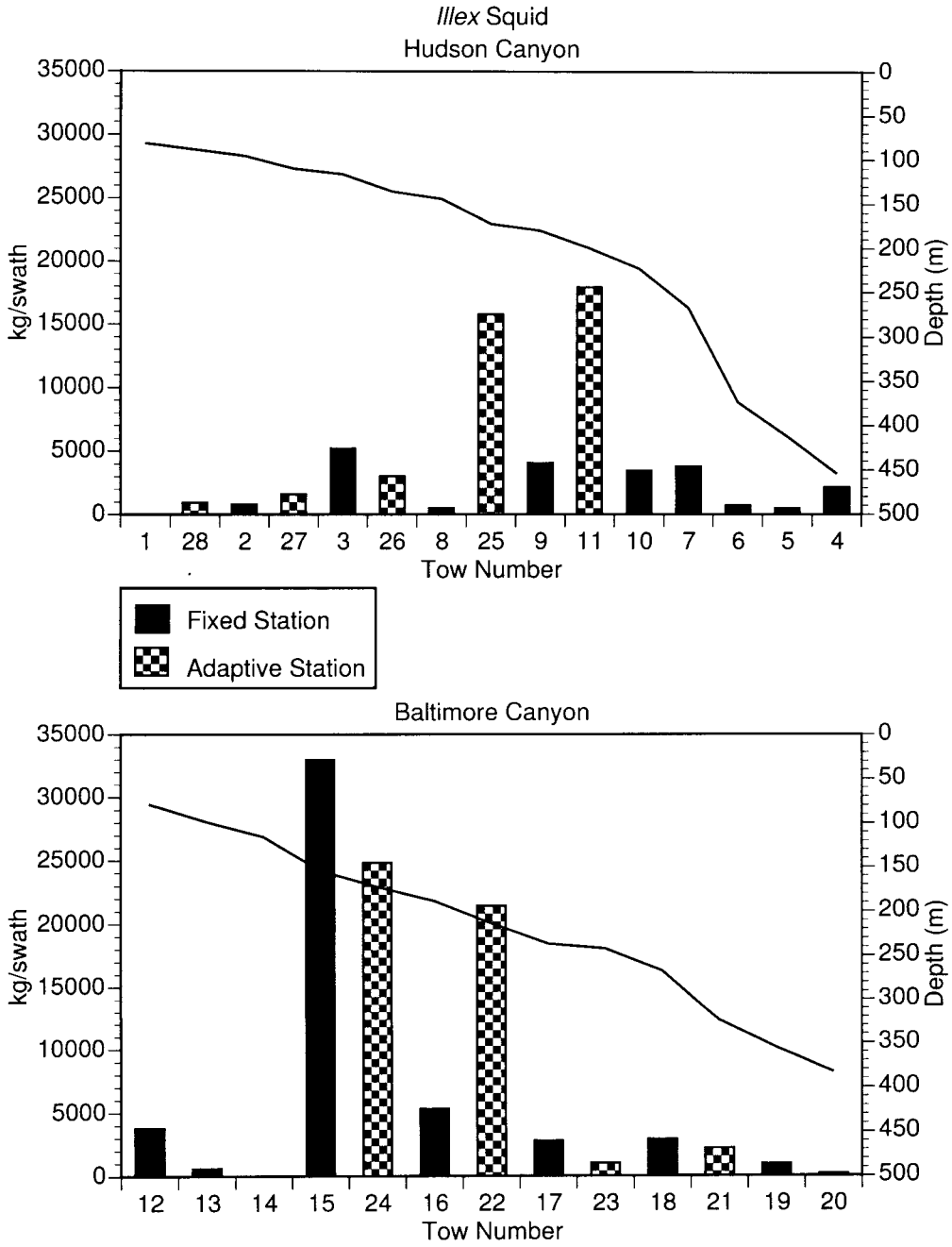


Figure 12a. Catches of little skate in each tow along the two transects. Catch is recorded in kg caught/swept area (km²). Depth is the average depth at which each tow was made (in meters). Tow numbers indicate the sampling sequence during the cruise. Tows are ordered shallowest to deepest along the x-axis.

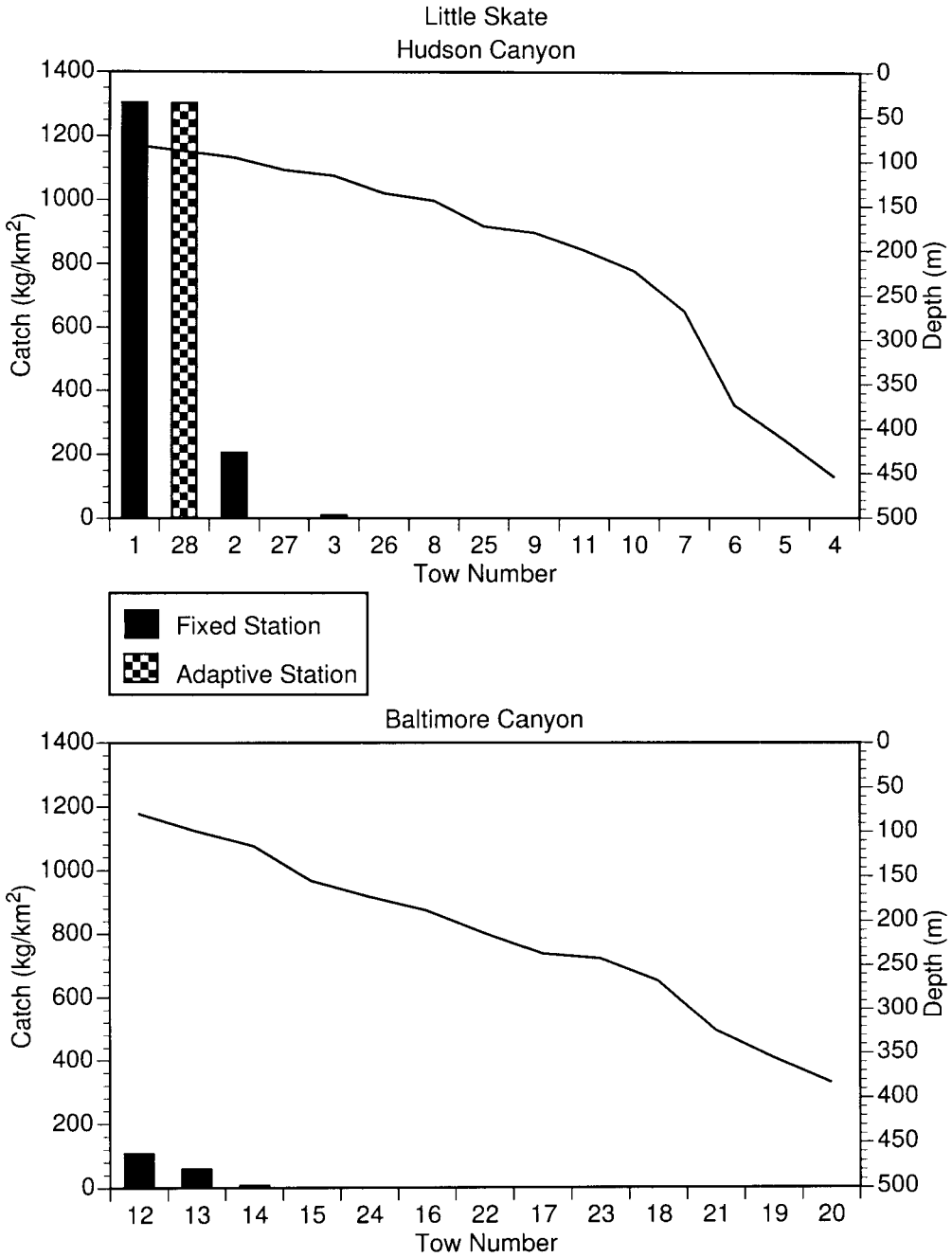


Figure 12b. Projected abundance of little skate along the transect with each tow representing the projected abundance for the distance along the transect. Tow numbers indicate the sampling sequence during the cruise. Tows are ordered shallowest to deepest along the x-axis.

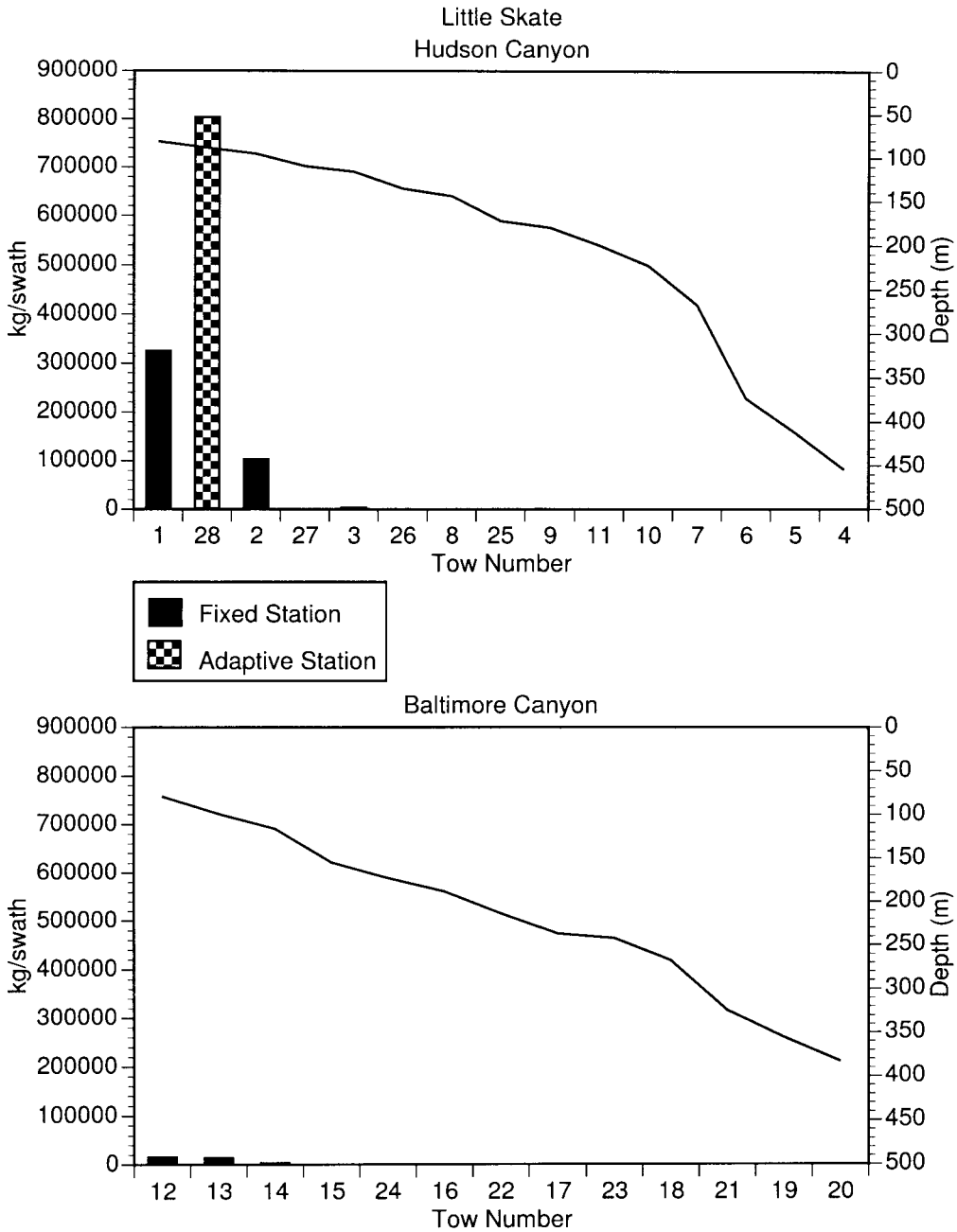


Figure 13a. Catches of *Loligo* squid in each tow along the two transects. Catch is recorded in kg caught/swept area (km²). Depth is the average depth at which each tow was made (in meters). Tow numbers indicate the sampling sequence during the cruise. Tows are ordered shallowest to deepest along the x-axis.

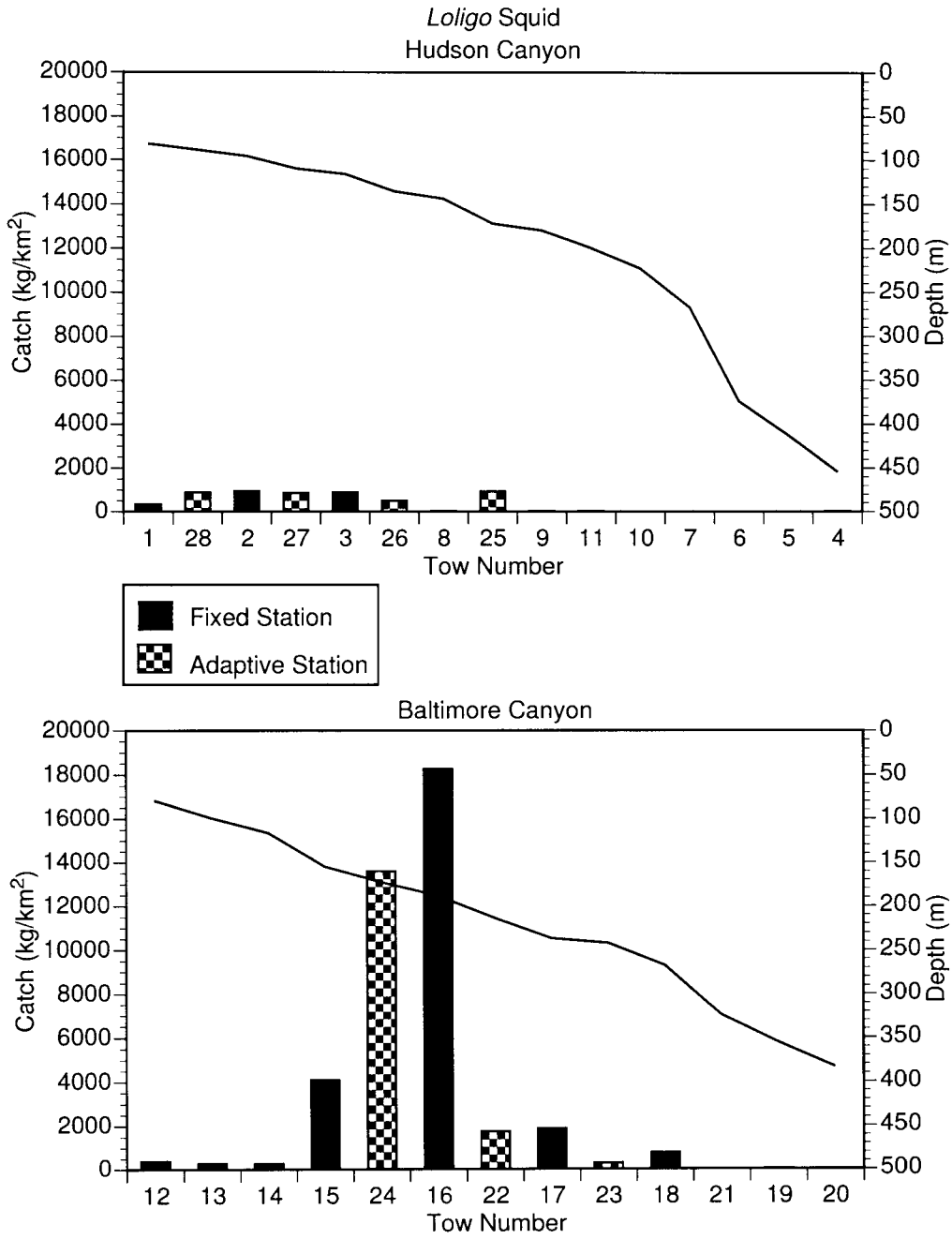


Figure 13b. Projected abundance of *Loligo* squid along the transect with each tow representing the projected abundance for the distance along the transect. Tow numbers indicate the sampling sequence during the cruise. Tows are ordered shallowest to deepest along the x-axis.

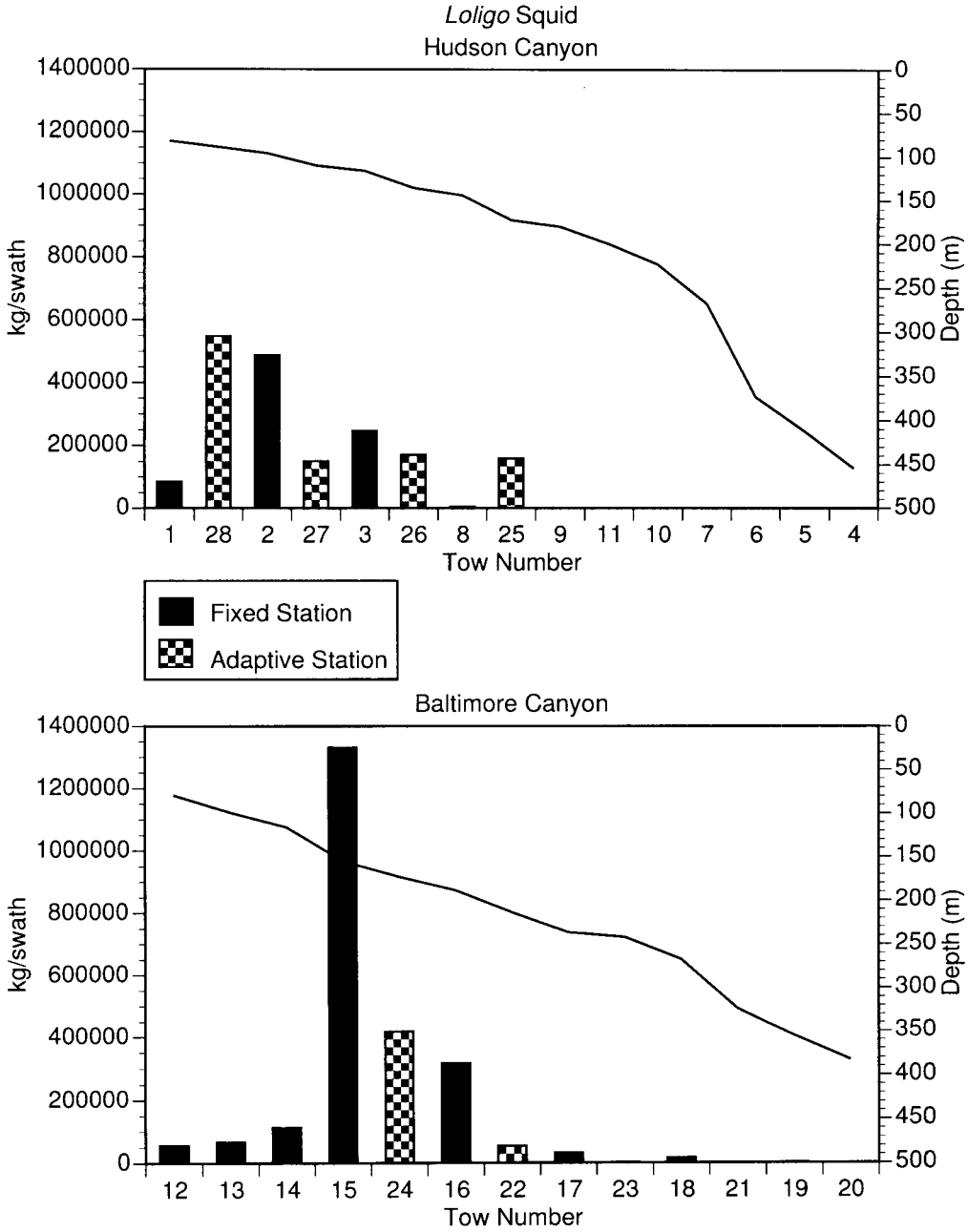


Figure 14a. Catches of monkfish in each tow along the two transects. Catch is recorded in kg caught/swept area (km²). Depth is the average depth at which each tow was made (in meters). Tow numbers indicate the sampling sequence during the cruise. Tows are ordered shallowest to deepest along the x-axis.

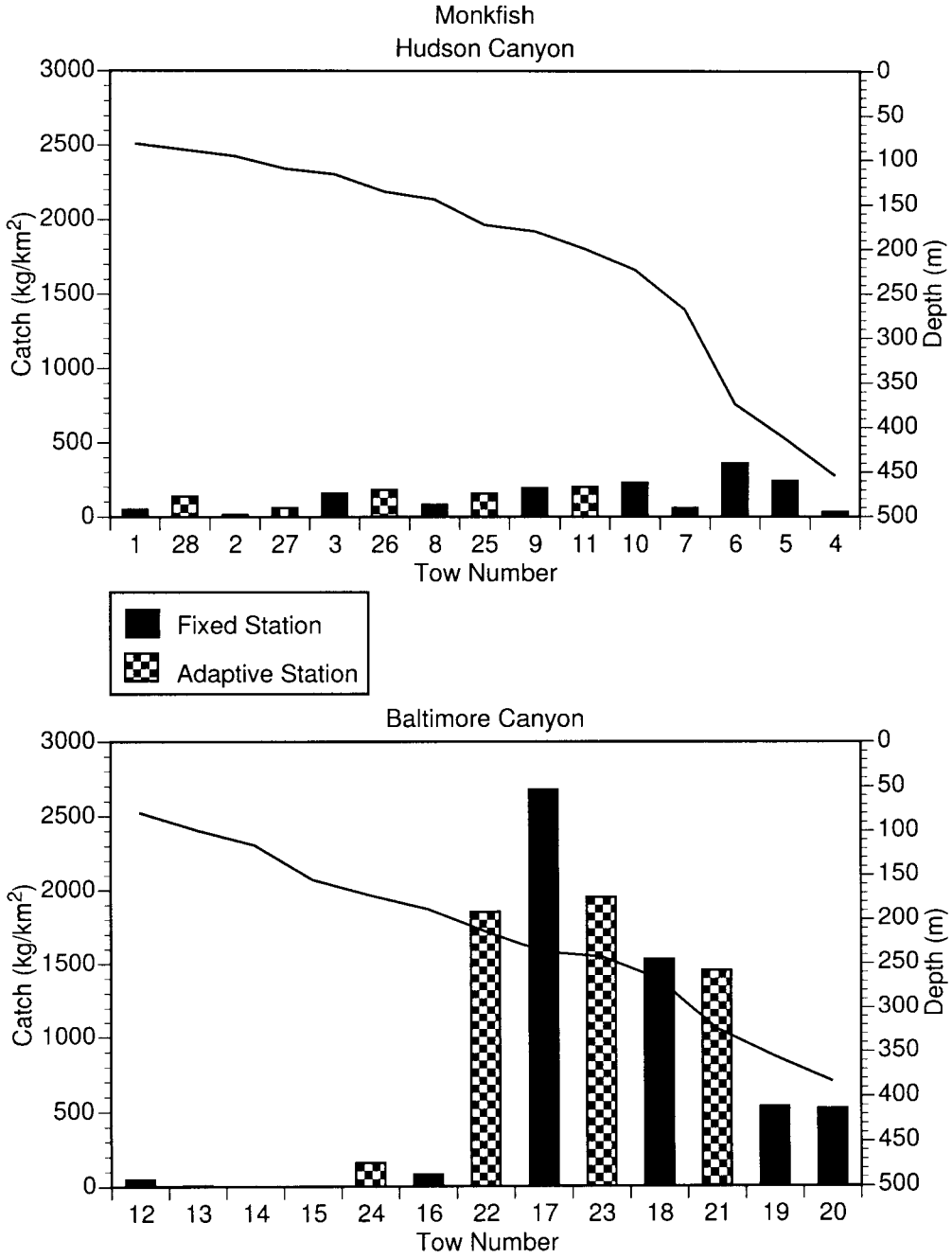


Figure 14b. Projected abundance of monkfish along the transect with each tow representing the projected abundance for the distance along the transect. Tow numbers indicate the sampling sequence during the cruise. Tows are ordered shallowest to deepest along the x-axis.

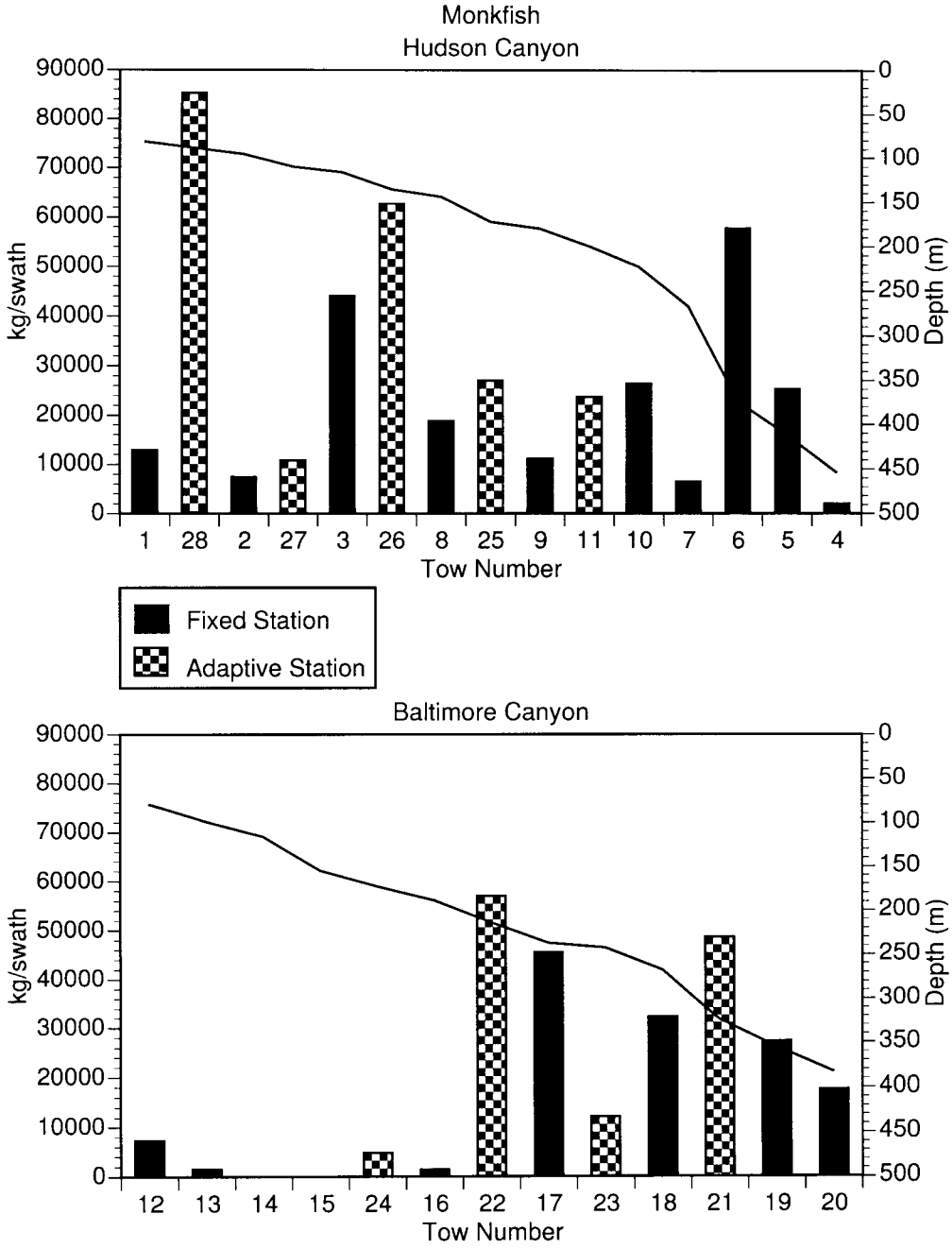


Figure 15a. Catches of offshore hake in each tow along the two transects. Catch is recorded in kg caught/swept area (km^2). Depth is the average depth at which each tow was made (in meters). Tow numbers indicate the sampling sequence during the cruise. Tows are ordered shallowest to deepest along the x-axis.

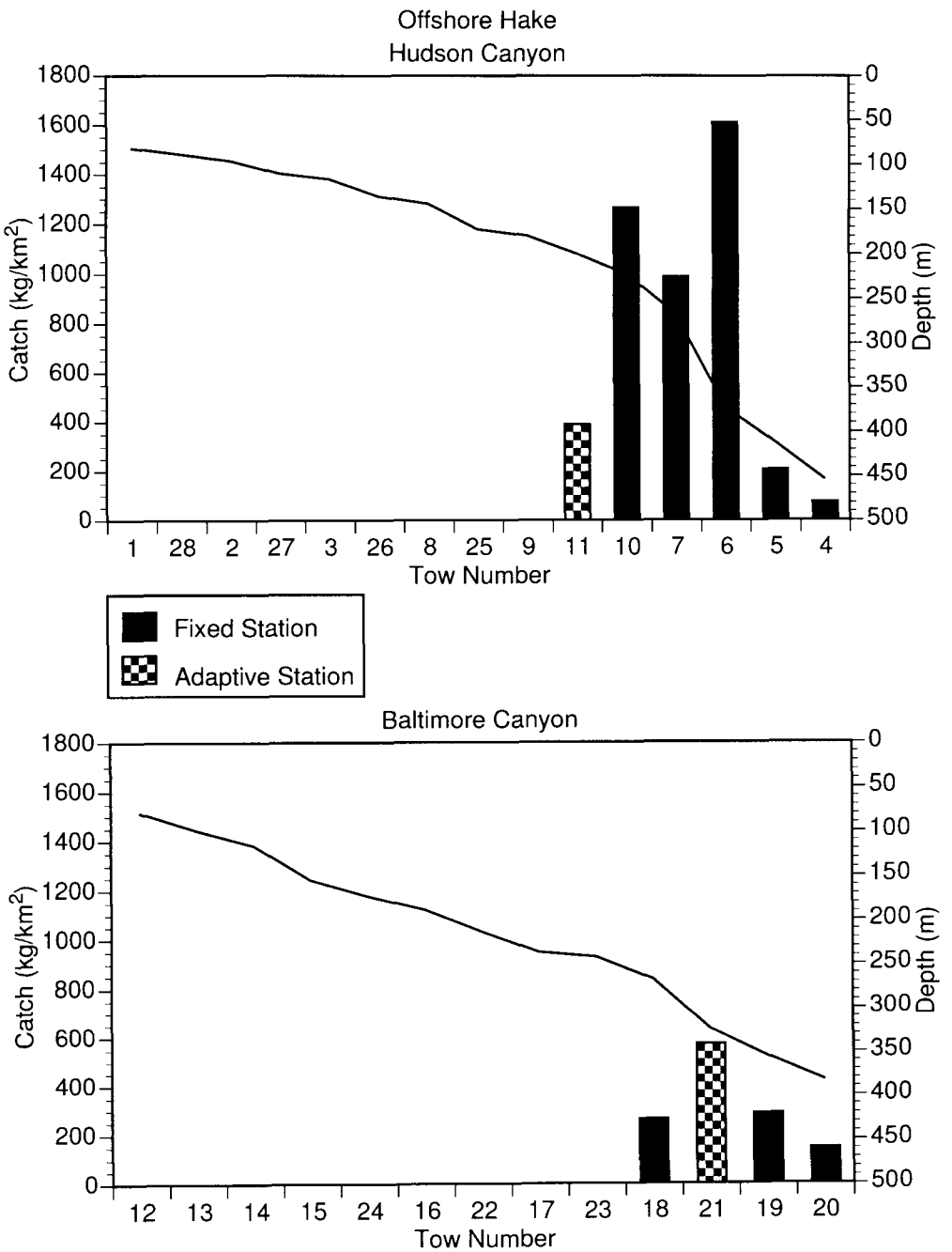


Figure 15b. Projected abundance of offshore hake along the transect with each tow representing the projected abundance for the distance along the transect. Tow numbers indicate the sampling sequence during the cruise. Tows are ordered shallowest to deepest along the x-axis.

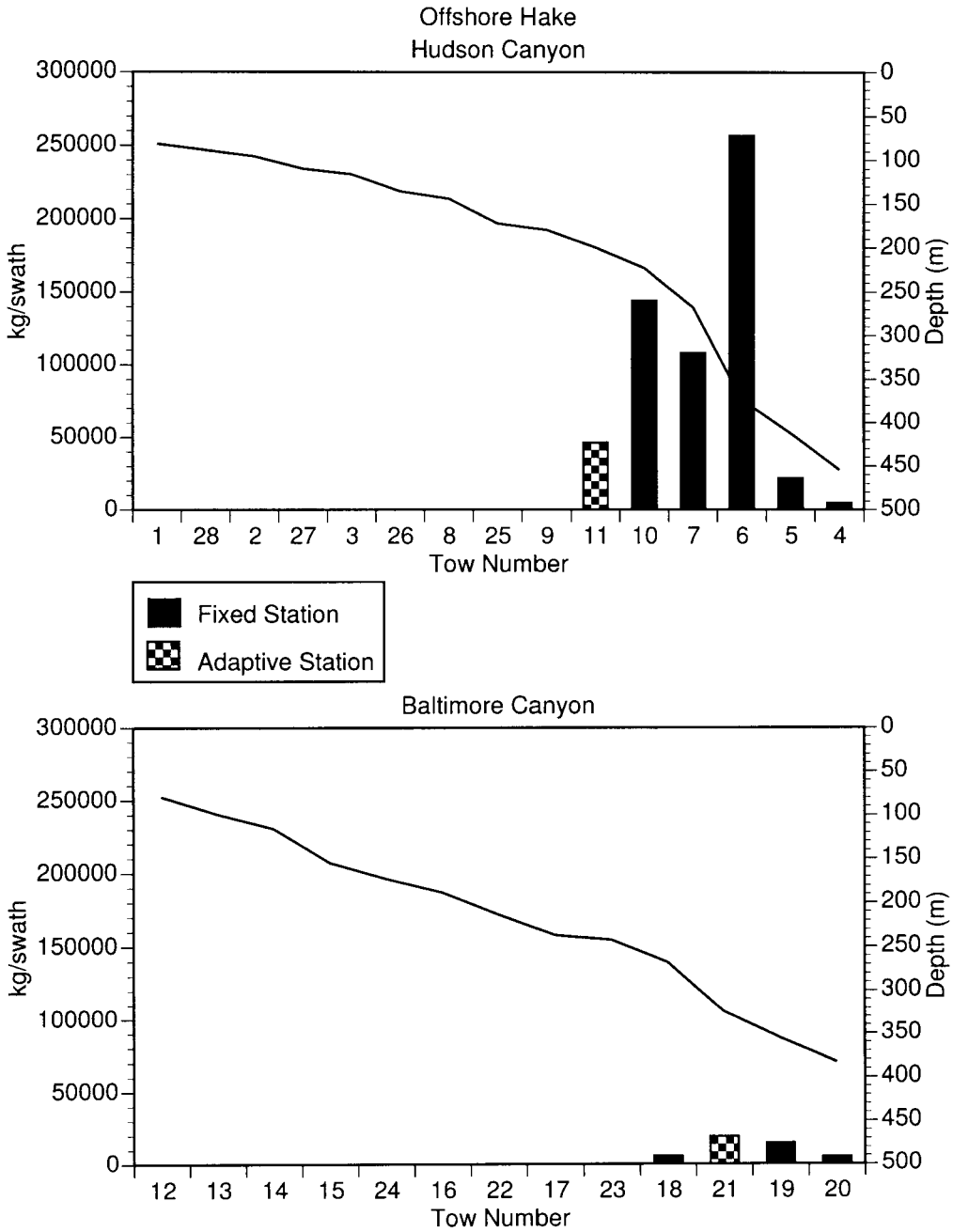


Figure 16a. Catches of red hake in each tow along the two transects. Catch is recorded in kg caught/swept area (km²). Depth is the average depth at which each tow was made (in meters). Tow numbers indicate the sampling sequence during the cruise. Tows are ordered shallowest to deepest along the x-axis.

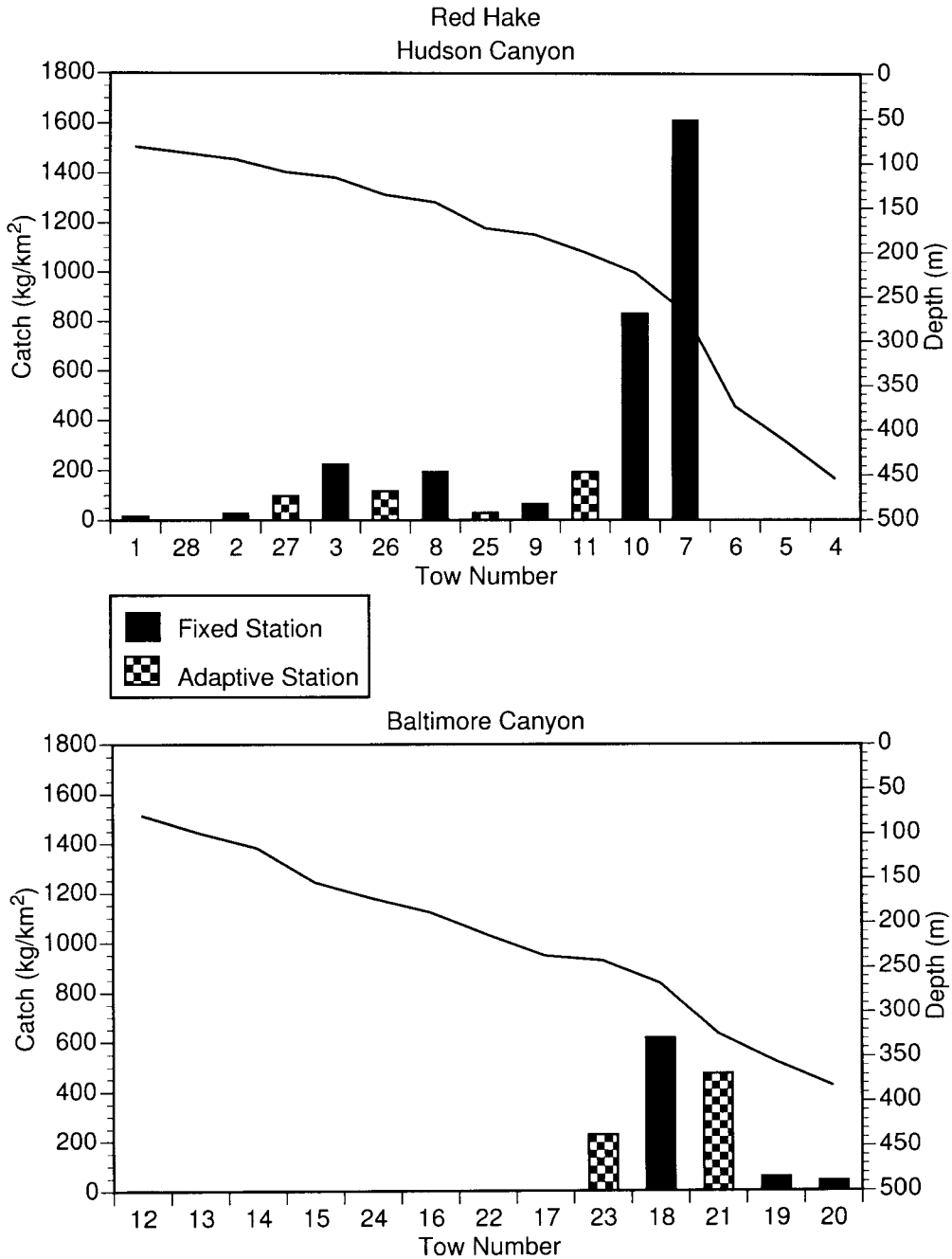


Figure 16b. Projected abundance of red hake along the transect with each tow representing the projected abundance for the distance along the transect. Tow numbers indicate the sampling sequence during the cruise. Tows are ordered shallowest to deepest along the x-axis.

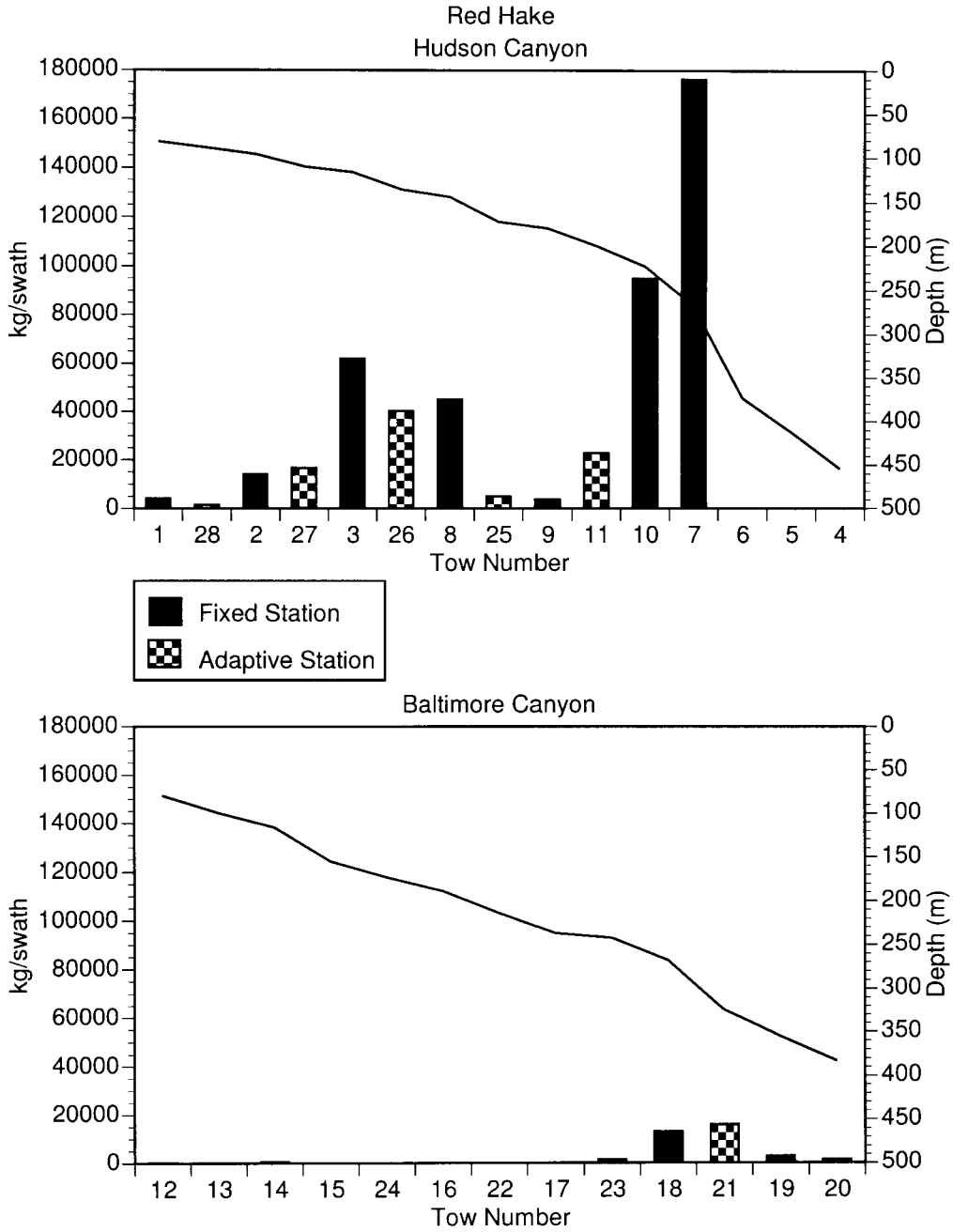


Figure 17a. Catches of rosette skate in each tow along the two transects. Catch is recorded in kg caught/swept area (km^2). Depth is the average depth at which each tow was made (in meters). Tow numbers indicate the sampling sequence during the cruise. Tows are ordered shallowest to deepest along the x-axis.

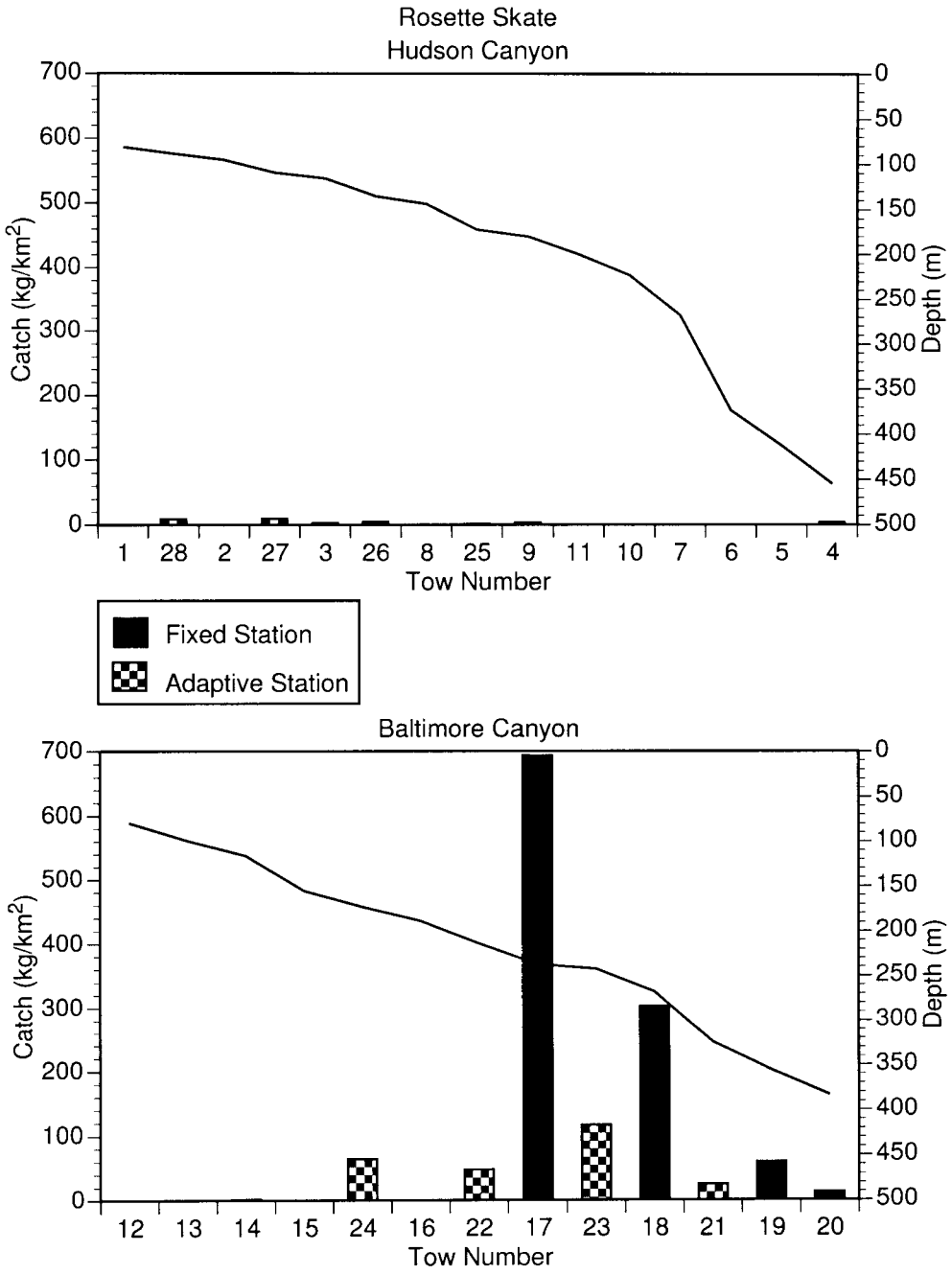


Figure 17b. Projected abundance of rosette skate along the transect with each tow representing the projected abundance for the distance along the transect. Tow numbers indicate the sampling sequence during the cruise. Tows are ordered shallowest to deepest along the x-axis.

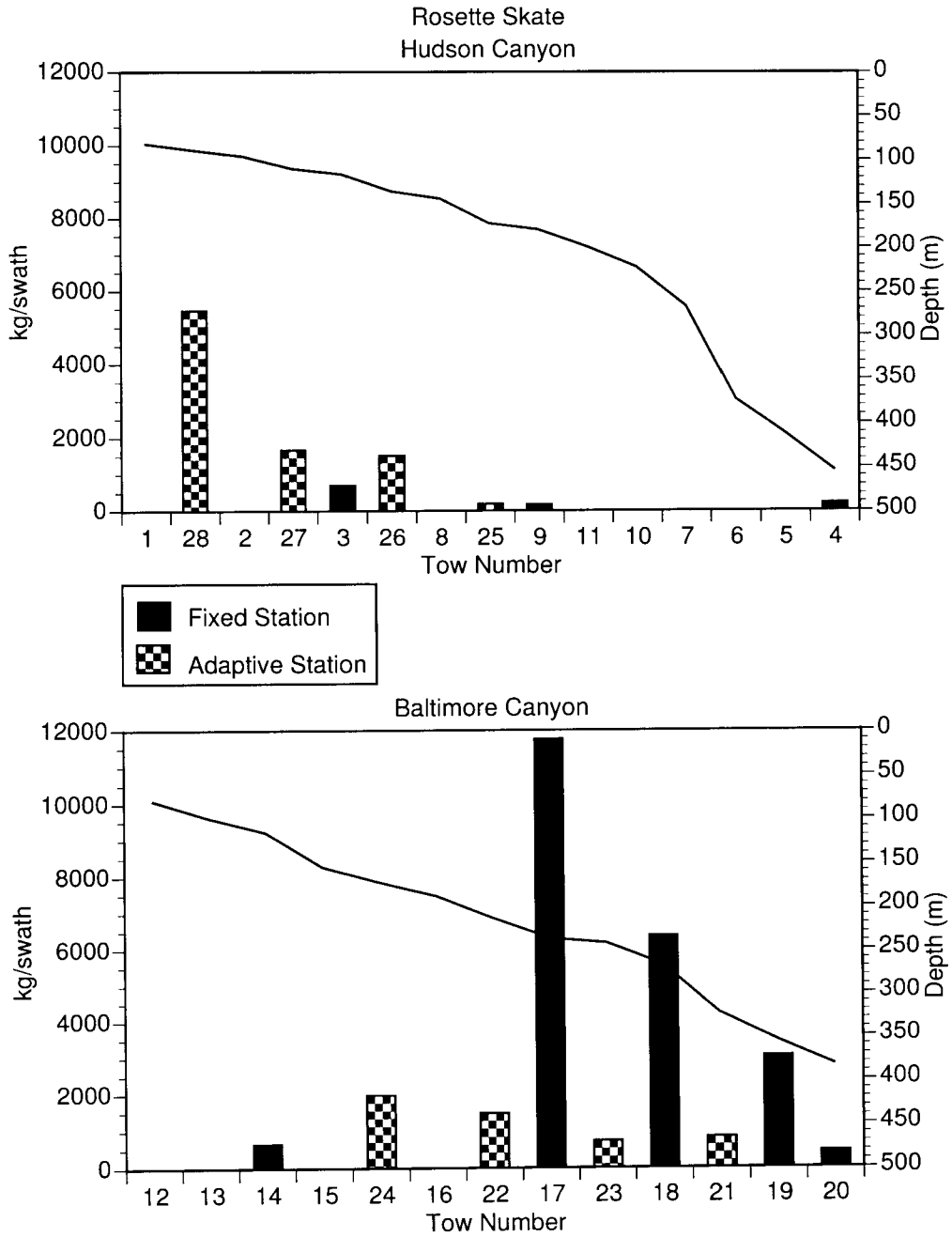


Figure 18a. Catches of scup in each tow along the two transects. Catch is recorded in kg caught/swept area (km^2). Depth is the average depth at which each tow was made (in meters). Tow numbers indicate the sampling sequence during the cruise. Tows are ordered shallowest to deepest along the x-axis.

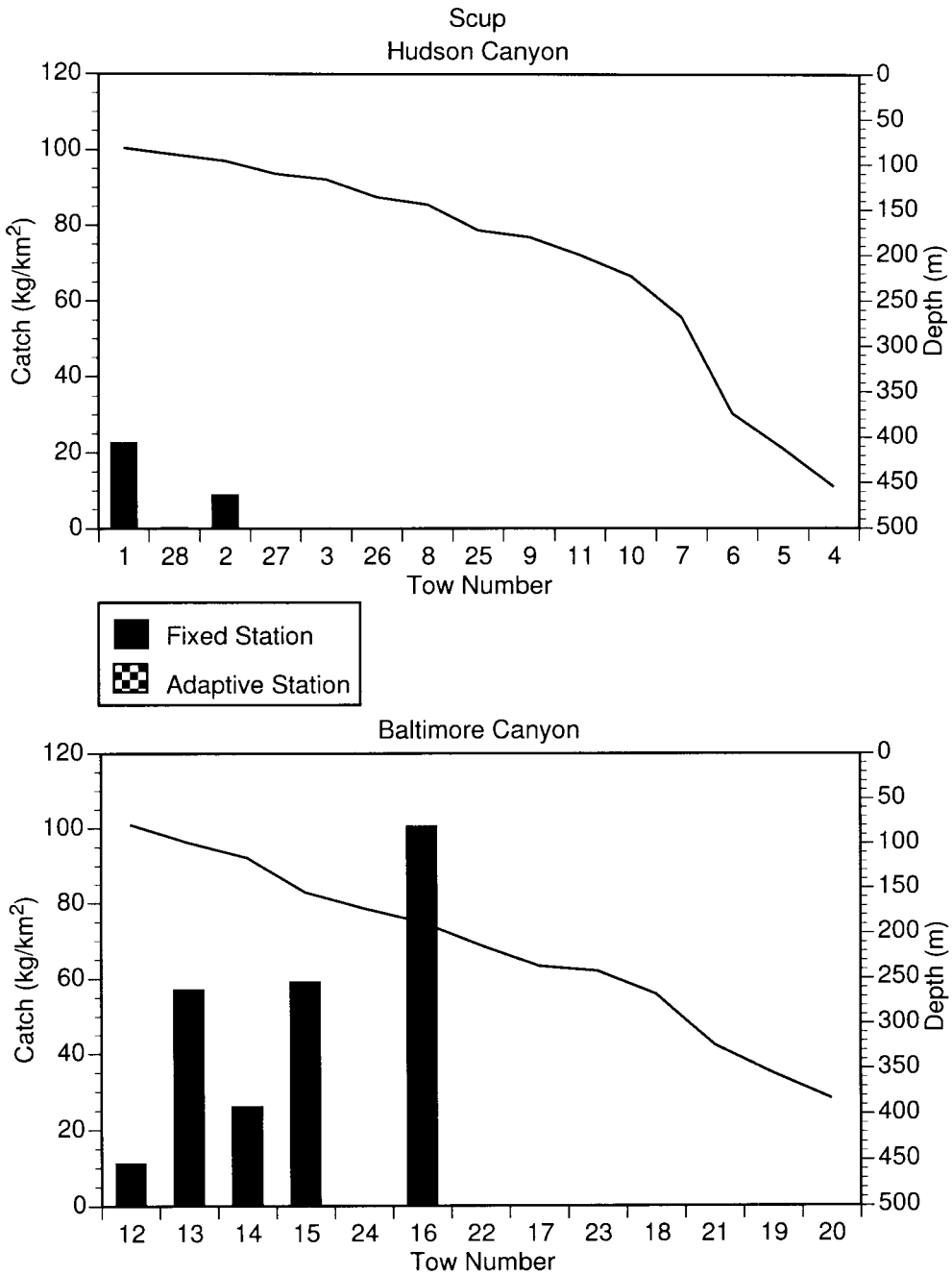


Figure 18b. Projected abundance of scup along the transect with each tow representing the projected abundance for the distance along the transect. Tow numbers indicate the sampling sequence during the cruise. Tows are ordered shallowest to deepest along the x-axis.

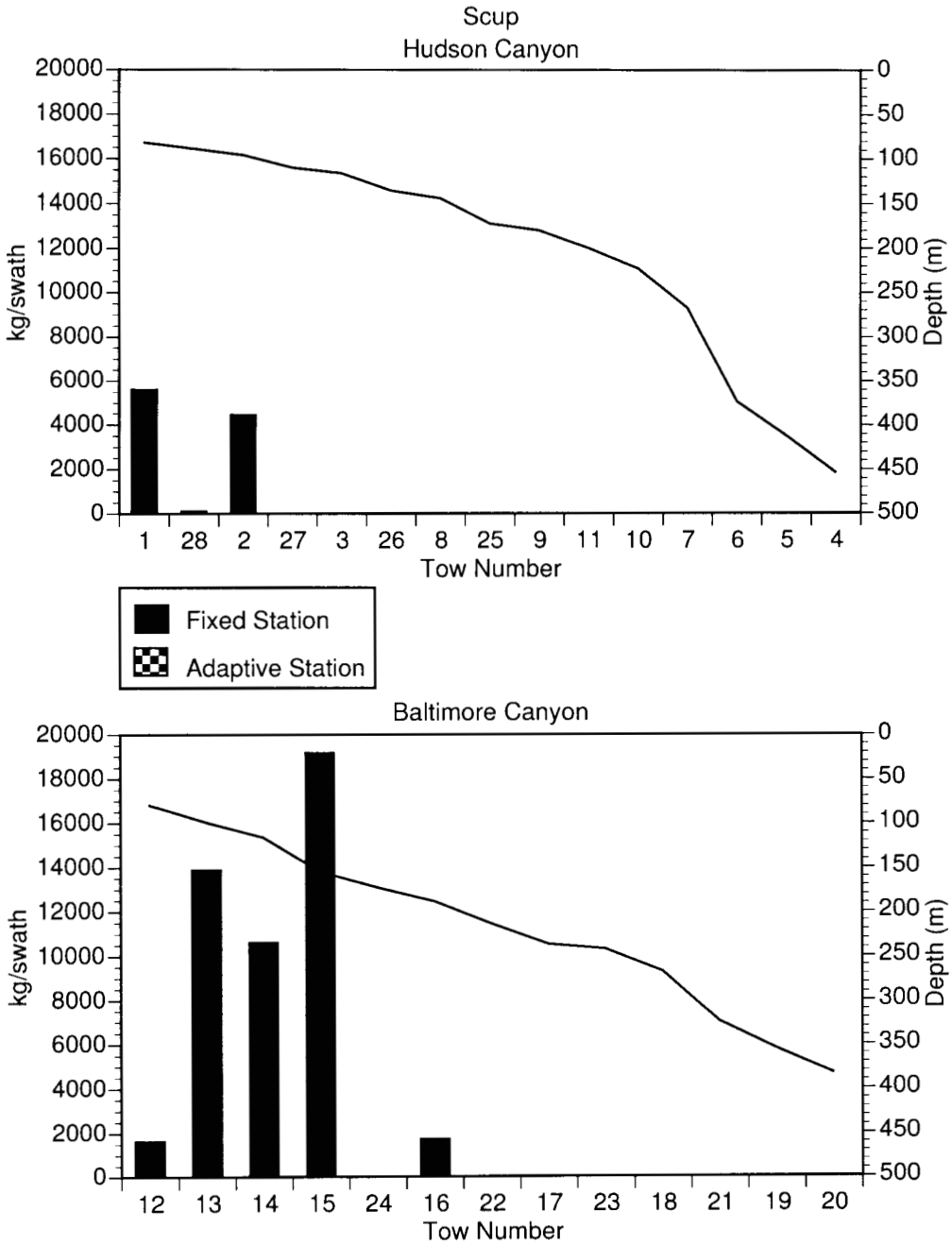


Figure 19a. Catches of silver hake in each tow along the two transects. Catch is recorded in kg caught/swept area (km^2). Depth is the average depth at which each tow was made (in meters). Tow numbers indicate the sampling sequence during the cruise. Tows are ordered shallowest to deepest along the x-axis.

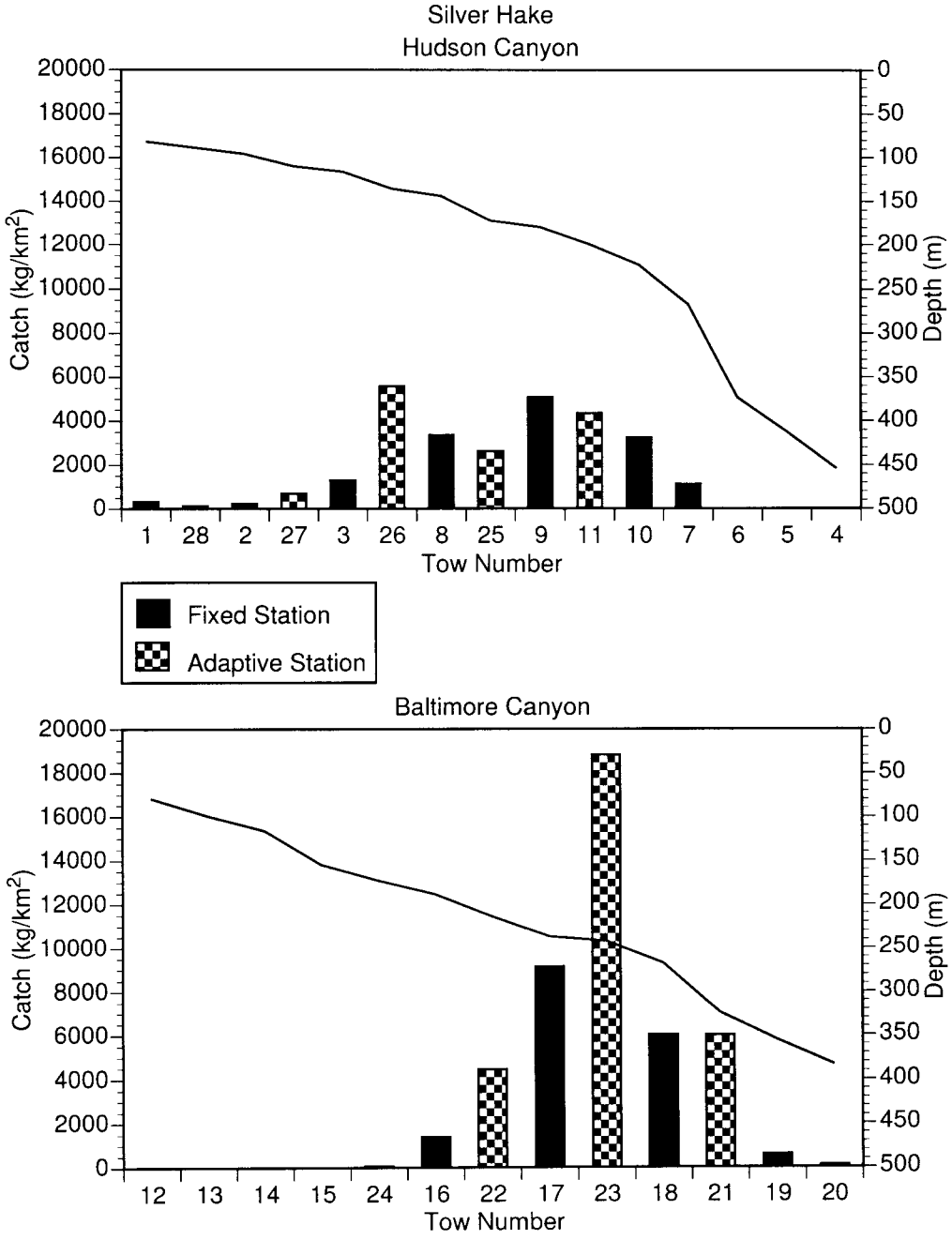


Figure 19b. Projected abundance of silver hake along the transect with each tow representing the projected abundance for the distance along the transect. Tow numbers indicate the sampling sequence during the cruise. Tows are ordered shallowest to deepest along the x-axis.

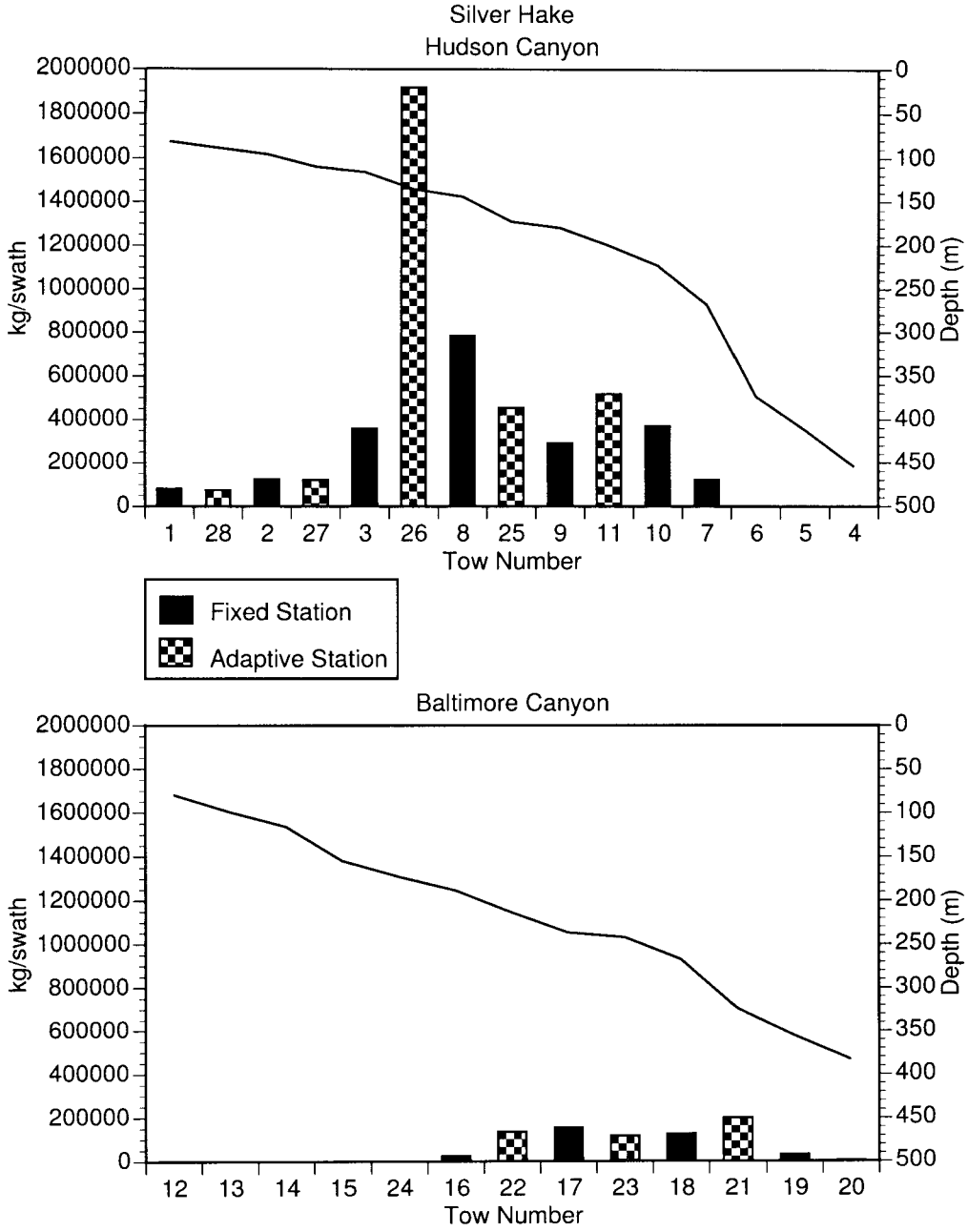


Figure 20a. Catches of smooth dogfish in each tow along the two transects. Catch is recorded in kg caught/swept area (km^2). Depth is the average depth at which each tow was made (in meters). Tow numbers indicate the sampling sequence during the cruise. Tows are ordered shallowest to deepest along the x-axis.

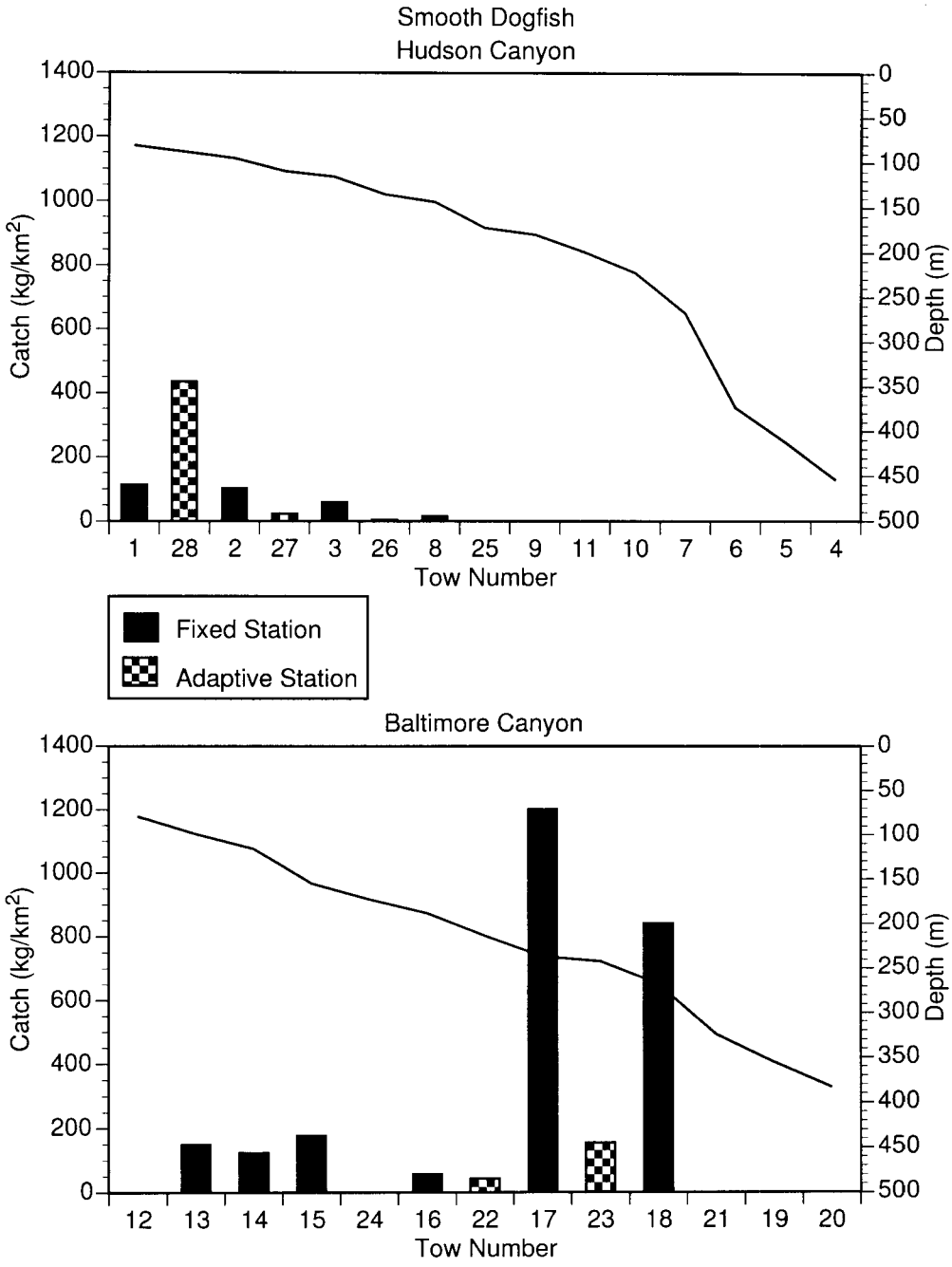


Figure 20b. Projected abundance of smooth dogfish along the transect with each tow representing the projected abundance for the distance along the transect. Tow numbers indicate the sampling sequence during the cruise. Tows are ordered shallowest to deepest along the x-axis.

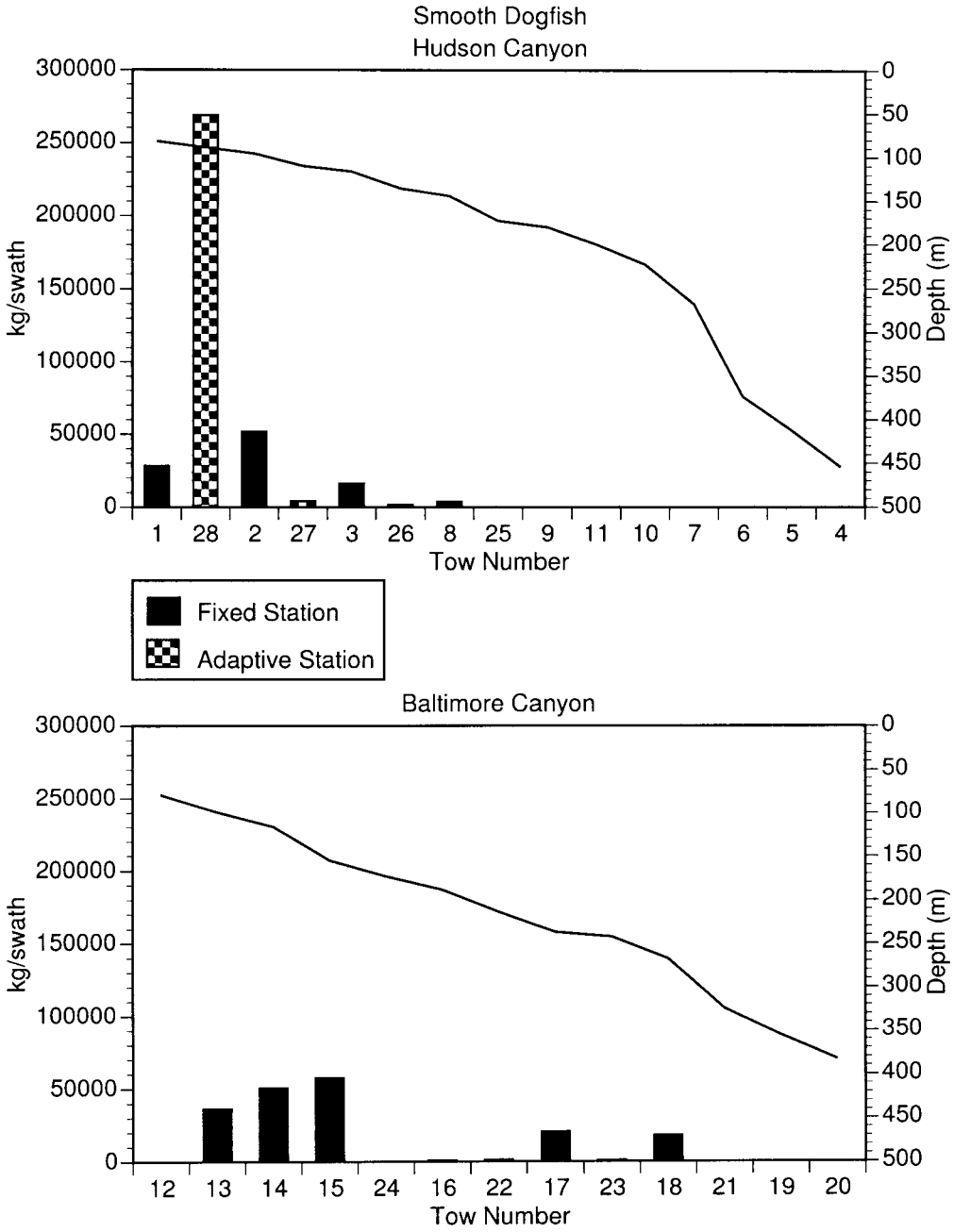


Figure 21a. Catches of female spiny dogfish in each tow along the two transects. Catch is recorded in kg caught/swept area (km²). Depth is the average depth at which each tow was made (in meters). Tow numbers indicate the sampling sequence during the cruise. Tows are ordered shallowest to deepest along the x-axis.

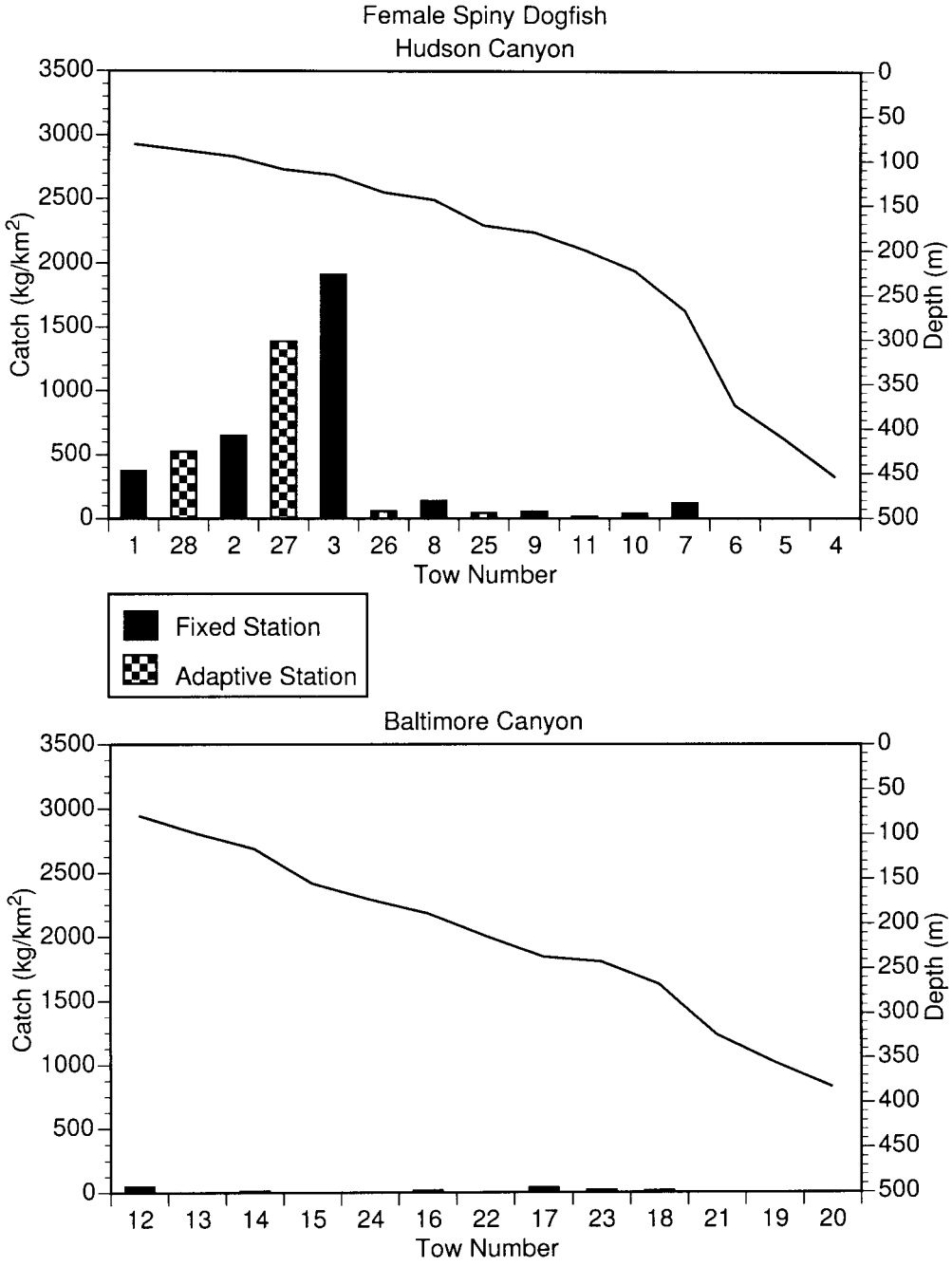


Figure 21b. Projected abundance of female spiny dogfish along the transect with each tow representing the projected abundance for the distance along the transect. Tow numbers indicate the sampling sequence during the cruise. Tows are ordered shallowest to deepest along the x-axis.

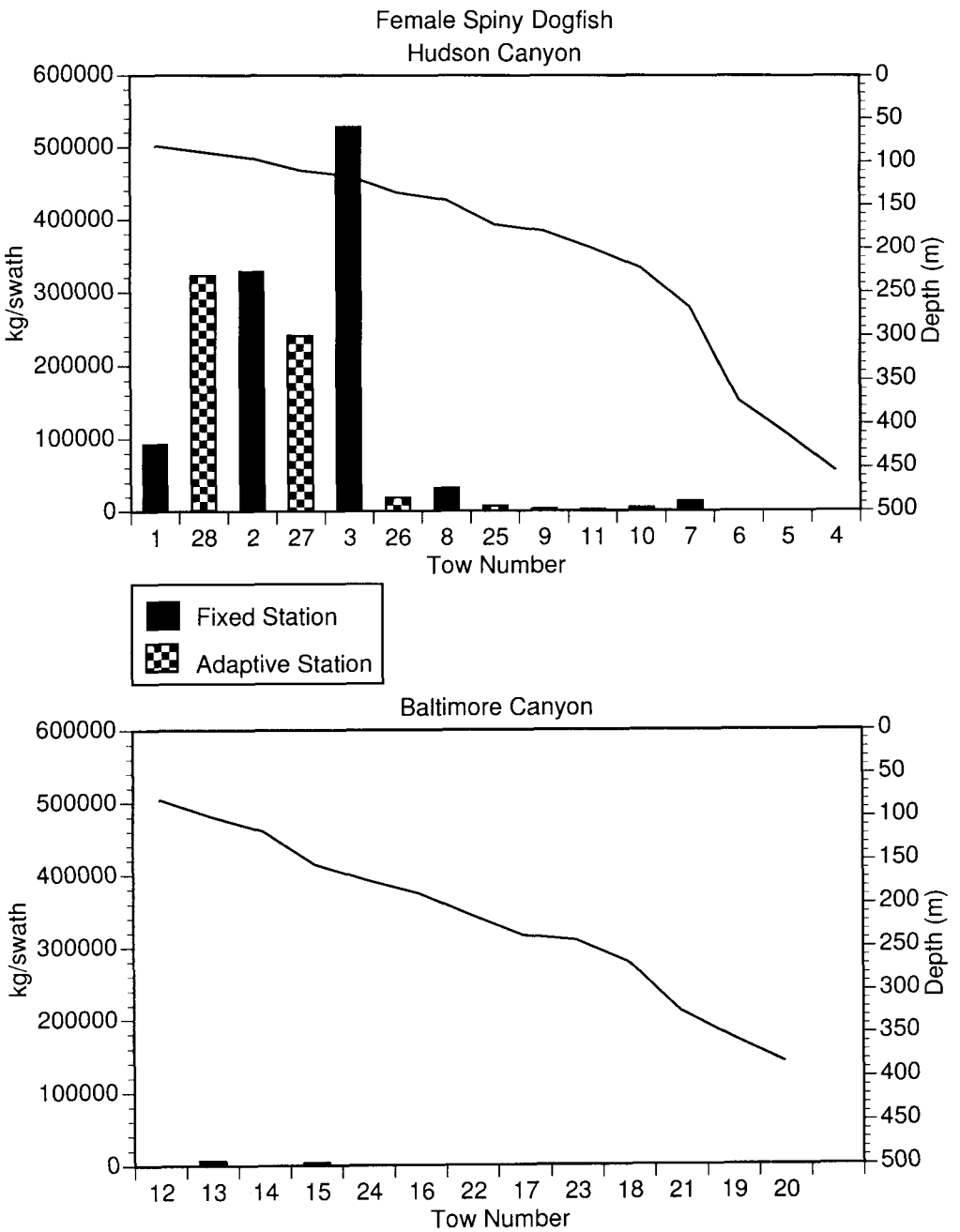


Figure 22a. Catches of male spiny dogfish in each tow along the two transects. Catch is recorded in kg caught/swept area (km^2). Depth is the average depth at which each tow was made (in meters). Tow numbers indicate the sampling sequence during the cruise. Tows are ordered shallowest to deepest along the x-axis.

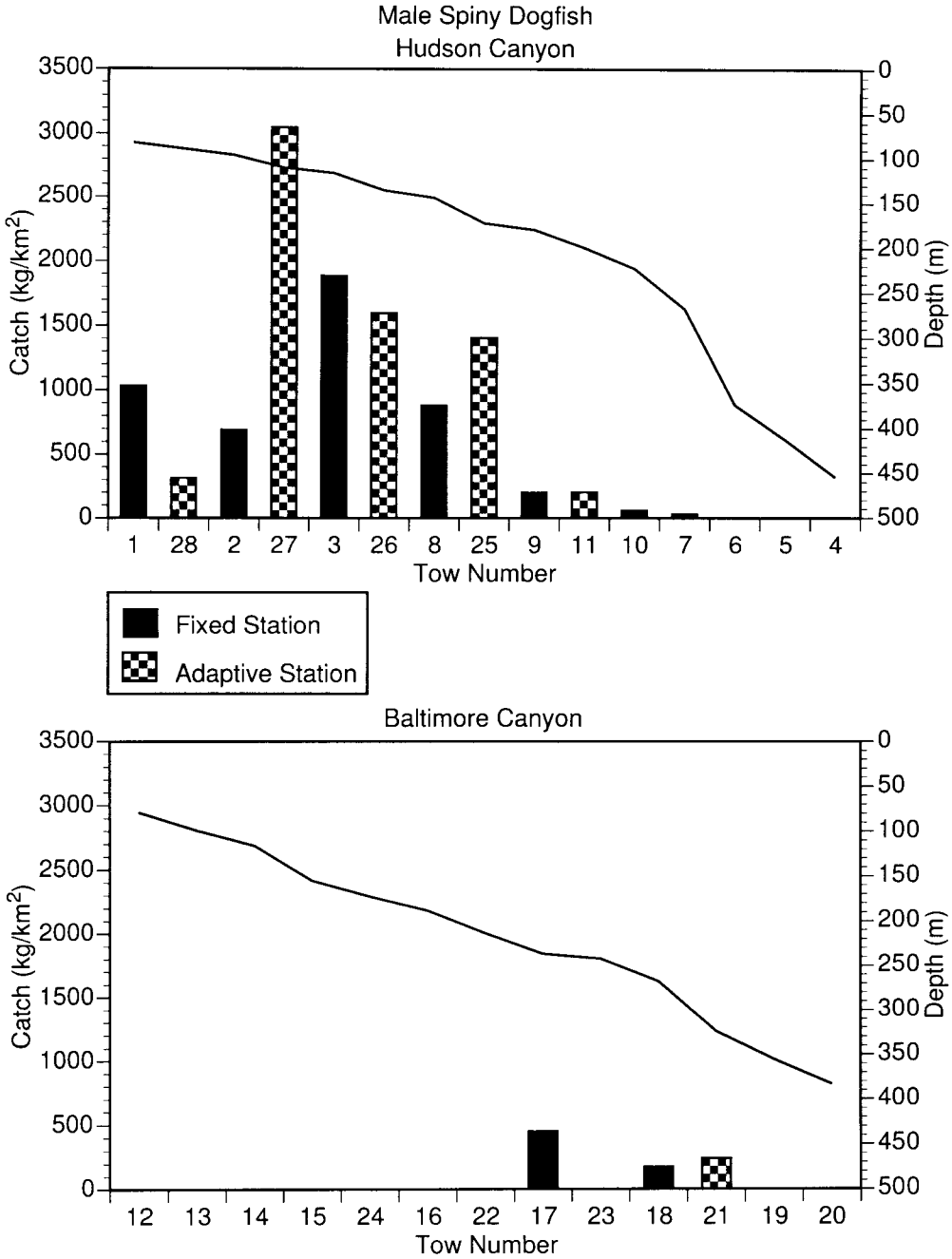


Figure 22b. Projected abundance of male spiny dogfish along the transect with each tow representing the projected abundance for the distance along the transect. Tow numbers indicate the sampling sequence during the cruise. Tows are ordered shallowest to deepest along the x-axis.

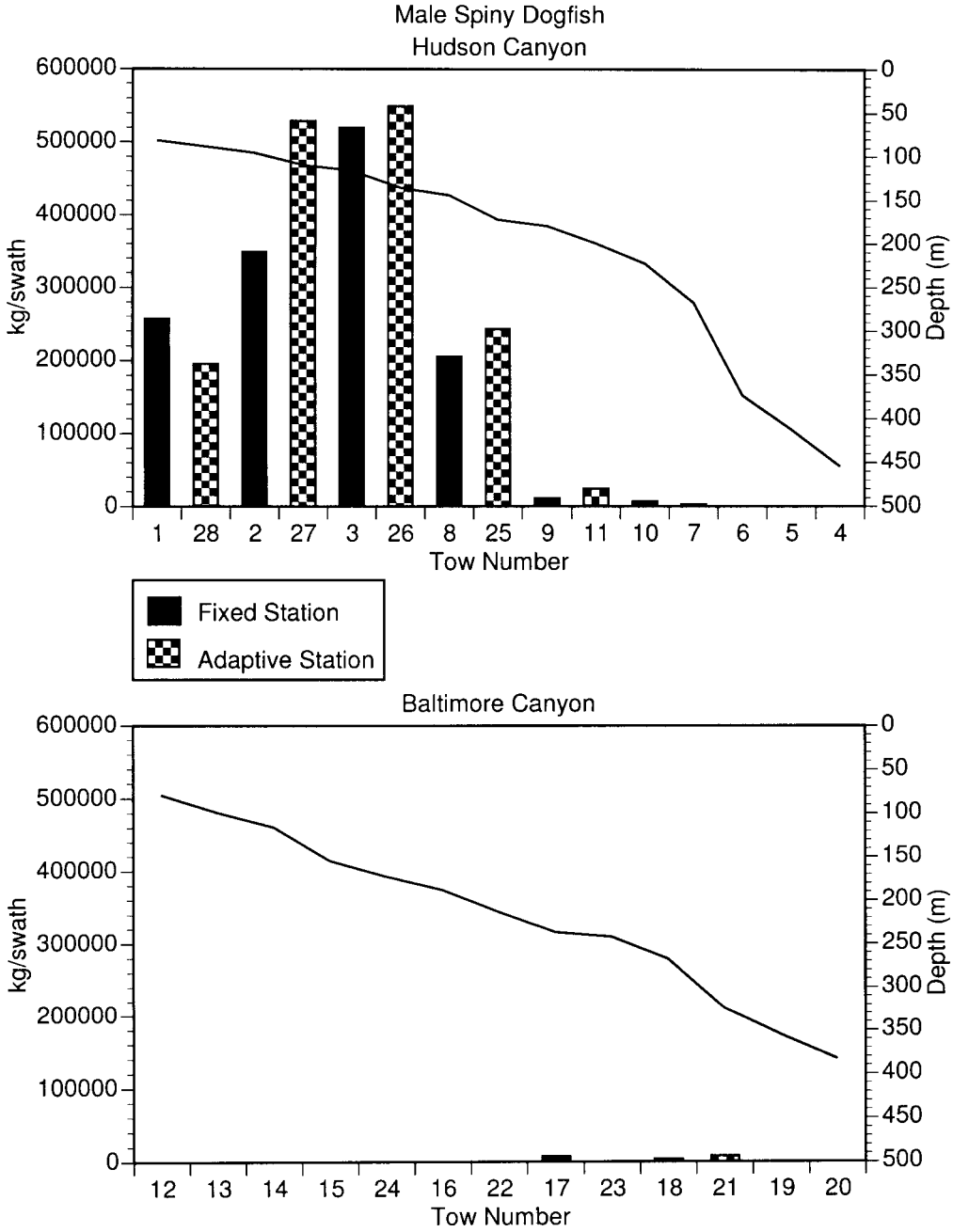


Figure 23a. Catches of summer flounder in each tow along the two transects. Catch is recorded in kg caught/swept area (km^2). Depth is the average depth at which each tow was made (in meters). Tow numbers indicate the sampling sequence during the cruise. Tows are ordered shallowest to deepest along the x-axis.

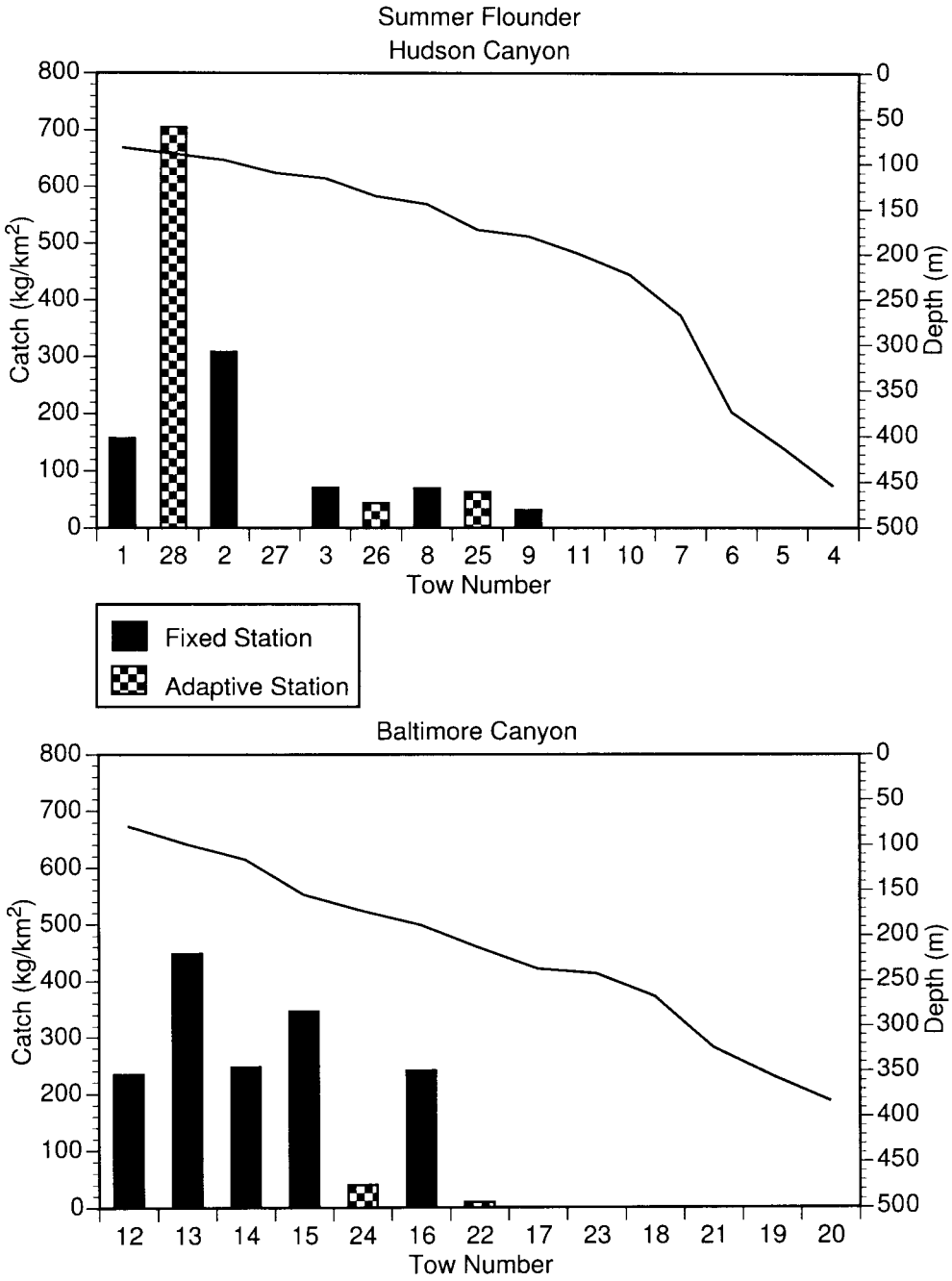


Figure 23b. Projected abundance of summer flounder along the transect with each tow representing the projected abundance for the distance along the transect. Tow numbers indicate the sampling sequence during the cruise. Tows are ordered shallowest to deepest along the x-axis.

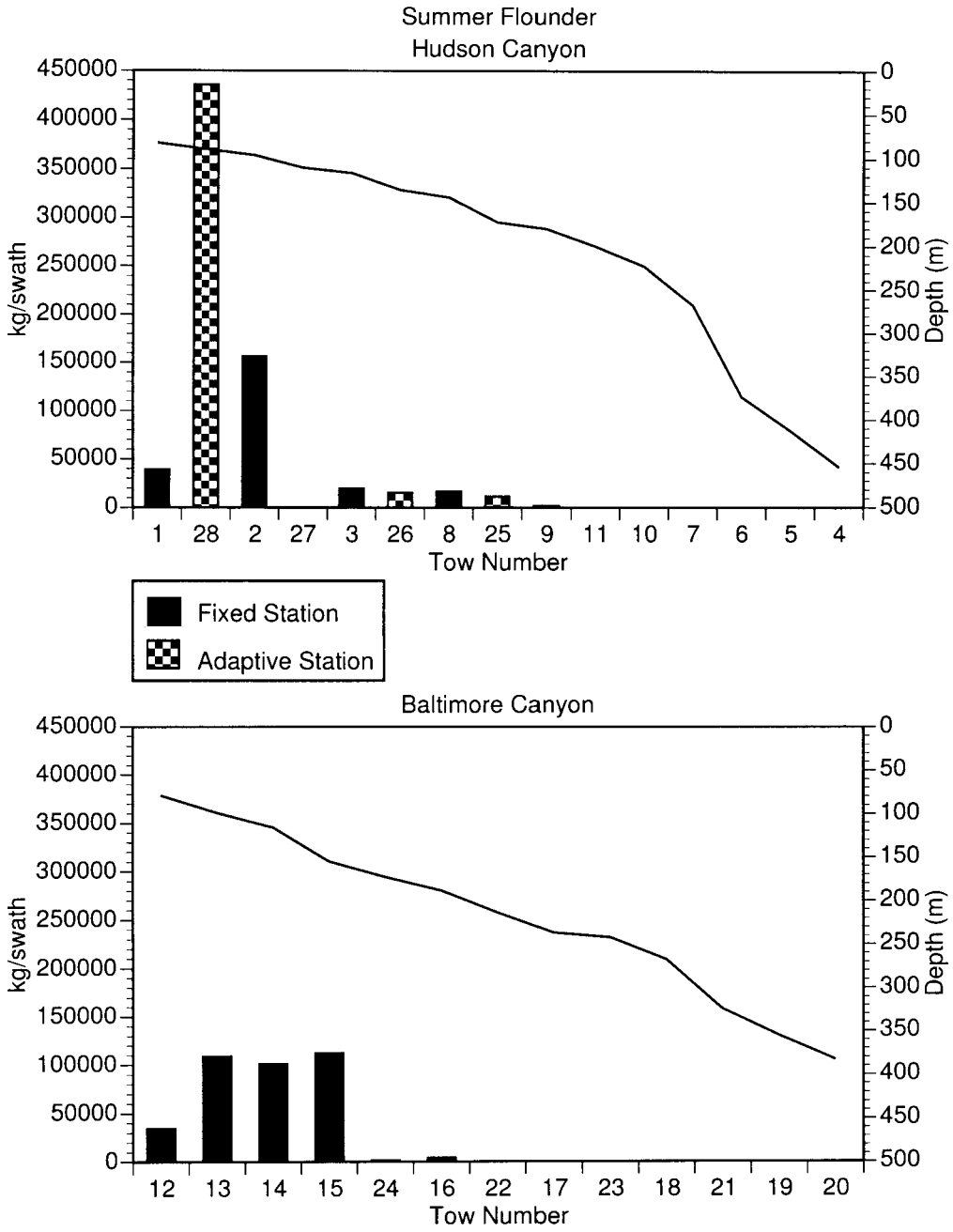


Figure 24a. Catches of tilefish in each tow along the two transects. Catch is recorded in kg caught/swept area (km^2). Depth is the average depth at which each tow was made (in meters). Tow numbers indicate the sampling sequence during the cruise. Tows are ordered shallowest to deepest along the x-axis.

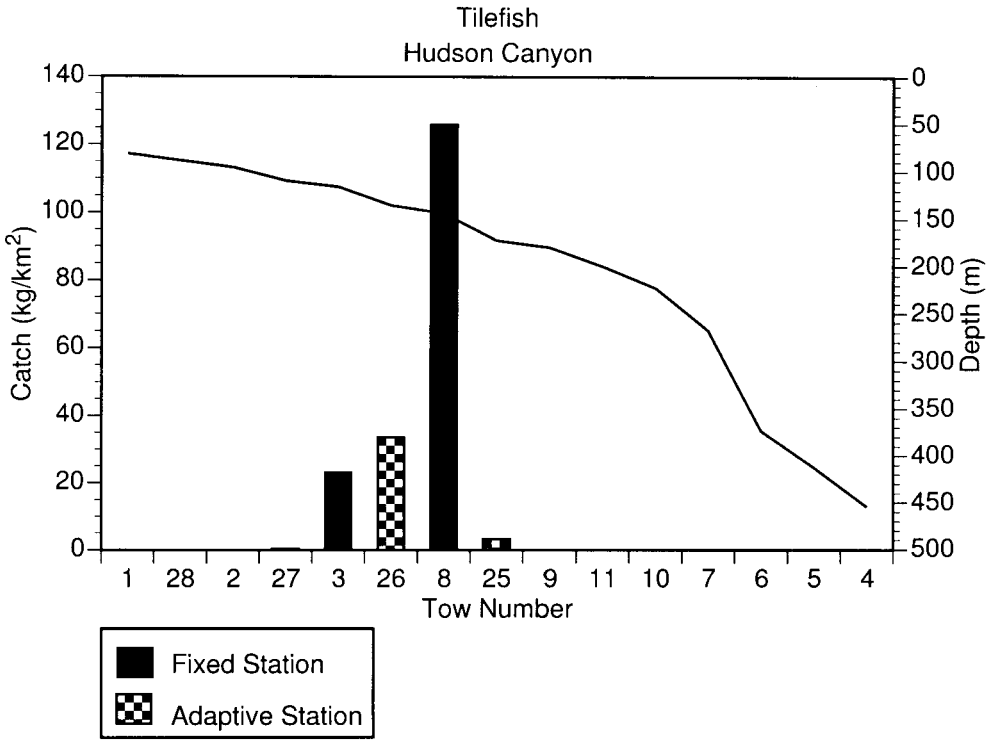


Figure 24b. Projected abundance of tilefish along the transect with each tow representing the projected abundance for the distance along the transect. Tow numbers indicate the sampling sequence during the cruise. Tows are ordered shallowest to deepest along the x-axis.

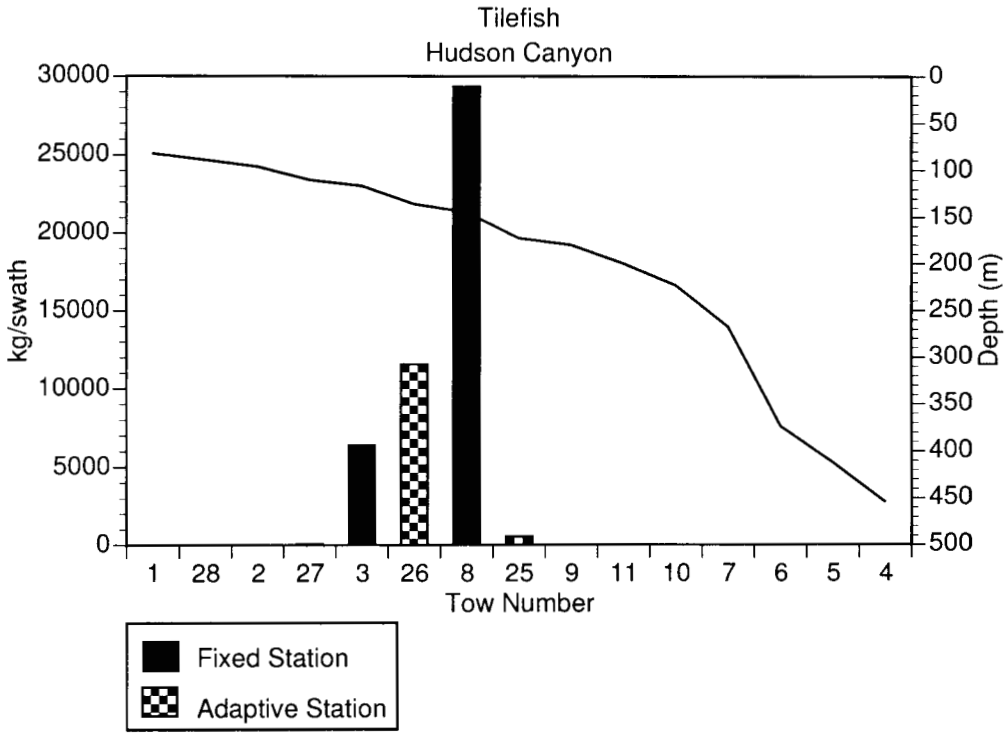


Figure 25a. Catches of witch flounder in each tow along the two transects. Catch is recorded in kg caught/swept area (km^2). Depth is the average depth at which each tow was made (in meters). Tow numbers indicate the sampling sequence during the cruise. Tows are ordered shallowest to deepest along the x-axis.

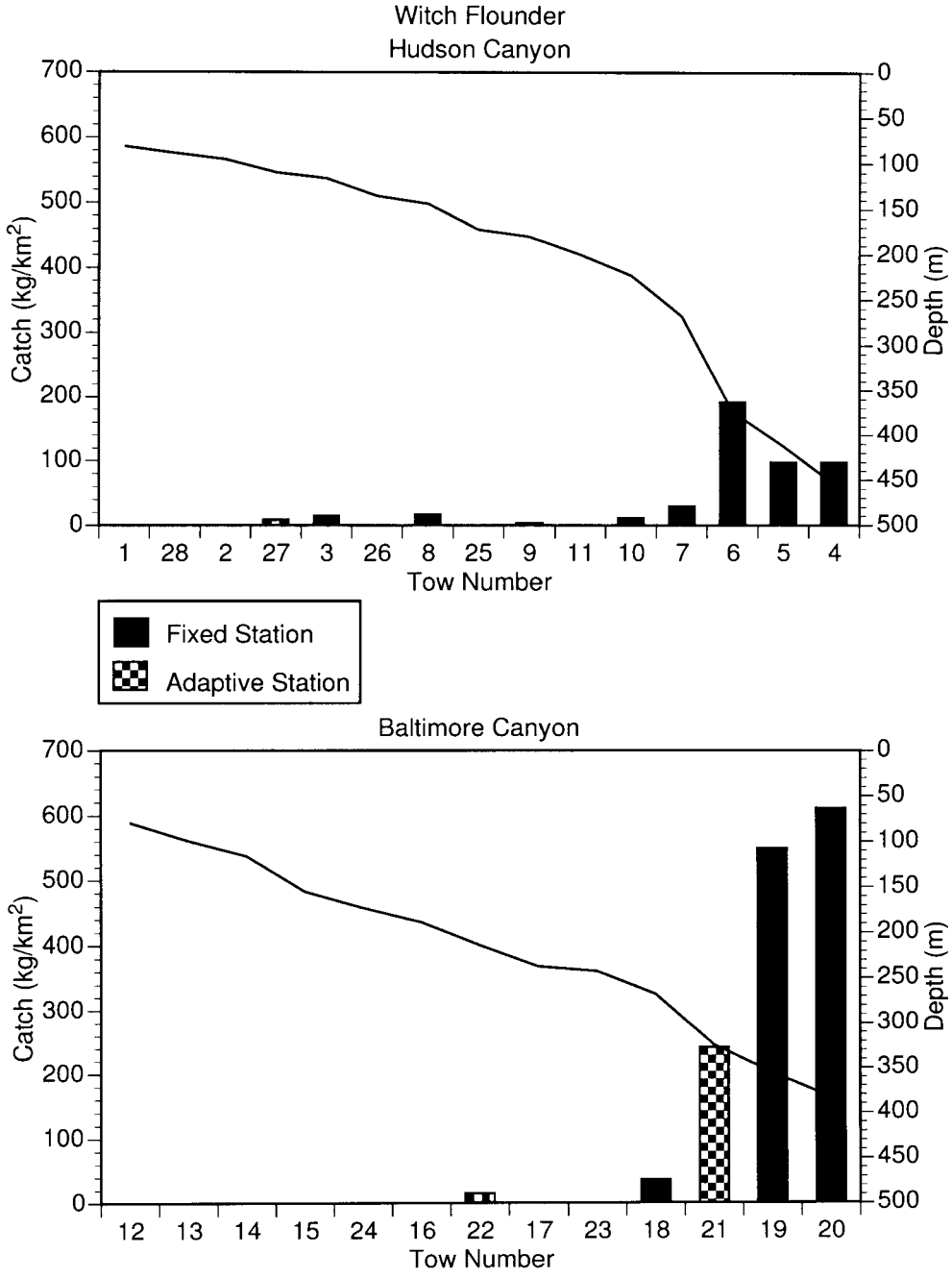


Figure 25b. Projected abundance of witch flounder along the transect with each tow representing the projected abundance for the distance along the transect. Tow numbers indicate the sampling sequence during the cruise. Tows are ordered shallowest to deepest along the x-axis.

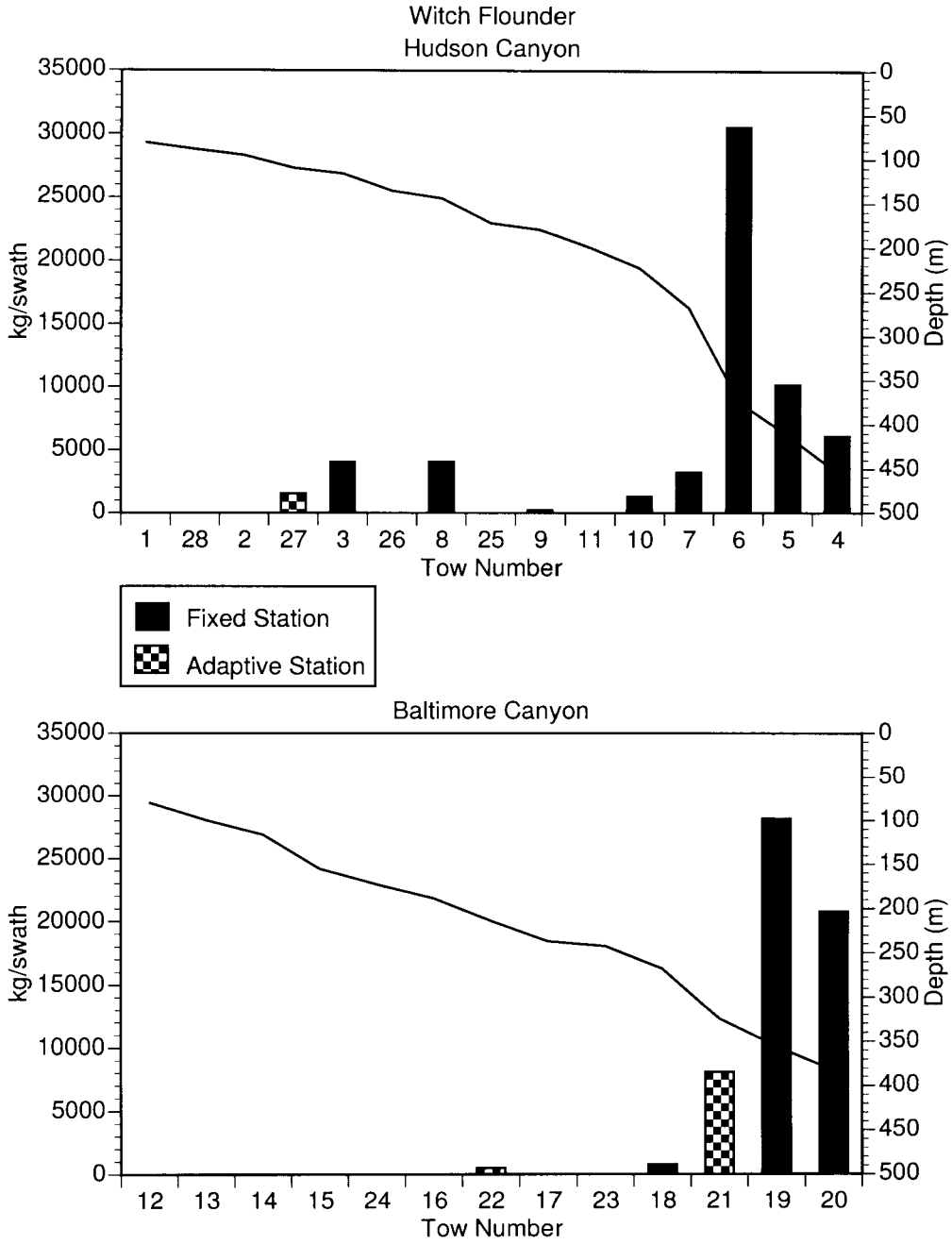


Figure 26a. Cumulative size-frequency distribution of American lobster across all tows. Tow size frequencies were corrected to the number caught per size class per km^2 swept area. The swept area-normalized abundances were then summed across all tows for each transect.

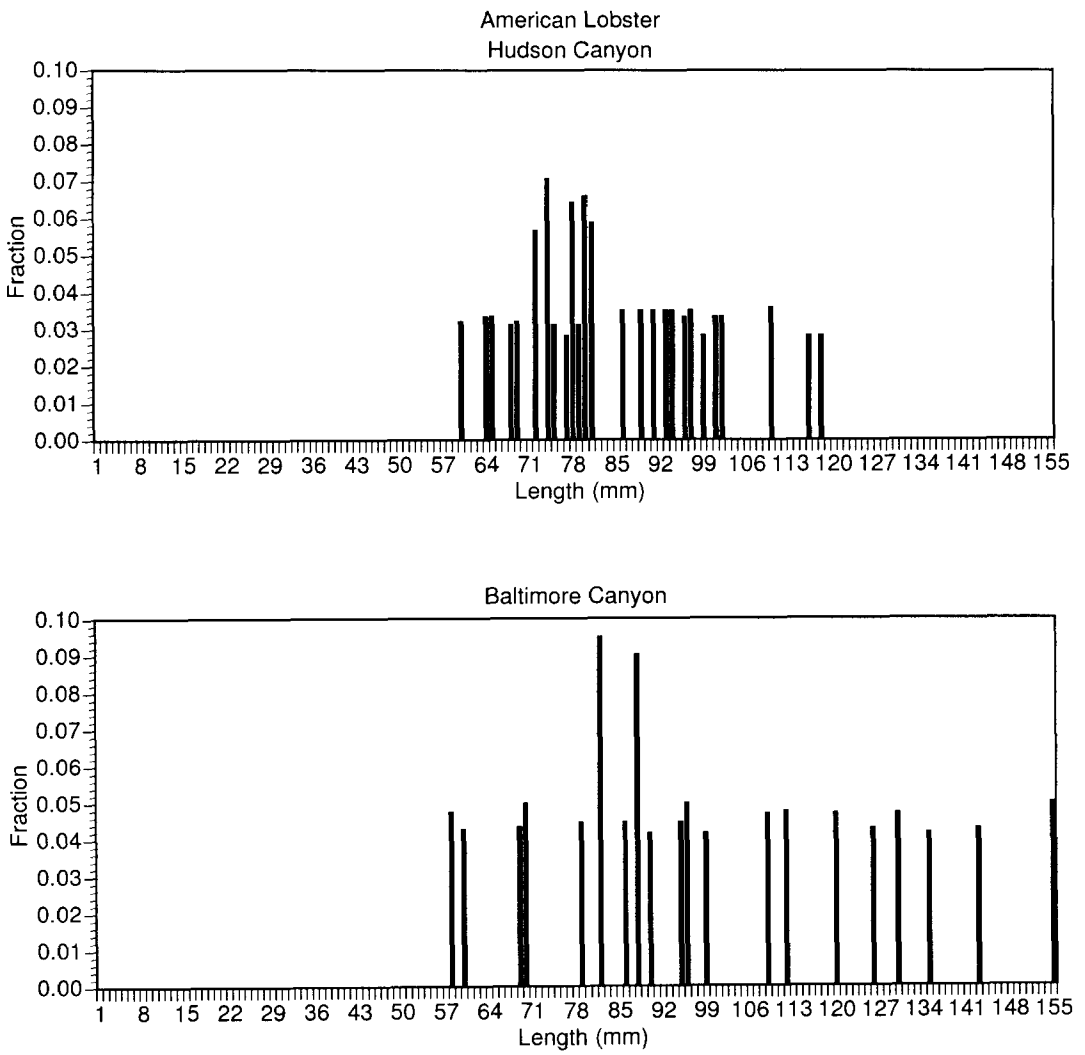
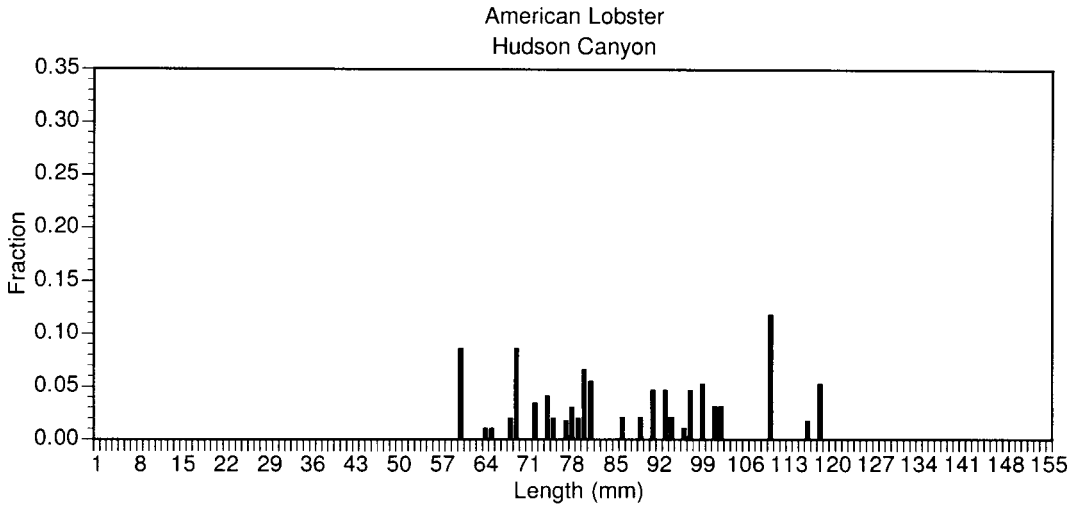


Figure 26b. Cumulative size-frequency distribution of American lobster across all tows. Tow size frequencies were corrected to the number caught per size class per km^2 swept area. Tows were then normalized to swath distance along the transect and the abundances were summed across all tows for each transect.



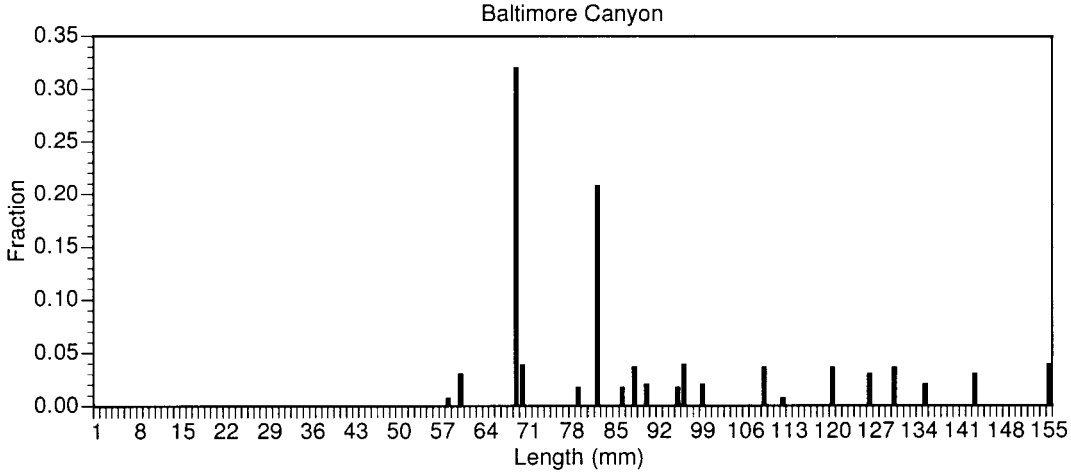


Figure 27a. Cumulative size-frequency distribution of black sea bass across all tows. Tow size frequencies were corrected to the number caught per size class per km^2 swept area. The swept area-normalized abundances were then summed across all tows for each transect.

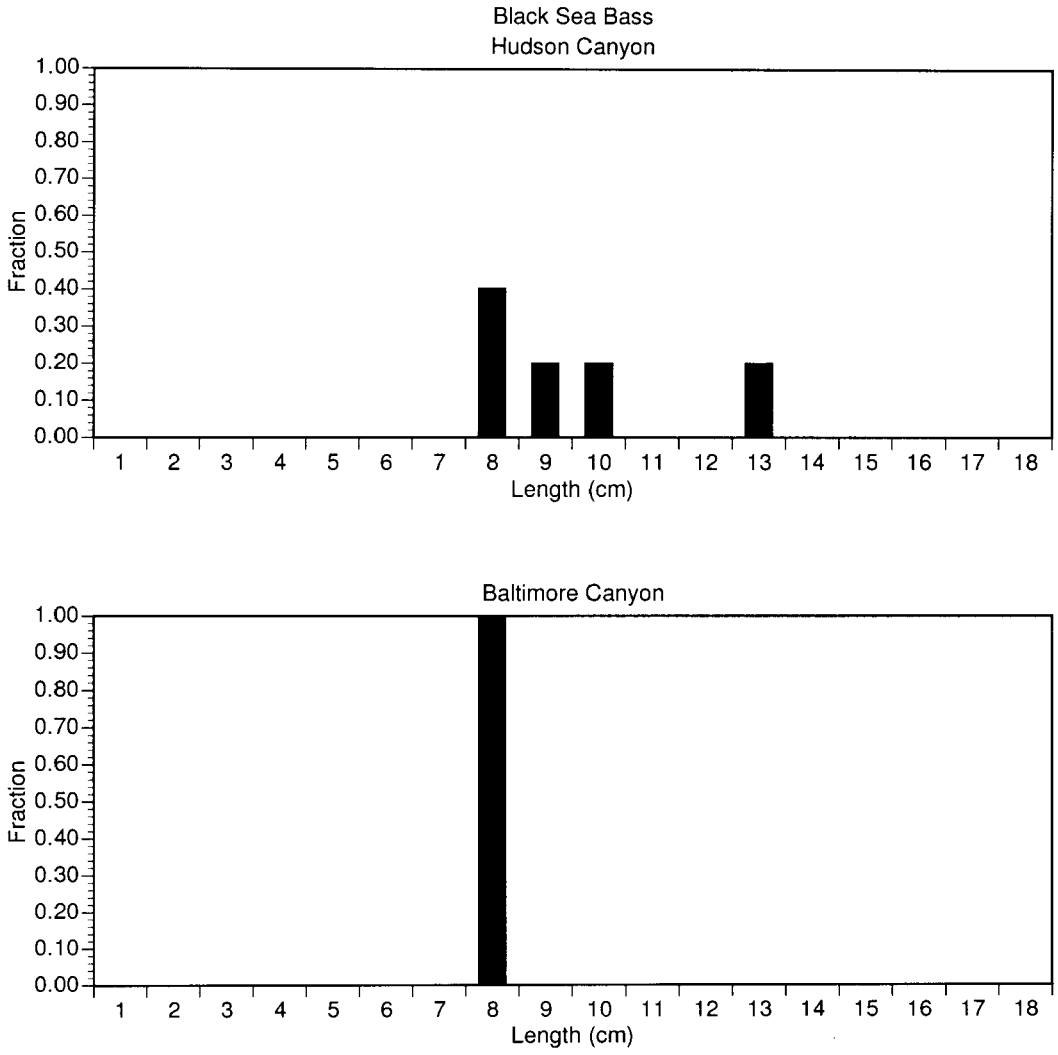


Figure 27b. Cumulative size-frequency distribution of black sea bass across all tows. Tow size frequencies were corrected to the number caught per size class per km^2 swept area. Tows were then normalized to swath distance along the transect and the abundances were summed across all tows for each transect.

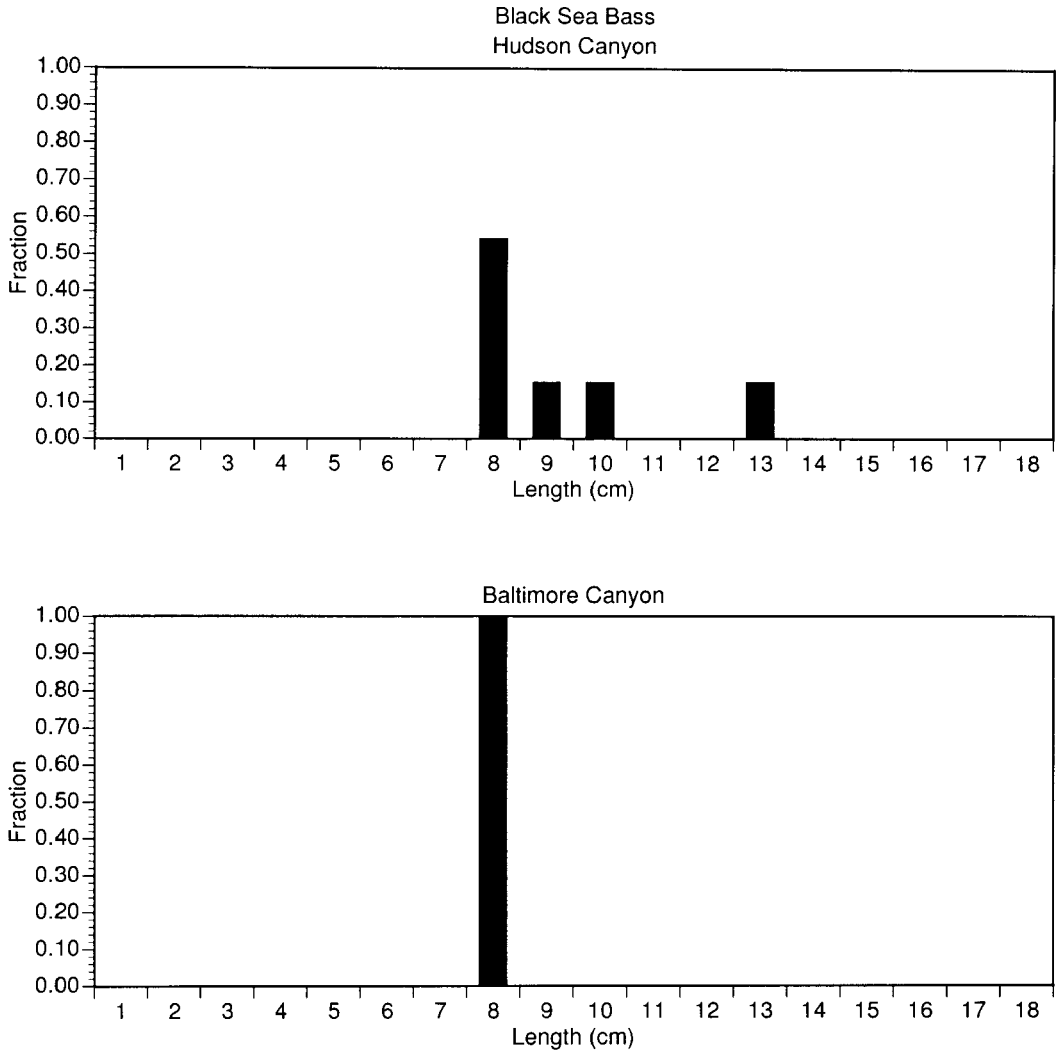


Figure 28a. Cumulative size-frequency distribution of bluefish across all tows. Tow size frequencies were corrected to the number caught per size class per km^2 swept area. The swept area-normalized abundances were then summed across all tows for each transect.

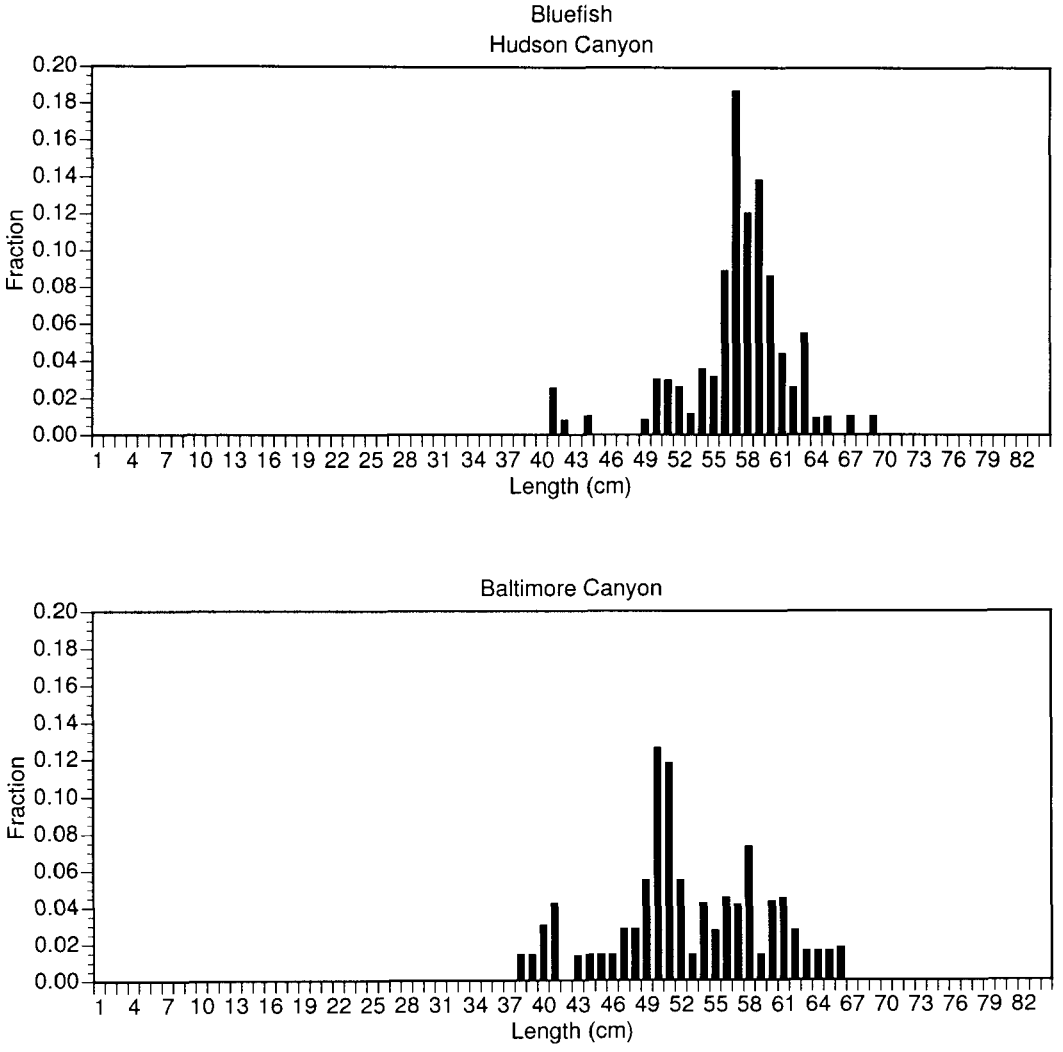


Figure 28b. Cumulative size-frequency distribution of bluefish across all tows. Tow size frequencies were corrected to the number caught per size class per km^2 swept area. Tows were then normalized to swath distance along the transect and the abundances were summed across all tows for each transect.

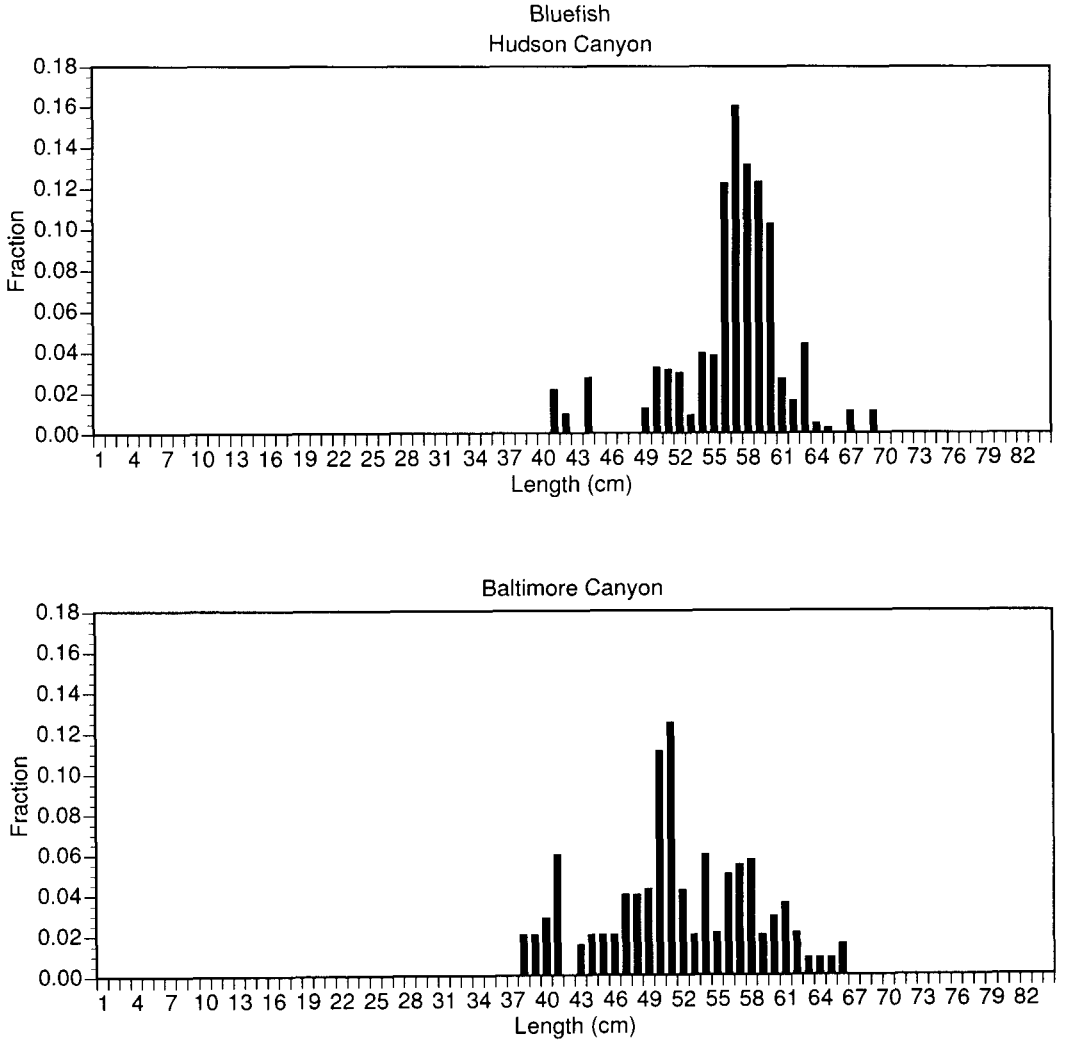
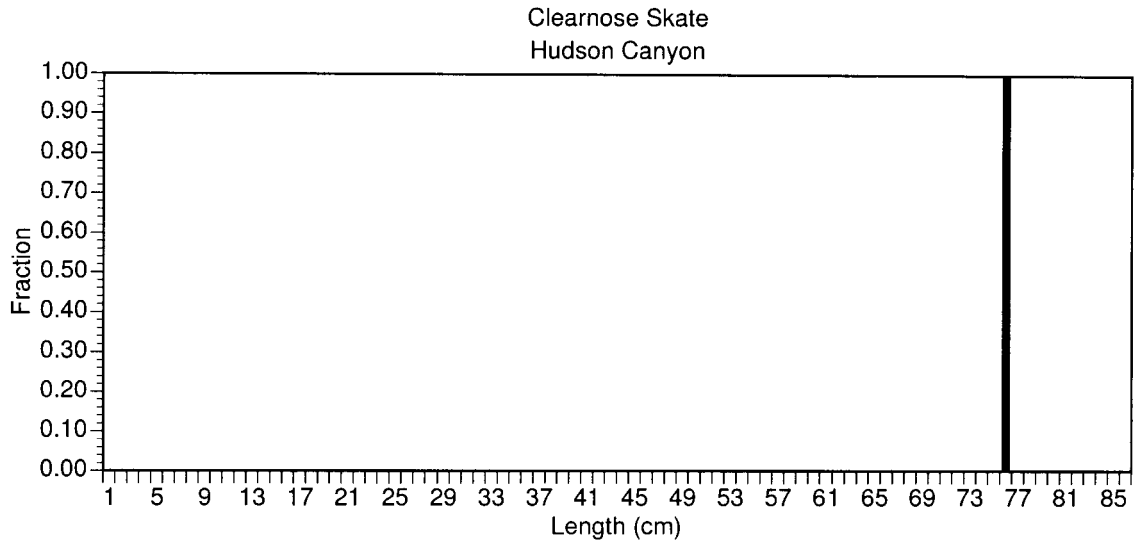


Figure 29a. Cumulative size-frequency distribution of clearnose skate across all tows. Tow size frequencies were corrected to the number caught per size class per km^2 swept area. The swept area-normalized abundances were then summed across all tows for each transect.



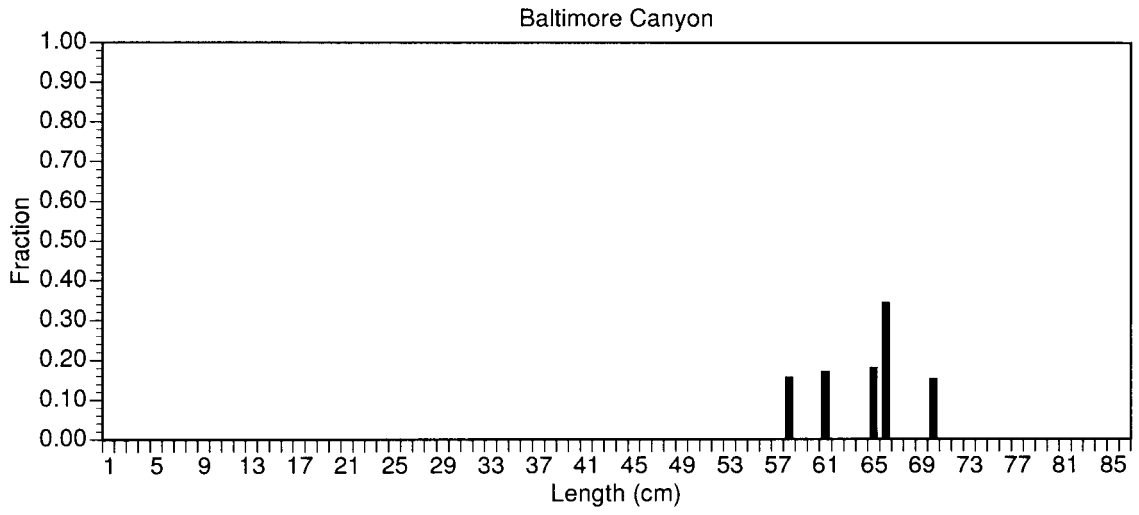


Figure 29b. Cumulative size-frequency distribution of clearnose skate across all tows. Tow size frequencies were corrected to the number caught per size class per km^2 swept area. Tows were then normalized to swath distance along the transect and the abundances were summed across all tows for each transect.

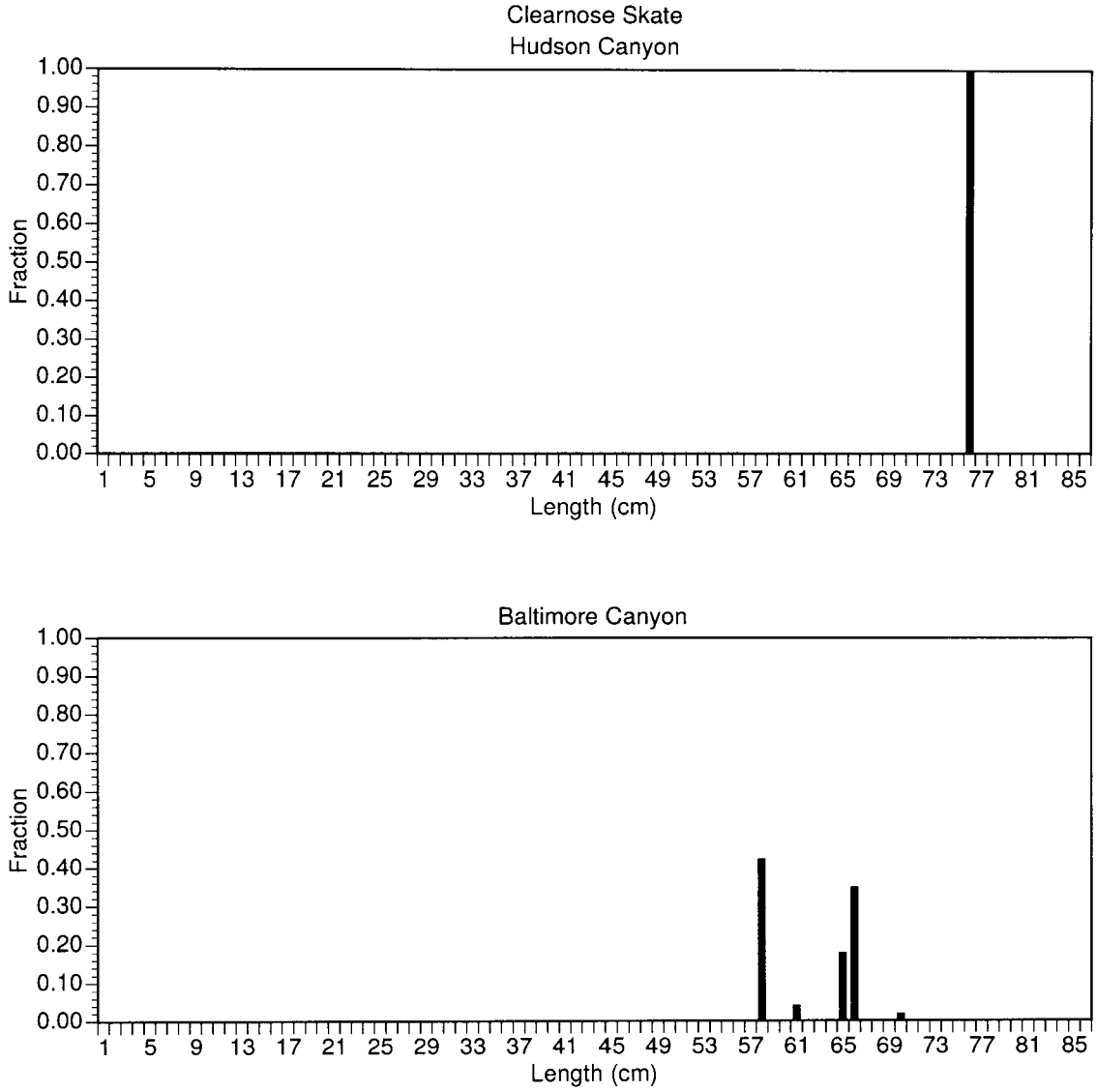


Figure 30a. Cumulative size-frequency distribution of *Illex* squid across all tows. Tow size frequencies were corrected to the number caught per size class per km^2 swept area. The swept area-normalized abundances were then summed across all tows for each transect.

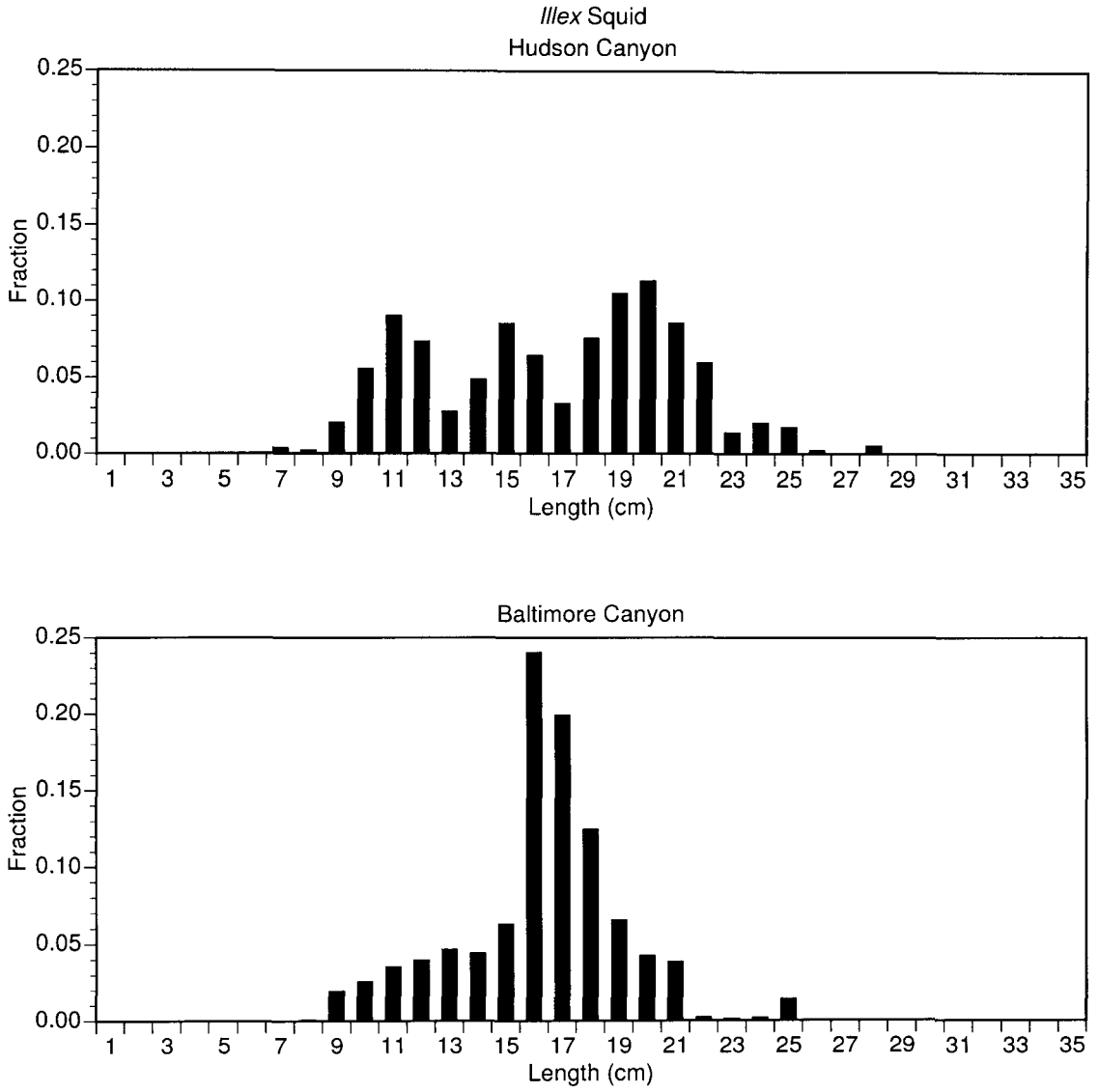
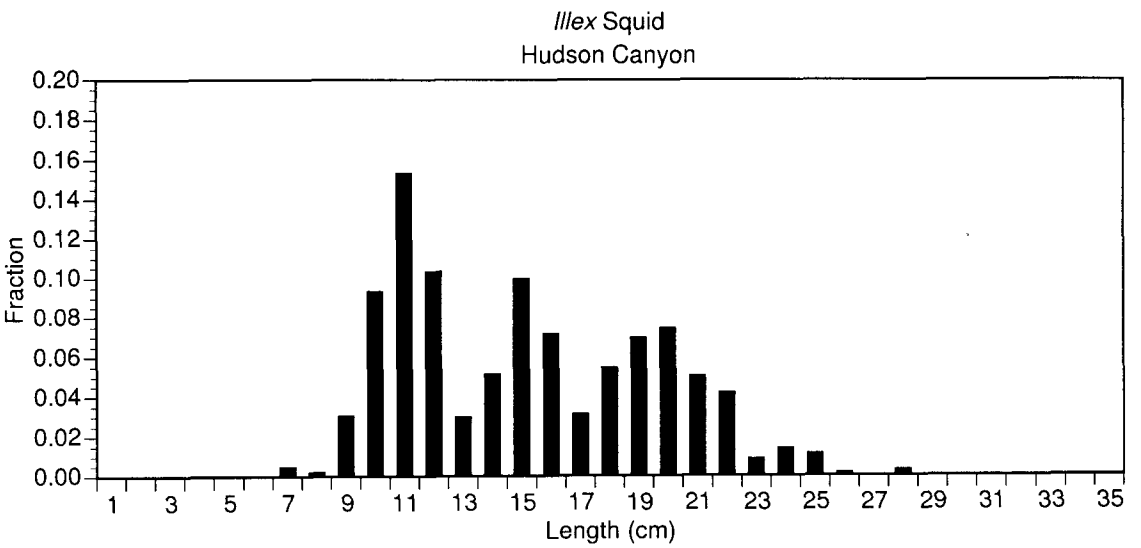


Figure 30b. Cumulative size-frequency distribution of *Illex* squid across all tows. Tow size frequencies were corrected to the number caught per size class per km^2 swept area. Tows were then normalized to swath distance along the transect and the abundances were summed across all tows for each transect.



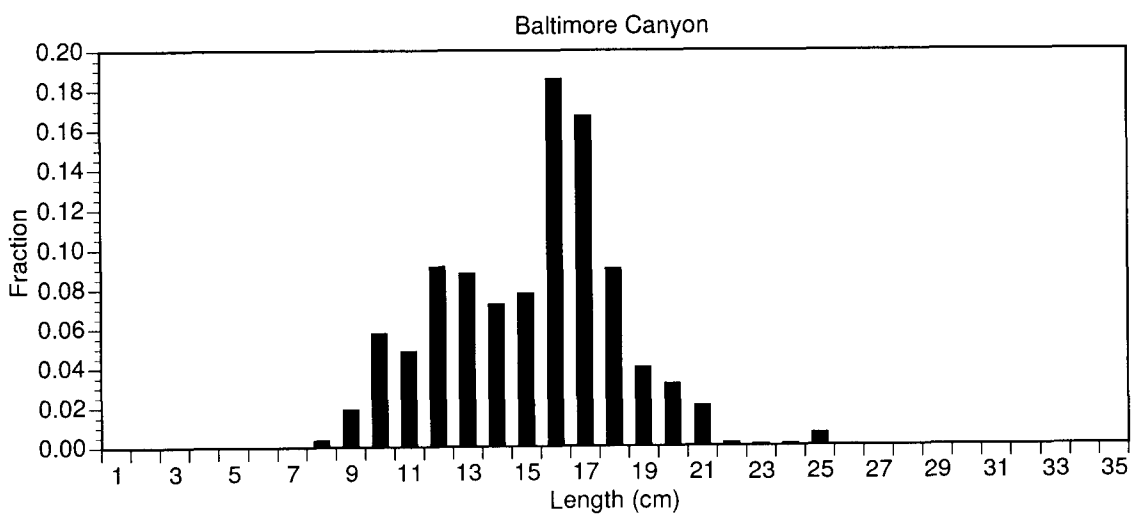
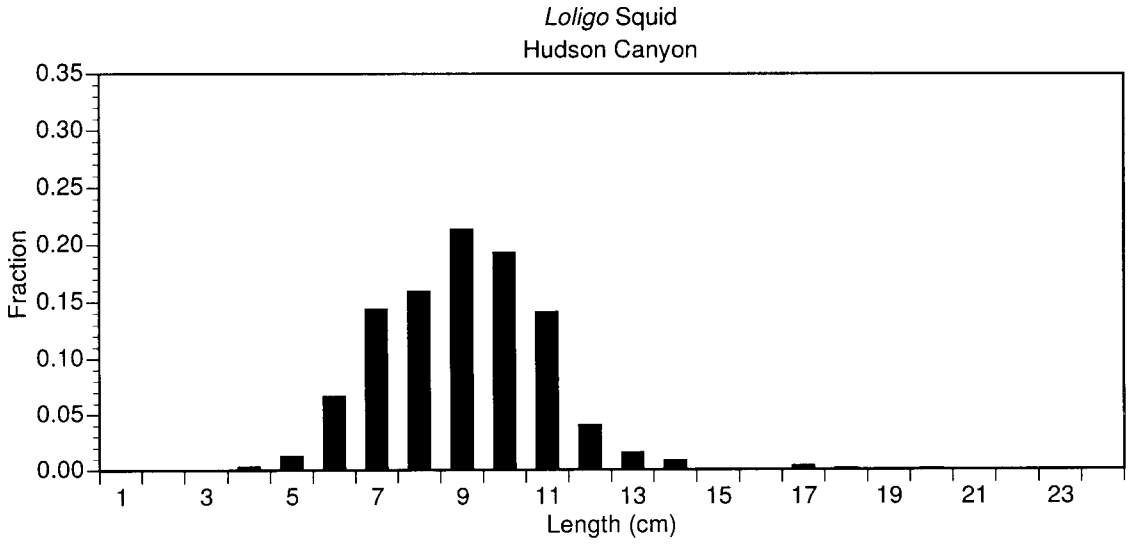


Figure 31a. Cumulative size-frequency distribution of *Loligo* squid across all tows. Tow size frequencies were corrected to the number caught per size class per km^2 swept area. The swept area-normalized abundances were then summed across all tows for each transect.



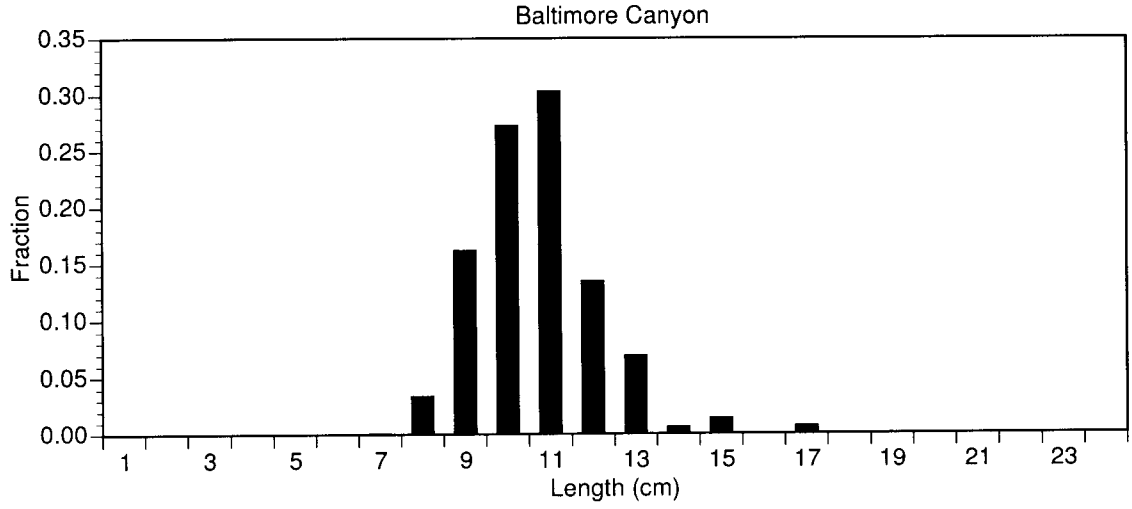
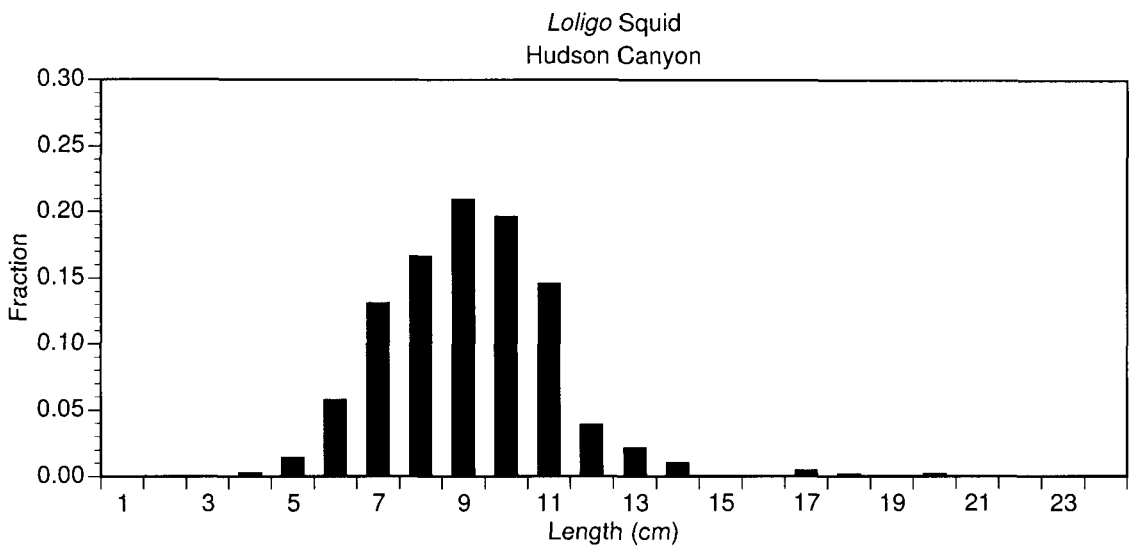


Figure 31b. Cumulative size-frequency distribution of *Loligo* squid across all tows. Tow size frequencies were corrected to the number caught per size class per km^2 swept area. Tows were then normalized to swath distance along the transect and the abundances were summed across all tows for each transect.



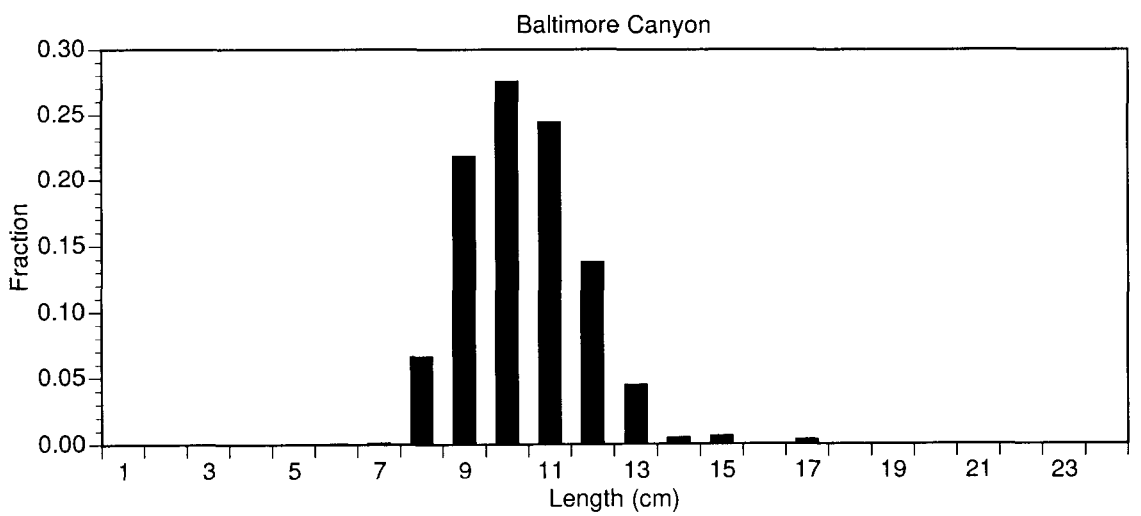
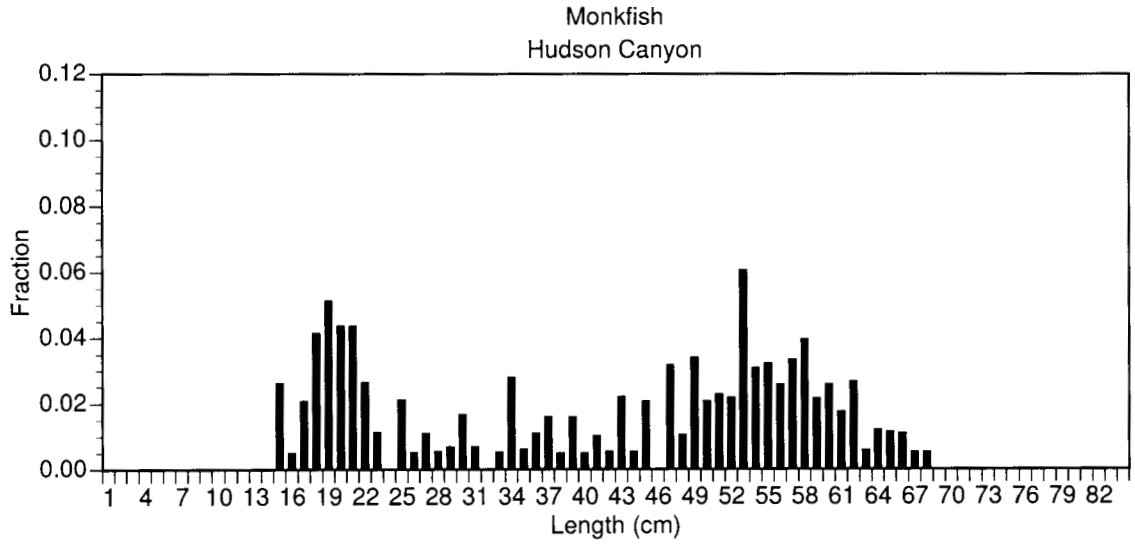


Figure 32a. Cumulative size-frequency distribution of monkfish across all tows. Tow size frequencies were corrected to the number caught per size class per km^2 swept area. The swept area-normalized abundances were then summed across all tows for each transect.



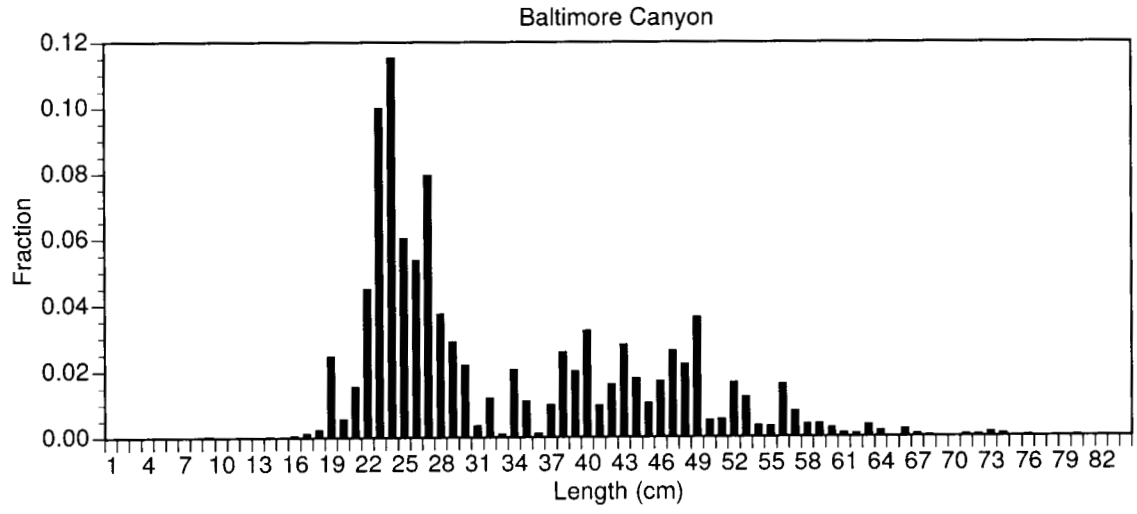
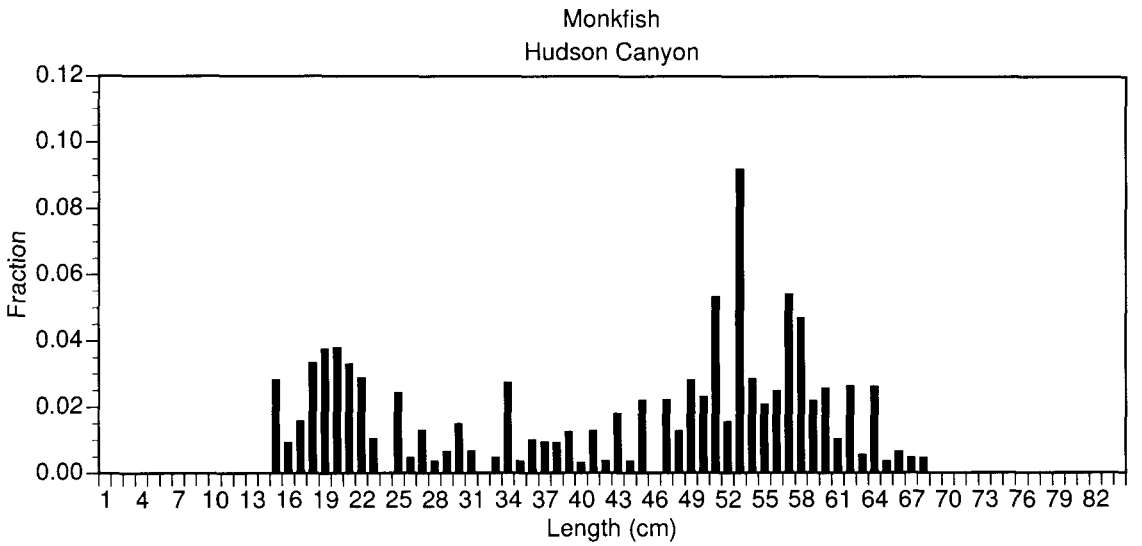


Figure 32b. Cumulative size-frequency distribution of monkfish across all tows. Tow size frequencies were corrected to the number caught per size class per km^2 swept area. Tows were then normalized to swath distance along the transect and the abundances were summed across all tows for each transect.



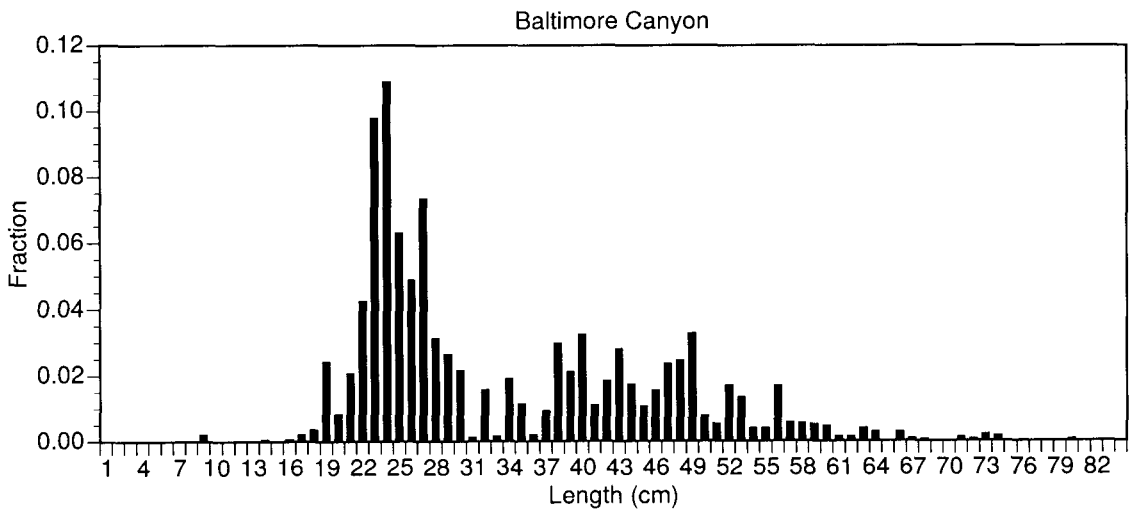
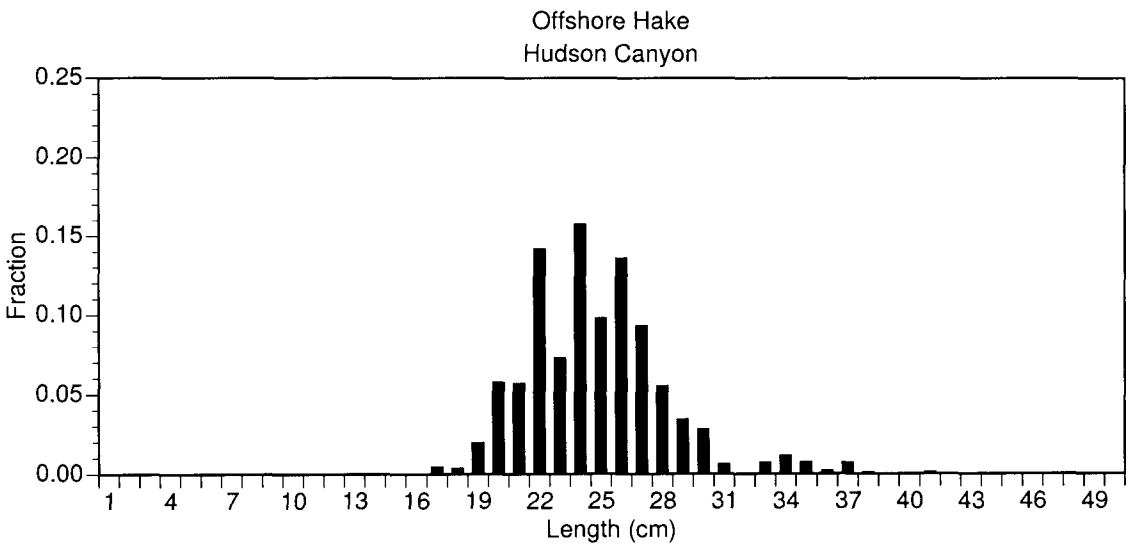


Figure 33a. Cumulative size-frequency distribution of offshore hake across all tows. Tow size frequencies were corrected to the number caught per size class per km^2 swept area. The swept area-normalized abundances were then summed across all tows for each transect.



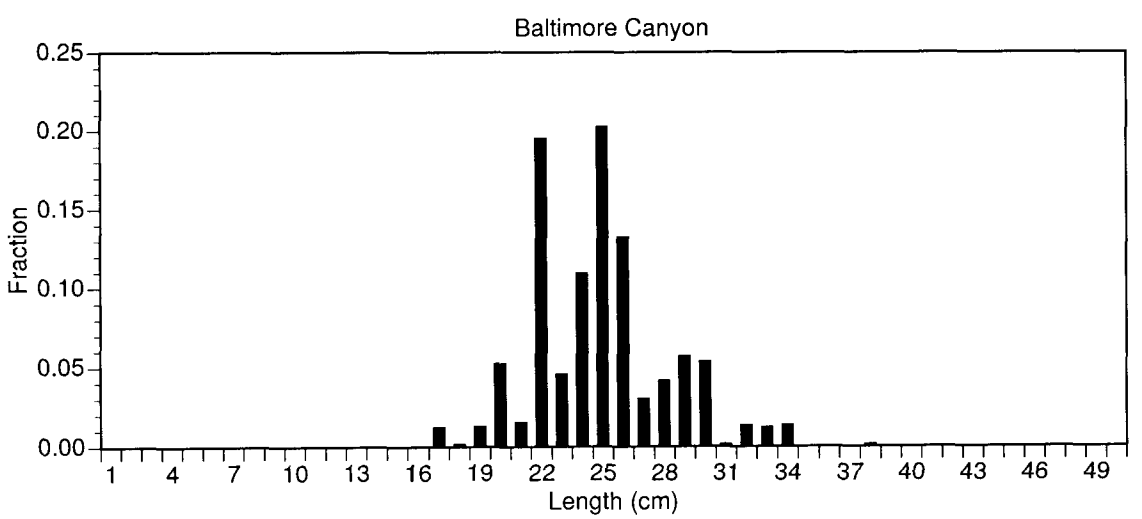
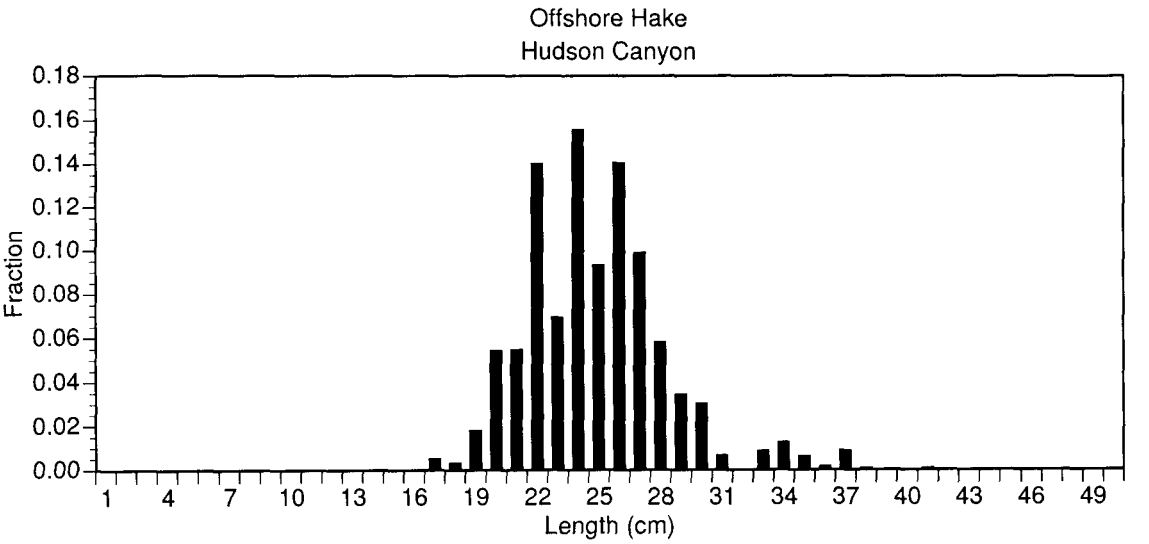


Figure 33b. Cumulative size-frequency distribution of offshore hake across all tows. Tow size frequencies were corrected to the number caught per size class per km^2 swept area. Tows were then normalized to swath distance along the transect and the abundances were summed across all tows for each transect.



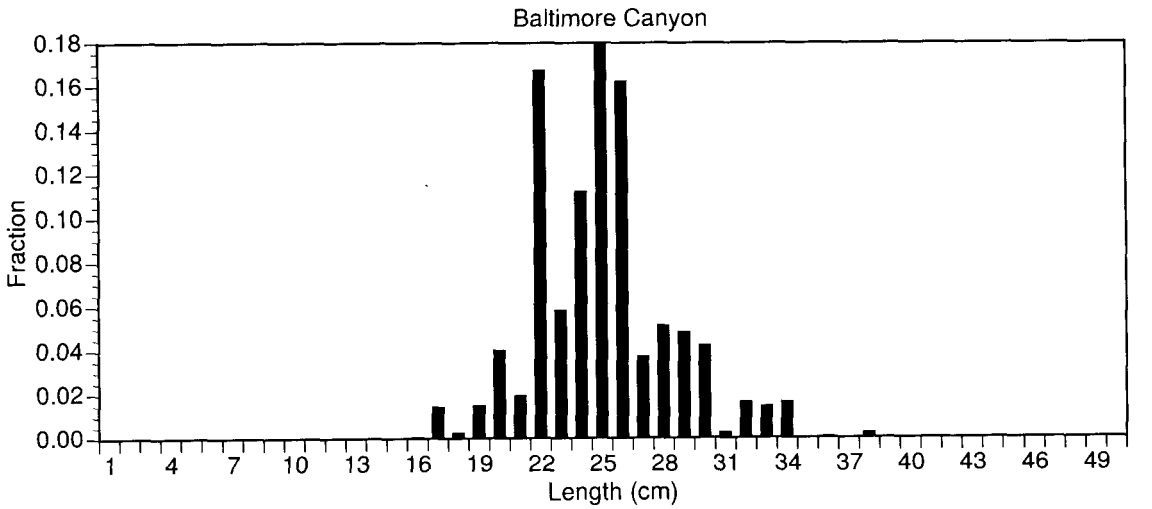
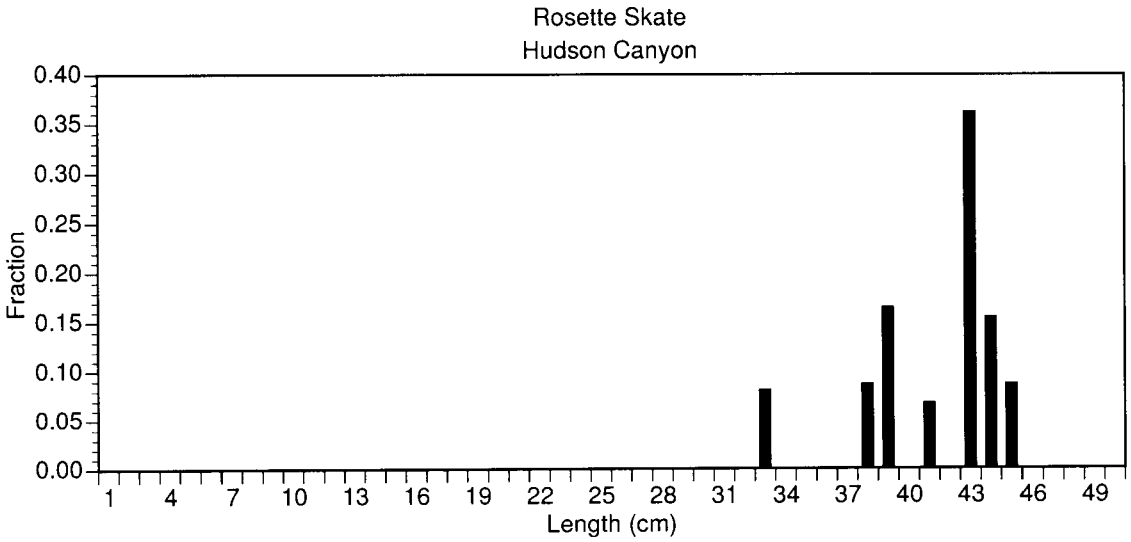


Figure 34a. Cumulative size-frequency distribution of rosette skate across all tows. Tow size frequencies were corrected to the number caught per size class per km^2 swept area. The swept area-normalized abundances were then summed across all tows for each transect.



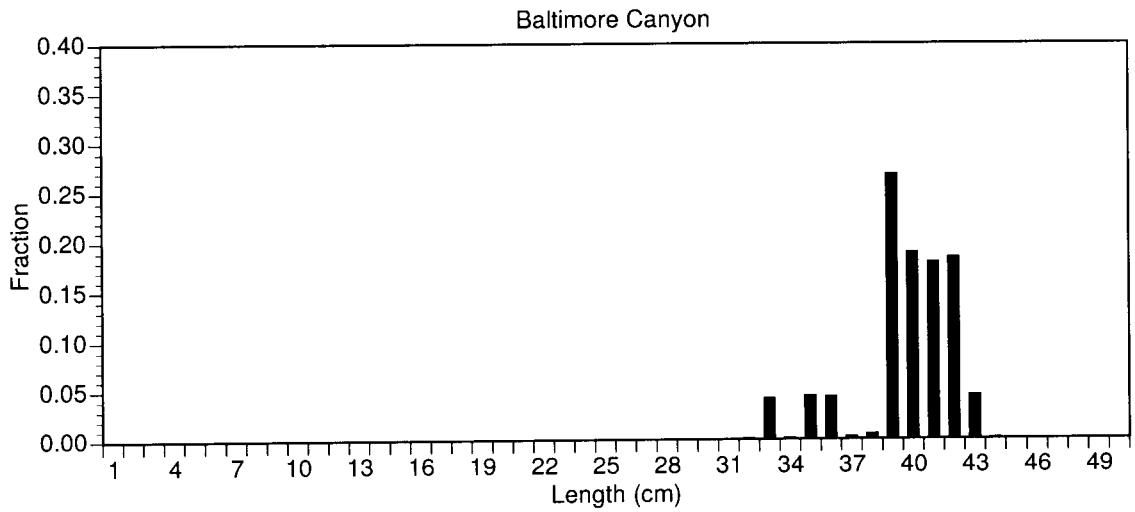
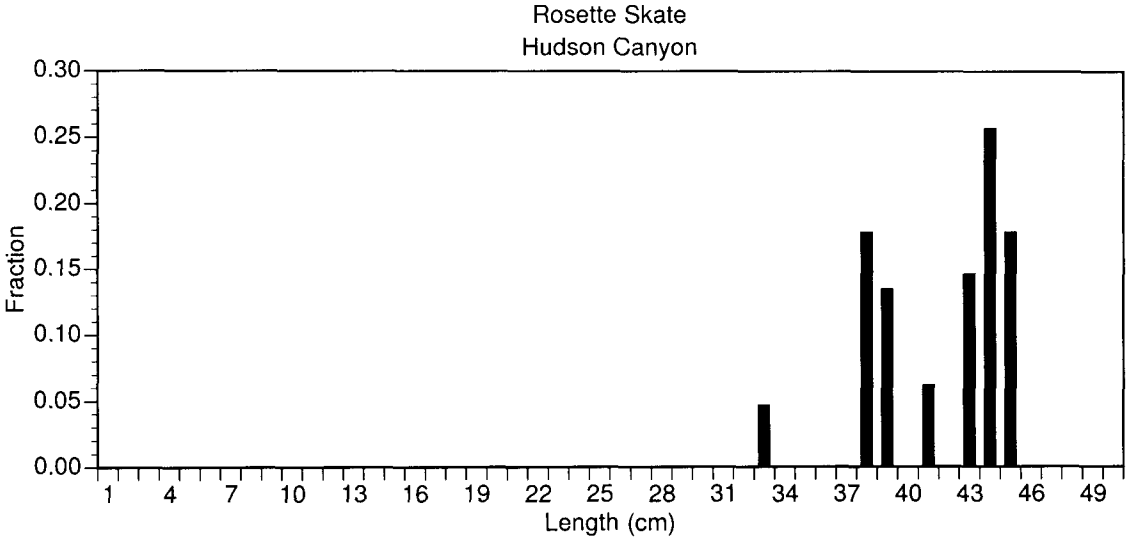


Figure 34b. Cumulative size-frequency distribution of rosette skate across all tows. Tow size frequencies were corrected to the number caught per size class per km^2 swept area. Tows were then normalized to swath distance along the transect and the abundances were summed across all tows for each transect.



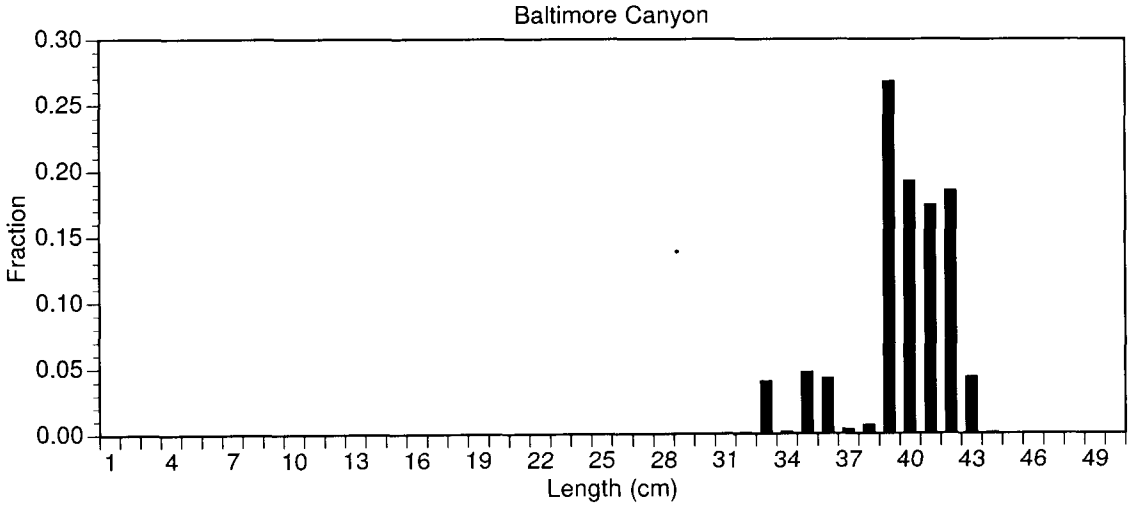
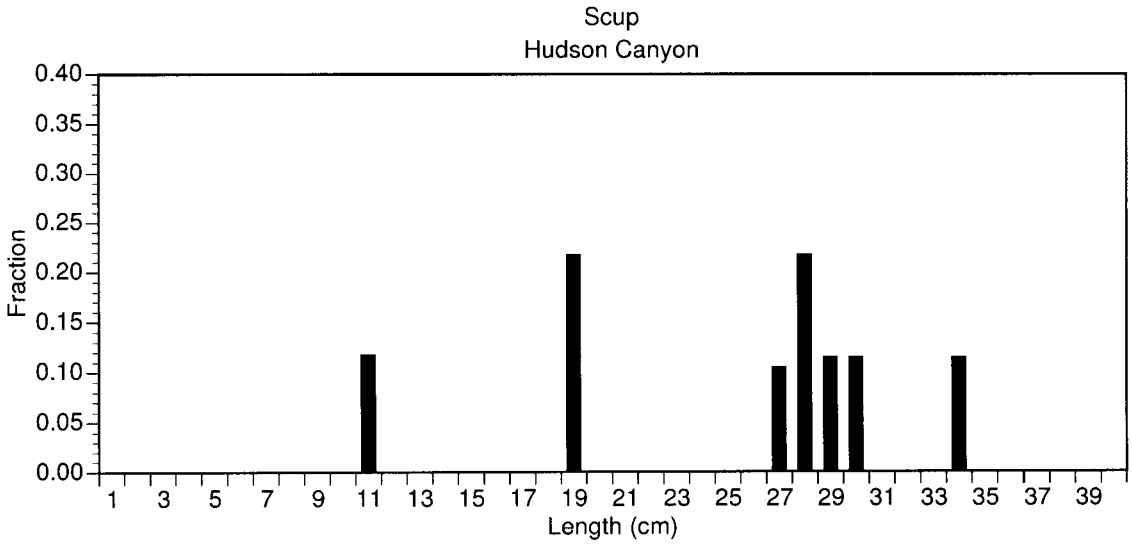


Figure 35a. Cumulative size-frequency distribution of scup across all tows. Tow size frequencies were corrected to the number caught per size class per km^2 swept area. The swept area-normalized abundances were then summed across all tows for each transect.



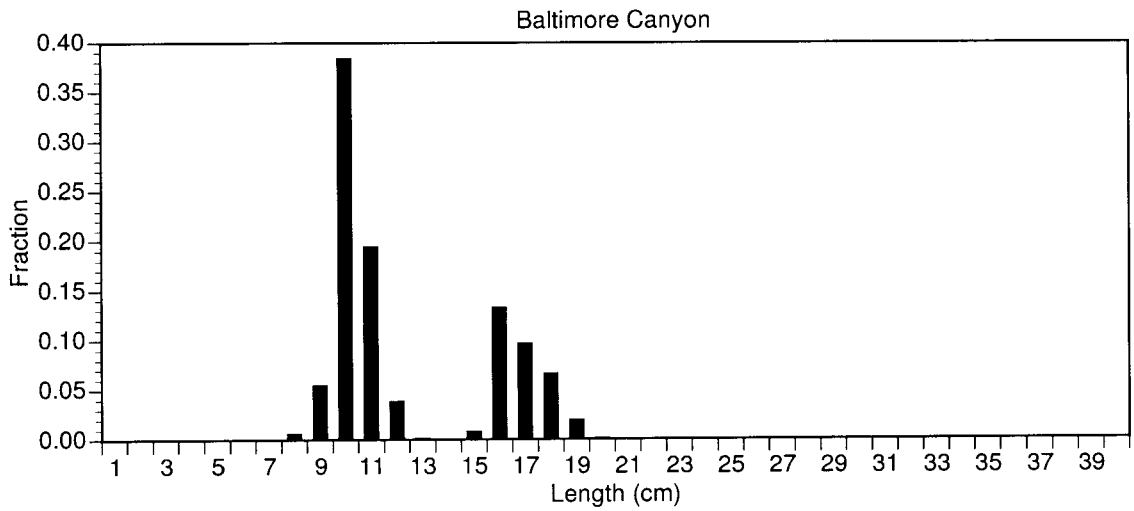
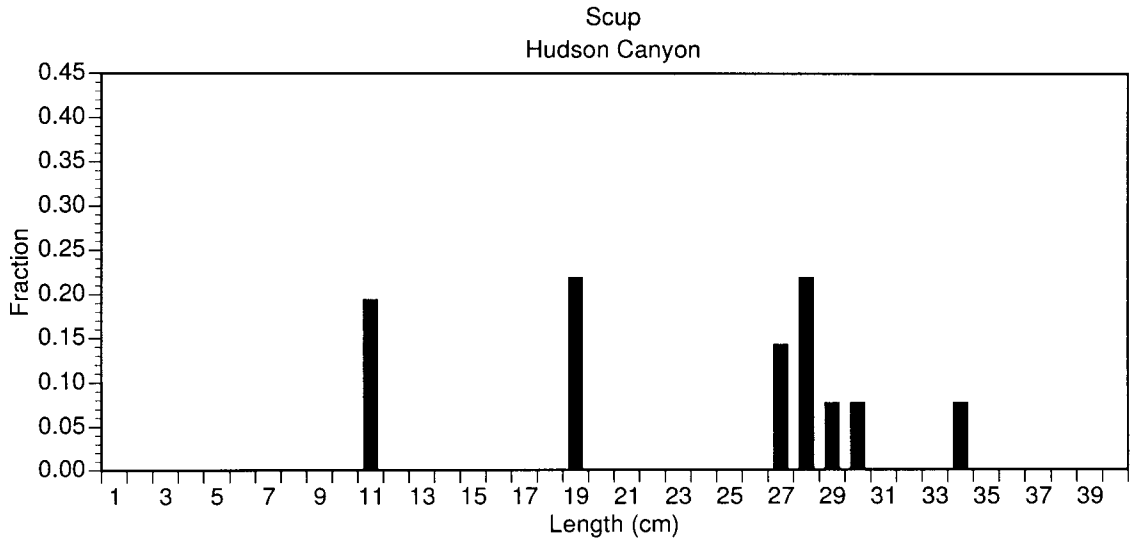


Figure 35b. Cumulative size-frequency distribution of scup across all tows. Tow size frequencies were corrected to the number caught per size class per km^2 swept area. Tows were then normalized to swath distance along the transect and the abundances were summed across all tows for each transect.



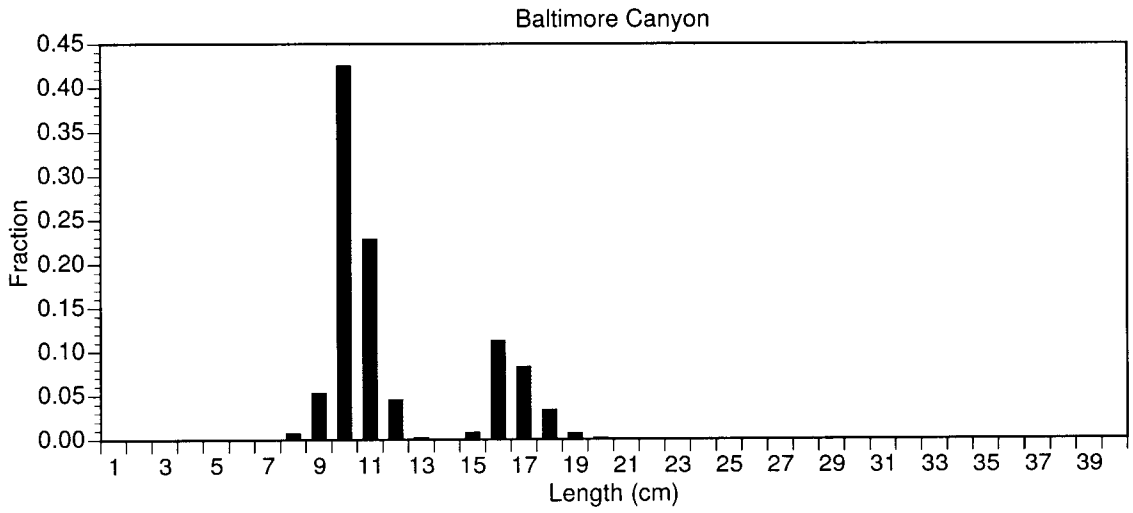
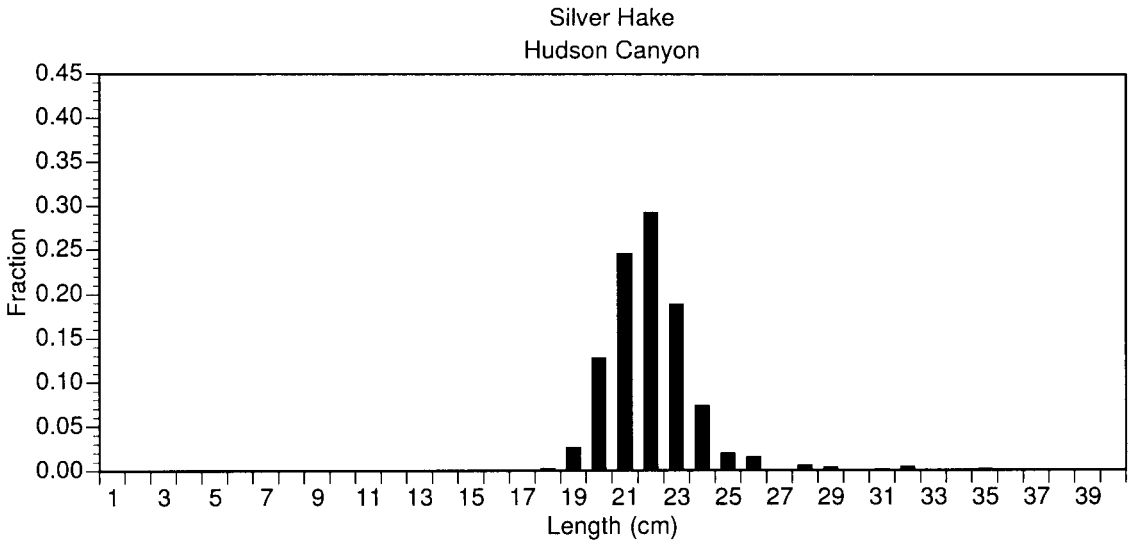


Figure 36a. Cumulative size-frequency distribution of silver hake across all tows. Tow size frequencies were corrected to the number caught per size class per km^2 swept area. The swept area-normalized abundances were then summed across all tows for each transect.



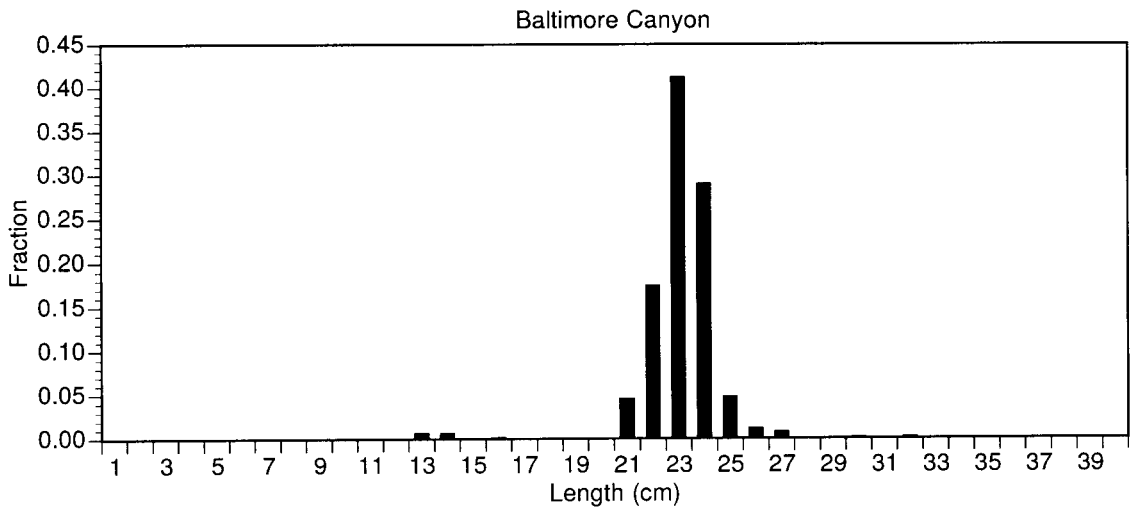
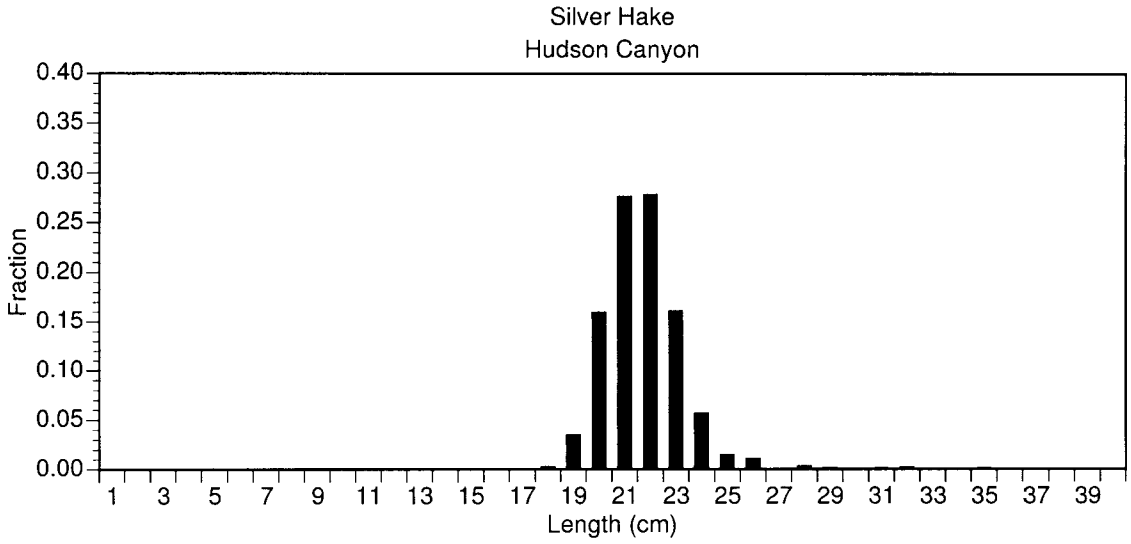


Figure 36b. Cumulative size-frequency distribution of silver hake across all tows. Tow size frequencies were corrected to the number caught per size class per km^2 swept area. Tows were then normalized to swath distance along the transect and the abundances were summed across all tows for each transect.



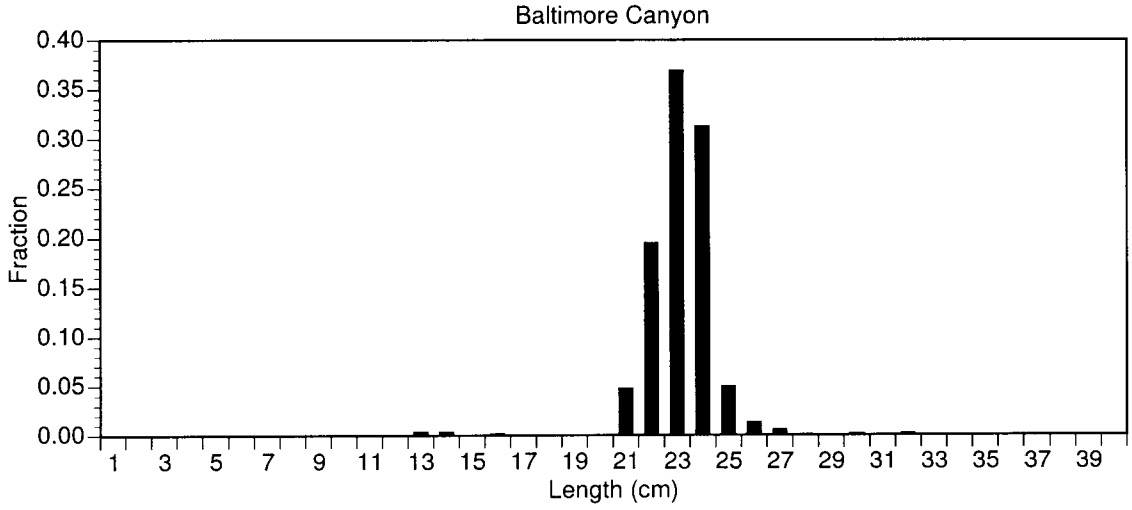


Figure 37a. Cumulative size-frequency distribution of smooth dogfish across all tows. Tow size frequencies were corrected to the number caught per size class per km^2 swept area. The swept area-normalized abundances were then summed across all tows for each transect.

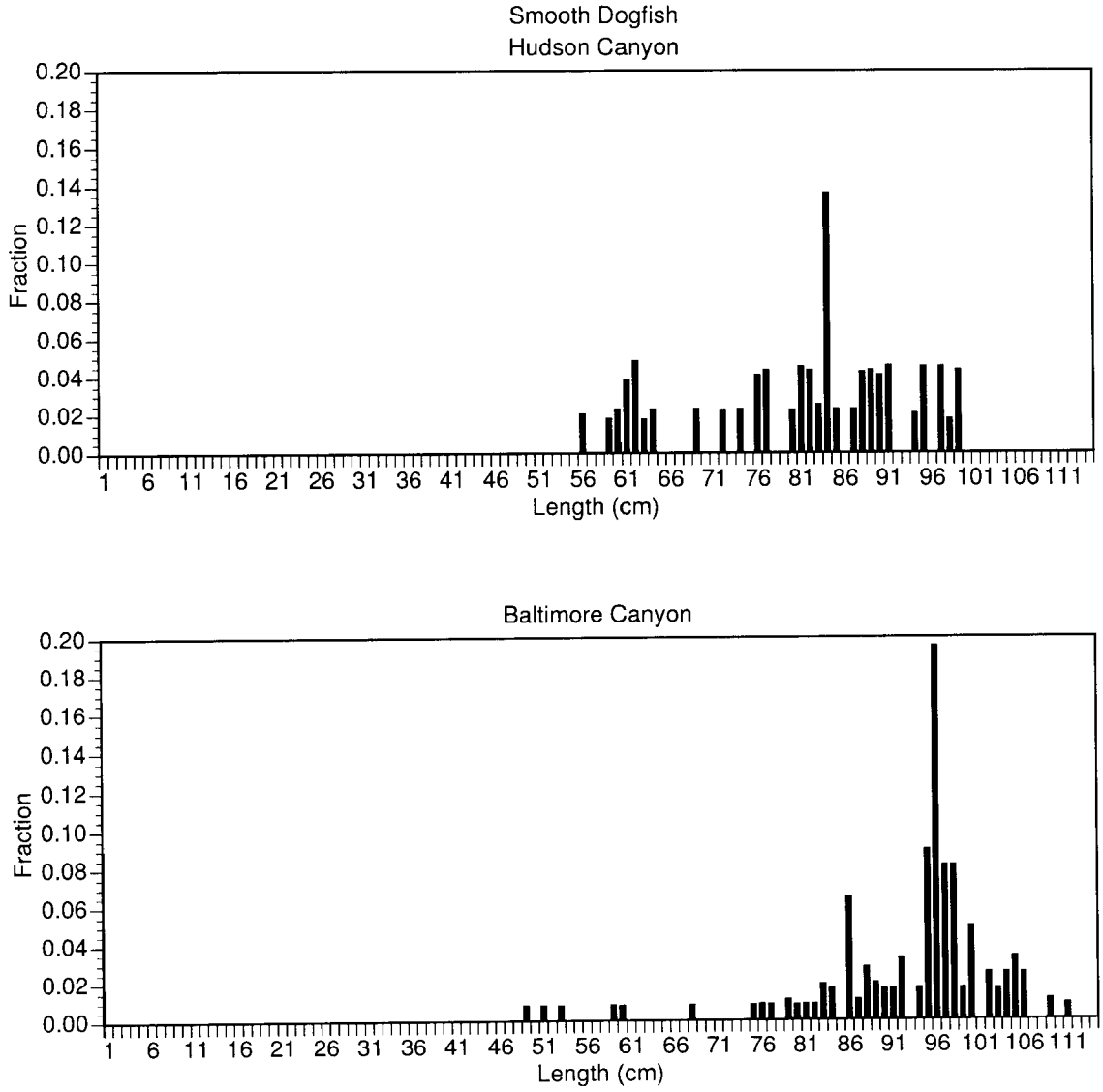
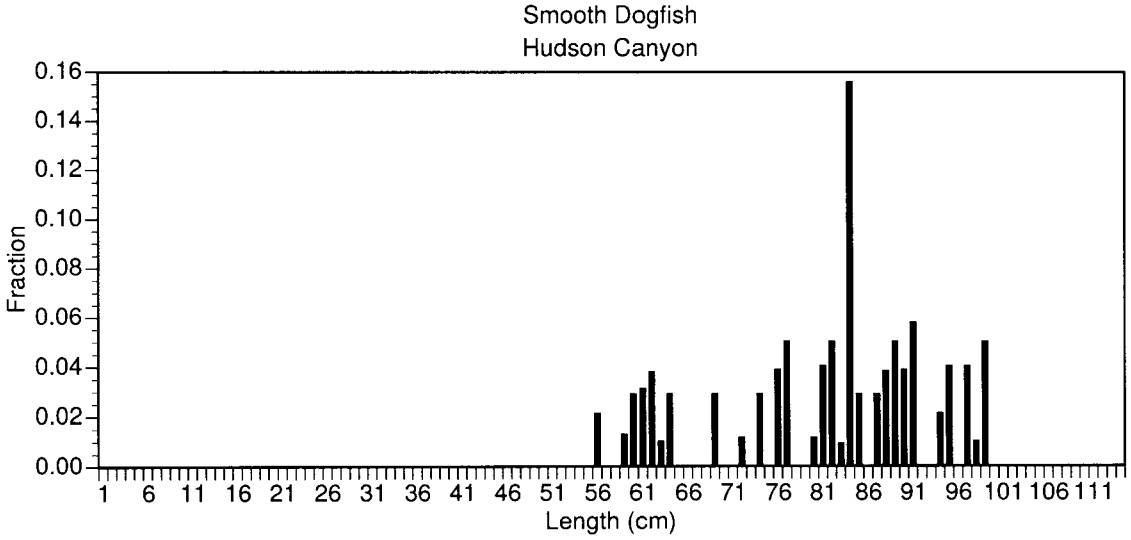


Figure 37b. Cumulative size-frequency distribution of smooth dogfish across all tows. Tow size frequencies were corrected to the number caught per size class per km^2 swept area. Tows were then normalized to swath distance along the transect and the abundances were summed across all tows for each transect.



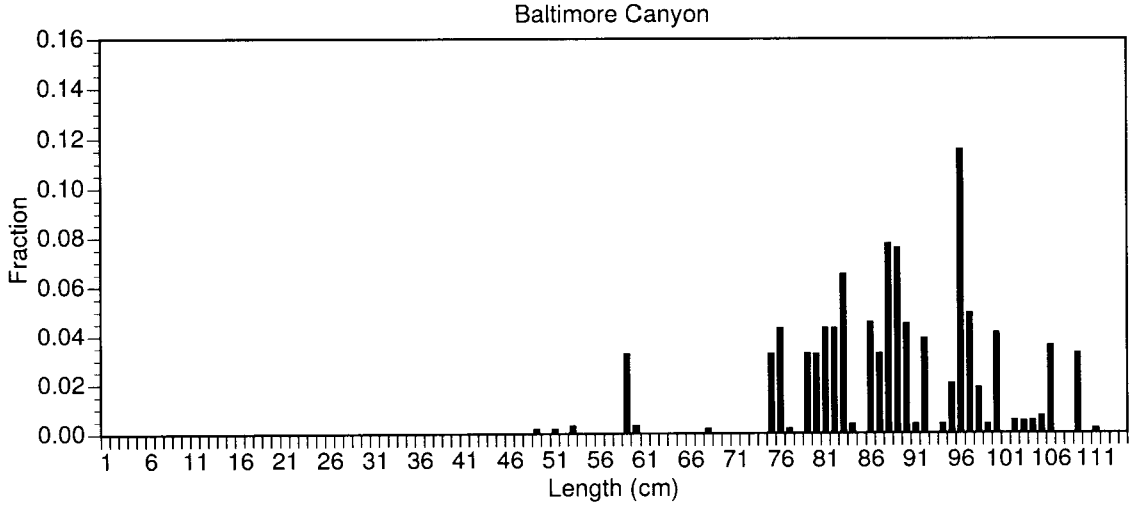
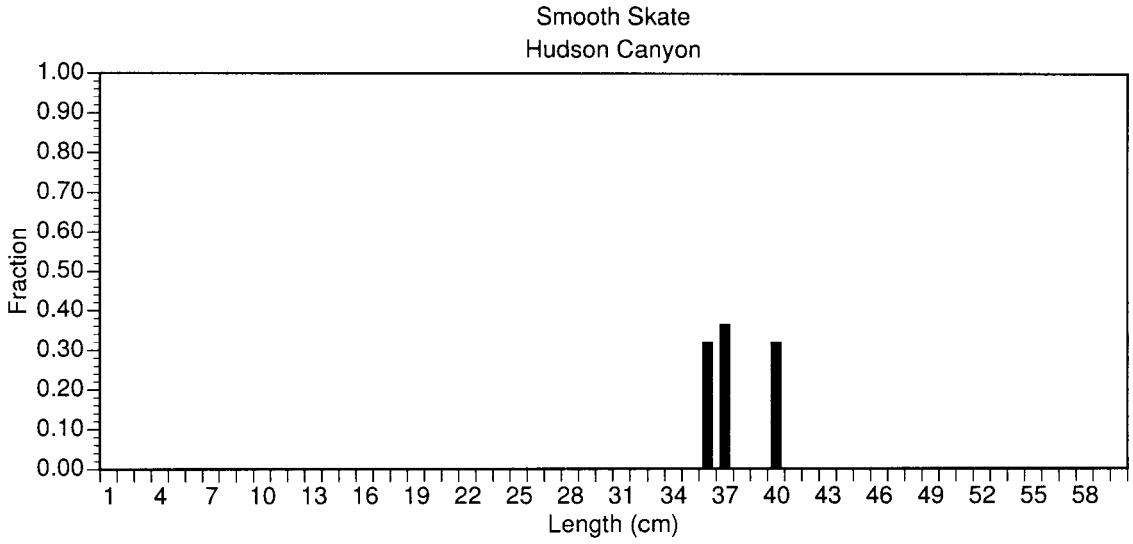


Figure 38a. Cumulative size-frequency distribution of smooth skate across all tows. Tow size frequencies were corrected to the number caught per size class per km^2 swept area. The swept area-normalized abundances were then summed across all tows for each transect.



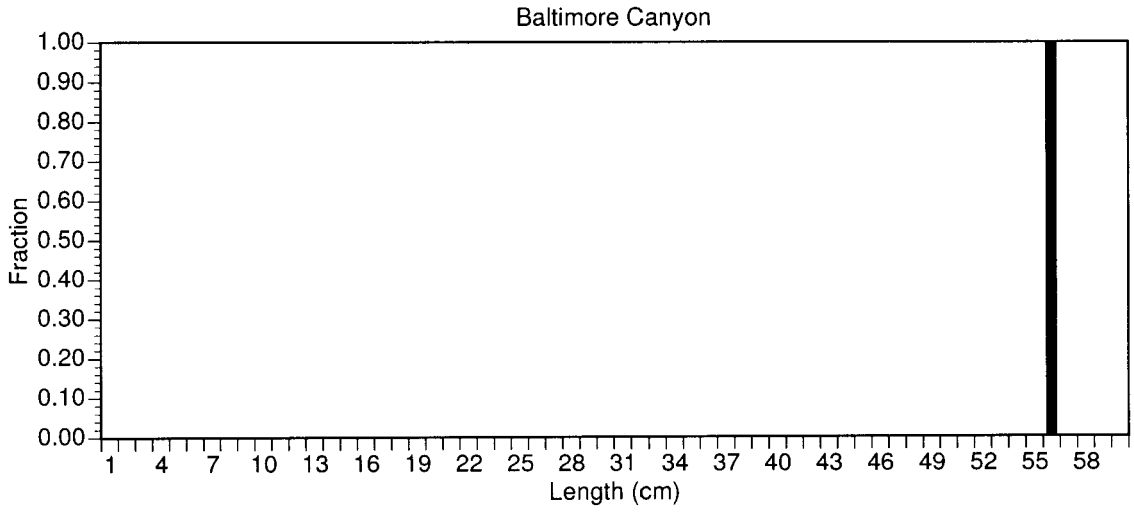
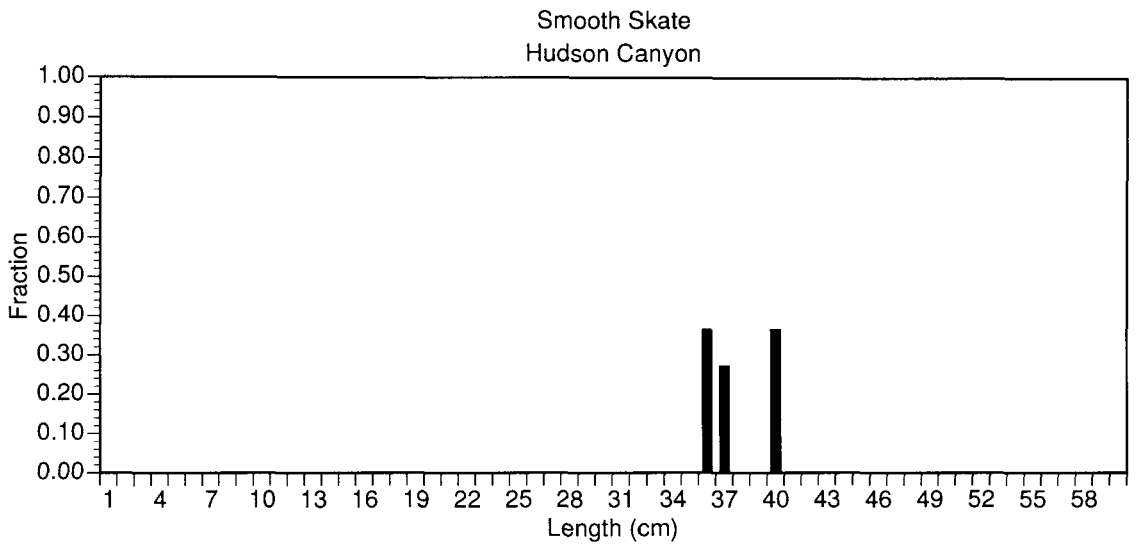


Figure 38b. Cumulative size-frequency distribution of smooth skate across all tows. Tow size frequencies were corrected to the number caught per size class per km^2 swept area. Tows were then normalized to swath distance along the transect and the abundances were summed across all tows for each transect.



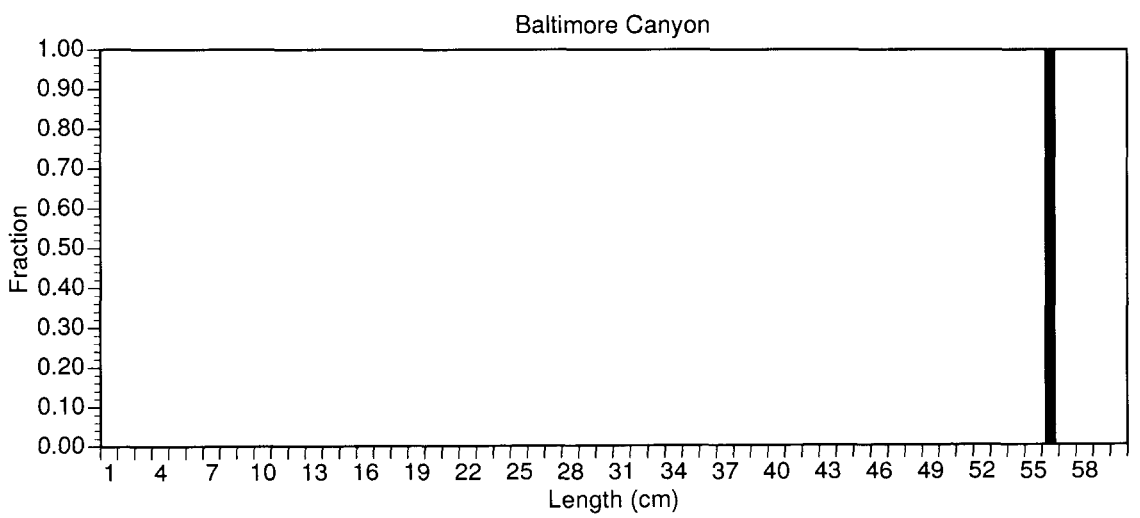
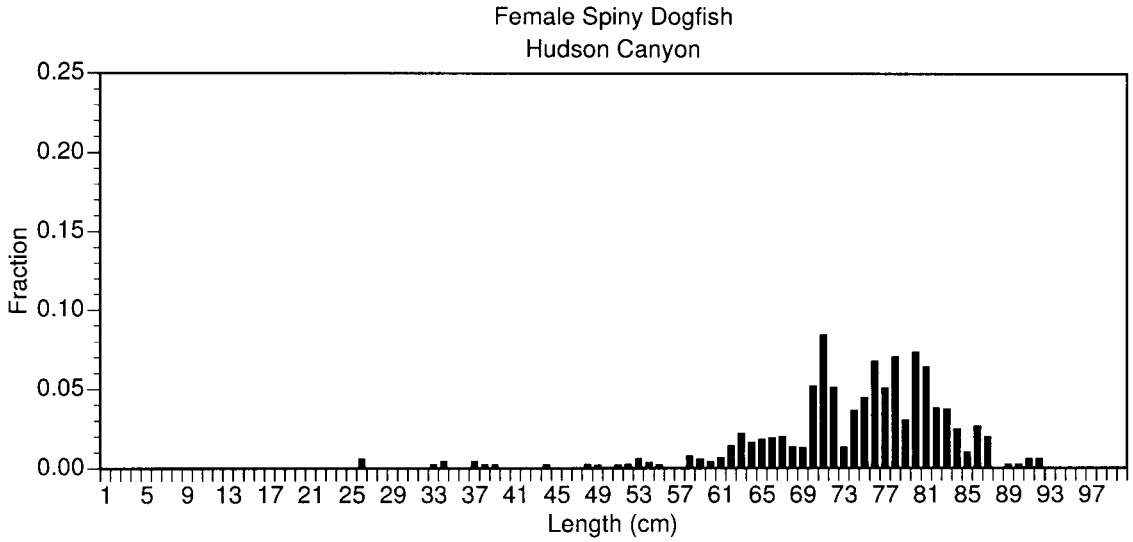


Figure 39a. Cumulative size-frequency distribution of female spiny dogfish across all tows. Tow size frequencies were corrected to the number caught per size class per km^2 swept area. The swept area-normalized abundances were then summed across all tows for each transect. Spiny dogfish <36 cm roughly corresponds to a pup less than one year old.



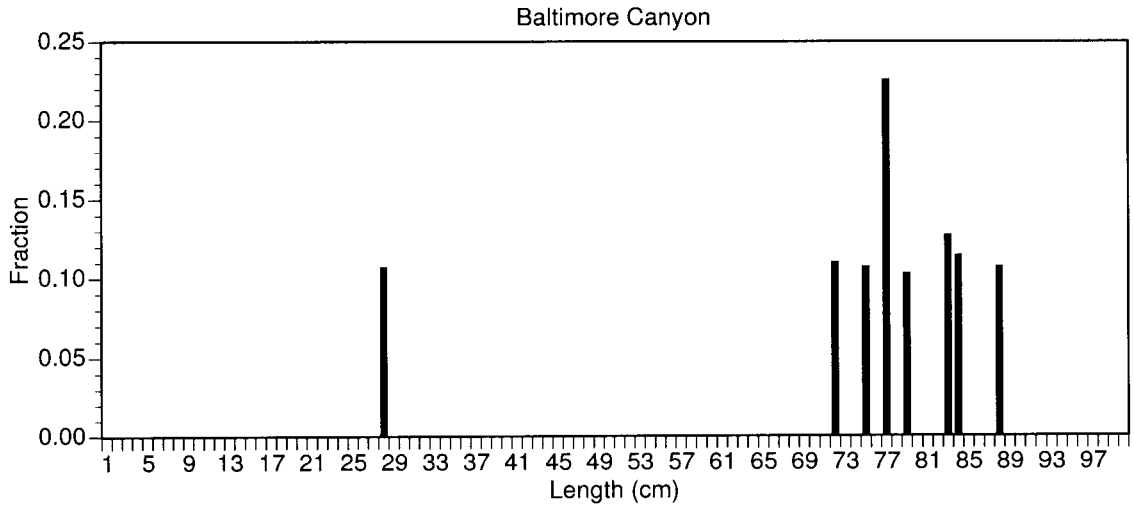


Figure 39b. Cumulative size-frequency distribution of female spiny dogfish across all tows. Tow size frequencies were corrected to the number caught per size class per km^2 swept area. Tows were then normalized to swath distance along the transect and the abundances were summed across all tows for each transect. Spiny dogfish <36 cm roughly corresponds to a pup less than one year old.

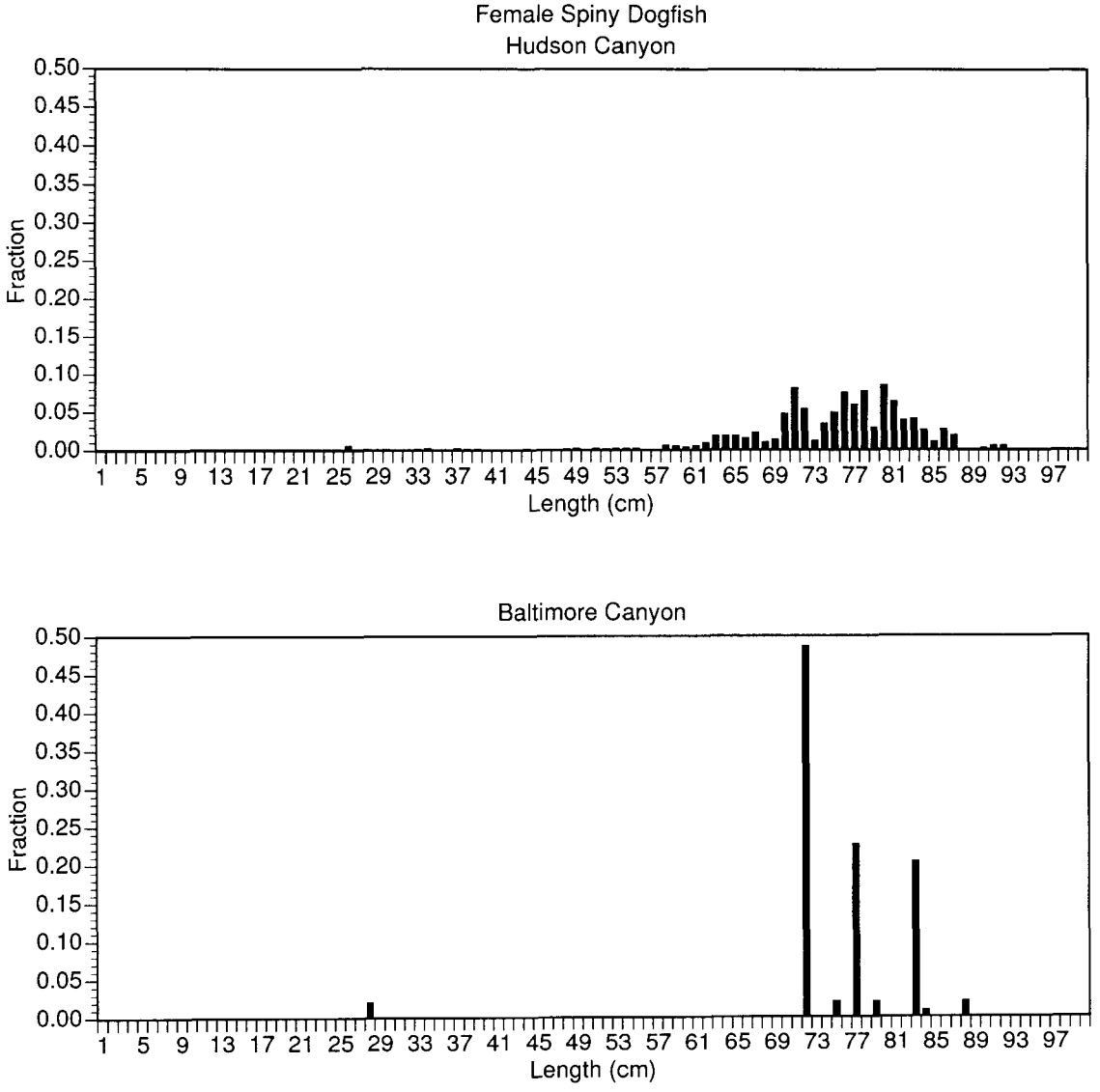


Figure 40a. Cumulative size-frequency distribution of male spiny dogfish across all tows. Tow size frequencies were corrected to the number caught per size class per km^2 swept area. The swept area-normalized abundances were then summed across all tows for each transect. Spiny dogfish <36 cm roughly corresponds to a pup less than one year old.

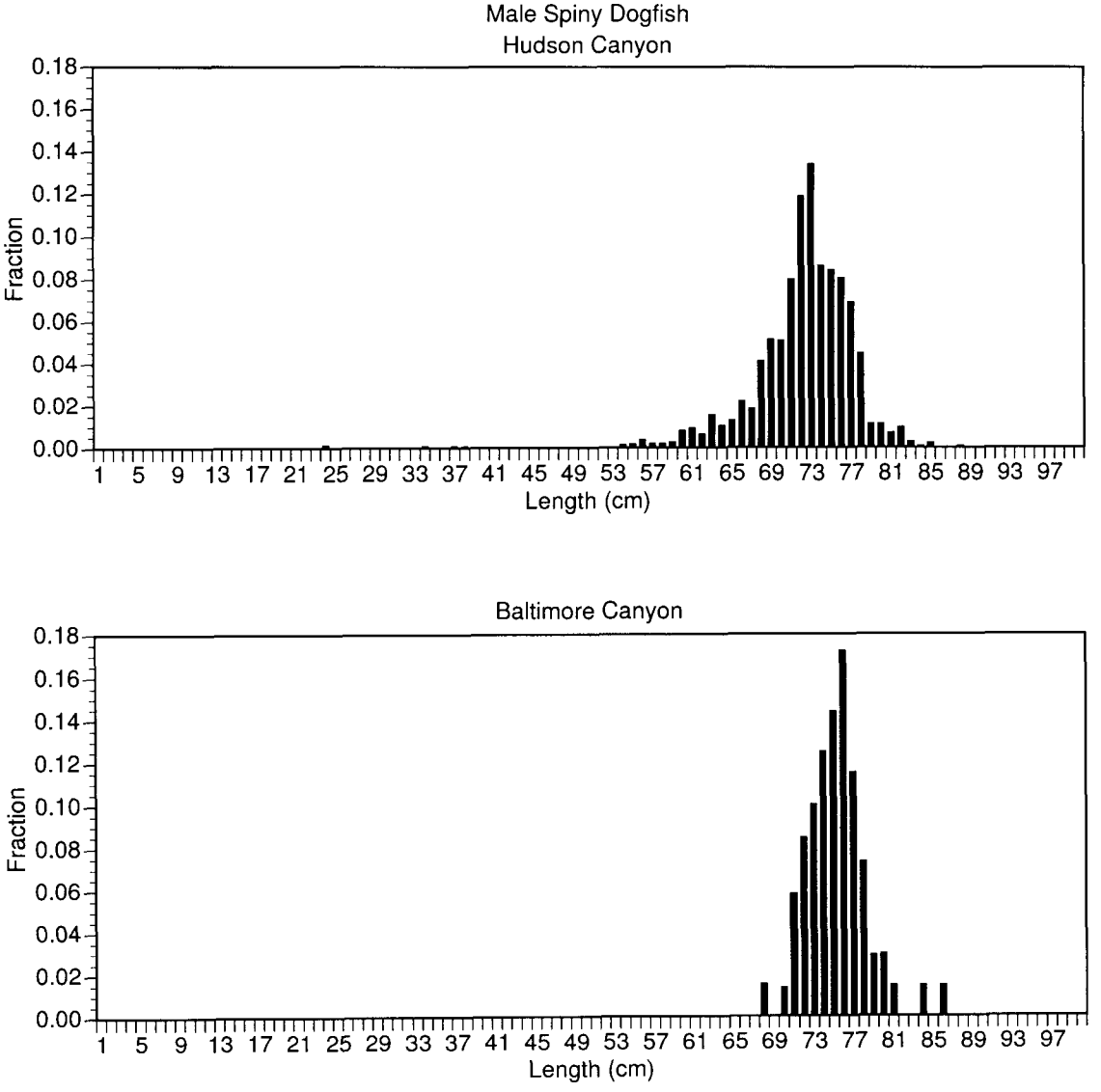
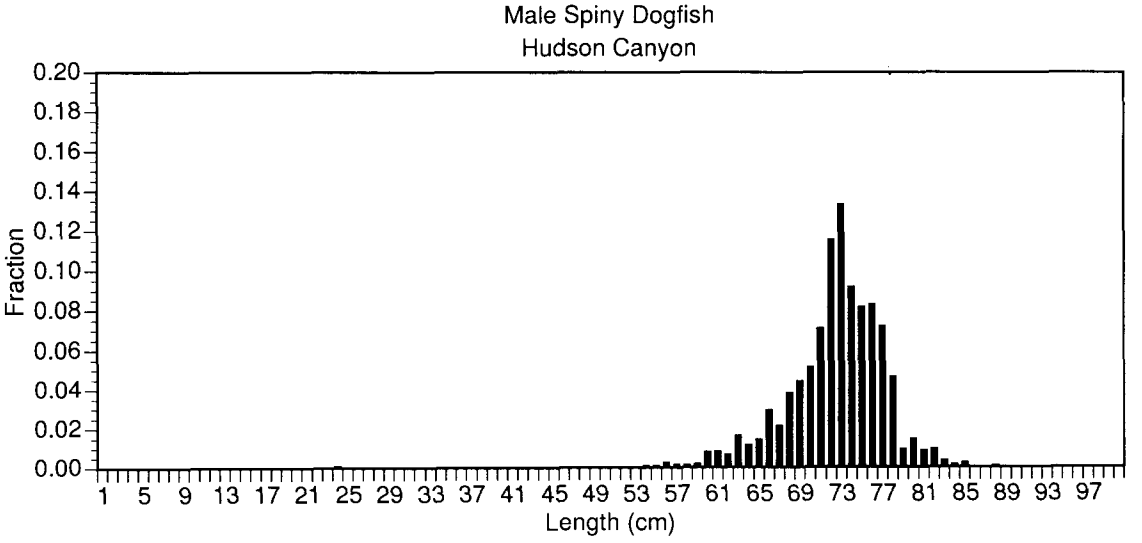


Figure 40b. Cumulative size-frequency distribution of male spiny dogfish across all tows. Tow size frequencies were corrected to the number caught per size class per km^2 swept area. Tows were then normalized to swath distance along the transect and the abundances were summed across all tows for each transect. Spiny dogfish <36 cm roughly corresponds to a pup less than one year old.



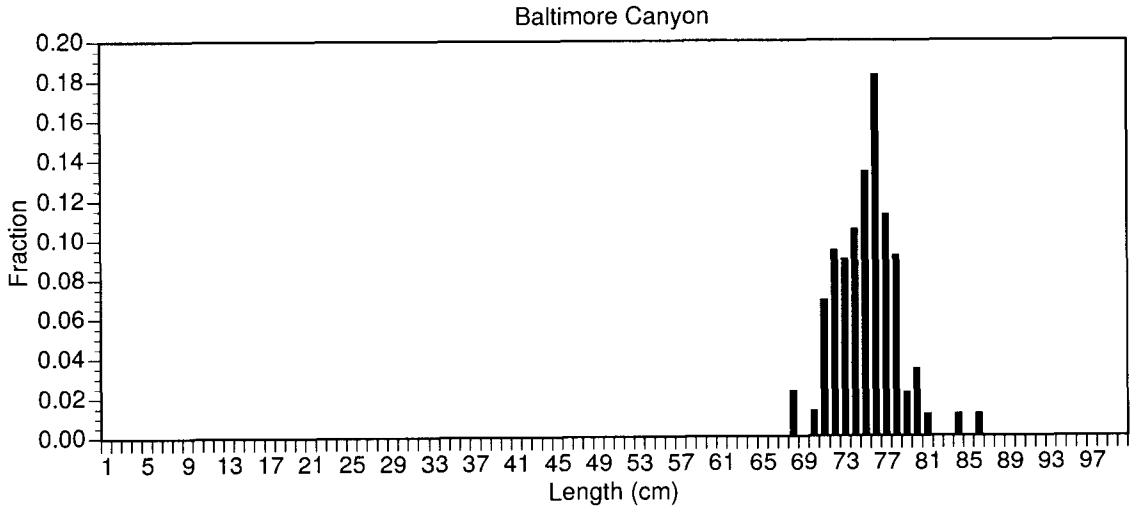
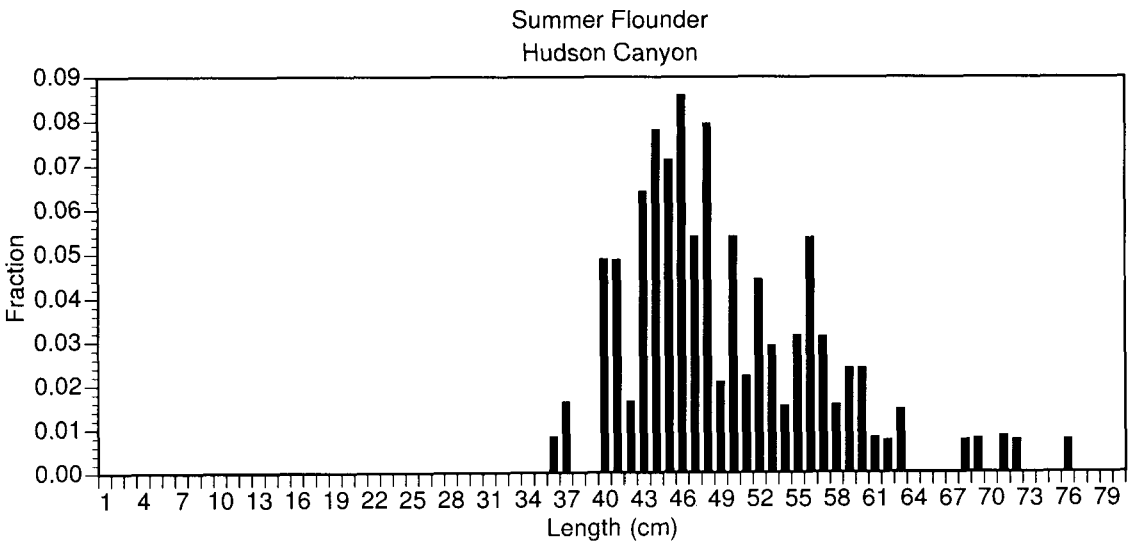


Figure 41a. Cumulative size-frequency distribution of summer flounder across all tows. Tow size frequencies were corrected to the number caught per size class per km^2 swept area. The swept area-normalized abundances were then summed across all tows for each transect.



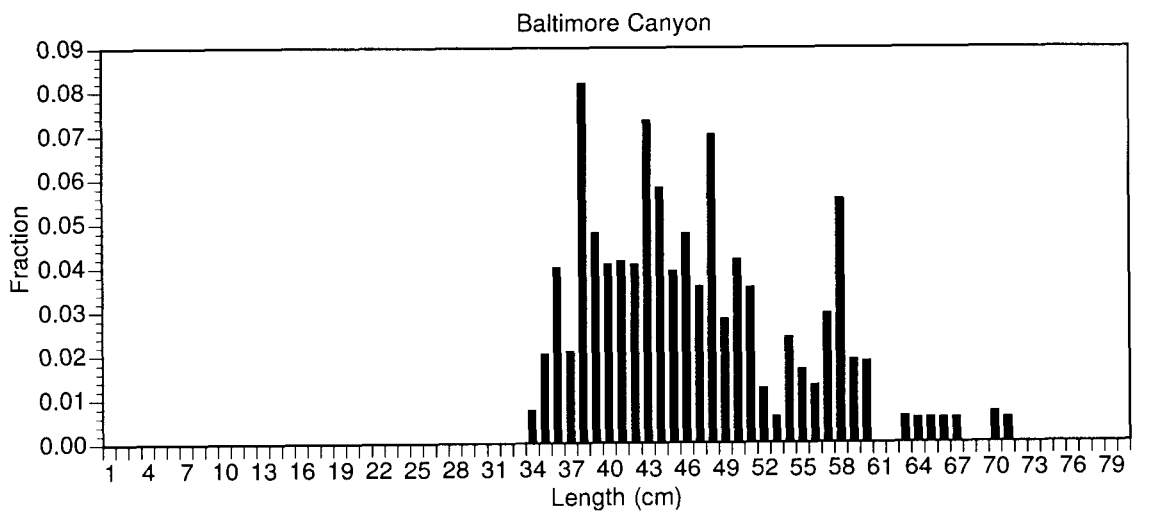
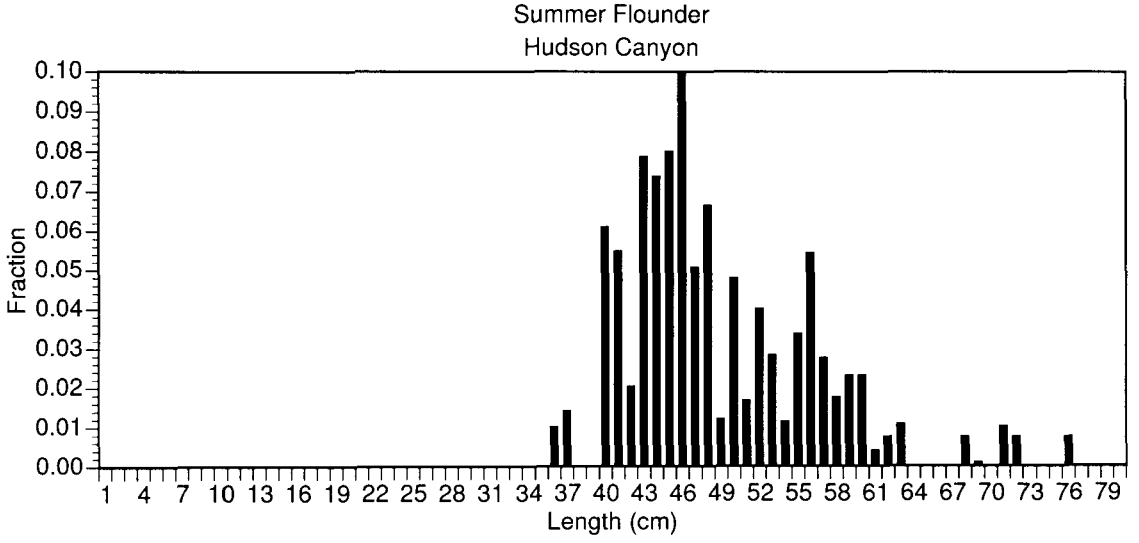


Figure 41b. Cumulative size-frequency distribution of summer flounder across all tows. Tow size frequencies were corrected to the number caught per size class per km^2 swept area. Tows were then normalized to swath distance along the transect and the abundances were summed across all tows for each transect.



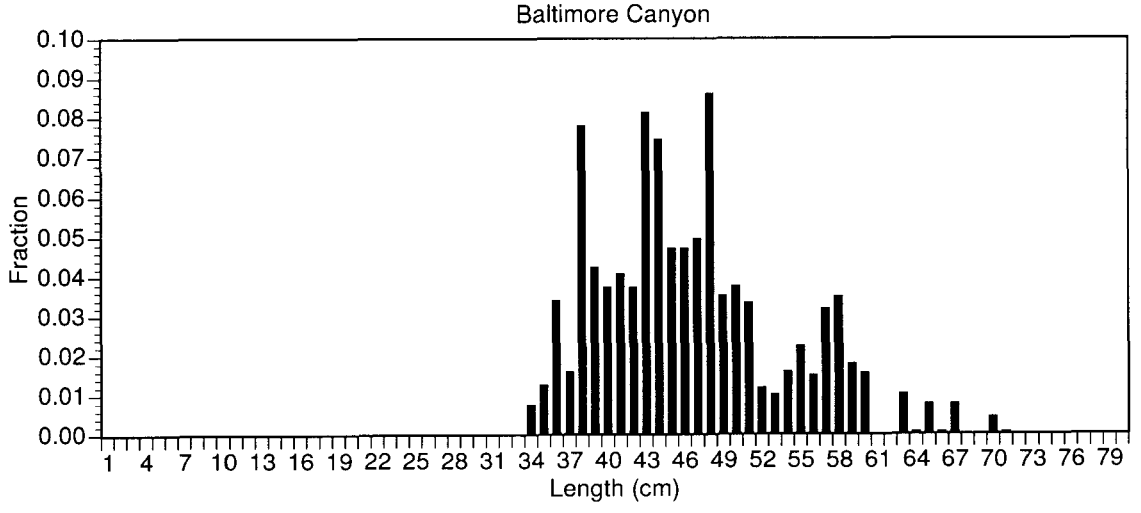
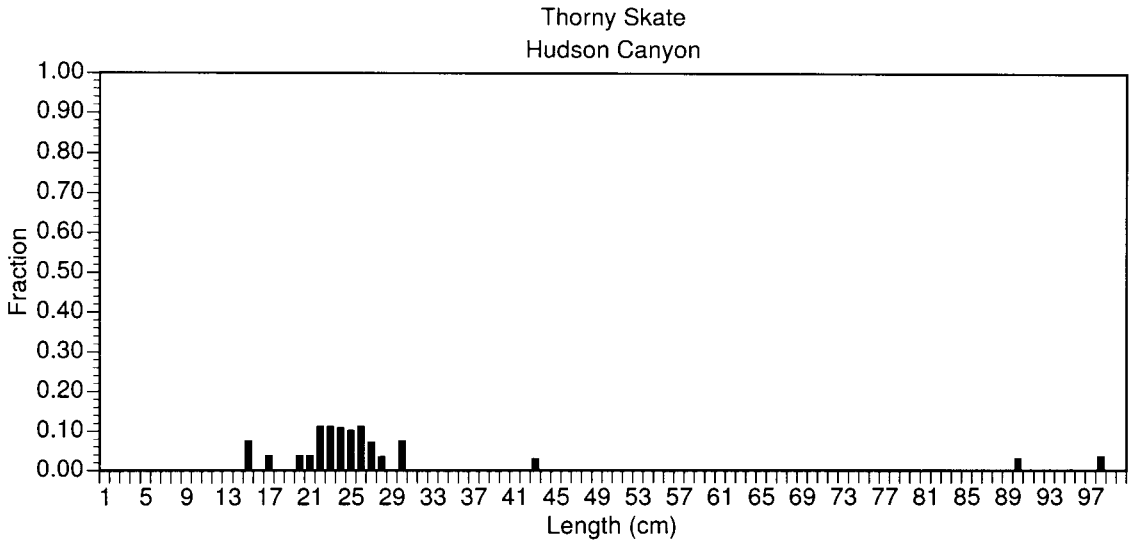


Figure 42a. Cumulative size-frequency distribution of thorny skate across all tows. Tow size frequencies were corrected to the number caught per size class per km^2 swept area. The swept area-normalized abundances were then summed across all tows for each transect.



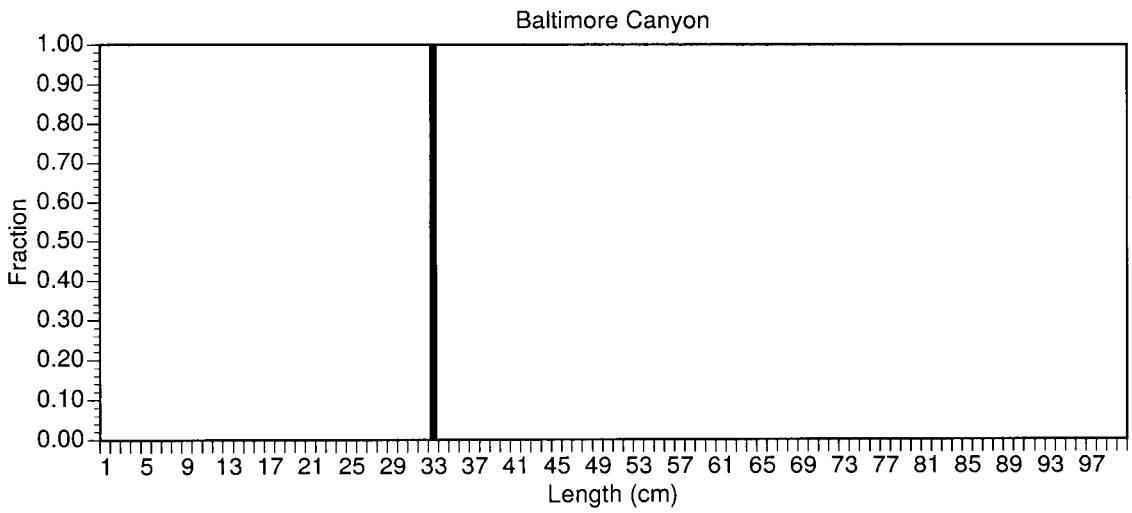
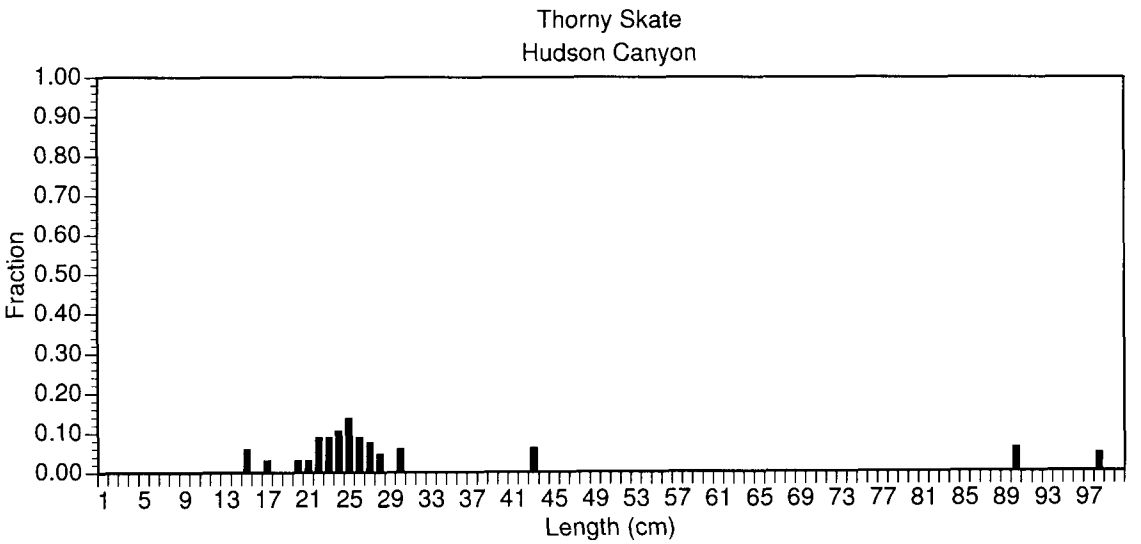


Figure 42b. Cumulative size-frequency distribution of thorny skate across all tows. Tow size frequencies were corrected to the number caught per size class per km^2 swept area. Tows were then normalized to swath distance along the transect and the abundances were summed across all tows for each transect.



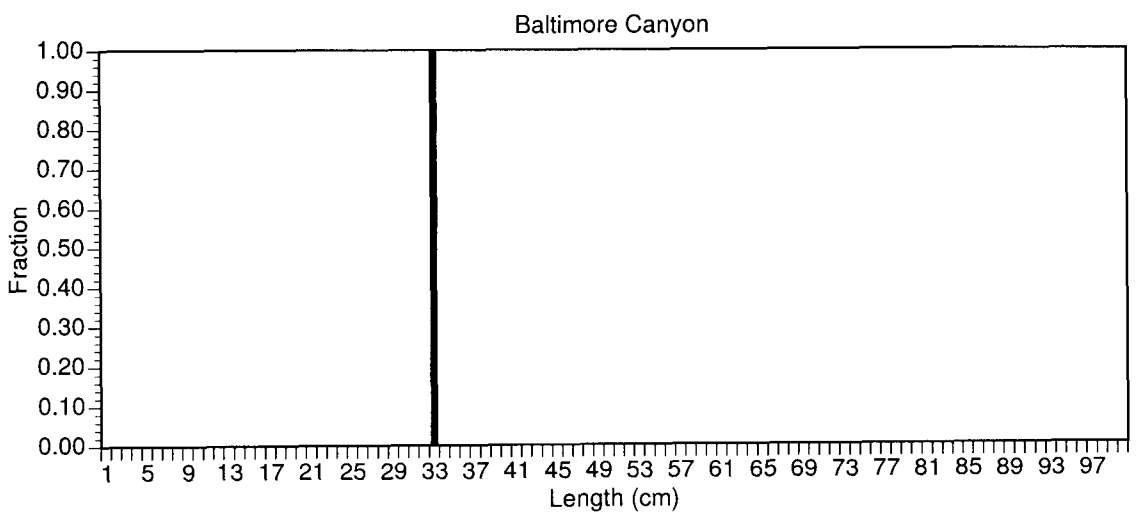
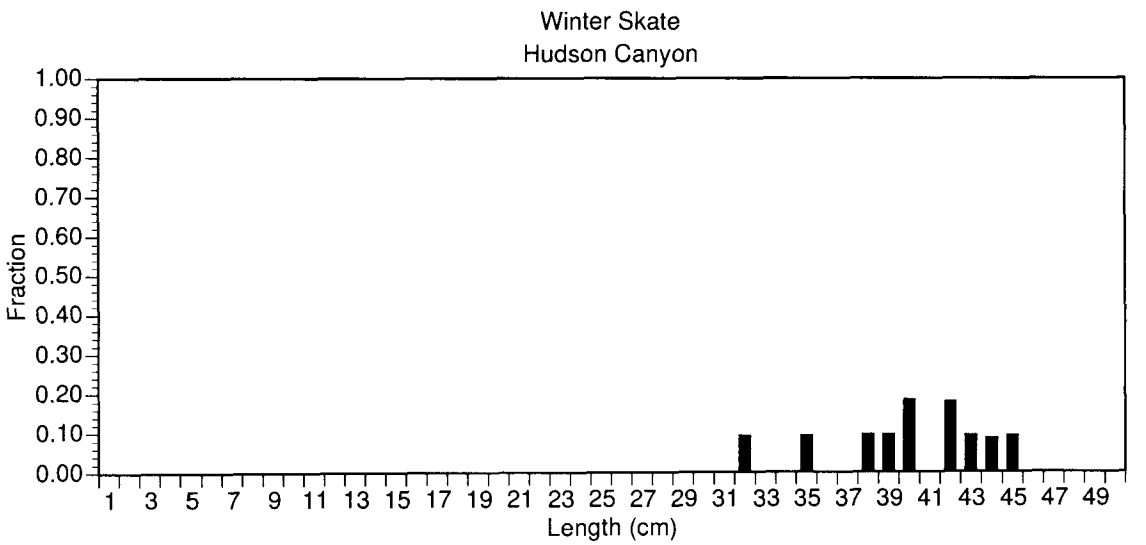


Figure 43a. Cumulative size-frequency distribution of winter skate across all tows. Tow size frequencies were corrected to the number caught per size class per km^2 swept area. The swept area-normalized abundances were then summed across all tows for each transect.



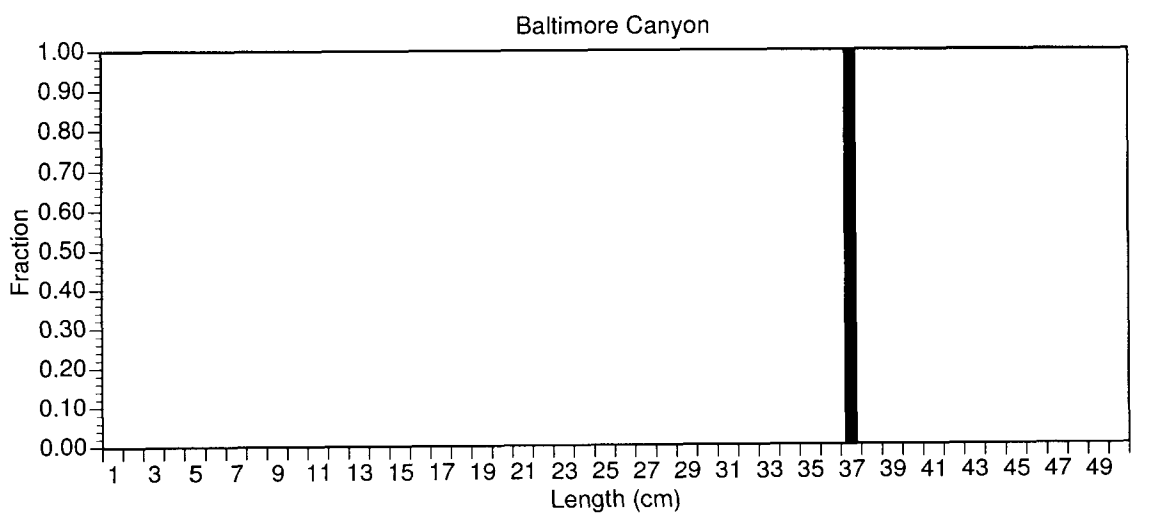
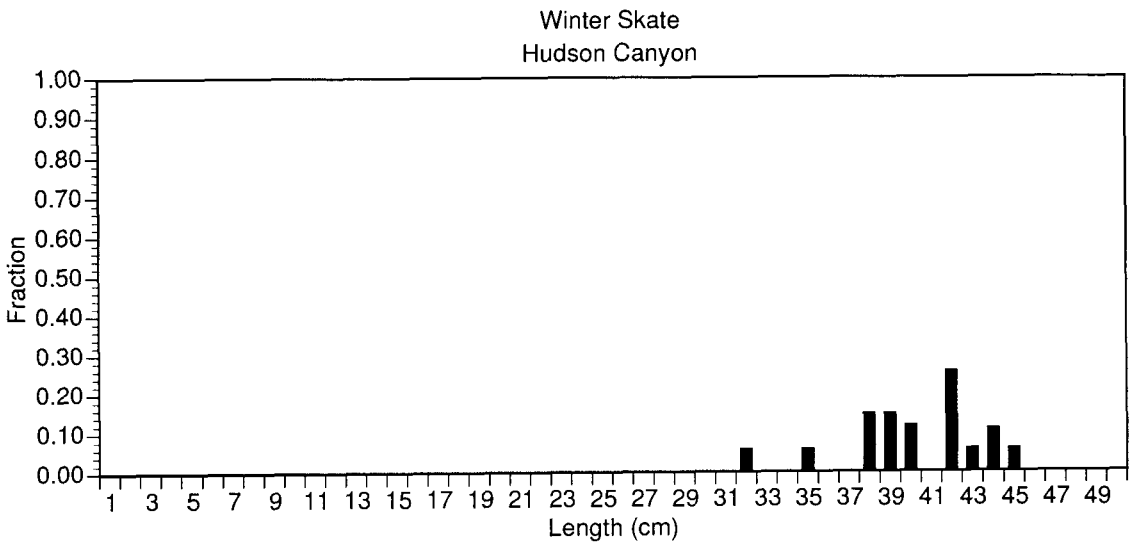


Figure 43b. Cumulative size-frequency distribution of winter skate across all tows. Tow size frequencies were corrected to the number caught per size class per km^2 swept area. Tows were then normalized to swath distance along the transect and the abundances were summed across all tows for each transect.



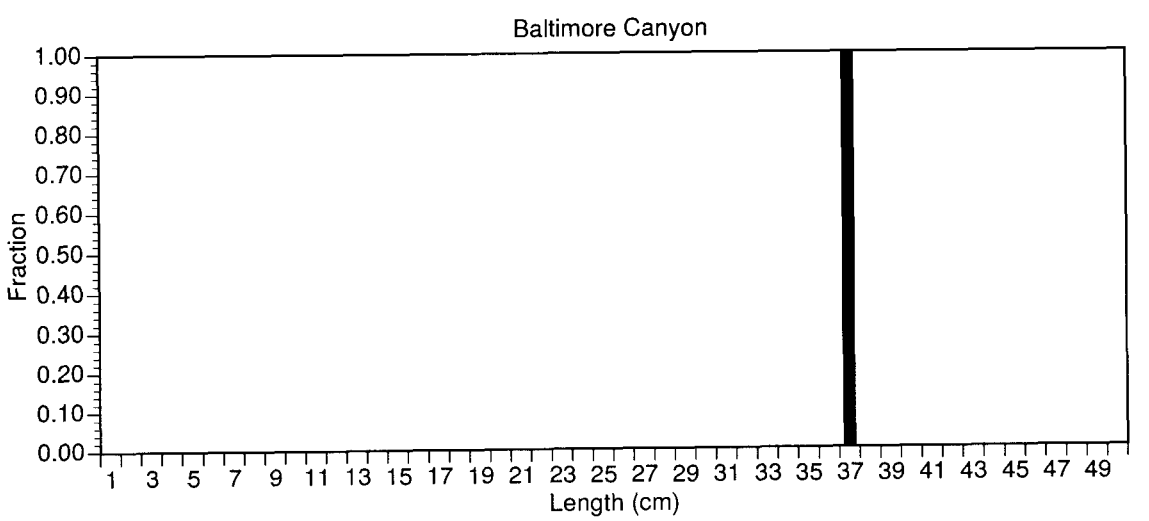


Figure 44. Cumulative size frequency, by tow, for bluefish, for tows with ≥ 20 measured individuals.

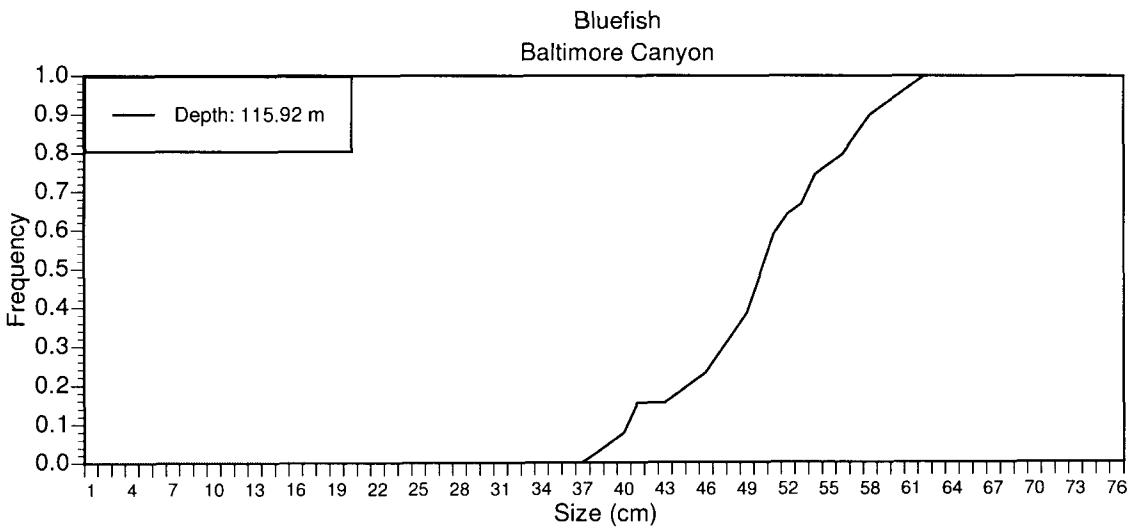


Figure 45. Cumulative size frequency, by tow, for *Illex* squid, for tows with ≥ 20 measured individuals.

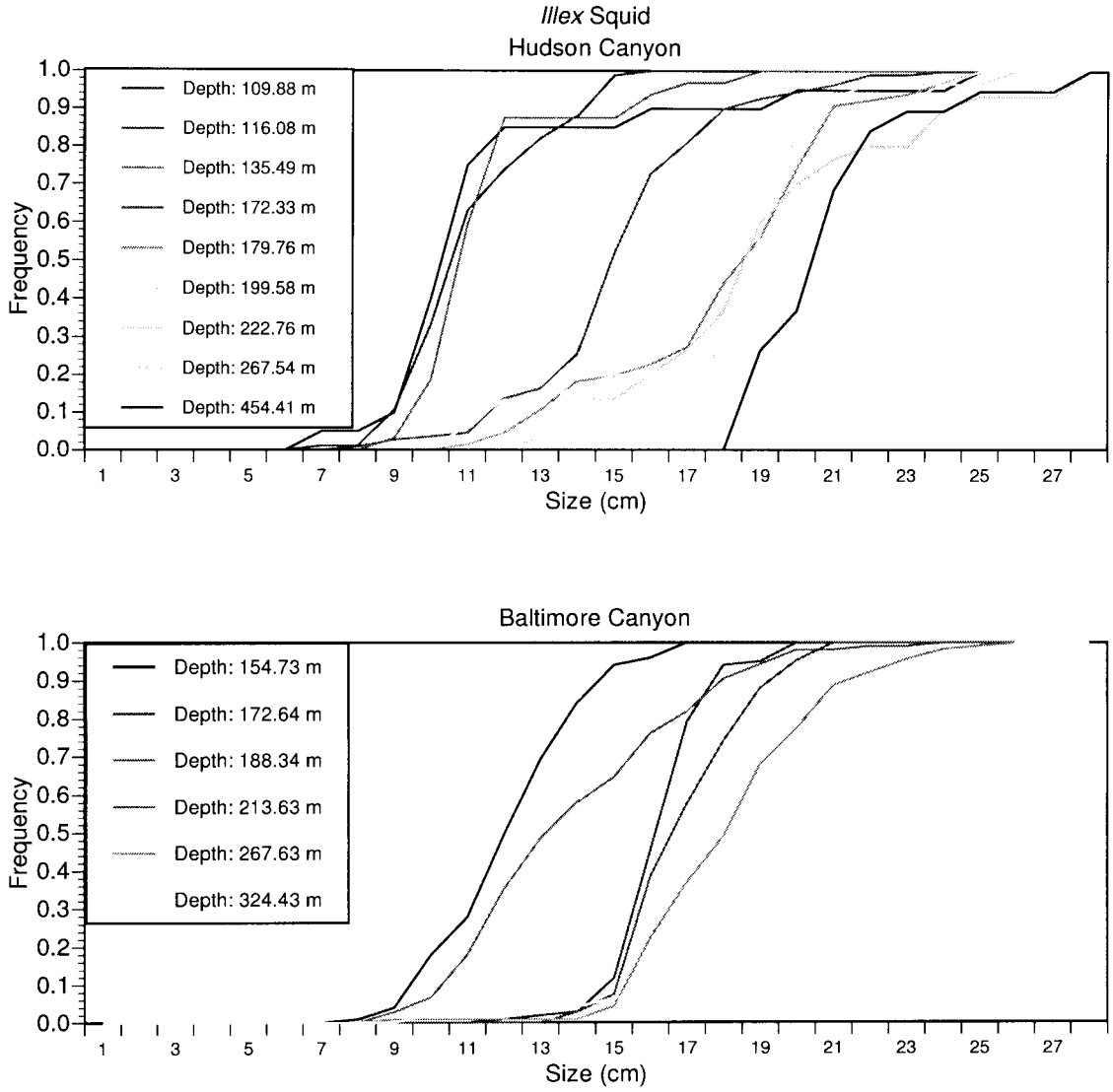
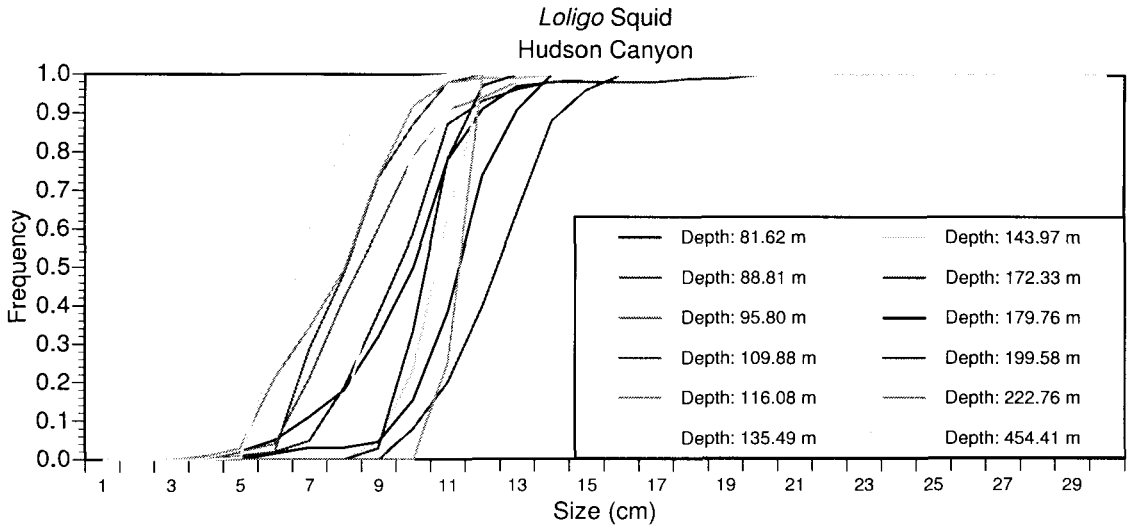


Figure 46. Cumulative size frequency, by tow, for *Loligo* squid, for tows with ≥ 20 measured individuals.



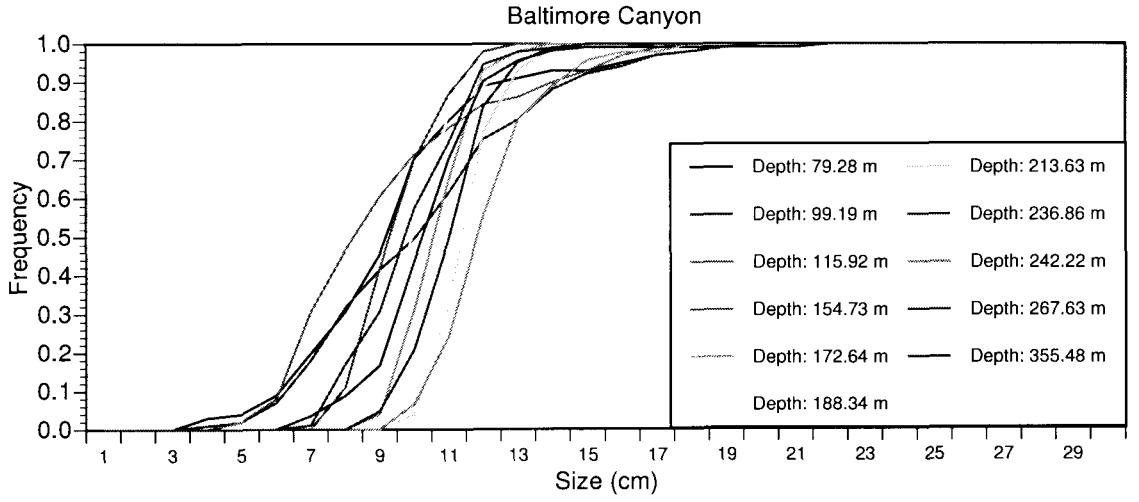


Figure 47. Cumulative size frequency, by tow, for monkfish, for tows with ≥ 20 measured individuals.

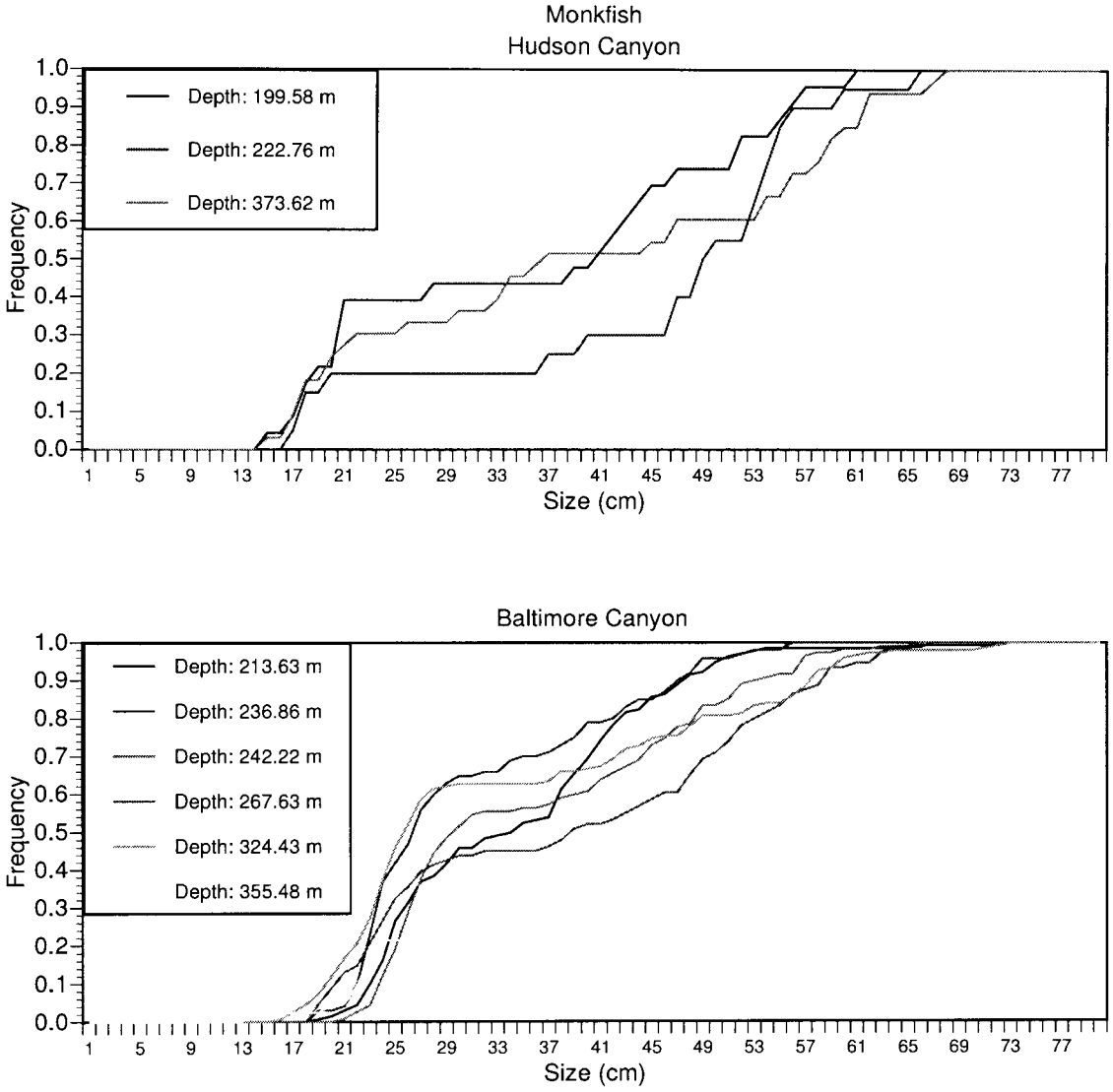


Figure 48. Cumulative size frequency, by tow, for offshore hake, for tows with ≥ 20 measured individuals.

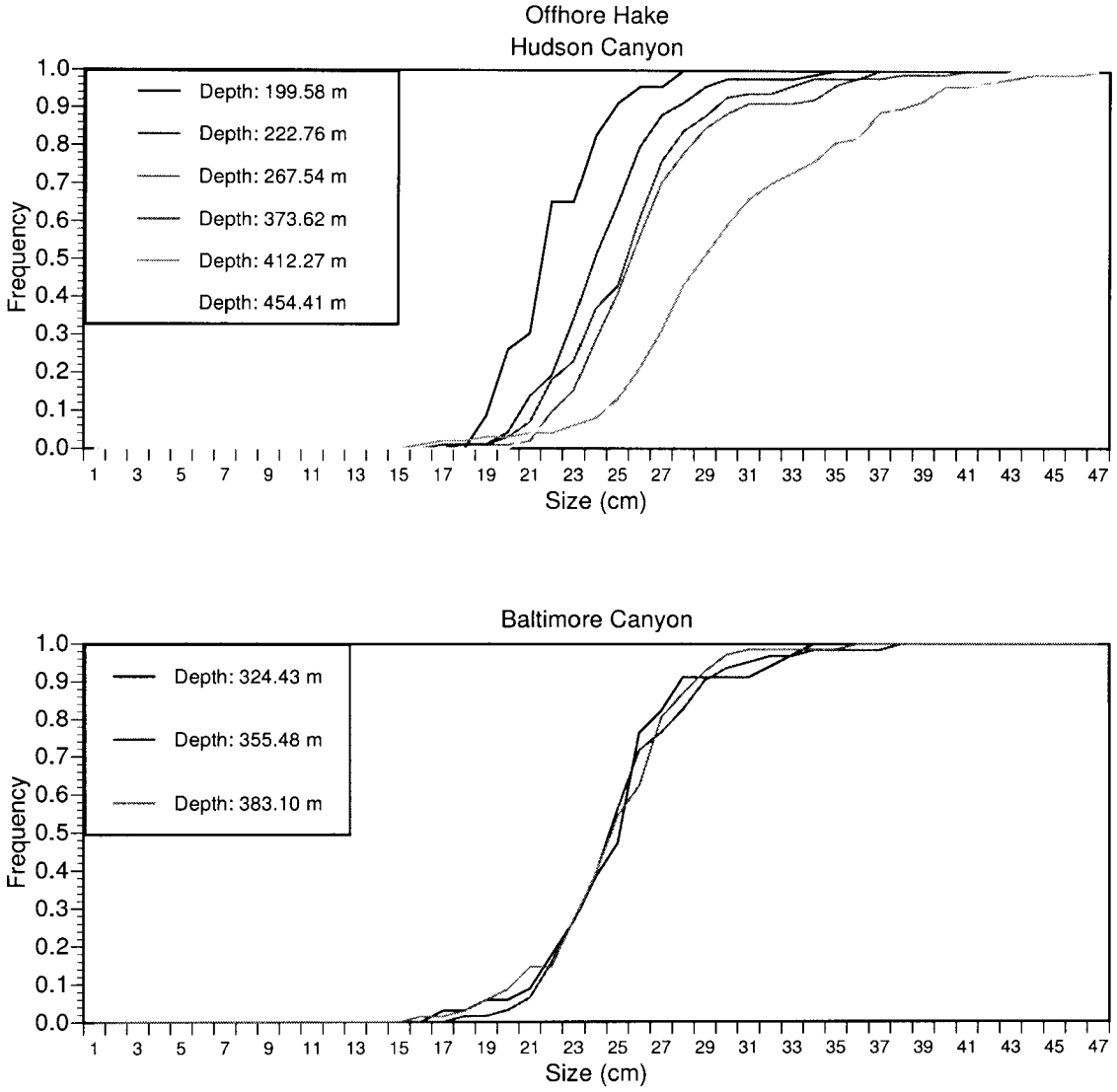


Figure 49. Cumulative size frequency, by tow, for rosette skate, for tows with ≥ 20 measured individuals.

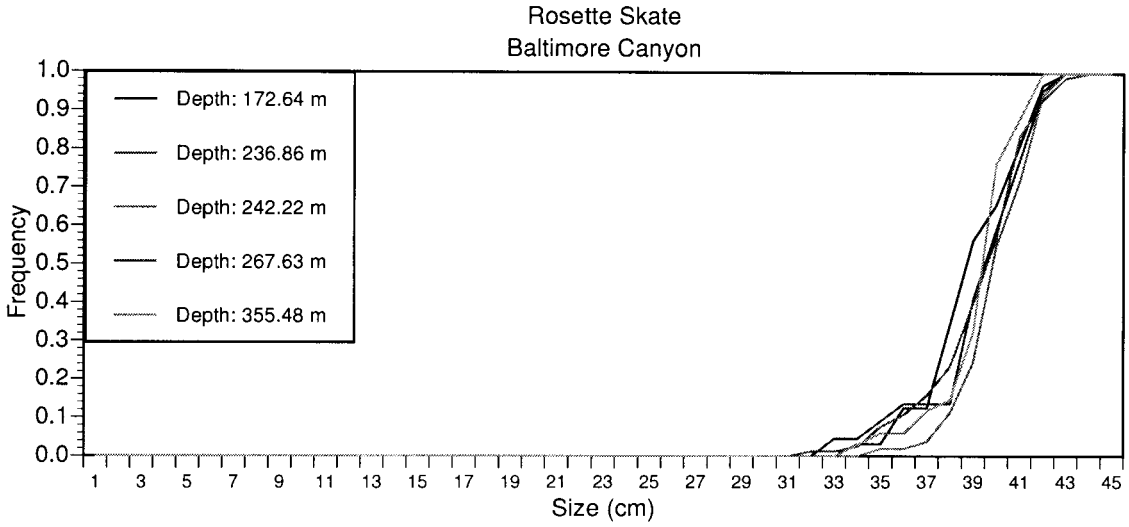


Figure 50. Cumulative size frequency, by tow, for scup, for tows with ≥ 20 measured individuals.

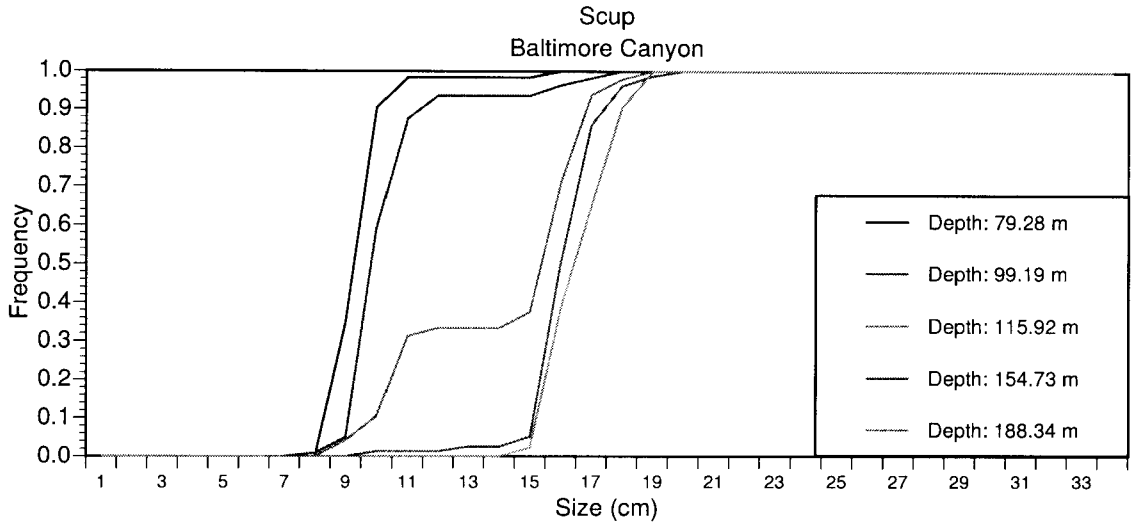


Figure 51. Cumulative size frequency, by tow, for silver hake, for tows with ≥ 20 measured individuals.

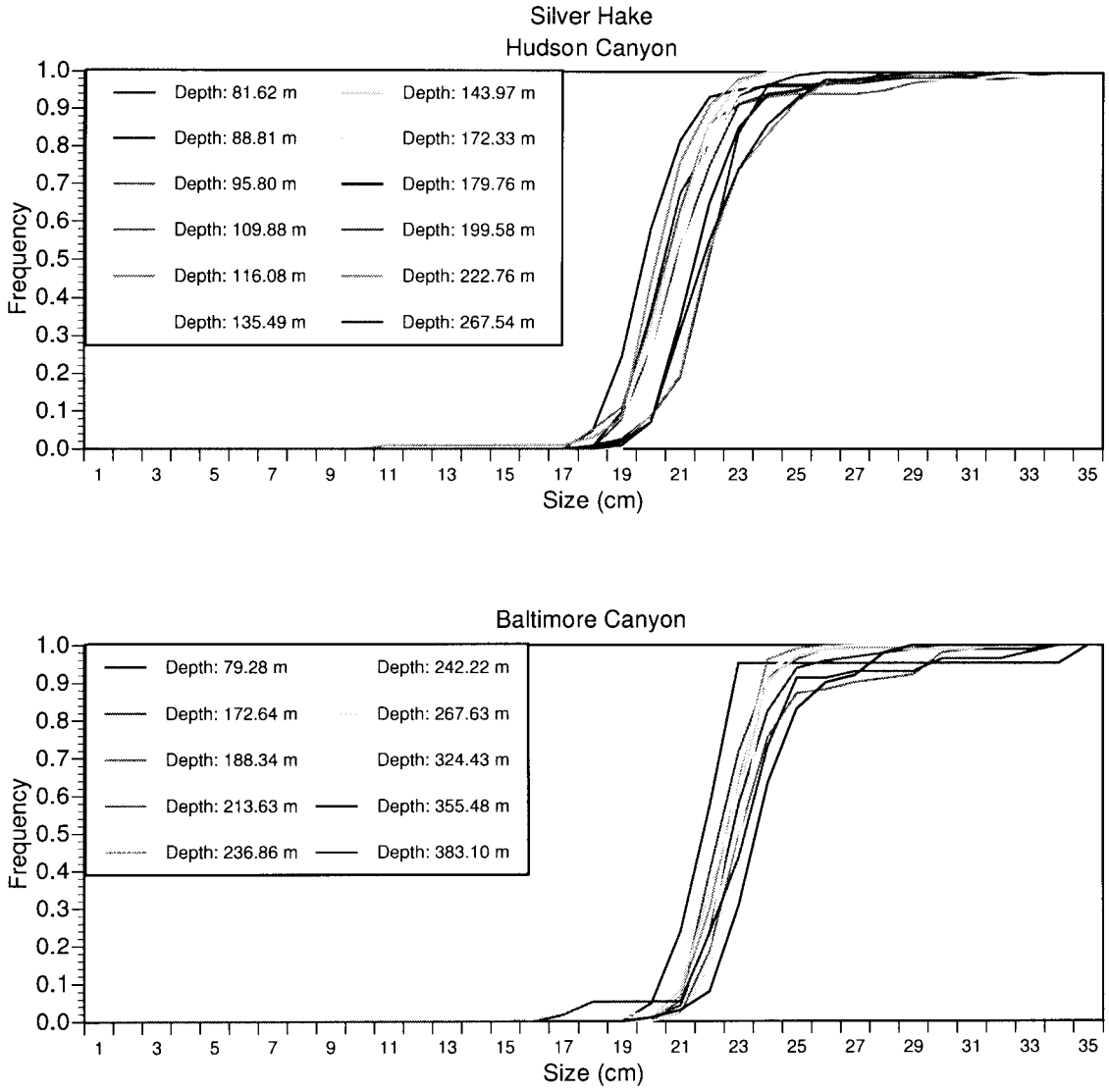


Figure 52. Cumulative size frequency, by tow, for smooth dogfish, for tows with ≥ 20 measured individuals.

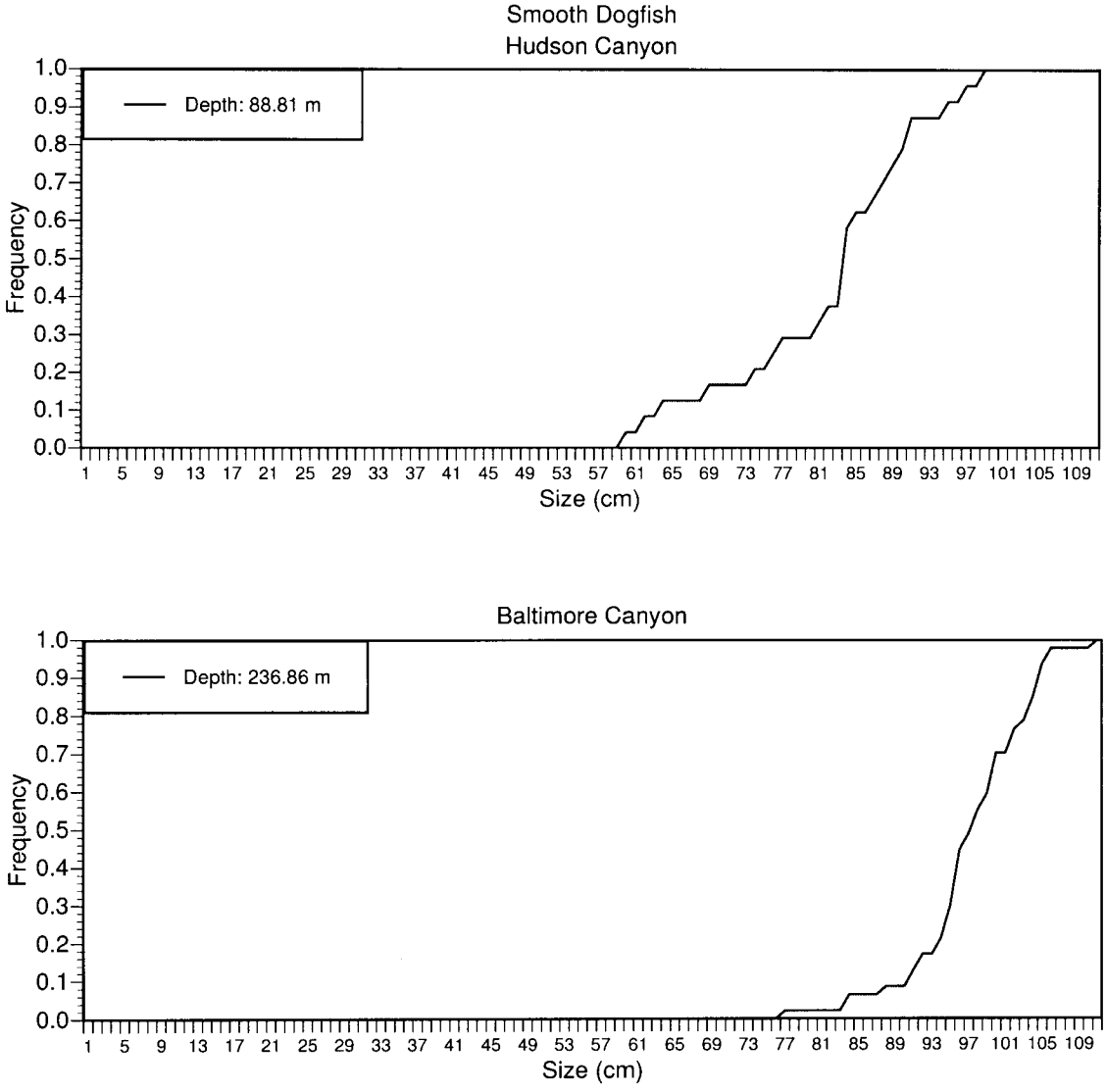


Figure 53. Cumulative size frequency, by tow, for female spiny dogfish, for tows with ≥ 20 measured individuals.

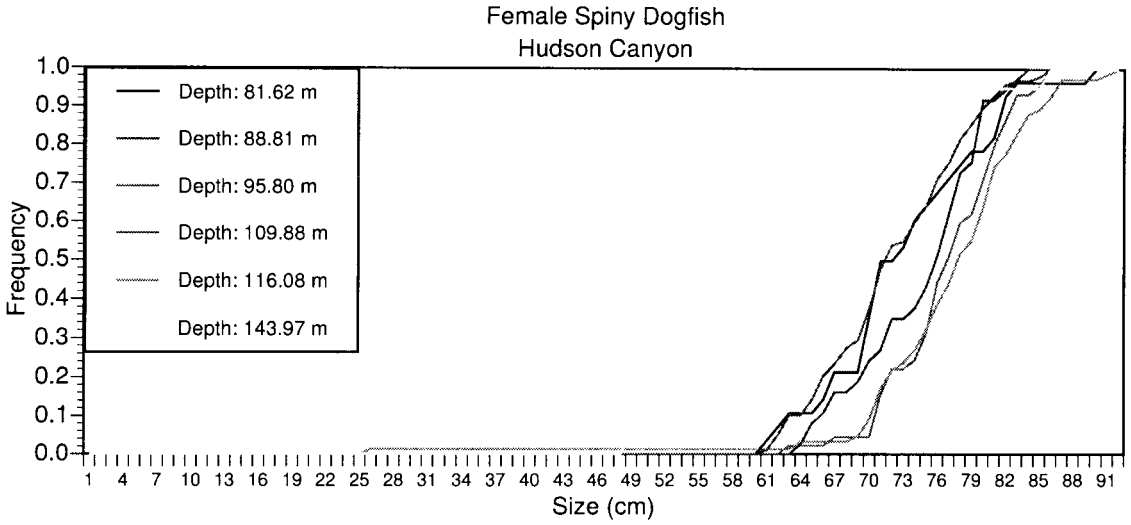
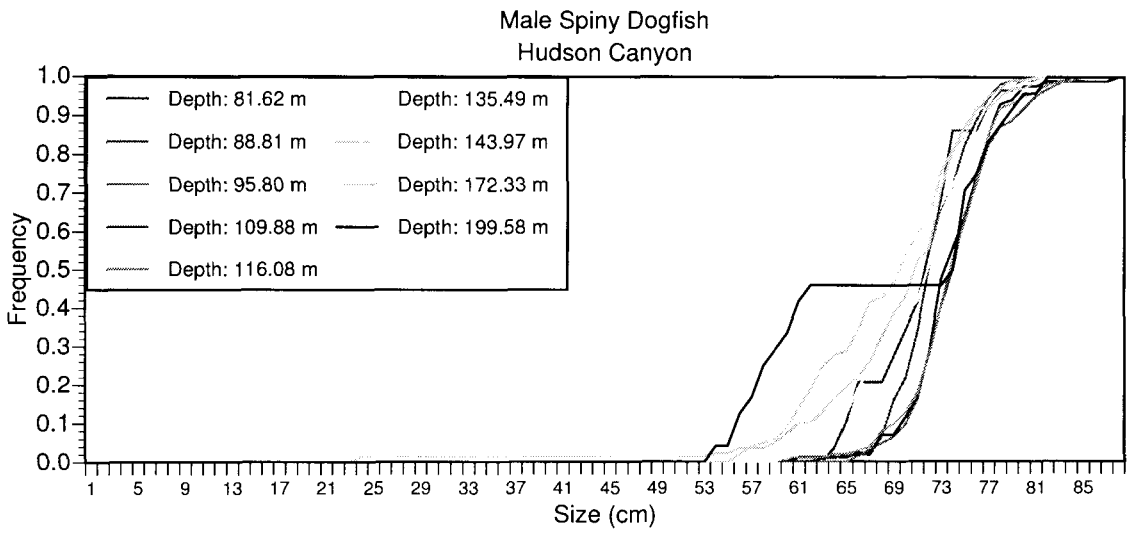


Figure 54. Cumulative size frequency, by tow, for male spiny dogfish, for tows with ≥ 20 measured individuals.



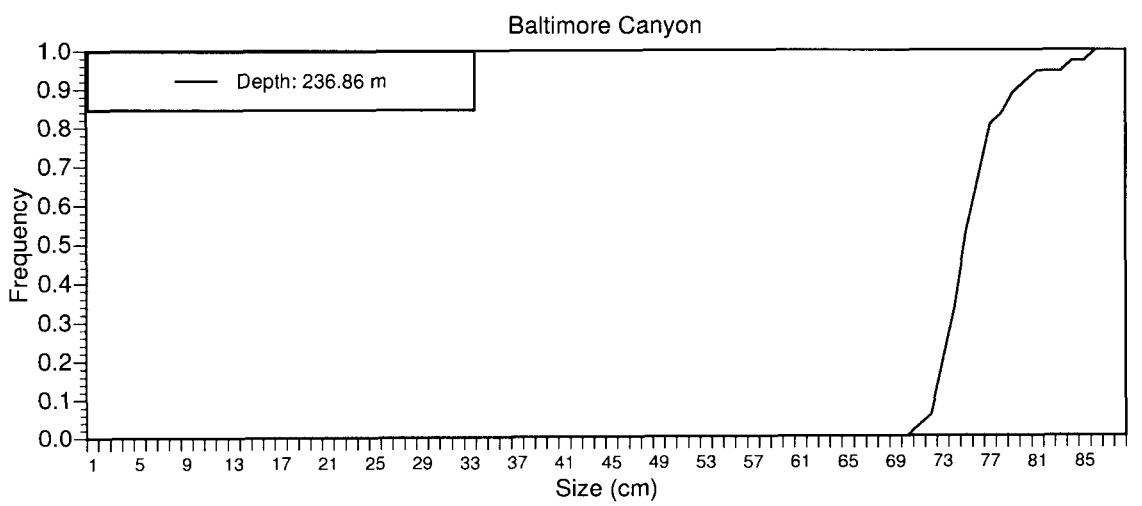


Figure 55. Cumulative size frequency, by tow, for summer flounder, for tows with ≥ 20 measured individuals.

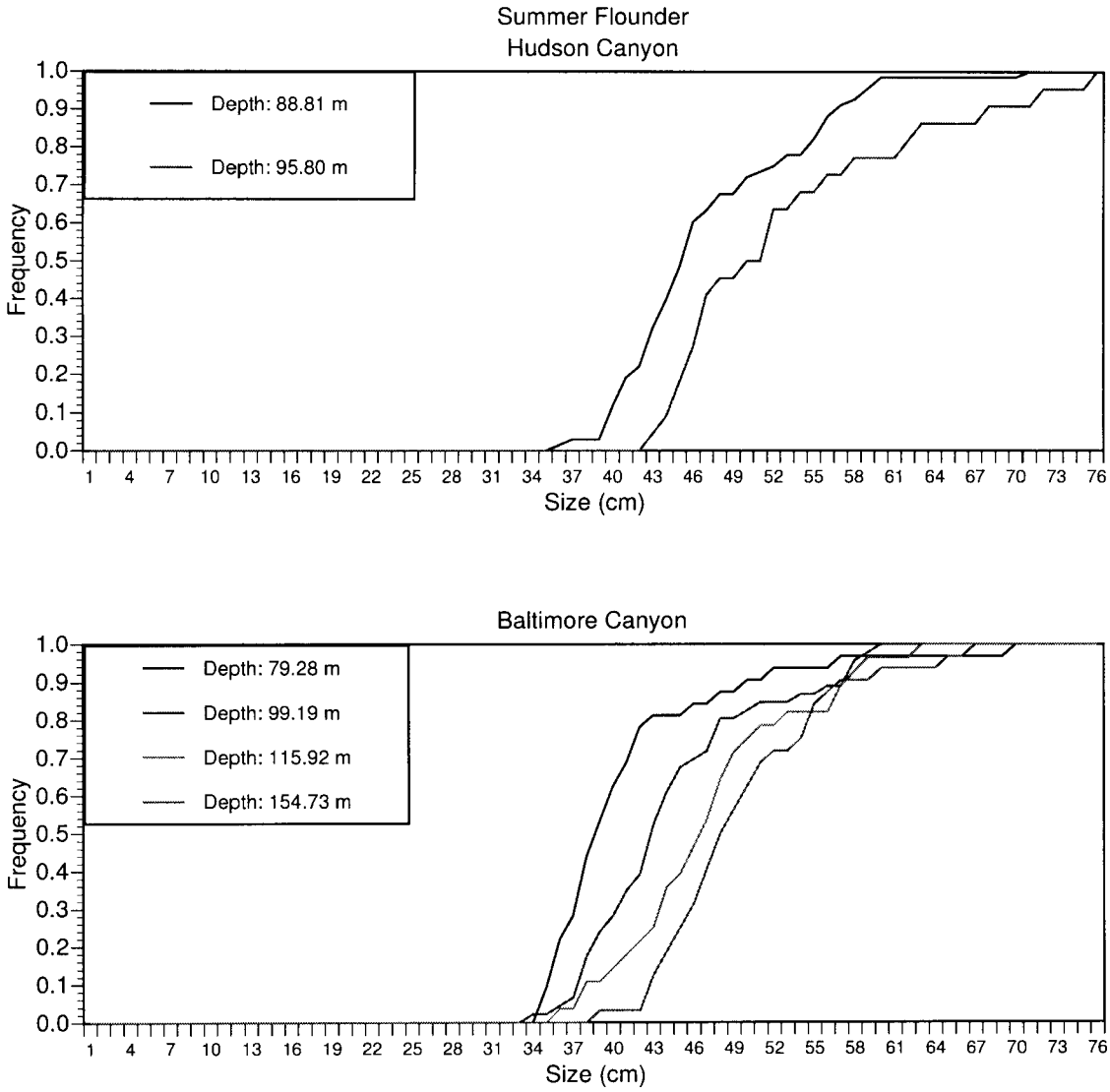


Figure 56. Cumulative size frequency, by tow, for thorny skate, for tows with ≥ 20 measured individuals.

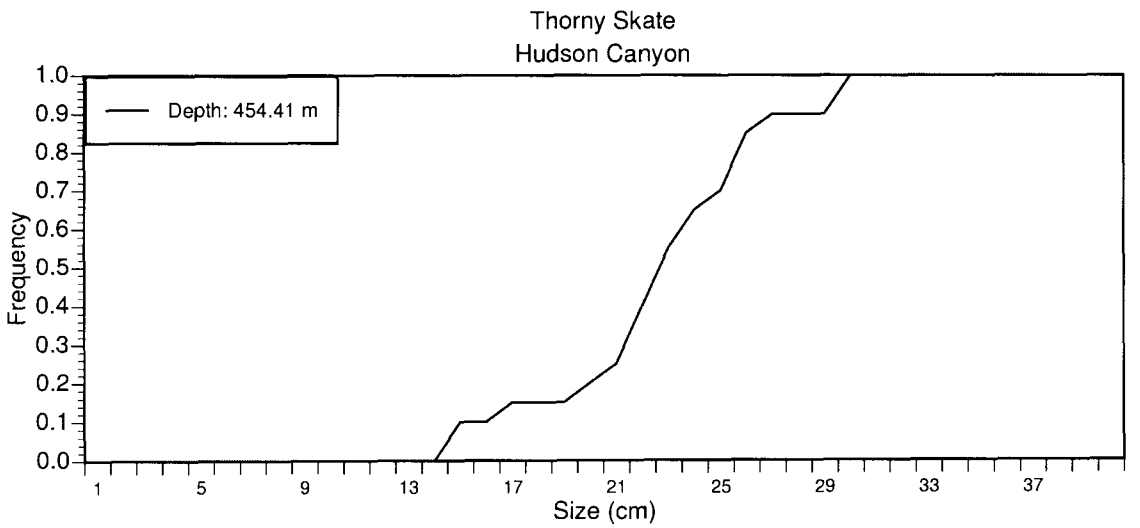
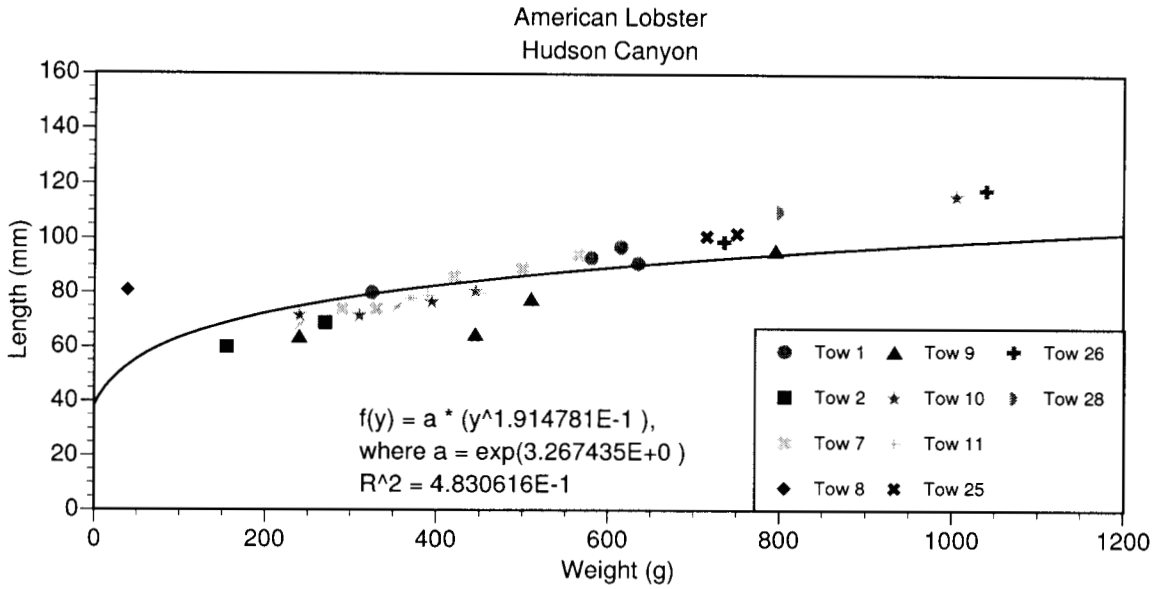


Figure 57. Relationship between length and weight for American lobster caught during November 2004. f(y)=length, y=weight.



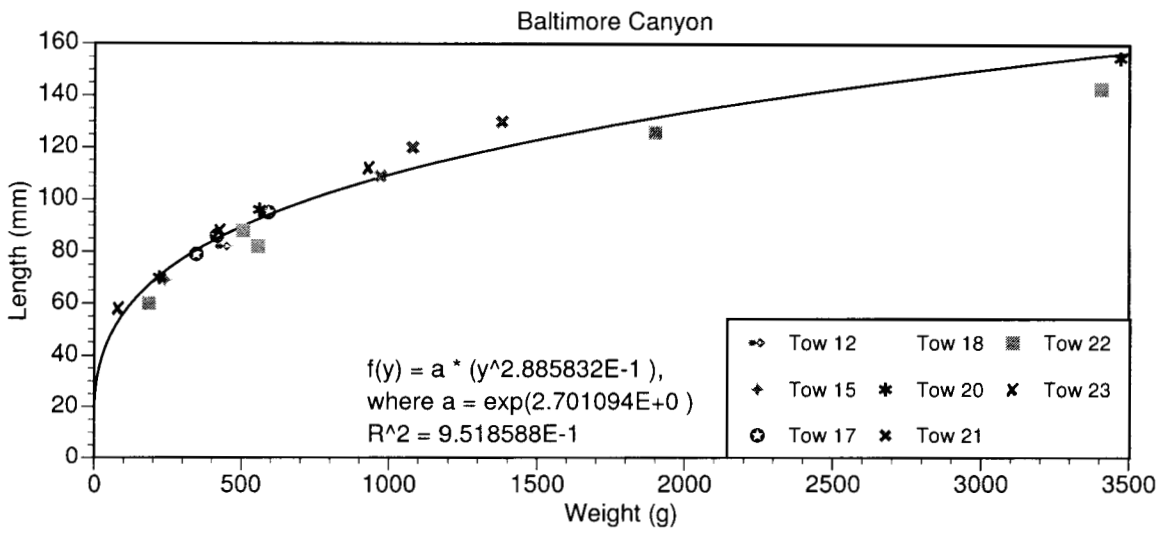
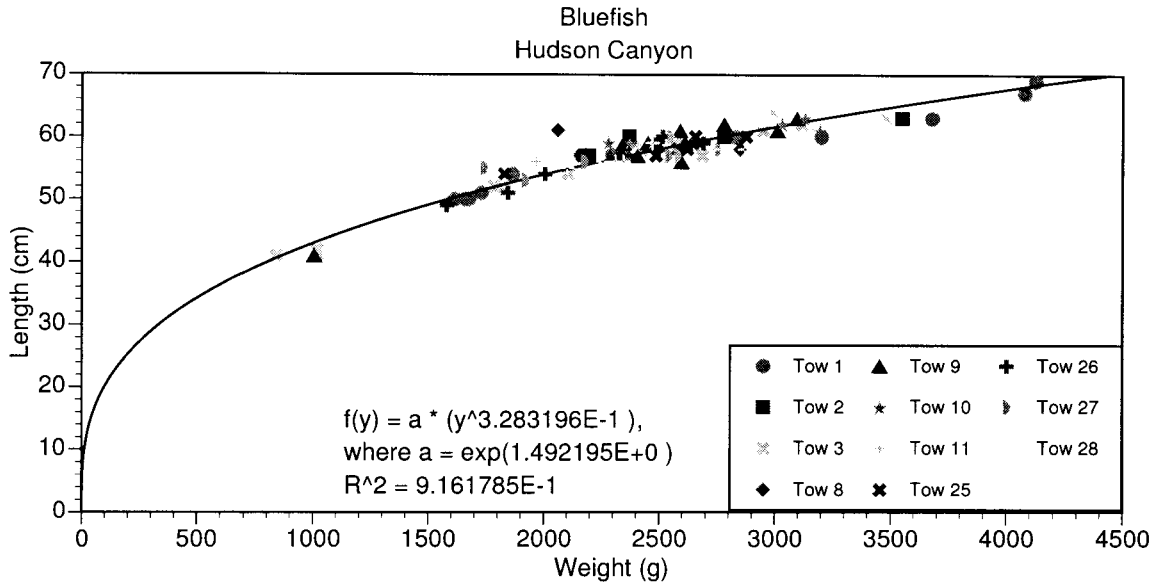


Figure 58. Relationship between length and weight for bluefish caught during November 2004. f(y)=length, y=weight.



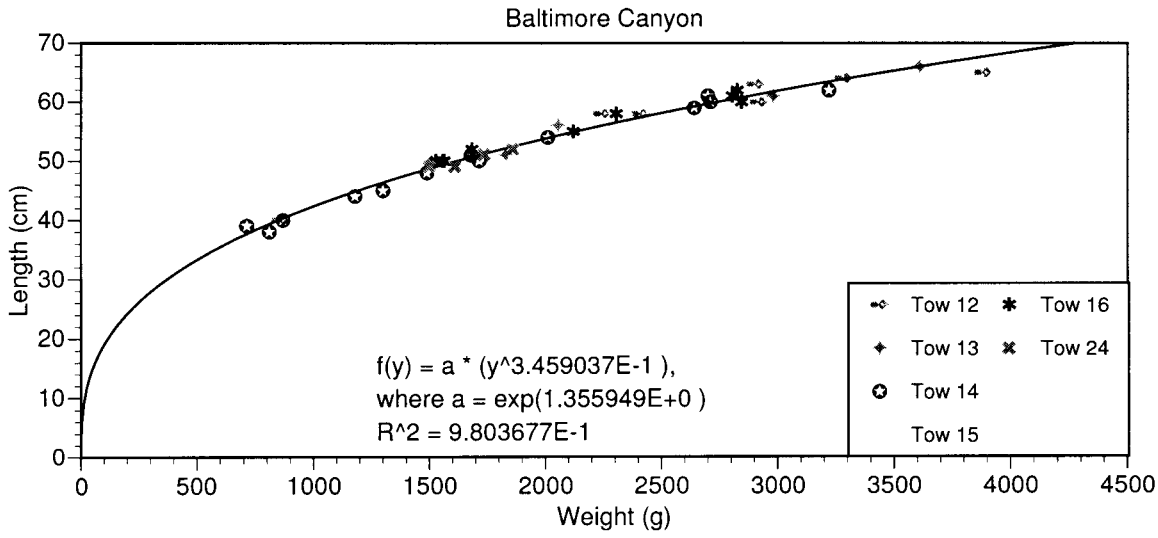


Figure 59. Relationship between length and weight for clearnose skate caught during November 2004. f(y)=length, y=weight.

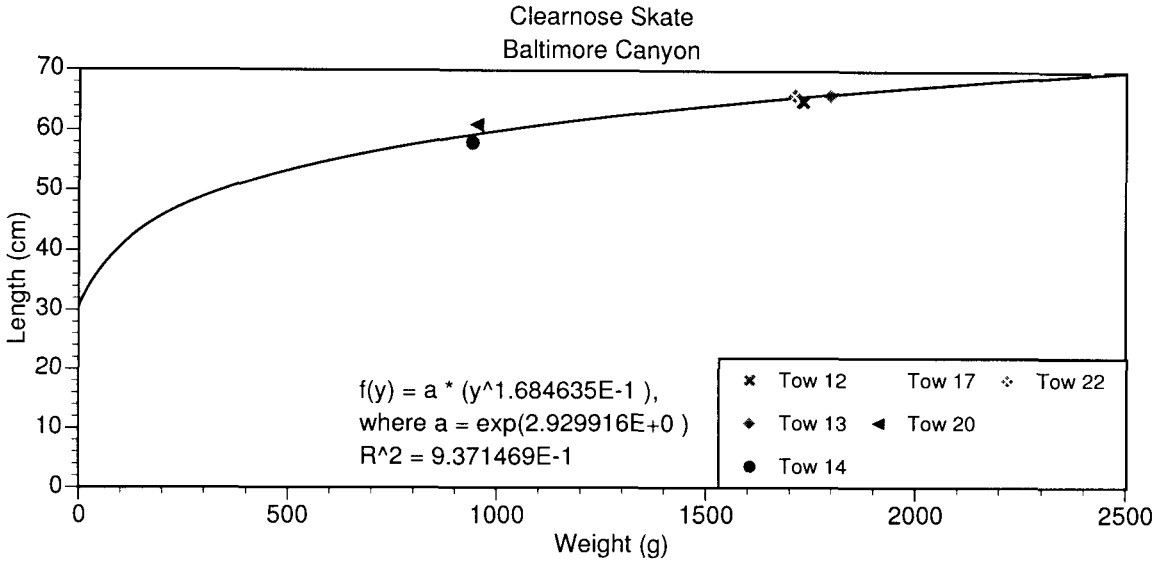
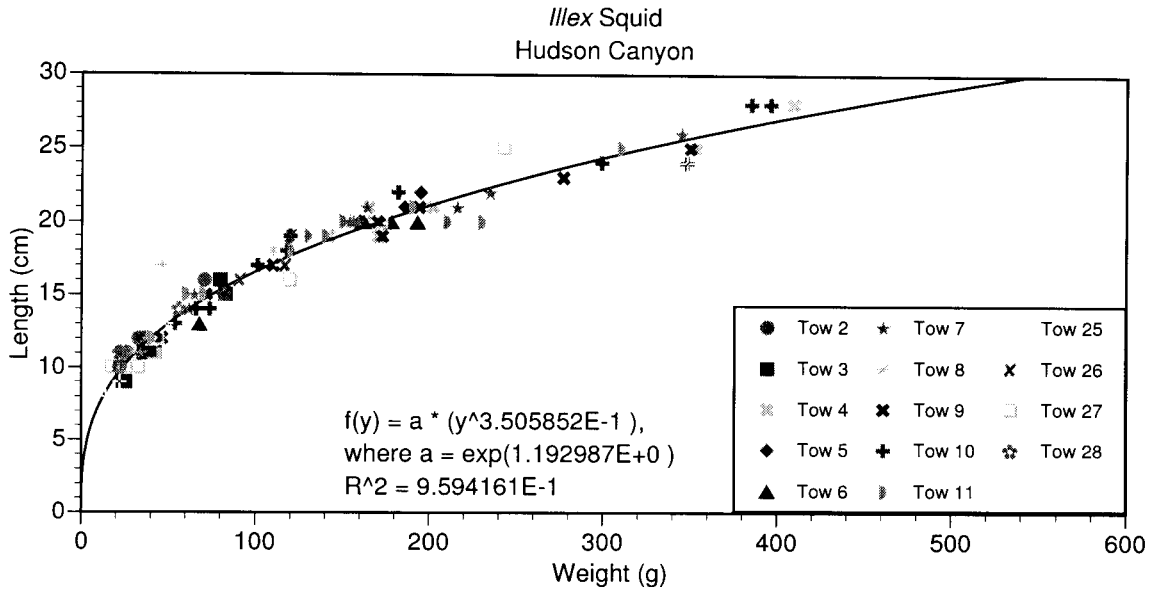


Figure 60. Relationship between length and weight for *Illex* squid caught during November 2004. f(y)=length, y=weight.



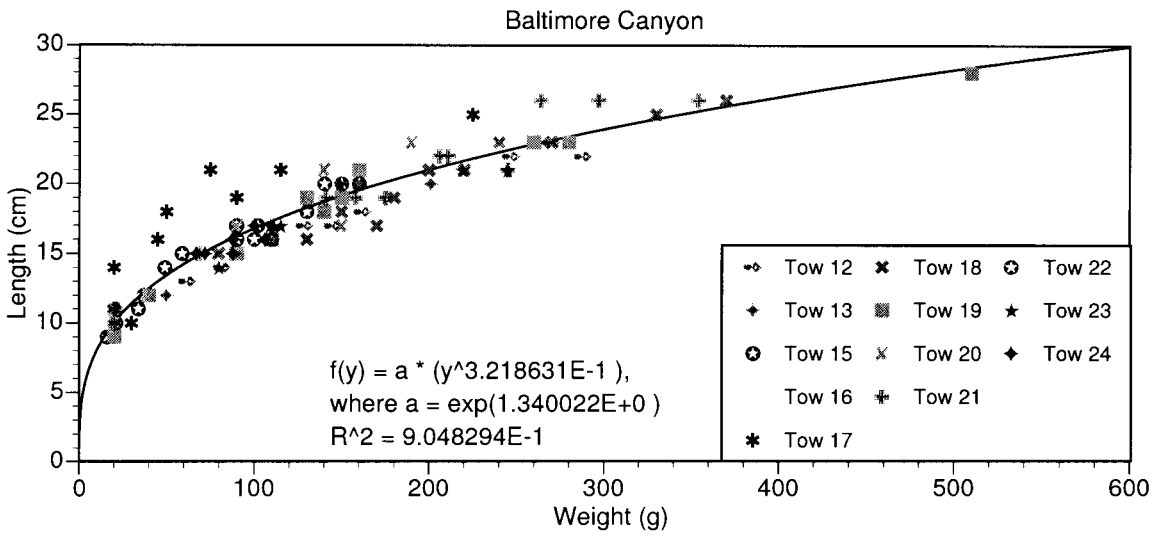
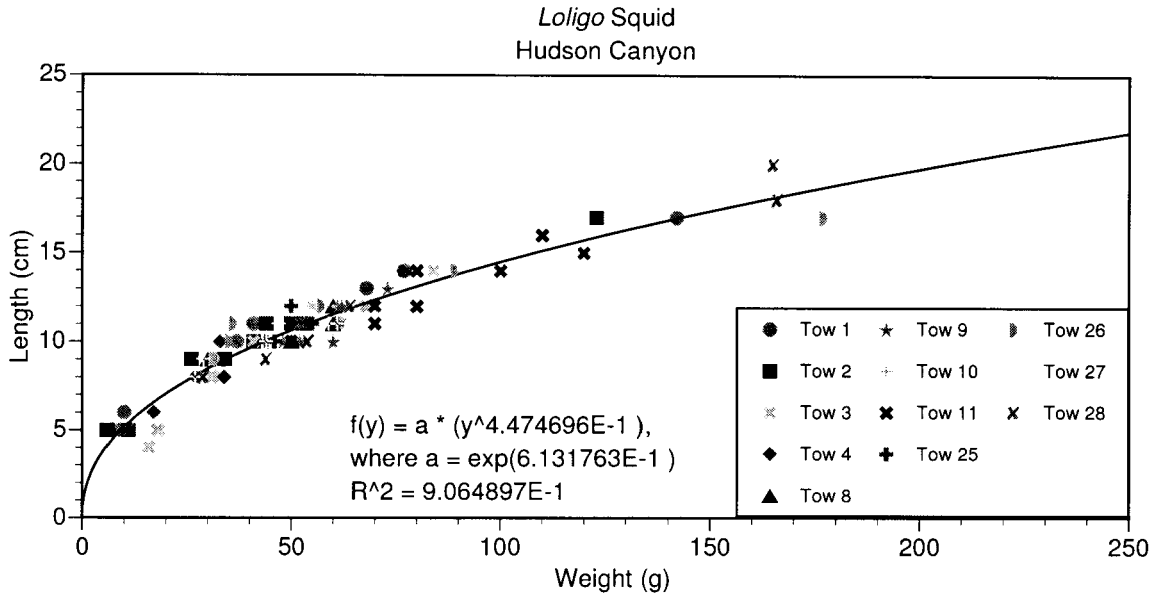


Figure 61. Relationship between length and weight for *Loligo* squid caught during November 2004. f(y)=length, y=weight.



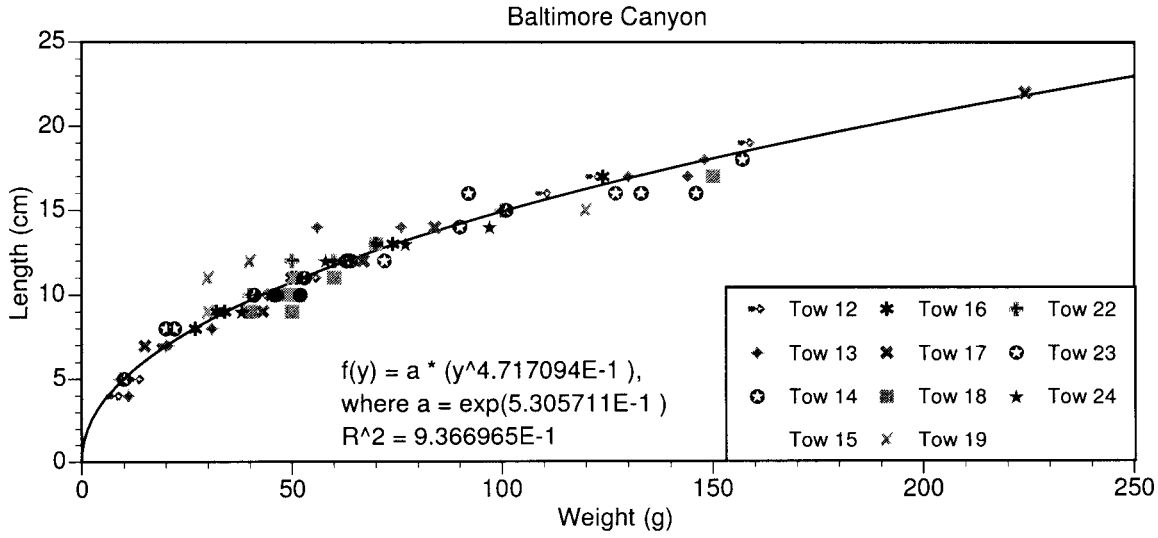
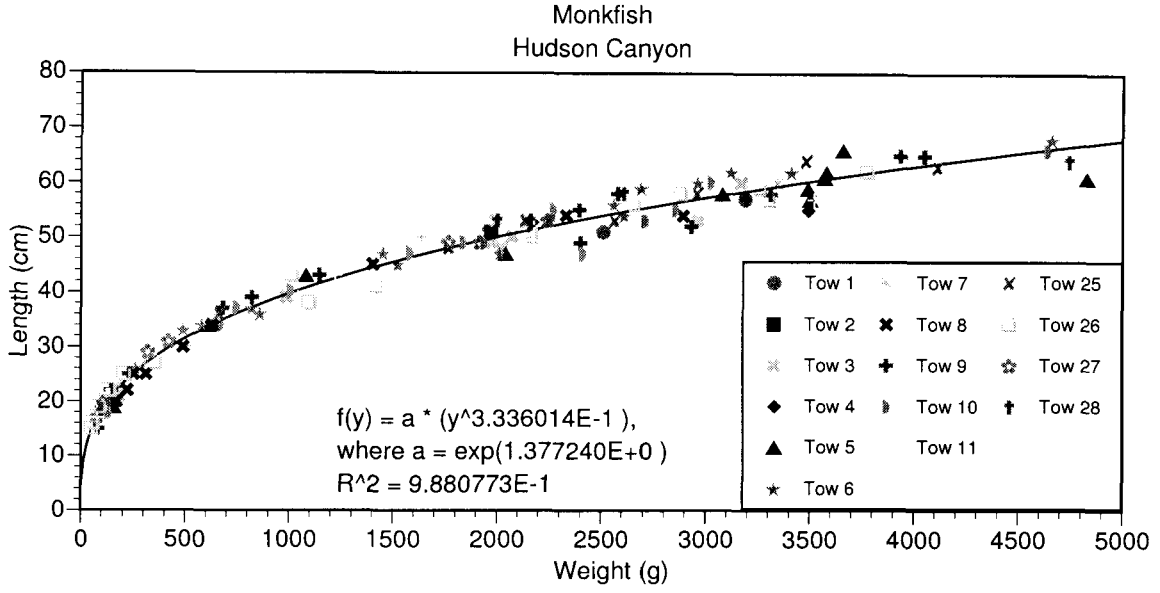


Figure 62. Relationship between length and weight for monkfish caught during November 2004. f(y)=length, y=weight.



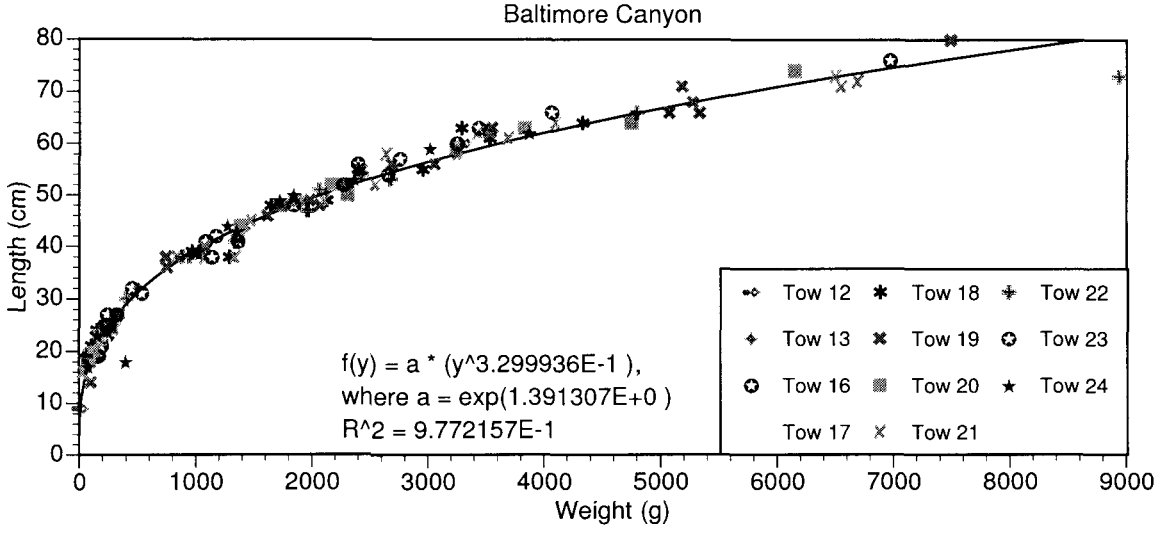
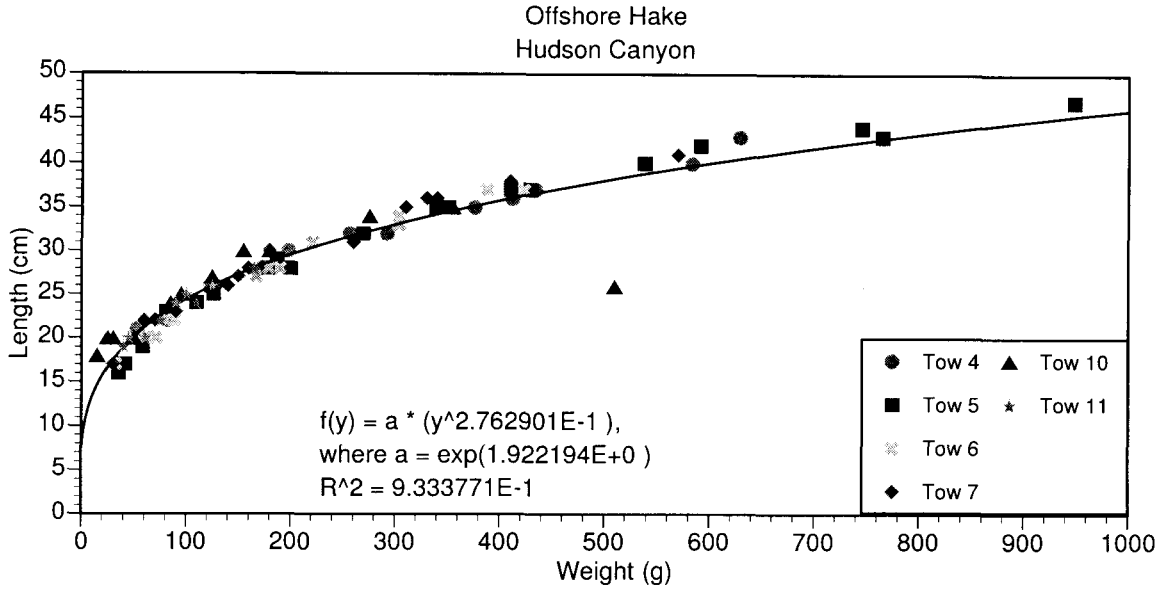


Figure 63. Relationship between length and weight for offshore hake caught during November 2004. f(y)=length, y=weight.



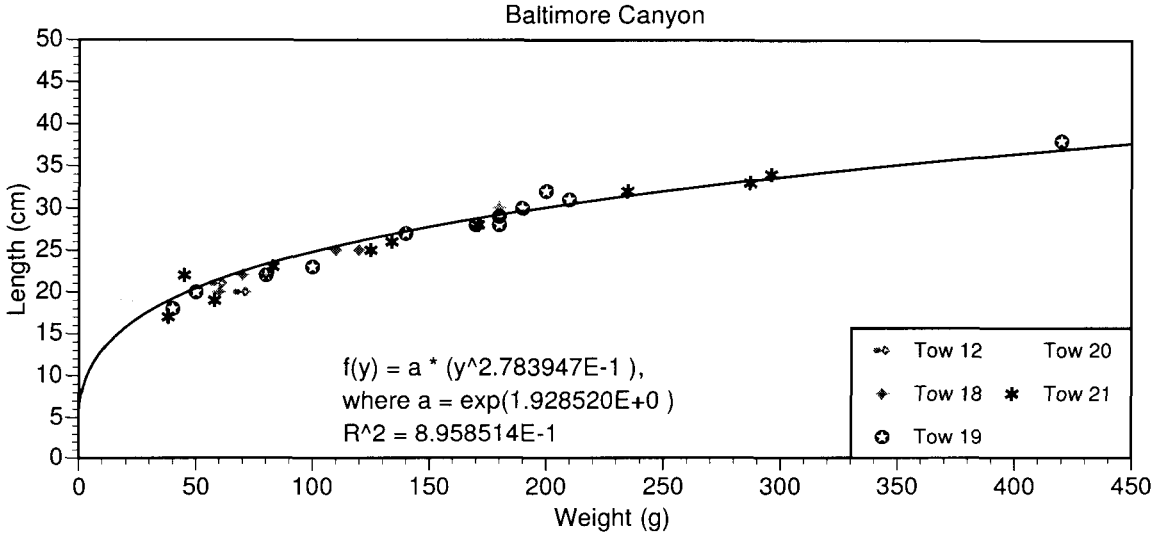
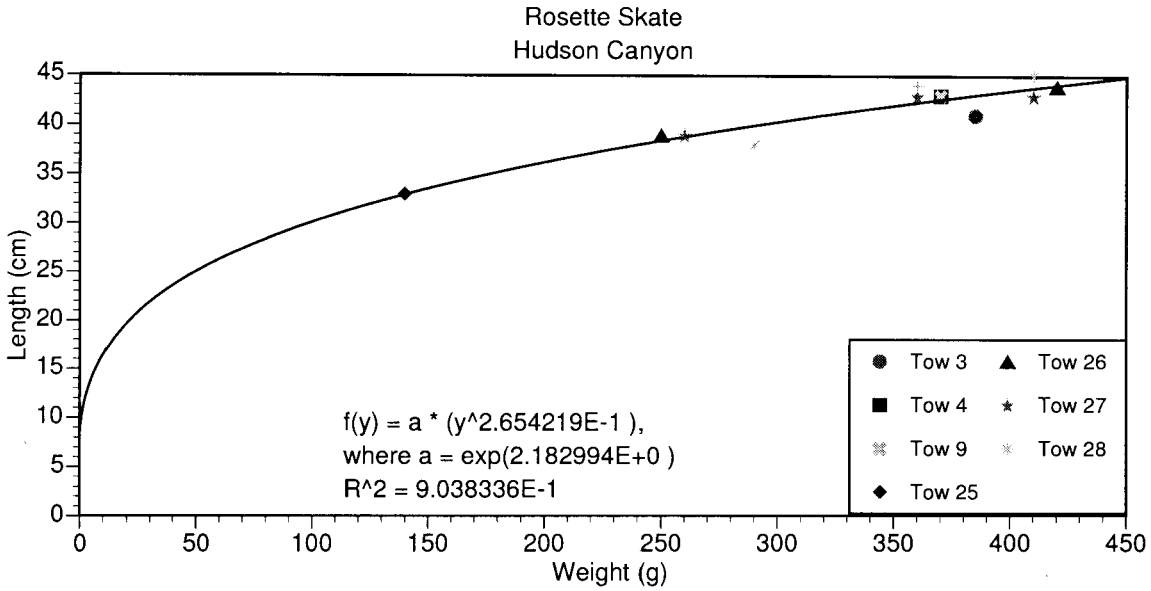


Figure 64. Relationship between length and weight for rosette skate caught during November 2004. f(y)=length, y=weight.



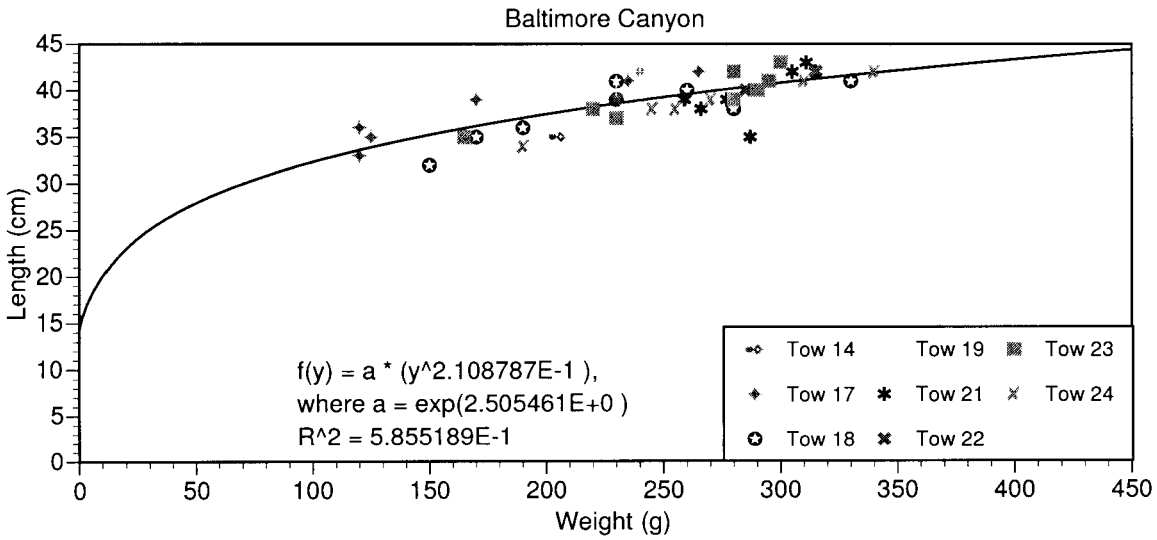
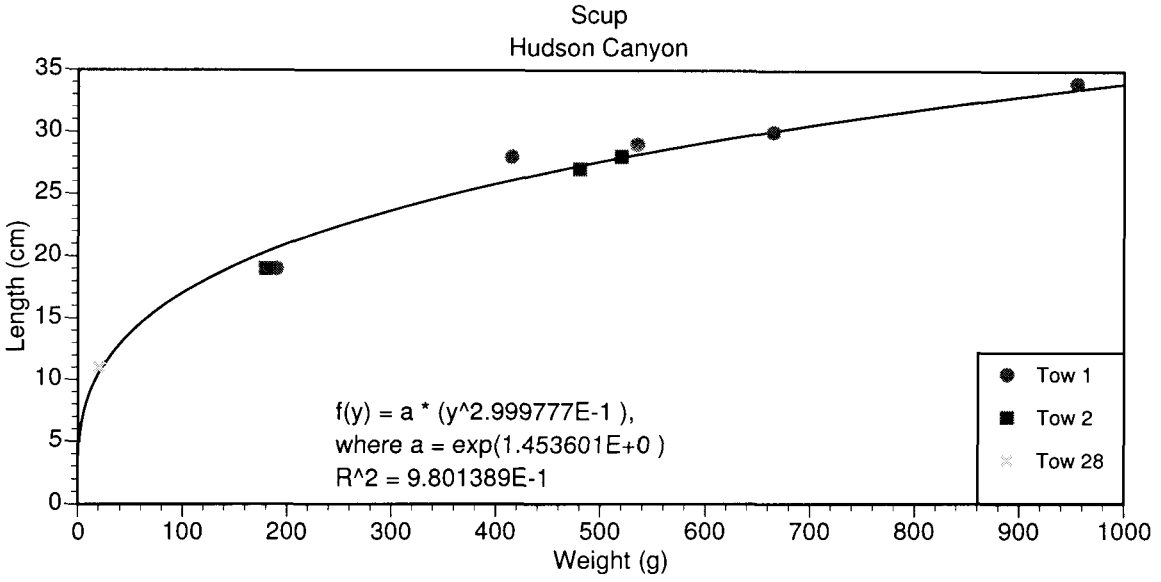


Figure 65. Relationship between length and weight for scup caught during November 2004. f(y)=length, y=weight.



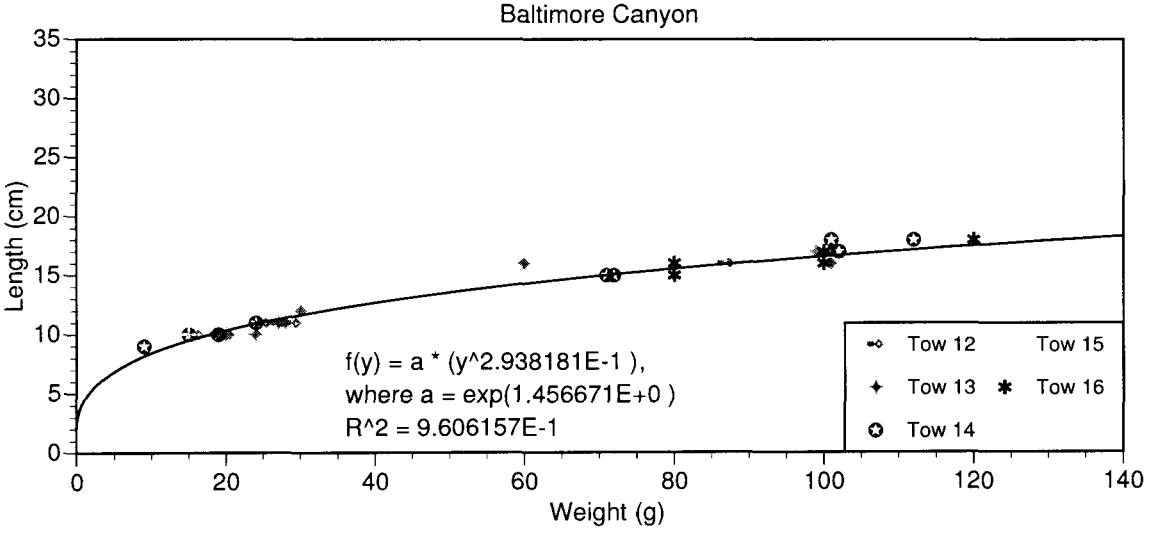
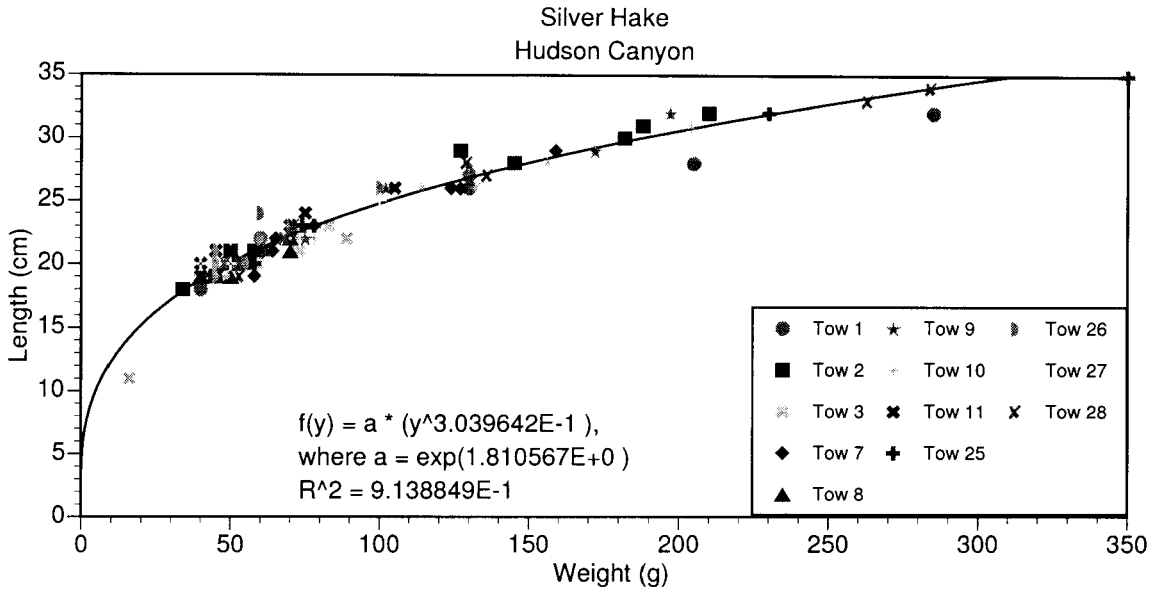


Figure 66. Relationship between length and weight for silver hake caught during November 2004. f(y)=length, y=weight.



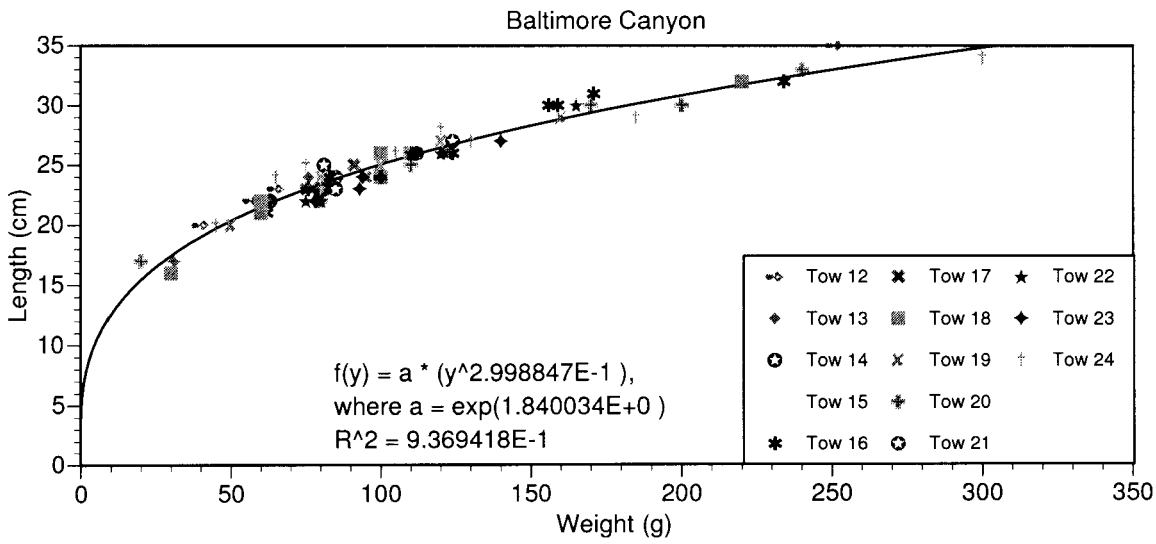
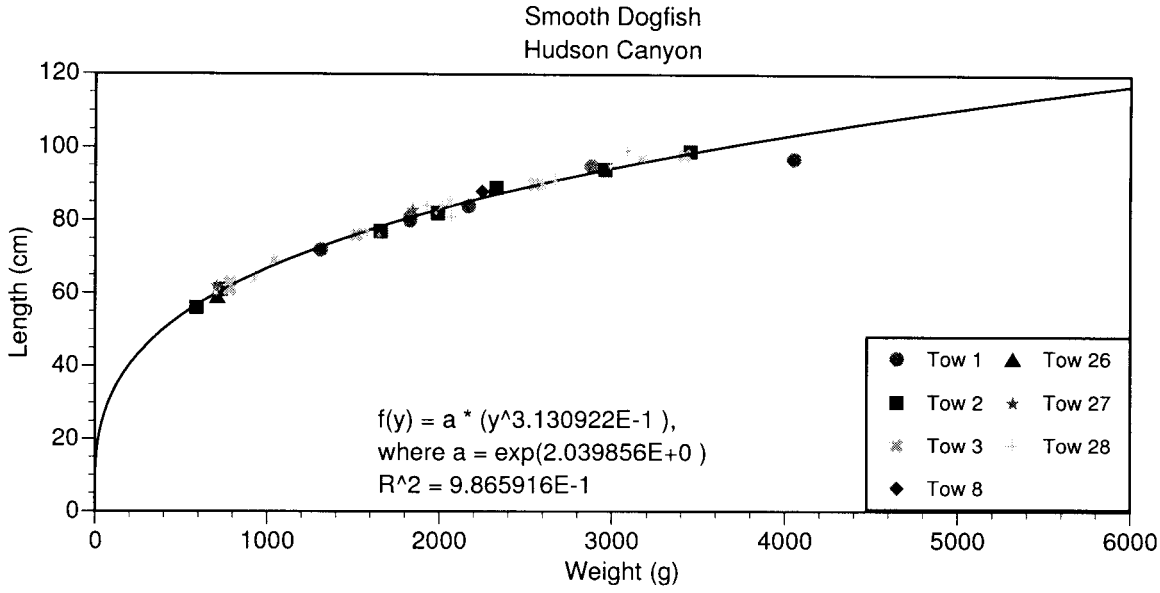


Figure 67. Relationship between length and weight for smooth dogfish caught during November 2004. f(y)=length, y=weight.



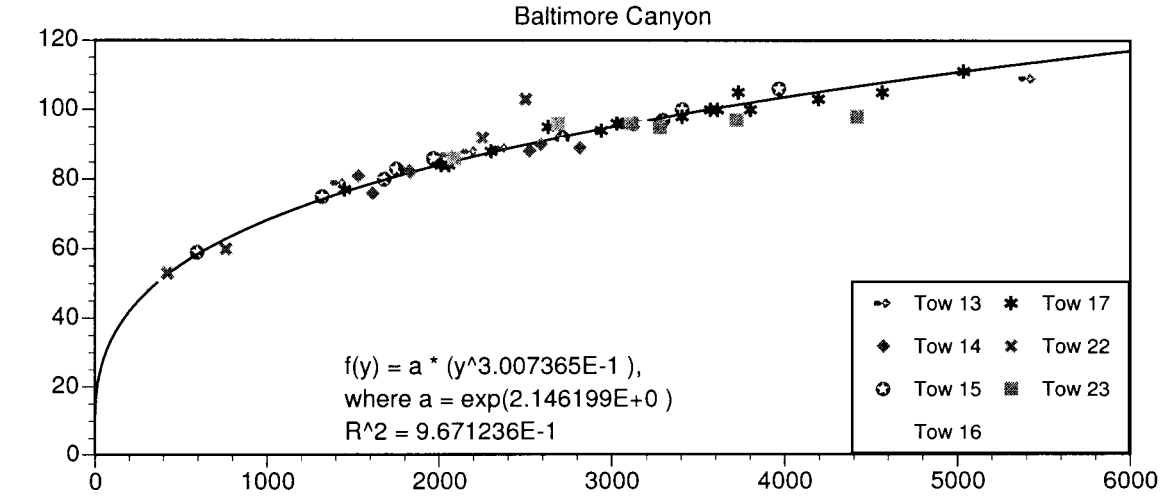
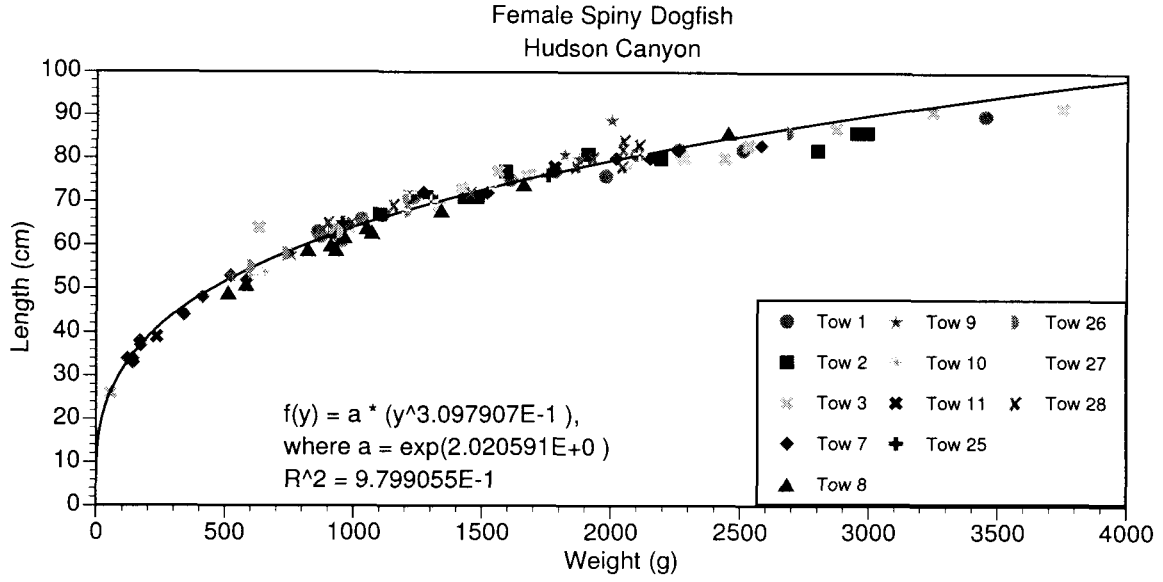


Figure 68. Relationship between length and weight for female spiny dogfish caught during November 2004. f(y)=length, y=weight.



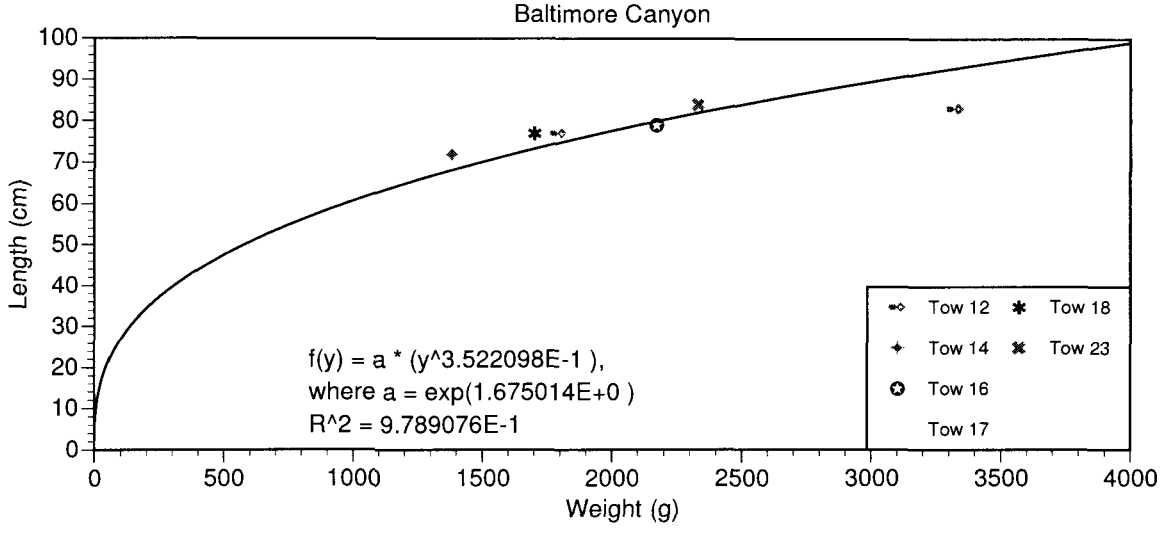
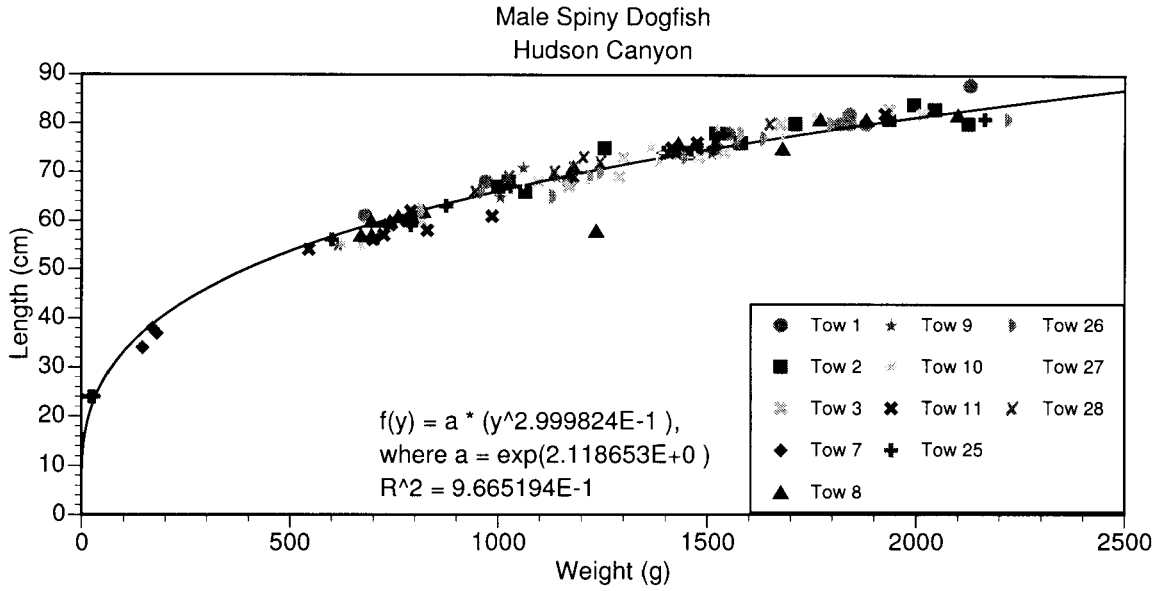


Figure 69. Relationship between length and weight for male spiny dogfish caught during November 2004. f(y)=length, y=weight.



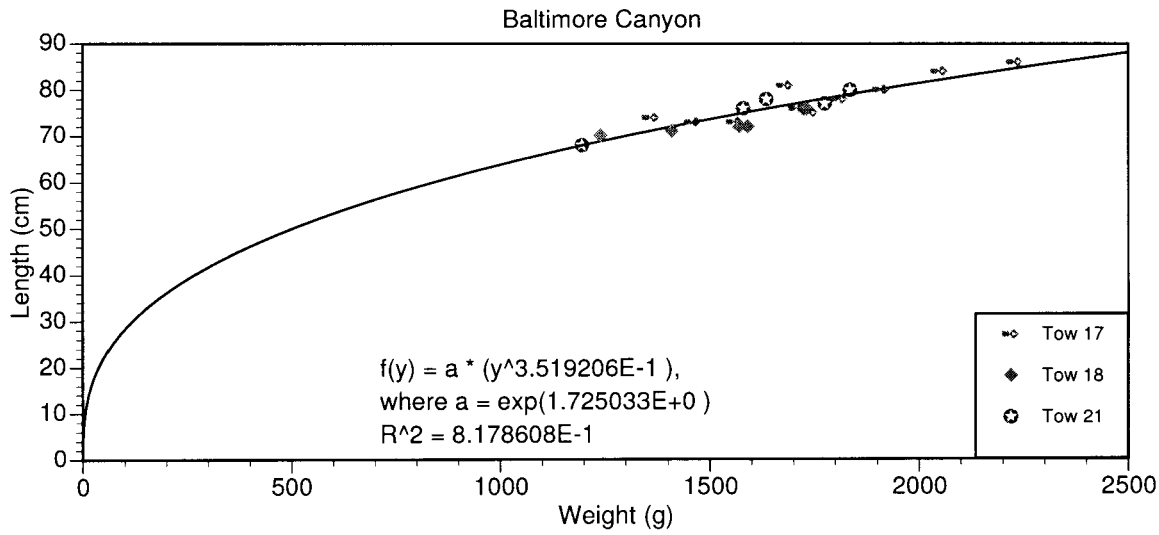
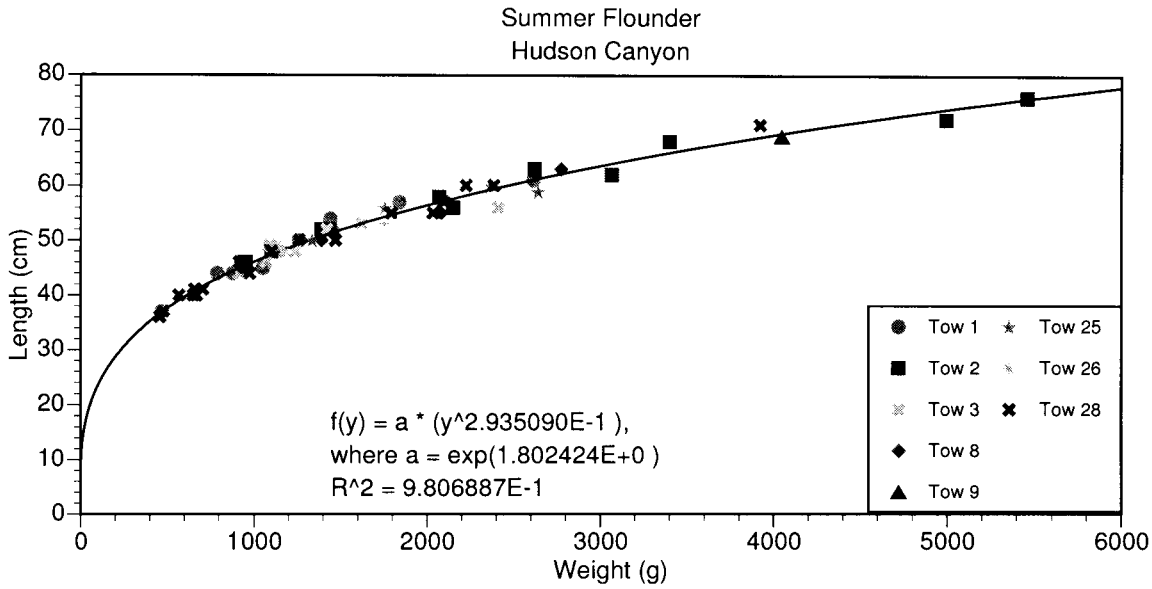


Figure 70. Relationship between length and weight for summer flounder caught during November 2004. f(y)=length, y=weight.



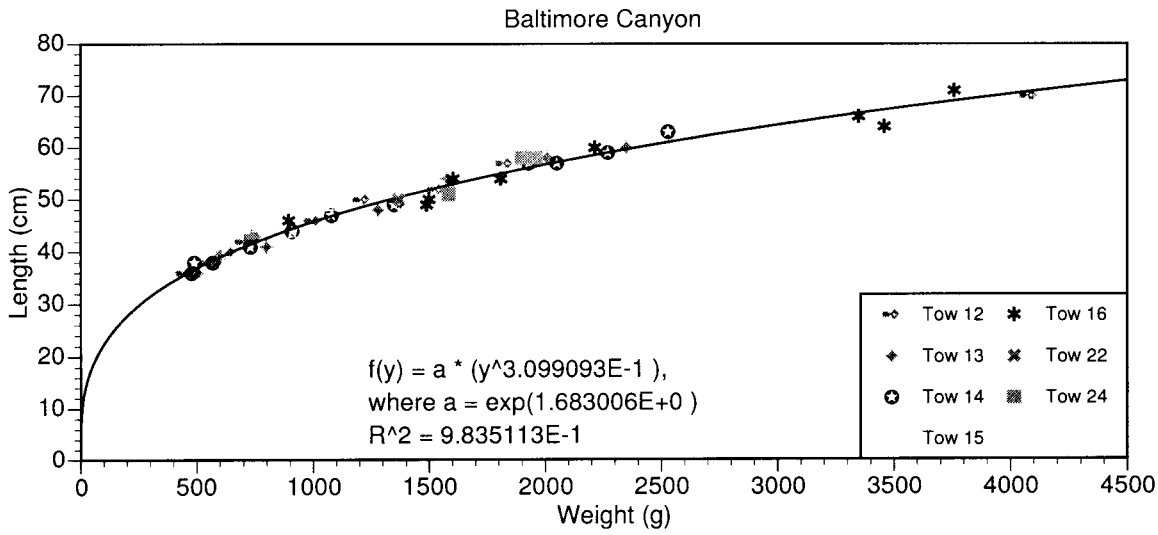


Figure 71. Relationship between length and weight for thorny skate caught during November 2004. f(y)=length, y=weight.

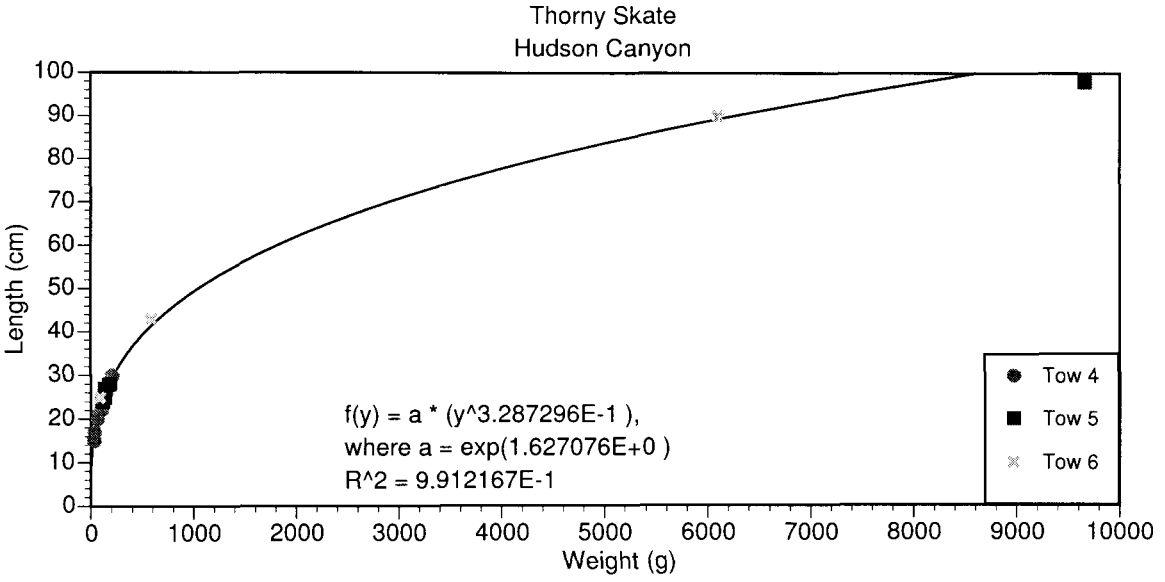


Figure 72. Relationship between length and weight for winter skate caught during November 2004. f(y)=length, y=weight.

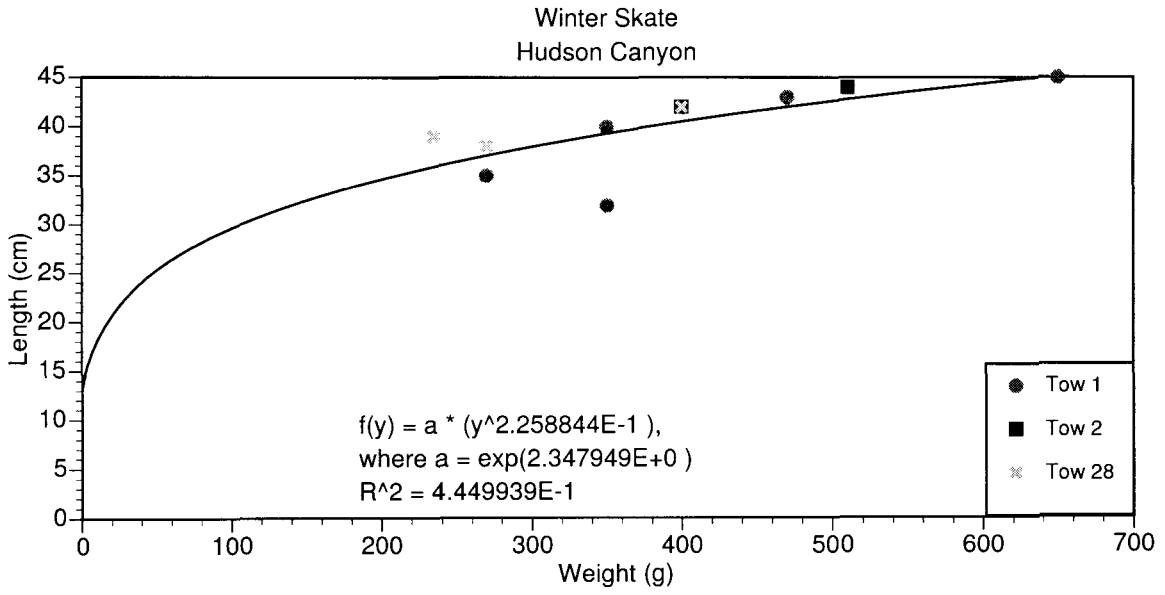


Figure 73a. Comparison of sampling performance data from the May and November 2004 surveys. and a comparison of bottom temperature data from the January and November 2004 surveys, since bottom temperatures were not measured in May. A slope of 1 (solid line) is expected if there is no change in the sampling performance for temperature, scope, depth and depth range.

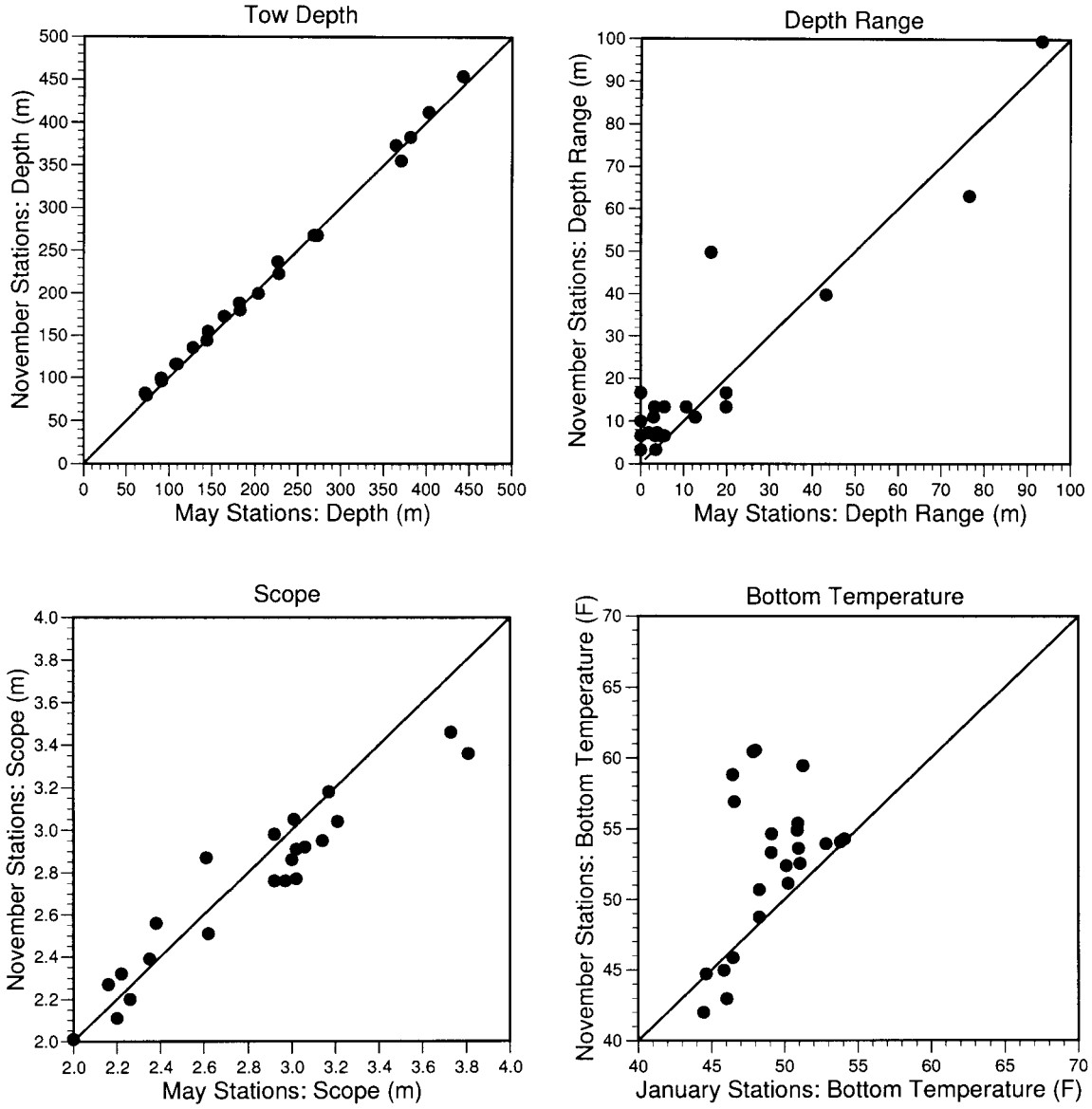


Figure 73b. Comparison of sampling performance data from the May and November 2004 surveys. A random distribution of points within a narrow two-dimensional field is expected if a change in sampling performace occurred.

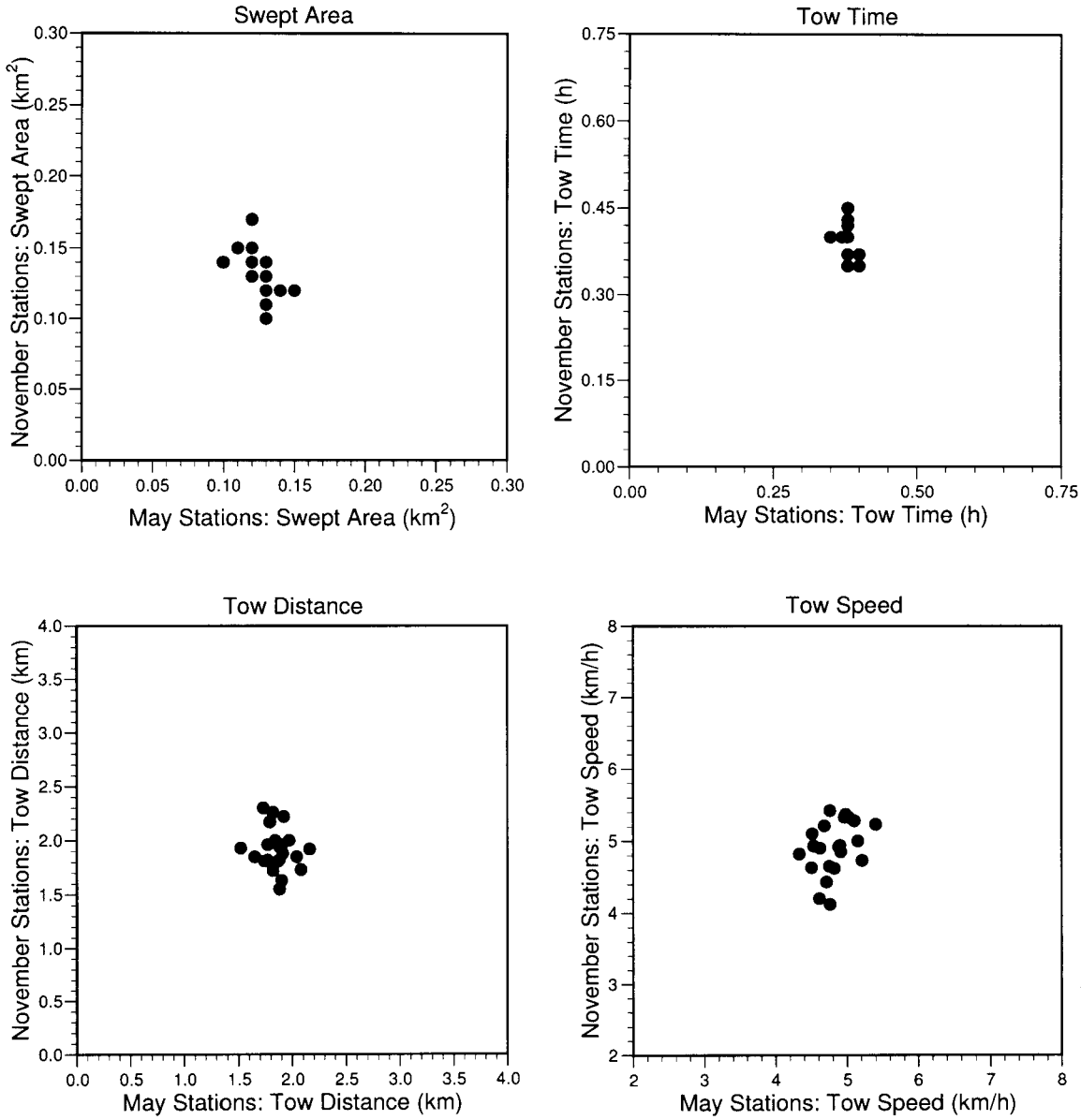


Figure 74. Changes in scope and depth range that occurred as tow depth increased during the November 2004 survey.

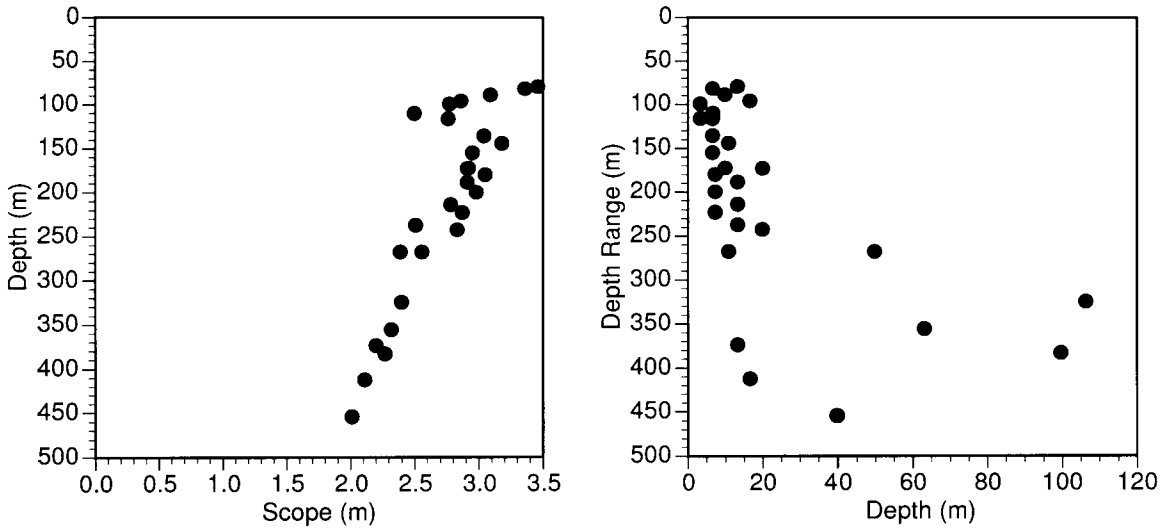


Figure 75a. Comparison of changes in depths for the 20th, 50th and 80th percentiles of cumulative catch during the March and May 2003 and January, March, May, and November 2004 surveys. To calculate the percentiles, swath area catch (Figures 5b-25b) was cumulated from the shallowest to the deepest station on each transect. The 20th percentile, for example, is the depth where the cumulative catch curve reached 20% of the total catch.

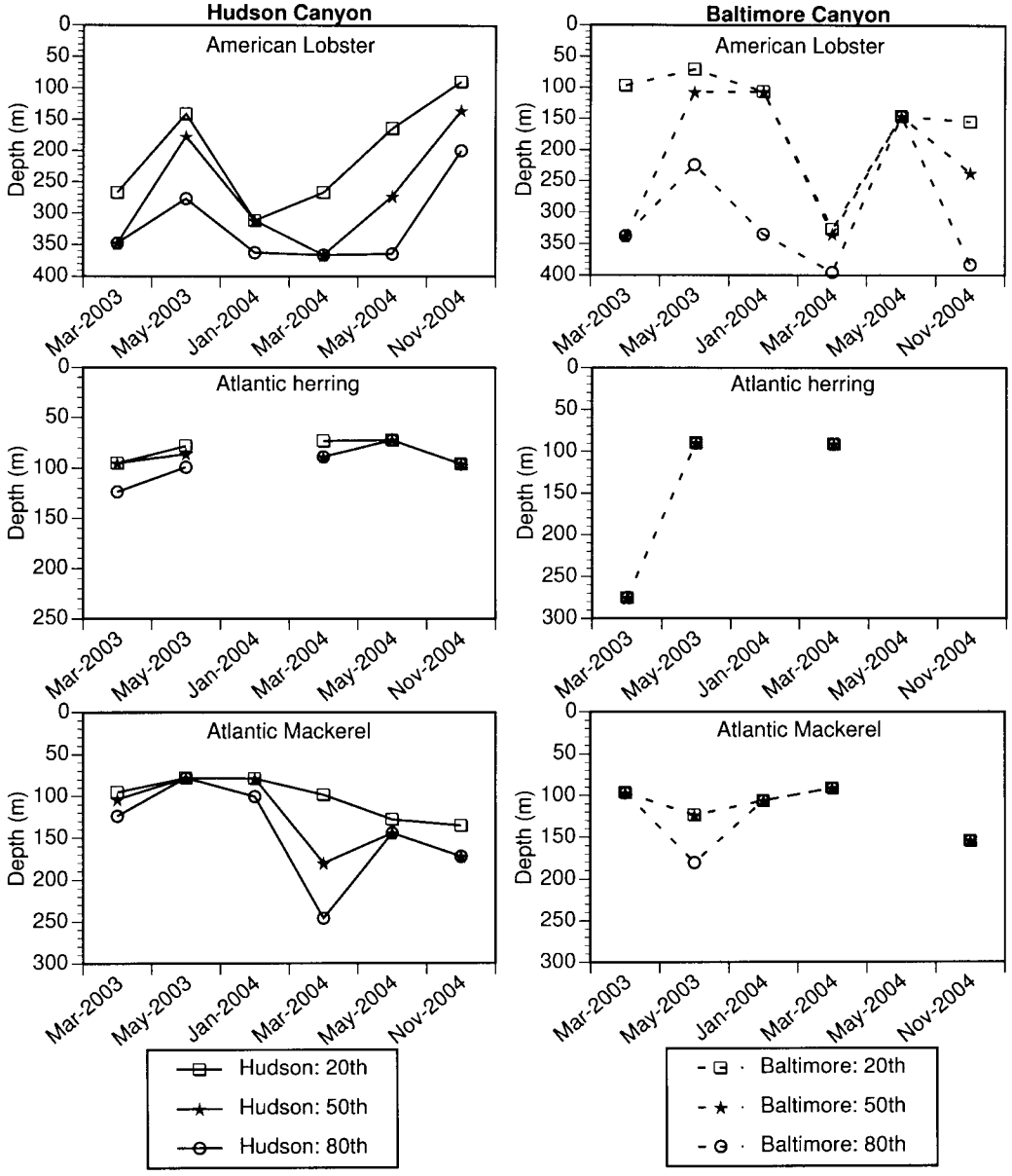


Figure 75b. Comparison of changes in depths for the 20th, 50th and 80th percentiles of cumulative catch during the March and May 2003 and January, March, May, and November 2004 surveys. To calculate the percentiles, swath area catch (Figures 5b-25b) was cumulated from the shallowest to the deepest station on each transect. The 20th percentile, for example, is the depth where the cumulative catch curve reached 20% of the total catch.

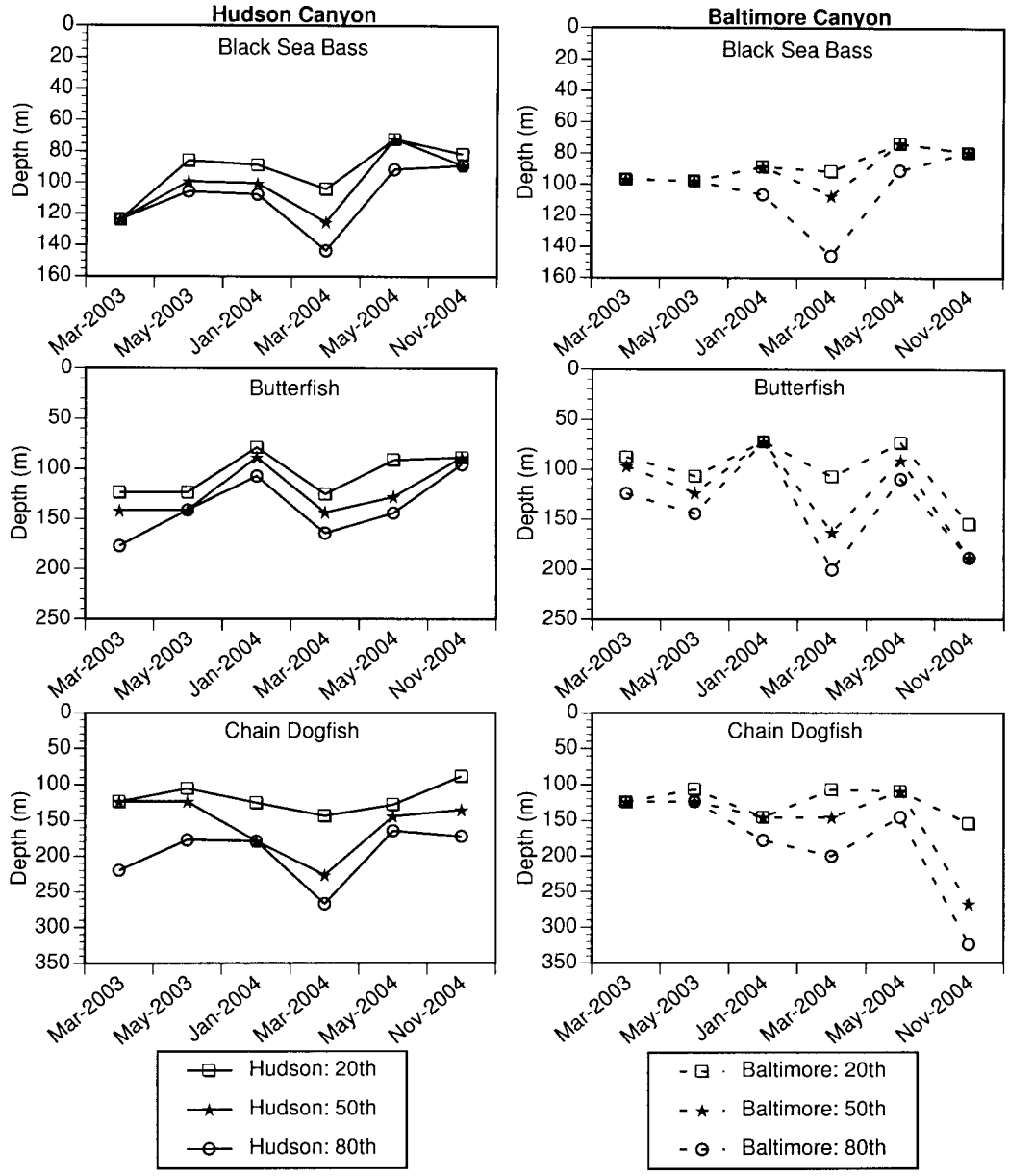


Figure 75c. Comparison of changes in depths for the 20th, 50th and 80th percentiles of cumulative catch during the March and May 2003 and January, March, May, and November 2004 surveys. To calculate the percentiles, swath area catch (Figures 5b-25b) was cumulated from the shallowest to the deepest station on each transect. The 20th percentile, for example, is the depth where the cumulative catch curve reached 20% of the total catch.

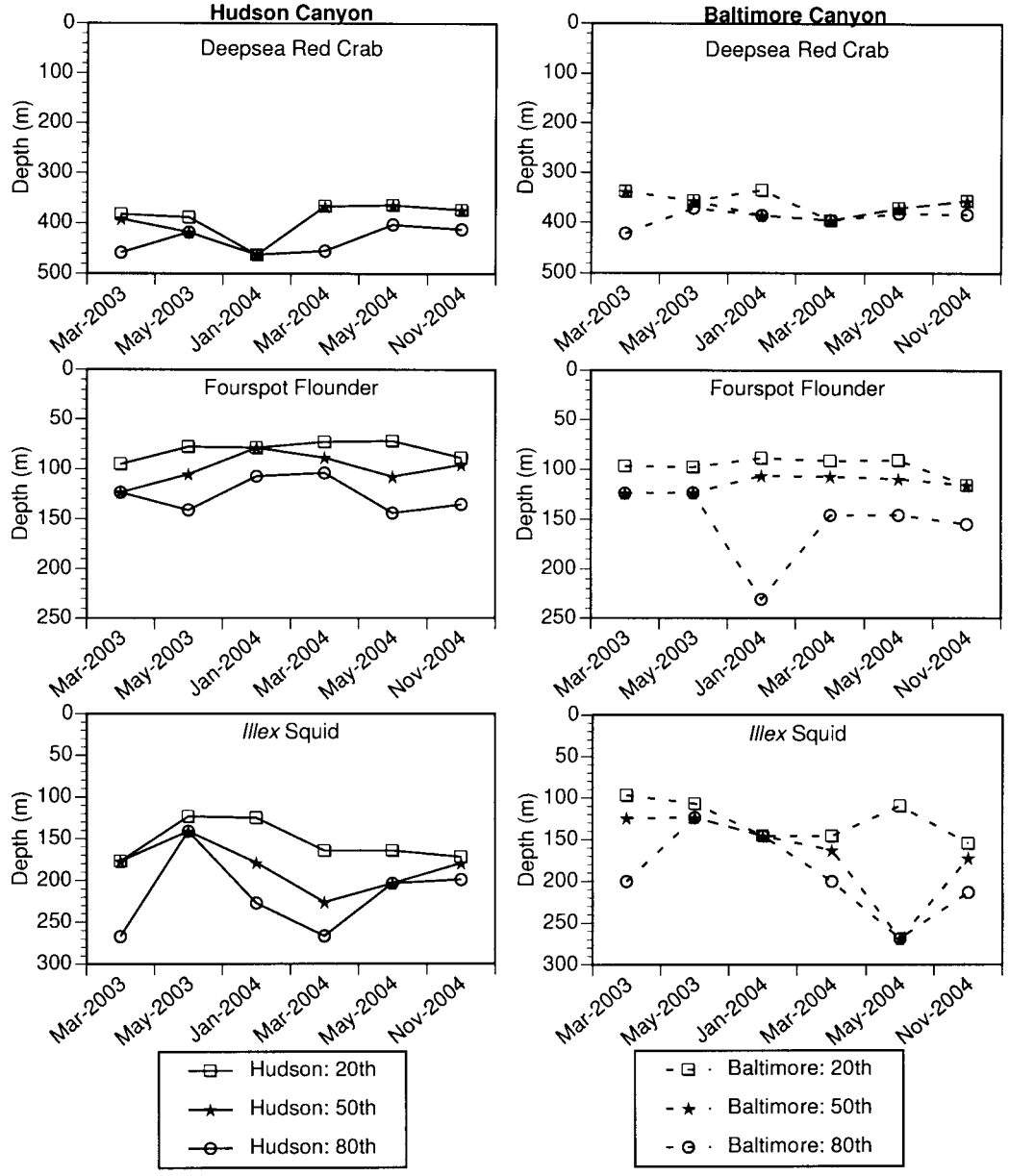


Figure 75d. Comparison of changes in depths for the 20th, 50th and 80th percentiles of cumulative catch during the March and May 2003 and January, March, May, and November 2004 surveys. To calculate the percentiles, swath area catch (Figures 5b-25b) was cumulated from the shallowest to the deepest station on each transect. The 20th percentile, for example, is the depth where the cumulative catch curve reached 20% of the total catch.

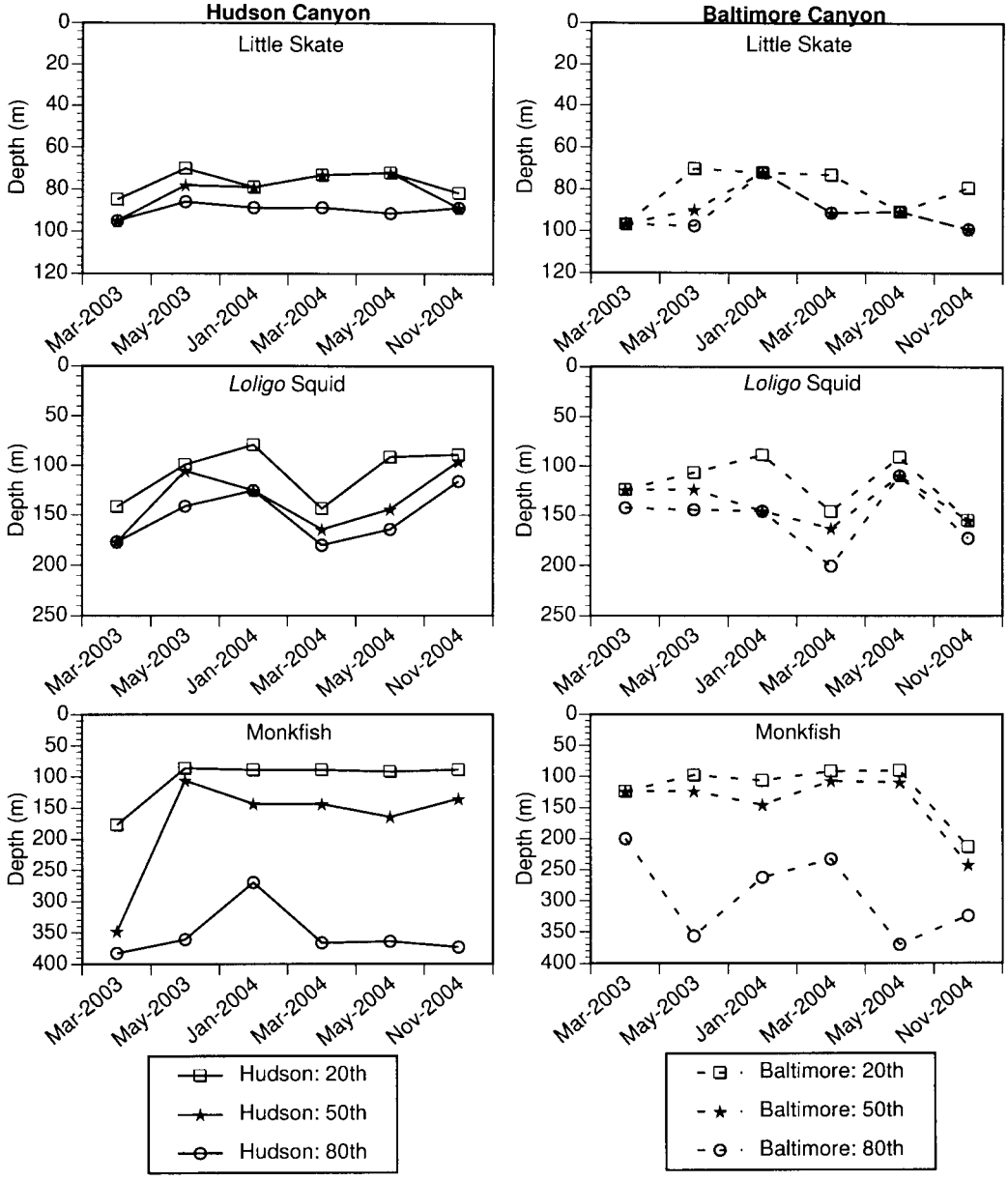


Figure 75e. Comparison of changes in depths for the 20th, 50th and 80th percentiles of cumulative catch during the March and May 2003 and January, March, May, and November 2004 surveys. To calculate the percentiles, swath area catch (Figures 5b-25b) was cumulated from the shallowest to the deepest station on each transect. The 20th percentile, for example, is the depth where the cumulative catch curve reached 20% of the total catch. Beginning in May 2003, silver and offshore hake were sorted separately.

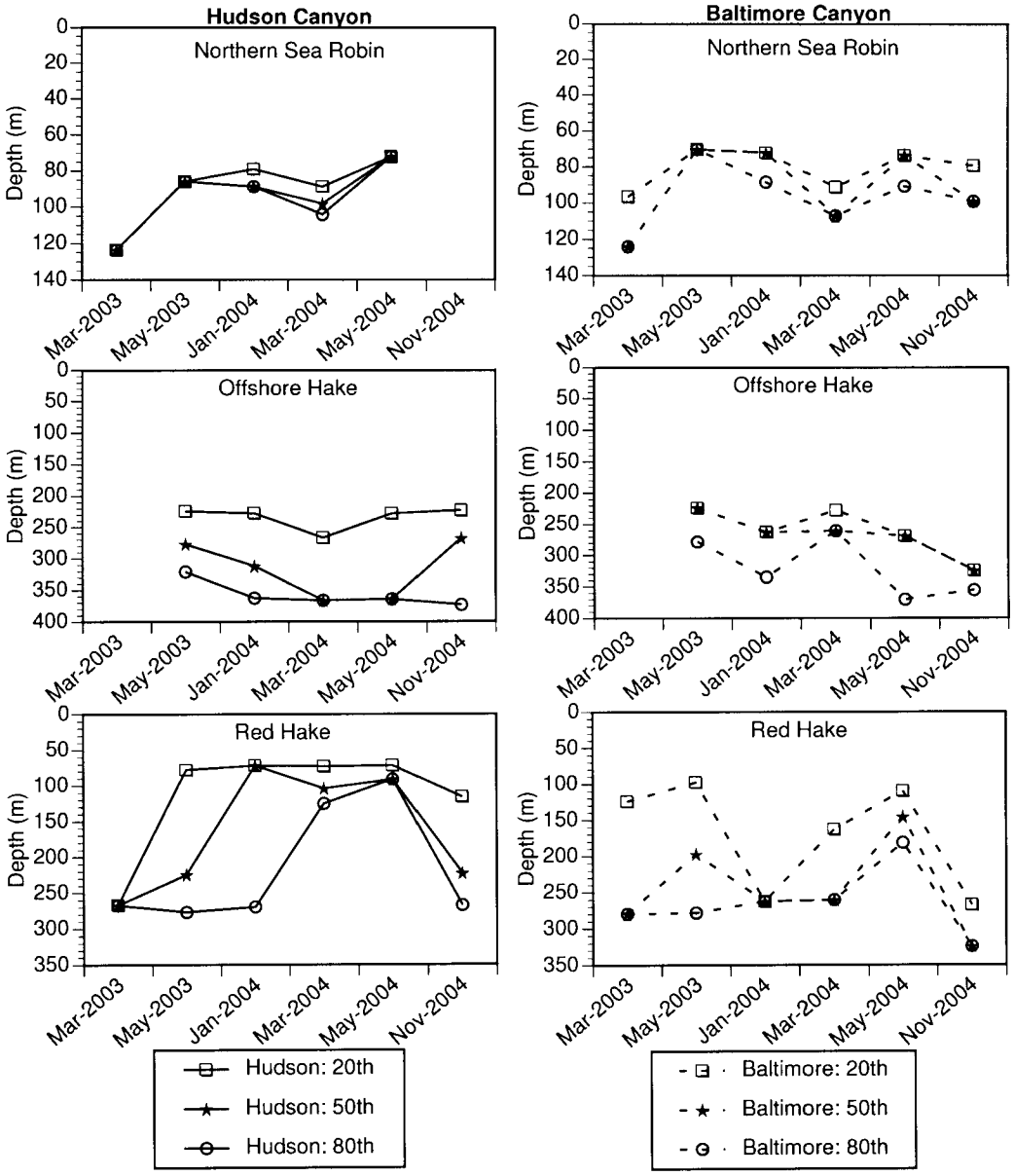


Figure 75f. Comparison of changes in depths for the 20th, 50th and 80th percentiles of cumulative catch during the March and May 2003 and January, March, May, and November 2004 surveys. To calculate the percentiles, swath area catch (Figures 5b-25b) was cumulated from the shallowest to the deepest station on each transect. The 20th percentile, for example, is the depth where the cumulative catch curve reached 20% of the total catch. Beginning in May 2003, silver and offshore hake were sorted separately.

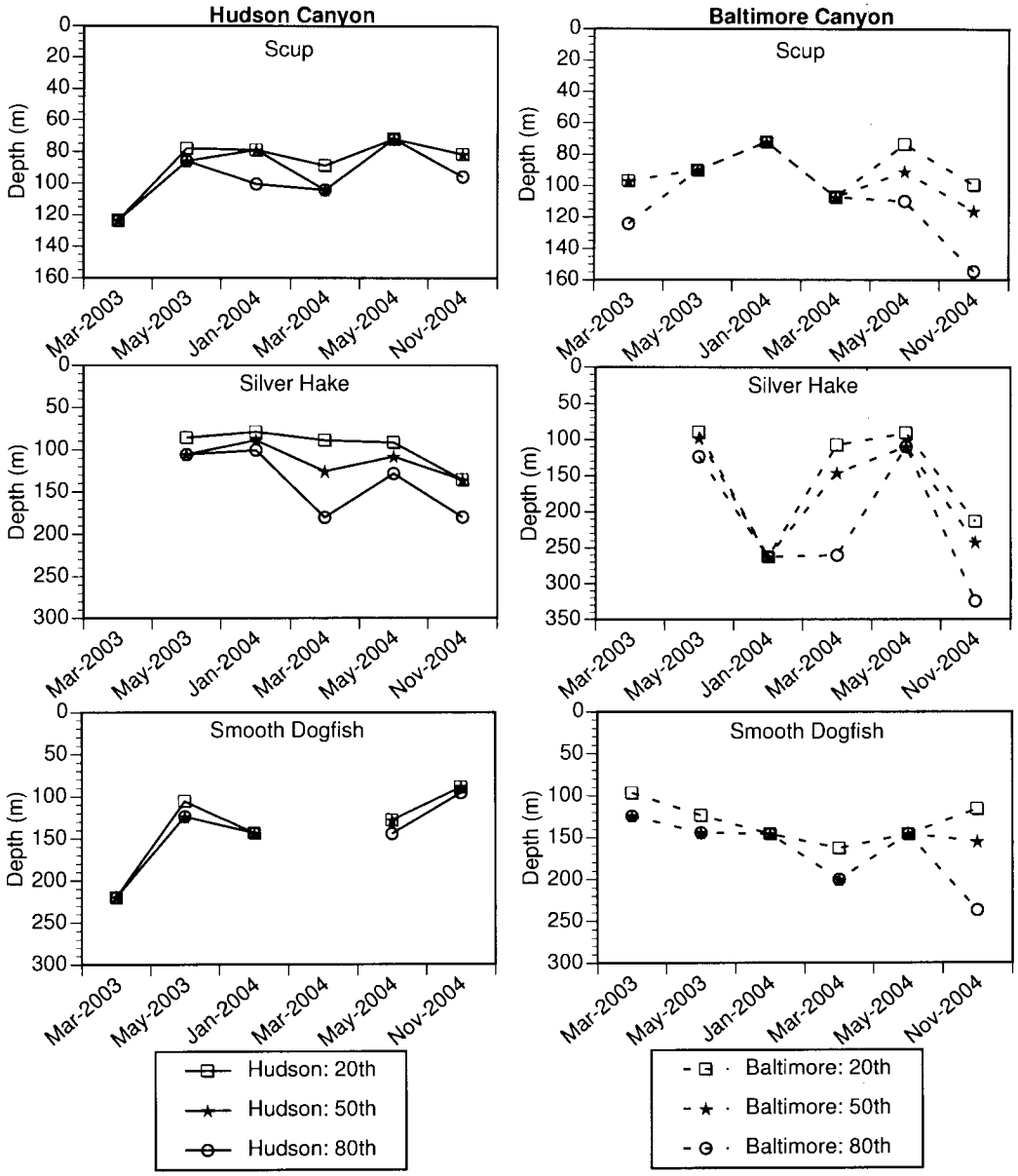


Figure 75g. Comparison of changes in depths for the 20th, 50th and 80th percentiles of cumulative catch during the March and May 2003 and January, March, May, and November 2004 surveys. To calculate the percentiles, swath area catch (Figures 5b-25b) was cumulated from the shallowest to the deepest station on each transect. The 20th percentile, for example, is the depth where the cumulative catch curve reached 20% of the total catch. Beginning in January, 2004, spiny dogfish were separated by sex.

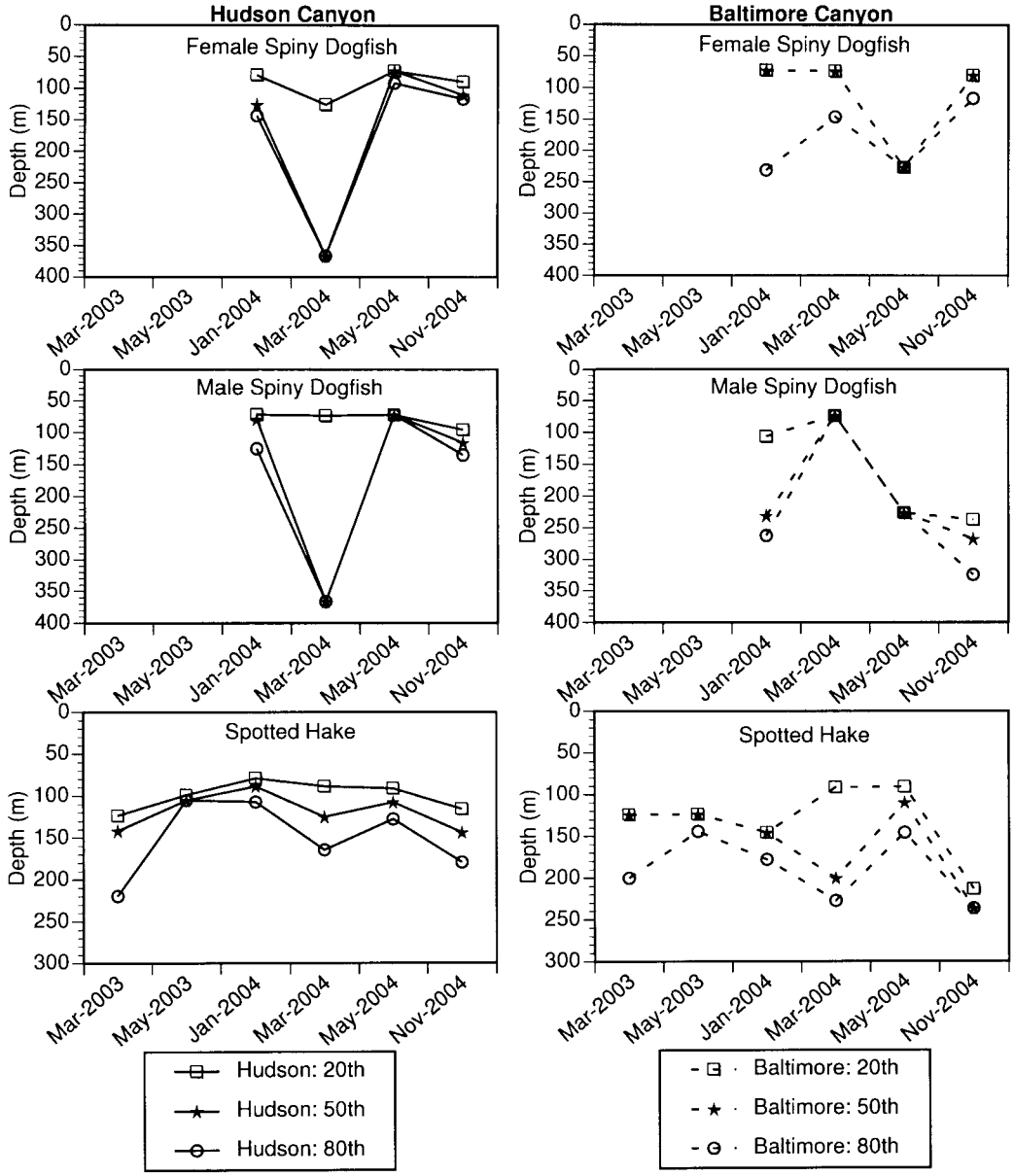
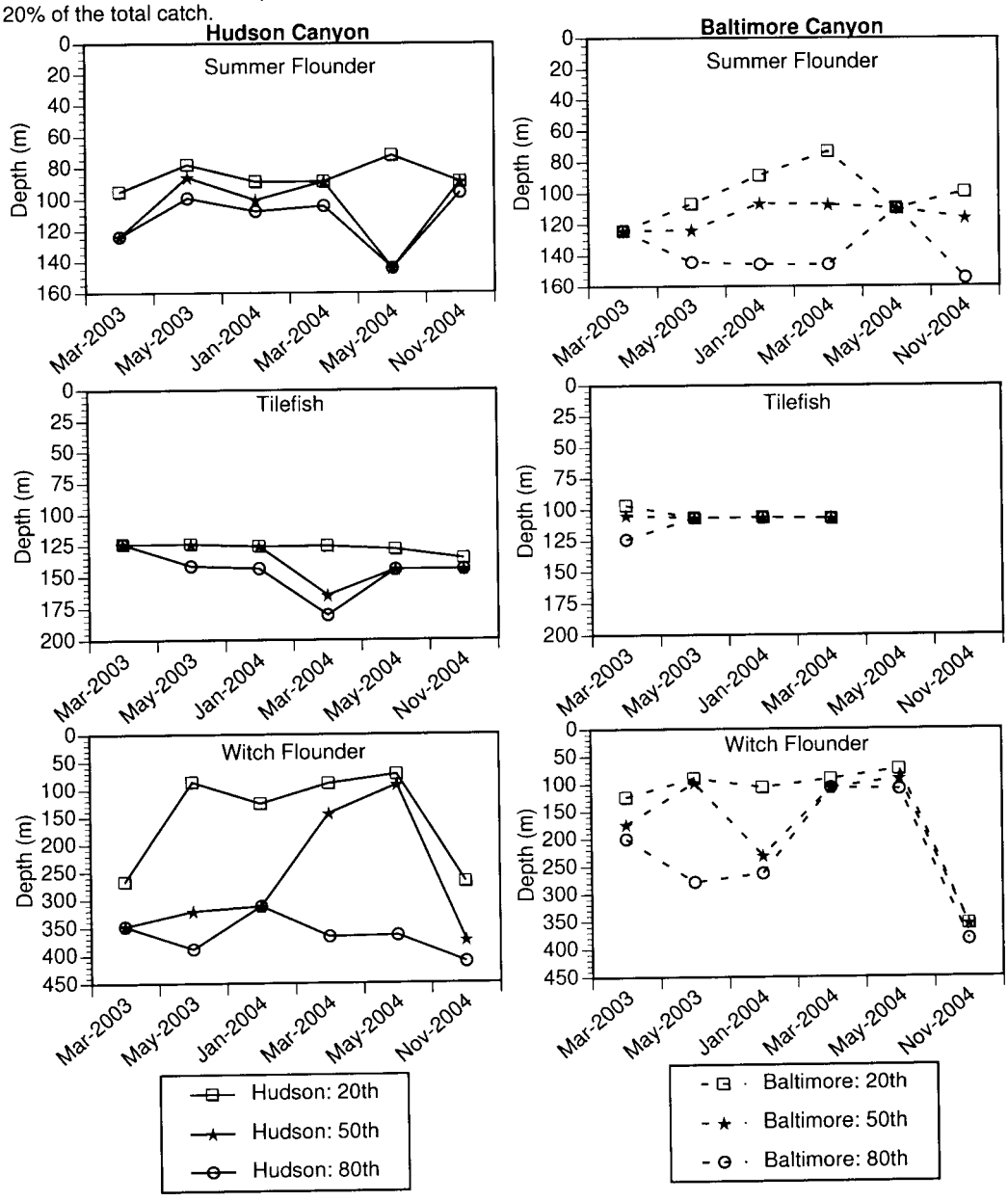


Figure 75h. Comparison of changes in depths for the 20th, 50th and 80th percentiles of cumulative catch during the March and May 2003 and January, March, May, and November 2004 surveys. To calculate the percentiles, swath area catch (Figures 5b-25b) was cumulated from the shallowest to the deepest station on each transect. The 20th percentile, for example, is the depth where the cumulative catch curve reached 20% of the total catch.



SFC
APPROVED
BY Macuda
DATE 9/29/04

Supplemental Finfish Survey Targeting Mid-Atlantic Migratory Species

January 2004 Cruise Report

Funded by the
MAFMC Research Set-Aside Program

National Fisheries Institute – Scientific Monitoring Committee
and
Haskin Shellfish Research Laboratory – Rutgers, The State University of New Jersey

January 2004 Supplemental Survey Cruise Report

The goals of the supplemental survey program are 1) to track the seasonal movements of selected fish species, particularly the fall offshore and downcoast migration coincident with declining temperatures and the spring upcoast and onshore migration that occurs as the water warms, and 2) to extend the supplemental survey beyond the domain of present-day NMFS-NEFSC surveys. As a consequence, the survey design includes spatial and temporal components, and sampling intensity is increased between 150 and 250 fm.

Organization of stations and target species

Stations are organized into cross-shelf transects oriented perpendicular to the average trend of the depth contours. The January survey sampled two fixed transects: oriented just east of Hudson Canyon (72°W) and just north of Baltimore Canyon (38°20′ N) (Figures 1 & 2). Stations were distributed by depth along each transect. Fixed stations were located at 40, 50, 60, 80, 100, 125, 150, 200, 225, and 250 fm along the Hudson Canyon transect. Fixed stations on the Baltimore Canyon transect were located at 40, 50, 60, 80, 100, 125, 150, 200, and 225 fm. The 250 fm station was not occupied on the Baltimore Canyon transect due to the steep depth gradient in the area.

An additional five adaptive stations at Hudson Canyon and four at Baltimore Canyon were sited in an unbiased way while at sea based on the catches of target species at the fixed stations. Target species were summer flounder, scup, black sea bass, monkfish, spiny dogfish, silver+offshore hake, and *Loligo* squid. To create adaptive stations, fixed stations providing the highest overall ranking based on the catch of target species were identified. Adaptive stations were placed one-half depth increment between fixed station pairs that had the highest combined station ranks based on the sum of the target species ranks at each station until all five adaptive stations were allocated. An example in the form of an Excel spreadsheet is presented as Figure 3.

January sampling included all fixed stations on the Hudson and Baltimore Canyon transects and all adaptive stations on the Hudson Canyon transect. Due to adverse weather conditions during the January survey, the four adaptive stations on Baltimore Canyon transect were not sampled.

Hudson Canyon

Fixed Stations, January Positions

	Starting Position		Ending Position		Depth	
Station #	Latitude	Longitude	Latitude	Longitude	Average	(Target)
1	39° 55.431′	72° 20.979′	39° 53.495′	72° 16.511′	40 fm	(40 fm)
2	39° 48.202′	72° 11.336′	39° 48.296′	72° 8.480′	50 fm	(50 fm)
3	39° 45.786′	72° 7.510′	39° 44.515′	72° 9.869′	59 fm	(60 fm)
4	39° 42.073′	72° 3.389′	39° 40.373′	72° 4.856′	80 fm	(80 fm)
5	39° 39.013′	71° 58.500′	39° 40.915′	71° 57.434′	200 fm	(200 fm)
6	39° 39.973′	71° 58.969′	39° 38.104′	71° 00.394′	223 fm	(225 fm)
7	39° 39.543′	72° 1.380′	39° 41.355′	71° 59.750′	252 fm	(250 fm)
8	39° 37.866′	71° 55.860′	39° 35.801′	71° 56.291′	150 fm	(150 fm)
9	39° 36.427′	71° 57.217′	39° 38.205′	71° 56.250′	125 fm	(125 fm)
10	39° 37.850′	71° 56.816′	39° 36.092′	71° 58.139′	99 fm	(100 fm)

Adaptive Stations, January Positions

	Starting Position		Ending Position		Depth	
Station #	Latitude	Longitude	Latitude	Longitude	Average	(Target)
11	39° 42 485′	72° 5.493′	39° 41.119′	72° 7.192′	69 fm	(70 fm)
12	39° 37.364′	71° 58.406′	39° 39.062′	71° 57.199′	175 fm	(175 fm)
22	39° 37.665′	72° 0.310′	39° 39.501′	71° 58.908′	135 fm	(137.5 fm)
23	39° 46.572′	72° 7.165′	39° 45.835′	72° 9.742′	55 fm	(55 fm)
24	39° 53.599′	72° 16.511′	39° 55.994′	72° 16.795′	44 fm	(45 fm)

Baltimore Canyon

Fixed Stations, January Positions

	Starting Position		Ending Position		Depth	
Station #	Latitude	Longitude	Latitude	Longitude	Average	(Target)
13	38° 23.206′	73° 47.426′	38° 21.751′	73° 49.564′	40 fm	(40 fm)
14	38° 22.085′	73° 45.245′	38° 23.407′	73° 43.013′	50 fm	(50 fm)
15	38° 17.237′	73° 36.042′	38° 15.134′	73° 36.211′	220 fm	(225 fm)
16	38° 15.777′	73° 36.761′	38° 17.797′	73° 36.017′	199 fm	(200 fm)
17	38° 21.498′	73° 42.240′	38° 23.123′	73° 40.244′	60 fm	(60 fm)
18	38° 17.492′	73° 38.107′	38° 15.479′	73° 39.626′	81 fm	(80 fm)
19	38° 16.320′	73° 38.365′	38° 18.006′	73° 36.912′	100 fm	(100 fm)
20	38° 17.533′	73° 36.891′	38° 15.612′	73° 38.202′	124 fm	(125 fm)
21	38° 15.882′	73° 37.726′	38° 17.907′	73° 36.421′	147 fm	(150 fm)

Station Sampling Protocol

Tows were made at the fixed stations according to the locations of tows from the May 2003 survey. In most cases, the captain set and hauled at a position close

to the set and haul positions from the May survey. If the adaptive stations fell at depths that were sampled during the May 2003 survey, the set and haul positions from the May survey were used. If new adaptive stations were chosen, the captain was allowed time to search an area of about 1 nautical mile in diameter at that depth to choose where to make the tow. These new positions will be used in the future should adaptive stations be chosen at those depths.

Tows were a fixed distance of 2 nautical miles. Tow speed was maintained near 3 knots. Tows were oriented along-slope to the extent possible, unless local conditions dictated a different approach. DGPS position was logged to 0.01′ latitude and longitude every 1 minute during the tow. Depth, door spread, GMT, and GPS position were logged manually every 5 minutes by the captain. Depth and bottom water temperature were logged remotely at 1-minute intervals using a Vemco sensor attached to the top of the codend.

Gear

The target species included a combination of groundfish and other species. To permit efficient capture of groundfish while also maintaining a reasonable degree of catchability for other species such as scup, a 4-seam box net with a standard 6-cm codend (liner) was used. The fishing circle of the net is 506 meshes of 6″ mesh. The extension of the net is 3″ mesh knot to knot, 100 meshes long, and 225 meshes around. The codend is made of 6.5″ mesh knot to knot, 100 meshes long, 70 meshes around, and is lined with a 6-cm mesh liner. The chaffing gear is a mat made of 6″ mesh covering 2/3 of the bottom of the codend. The doors are 104″ Thyboron with a spoiler. Each door weighs 1640 pounds. The footrope is constructed from 114′ 6.5″ × 1/2″ stainless steel wire wrapped with #12 polyester with 2 wire extensions of 6′ 5.16″ eye to eye joined with two 3/4″ bow shackles for an overall length of 127′ 11″. The headrope is 117′ 11.52″ overall length, including the extensions. There are 92 8″ hi-impact floats hung in groups of 6 on 5/8″ poly plus, grouped closely together in the center with a set of 6 on each wing. The traveler is made of 1/2″ stainless steel wire banded with 1/2″ stainless steel bands to the footrope. The overall length is 119′, with the stainless steel bands spaced at 1′ 11″ intervals. The sweep is made up of 5/8″ stainless steel wire with 84 1.4 pound leads in the center section and 3 link 1/2″ trix drop chains at 1′ 11″ intervals throughout. The sweep is in three sections joined with 1/2″ hanging locks and 2′ 6″ of 1/2″ trix chains on each wing end. Each wing is 46′ 6.84″ eye to eye and the bosom is 29′ 2.28″ eye to eye. The sweep is covered with 3″ rubber cookies.

Sample Processing Protocol

Sample processing protocol followed standard NMFS survey methods. Each tow was sorted to species and catch weights were obtained for each species. Target

species for length measurements included: summer flounder, scup, black sea bass, monkfish, spiny dogfish, skates, yellowtail flounder, winter flounder, American lobster, silver/offshore hake, and *Loligo* squid. Priority species were then measured. The goal for each priority species was 100 length measurements for each tow. If fewer than 100 individuals were caught, all of the individuals were measured. Each priority species was then divided into size classes and the first 3 individuals measured in each size class were weighed. Beginning in January, 2004, spiny dogfish were separated by sex prior to analysis. Neither yellowtail flounder nor winter flounder were caught in any of the tows. Personnel availability limited the amount of biological sampling done on the January survey, but scale samples were taken from large black sea bass (> 40 cm).

Species	# Length Measurements	# Weight Measurements	# Samples Taken/Type
Loligo squid	1910	238	0
Summer flounder	1260	193	0
Male spiny dogfish	1257	216	0
Offshore hake	1048	131	0
Silver hake	929	190	0
Black sea bass	654	177	13/Scales
Illex squid	611	109	0
Monkfish	557	301	0
Female spiny dogfish	294	158	0
Scup	291	48	0
Rosette skate	201	94	0
American lobster	85	58	0
Thorny skate	44	34	0
Barndoor skate	41	39	0
Clearnose skate	20	20	0
Smooth skate	2	2	0

Results

A total of 24 tows were made during the January 2004 survey. Fifteen tows were taken along the Hudson Canyon transect and 9 along the Baltimore Canyon transect. Table 1 presents the basic tow information for each tow. Average depth was calculated as the average of all of the depths recorded by the Vemco minilogger during the tow. Depth range is the difference between the deepest and shallowest depth recorded during each tow. Scope was calculated by dividing the amount of tow wire out (m) by the average depth (m) of each tow, and normally fell between 2.2 and 3.5 m. Tow time (h) is the duration of each tow and speed (km/h) is the distance traveled divided by the duration of each tow. Distance (km) was calculated using 1-minute DGPS positions after establishing the beginning and ending positions of each tow using the Vemco minilogger depth record. Tow distance was approximately

3.5 to 4.5 km in most cases and tow speed range varied by no more than 15% from 5.5 km/hr. Swept area (km^2) was calculated by multiplying the average door spread (m) by the distance traveled for each tow (km), and normally fell between 0.25 and 0.30 km^2. Due to the rapidly changing depth contours in Baltimore Canyon, it was difficult to maintain a constant depth in the deep-water stations. Nevertheless, the average tow depths were relatively close to the target depths for all tows (Table 1).

Swath area measures the relative importance of each sampled depth according to its contribution to total distance along the transect set perpendicular to the depth contour. Figure 4 shows an example of how the distance along the transect was allocated to each tow for the calculation of swath area. The calculation projects the swept area of the tow had the net been towed along the main axis of the transect for the distance allocated to each sample depth. This distance is established by the midpoints between perpendiculars dropped to the transect line from the midpoints of each tow.

Table 2 lists the total catch, in kilograms, for each species caught on the survey. A line indicates the species whose total catch was greater than 1% of the total catch of all species. Table 3 lists the number of tows and the percentage of the total tows in which each species was caught.

Figures 5a-24a depict, by transect, the swept area catch (kg/km^2) for most species whose total catch was greater than 1% of the total catch of all species, and for selected other commercially-important species. Figures 5b-24b depict, by transect, the projected catch of each species for a distance along the transect represented by each tow swath. Figures 25a-39a represent the cumulative size-frequency distributions obtained by first normalizing each tow's data to swept area and then summing across all tows in each transect. Figures 25b-39b show the cumulative size-frequency distributions, corrected first to swept area as before, but then normalized to swath distance along the transect, and finally summed across all tows in each transect. Figures 40-51 are the cumulative size-frequencies, by tow, for each measured species with greater than 20 individuals measured per tow. Figures 52-63 show the relationship between length and weight per species by tow for each transect.

Figures 64a and 64b show the relationship between selected measures of sampling performance and temperature between the May 2003 and January 2004 surveys. Overall, little variation occurred between the two surveys. Tow depth varied little. Depth range was more variable and increased with increasing target depth (Figure 65). Higher bottom temperatures were observed during January 2004. Scope varied consistently with depth as expected (Figure 65). Swept area and tow distance varied little (Figure 64b). The two surveys resulted in a similar distribution between tow times and tow speeds. The ranges of tow times is about

the same in May and January.

Figures 66a-d compare the 20th, 50th, and 80th percentiles of depth distribution of species based on kg caught at each depth for each species in March and May 2003 and January 2004. To calculate the percentiles, swath area catch (Figures 5b-24b) was cumulated from the shallowest to the deepest station on each transect. The 20th percentile, for example, is the depth where the cumulative catch curve reached 20% of the total catch. As examples, the figure for scup indicates that the population moved to shallower depths from March to May on both the Hudson and Baltimore Canyon transects and appear to have remained at that depth in January. The same is true of northern sea robin. On both Hudson and Baltimore Canyon transects, American lobster moved to shallower depths from March to May and then moved back to deeper water in January. The figure for spiny dogfish indicates that over time the population moved to shallower areas in Hudson Canyon and to deeper areas in Baltimore Canyon. The figure for silver hake indicates that the population moved deeper in Baltimore Canyon from May to January, while remaining at approximately 100 m in Hudson Canyon during the same time period. *Illex* squid shows a broad distribution across the shelf in March and January and a narrower depth range in May, mainly due to consolidation of individuals from the deeper areas into the shallower depths.

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Table 1. Results of data recorded for each tow in January 2004. Transect 1 = Hudson Canyon Transect; Transect 2= Baltimore Canyon Transect. Target depth represents the depths at which the fixed positions were chosen before the cruise. Tow depth represents the actual depth at which each tow was made, calculated as the average of the depths recorded every minute during the tow.

Transect	Tow	Date	Tow Begin Time (Military)	Target Depth m	Tow Depth m	Depth Range m	Scope m	Swept Area km^2	Swath Area km^2	Bottom Temperature F	Tow Time h	Tow Speed km/h	Tow Distance km
1	1	01/25/04	07:41	73.15	71.82	9.80	3.82	0.25	129.54	46.57	0.77	5.28	4.05
1	2	01/25/04	10:36	91.44	88.71	9.80	3.09	0.24	584.52	49.10	0.78	5.21	4.08
1	3	01/25/04	13:45	109.73	107.50	6.50	2.98	0.27	255.33	50.86	0.73	5.89	4.32
1	4	01/25/04	16:51	146.30	143.31	19.60	3.19	0.25	261.23	54.08	0.72	4.93	3.53
1	5	01/25/04	20:30	365.76	362.65	13.00	2.27	0.25	77.21	45.85	0.73	5.07	3.72
1	6	01/25/04	23:01	411.48	401.46	35.90	2.28	0.26	54.98	46.04	0.80	4.76	3.80
1	7	01/26/04	00:54	457.20	462.66	123.80	2.17	0.27	45.10	44.46	0.67	5.84	3.90
1	8	01/26/04	07:25	274.32	269.63	16.30	2.54	0.27	78.82	48.26	0.75	5.13	3.85
1	9	01/26/04	09:56	228.60	227.38	32.60	2.82	0.28	122.22	51.05	0.70	5.75	4.03
1	10	01/26/04	12:04	182.88	179.04	6.50	3.06	0.30	266.19	52.82	0.72	5.75	4.12
1	11	01/26/04	15:03	128.02	125.47	6.50	3.28	0.25	353.70	53.81	0.67	5.29	3.53
1	12	01/26/04	17:32	320.04	311.93	22.80	2.49	0.25	158.12	48.26	0.75	4.80	3.60
2	13	01/31/04	11:43	73.15	72.14	6.50	3.80	0.30	176.60	48.01	0.80	5.17	4.13
2	14	01/31/04	15:51	91.44	88.52	6.50	3.10	0.28	306.23	47.85	0.70	5.84	4.09
2	15	01/31/04	18:24	411.48	385.21	101.00	2.26	0.29	32.27	44.63	0.83	5.10	4.25
2	16	01/31/04	19:56	365.76	334.77	127.10	2.59	0.29	65.10	46.47	0.82	5.15	4.21
2	17	02/01/04	07:04	109.73	106.42	3.30	3.01	0.30	460.70	47.86	0.73	5.73	4.20
2	18	02/01/04	09:07	146.30	145.74	9.80	2.82	0.31	348.10	51.26	0.80	5.48	4.38
2	19	02/01/04	11:39	182.88	177.87	6.50	3.08	0.27	53.08	50.90	0.67	5.70	3.80
2	20	02/01/04	14:13	228.60	230.86	35.80	2.77	0.30	34.24	50.11	0.80	5.21	4.17
2	21	02/01/04	16:02	274.32	262.60	58.60	2.61	0.30	40.40	50.23	0.82	5.27	4.31
1	22	02/02/04	07:14	250.55	240.65	6.50	2.85	0.28	14.35	50.94	0.68	5.80	3.96
1	23	02/02/04	09:25	100.58	100.42	3.30	2.73	0.25	169.46	49.08	0.63	6.21	3.93
1	24	02/02/04	11:40	82.30	78.94	6.50	3.48	0.28	610.13	46.46	0.75	5.95	4.46

Table 2. Total catch in kg for each species caught during the January 2004 survey. Species above the line represent those species whose total catch was greater than 1% of the total catch of all species.

Species	Total Catch (kg)	Species	Total Catch (kg)
Male Spiny Dogfish	9478.796	Scup	31.121
Butterfish	5655.865	Weakfish	29.452
Spotted Hake	4527.405	Alewife	28.000
Summer Flounder	3694.518	Longfin Hake	19.799
Loligo Squid	2868.309	Thorny Skate	12.696
Silver Hake	1619.066	Armored Sea Robin	10.769
Offshore Hake	1395.504	Shrimp, Unk.	9.199
Monkfish	1210.112	Marlinspike Grenadier	8.305
Fourspot Flounder	1121.671	Starfish, Unk.	6.695
Northern Sea Robin	1066.899	Crab, Unk.	5.298
Witch Flounder	811.300	Redfish, Unk.	4.559
Female Spiny Dogfish	809.980	Spotfin Dragonet	4.096
Striped Sea Robin	804.319	Smooth Skate	3.701
Little Skate	581.927	American Eel	3.298
Anemone, Unk.	497.999	Atlantic Mackerel	2.676
Deepsea Red Crab	424.000	Galatheid, Unk.	2.431
Black Sea Bass	423.964	Spider Crab, Unk.	1.855
Buckler Dory	332.919	Daggertooth	1.751
Chain Dogfish	326.727	Roughy, Unk.	1.352
Hickory Shad	181.328	Winter Skate	1.302
Jonah Crab	172.002	Batfish, Unk.	1.297
Illex Squid	170.333	Lancetfish	1.270
Red Hake	161.579	Deepbody Boarfish	0.898
Rosette Skate	139.403	Duckbill Flathead	0.798
White Hake	127.940	Slender Snipe Eel	0.531
Barndoor Skate	119.998	Longnose Greeneye	0.499
Blackbelly Rosefish	104.948	Shell, Unk.	0.499
Sea Scallop	74.525	Gulfstream Flounder	0.340
Sea Potato	72.747	Octopus, Unk.	0.200
Smooth Dogfish	59.303	Shortspine Boarfish	0.200
American Lobster	43.758	Shark, Unk.	0.200
Tilefish	38.297	Fish, Unk.	0.200
Clearnose Skate	34.278	Hake, Unk.	0.100

Table 3. Number and percentage of tows in which each species was caught.

Species	# Times Caught	Percentage
Monkfish	24	100
Loligo Squid	24	100
Male Spiny Dogfish	23	96
Female Spiny Dogfish	23	96
Jonah Crab	21	88
Witch Flounder	21	88
Silver Hake	19	79
Fourspot Flounder	19	79
Spotted Hake	19	79
Illex Squid	19	79
Summer Flounder	17	71
Chain Dogfish	17	71
Butterfish	16	67
Hickory shad	14	58
Buckler Dory	13	54
Offshore Hake	13	54
Black Sea Bass	11	46
Armored Sea Robin	11	46
Clearnose Skate	11	46
Rosette Skate	11	46
American Lobster	11	46
White Hake	10	42
Blackbelly Rosefish	10	42
Little Skate	9	38
Northern Sea Robin	9	38
Weakfish	9	38
Crab, Unk.	9	38
Red Hake	8	33
Tilefish	8	33
Anemone, Unk.	8	33
Marlinspike Grenadier	8	33
Scup	7	29
Striped Sea Robin	7	29
Atlantic Mackerel	6	25
Sea Potato	6	25
Sea Scallop	5	21
Barndoor Skate	5	21
Galatheid, Unk.	5	21
Deepsea Red Crab	5	21
Shrimp, Unk.	5	21
Spider Crab, Unk.	5	21
Roughy, Unk.	5	21
Spotfin Dragonet	5	21
Starfish, Unk.	5	21
Alewife	4	17
American Eel	4	17
Smooth Dogfish	4	17
Longfin Hake	4	17
Batfish, Unk.	4	17
Smooth Skate	3	13
Slender Snipe Eel	3	13
Lancetfish	3	13
Thorny Skate	3	13
Gulfstream Flounder	3	13
Daggertooth	2	8
Redfish, Unk.	2	8
Winter Skate	1	4
Octopus, Unk.	1	4
Longnose Greeneye	1	4
Hake, Unk.	1	4
Shortspine Boarfish	1	4
Duckbill Flathead	1	4
Deepbody Boarfish	1	4
Shark, Unk.	1	4
Fish, Unk.	1	4
Shell, Unk.	1	4

Figure 1. Location of tows made along the Hudson Canyon Transect in January 2004. Fixed tows are marked with triangles as the tow begin point and circles as the tow end point. Adaptive tows are marked with stars as the beginning and ending points.

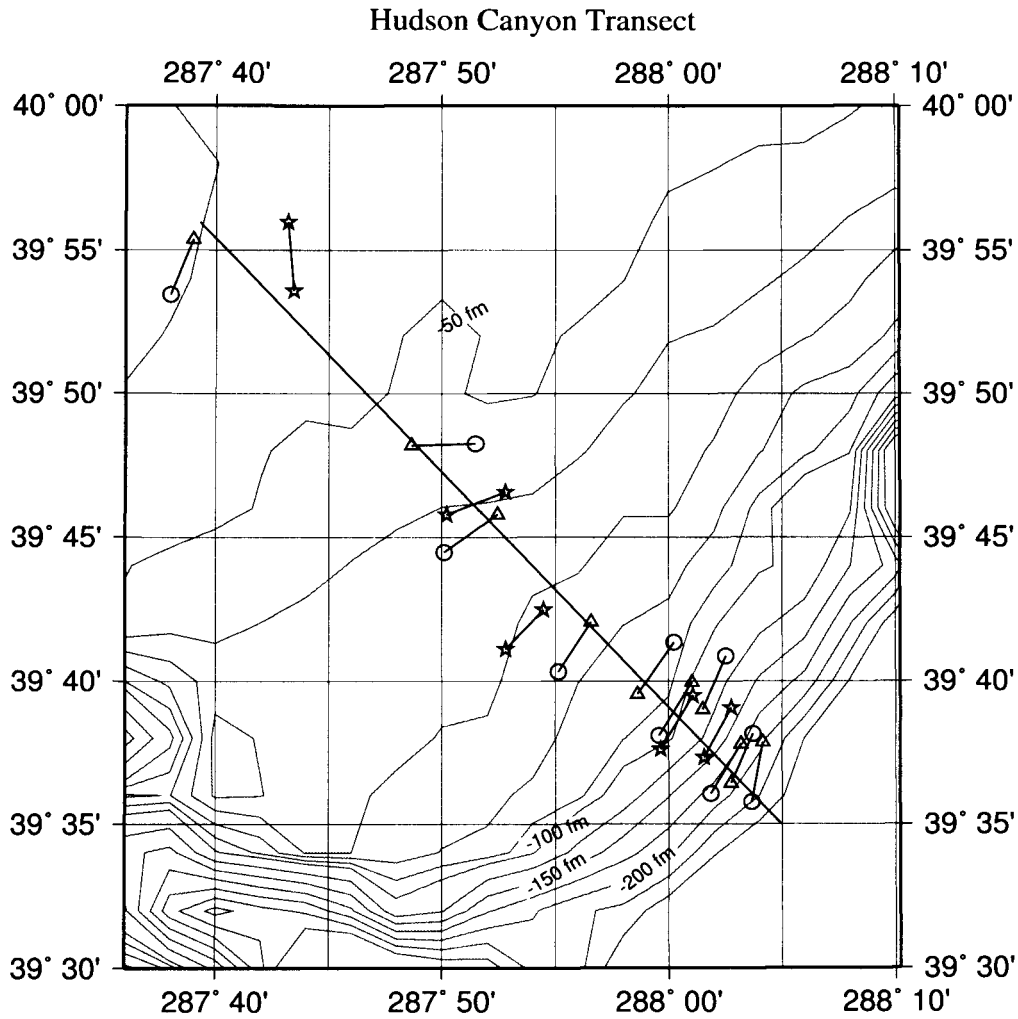


Figure 2. Location of tows made along the Baltimore Canyon Transect in January 2004. Fixed tows are marked with triangles as the tow begin point and circles as the tow end point.

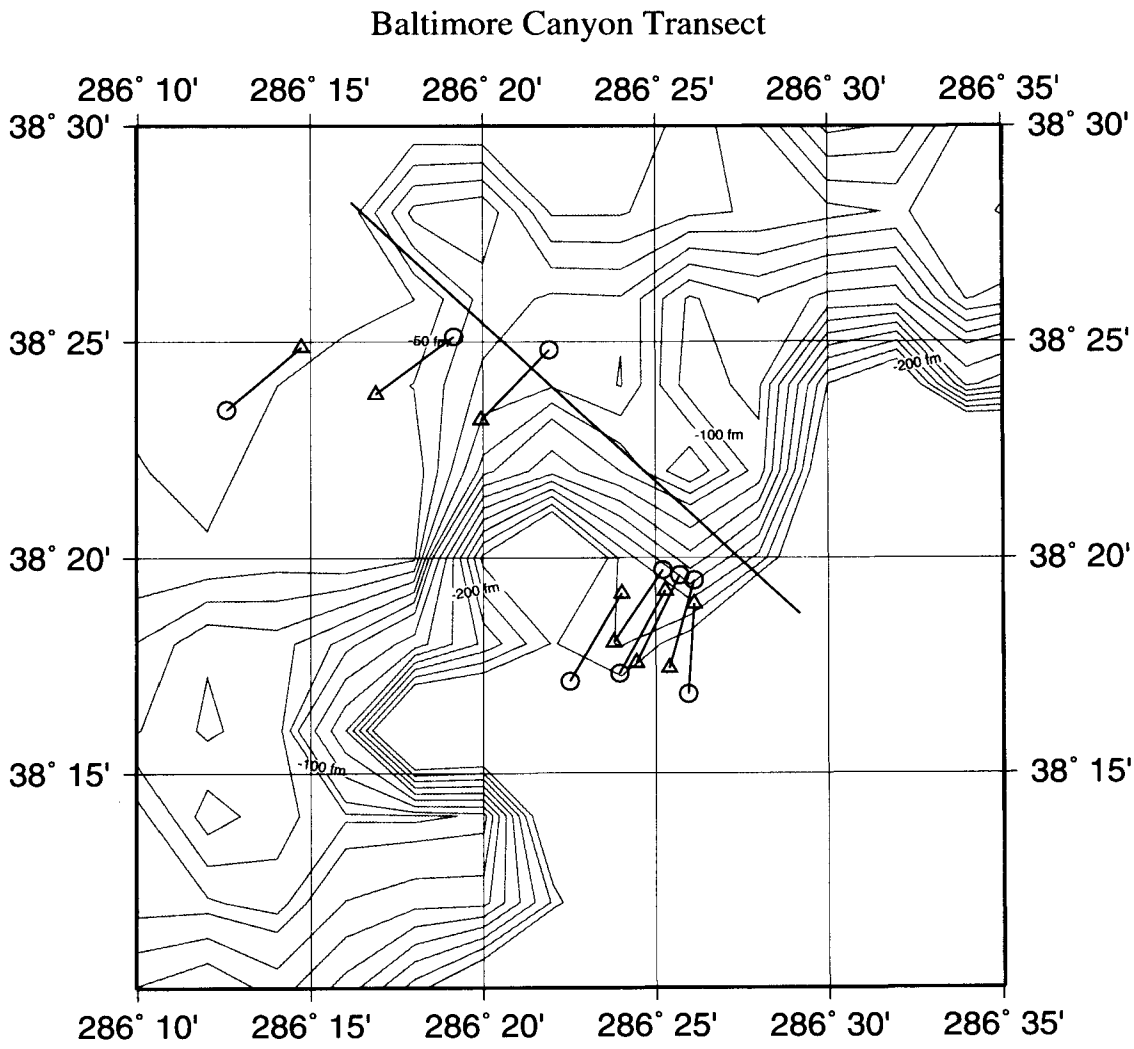


Figure 3. Selection of adaptive tows on Hudson Canyon transect for the January 2004 survey. The stations are ranked according to catches of target species. The ranks are summed (Sum column in lower left table). Potential intermediate stations are established between each of the fixed stations (upper right table). The five to be sampled are identified by the five lowest scores (average sum of ranks between adjacent fixed stations) in the Sum column (*** in lower right table).

Catch (kg) for All Fixed Stations of the Hudson Transect

Fixed Station Depth (fm)	Monkfish	Scup	Black Sea Bass	Loligo Squid	Silver + Offshore Hake	Summer Flounder	Spiny Dogfish
40	24.9	1.3	5.2	71.1	93.4	155.4	1596.9
50	12.0	0.2	24.4	94.3	77.9	321.4	32.3
60	32.0	0.0	78.8	61.1	31.9	1191.1	44.8
80	26.1	0.0	2.1	183.8	0.6	77.6	324.6
100	13.8	0.0	0.0	48.9	23.8	7.8	59.6
125	51.4	0.0	0.0	20.4	189.1	0.0	61.1
150	109.1	0.0	0.0	9.3	469.6	0.0	173.3
200	59.8	0.0	0.0	9.2	164.5	17.8	147.7
225	27.0	0.0	0.0	0.7	61.9	0.0	6.8
250	26.0	0.0	0.0	0.6	163.4	0.0	90.5

Potential Adaptive Stations at Intermediate Depths:

Depth (fm)
45
55
70
90
112.5
137.5
175
212.5
237.5

Rank of Catch by Species

Fixed Station Depth (fm)	Monkfish	Scup	Black Sea Bass	Loligo Squid	Silver + Offshore Hake	Summer Flounder	Spiny Dogfish	Sum
40	8	1	3	3	5	3	1	24
50	10	2	2	2	6	2	9	33
60	4	3	1	4	8	1	8	29
80	7	3	4	1	10	4	2	31
100	9	3	5	5	9	6	7	44
125	3	3	5	6	2	7	6	32
150	1	3	5	7	1	7	3	27
200	2	3	5	8	3	5	4	30
225	5	3	5	9	7	7	10	46
250	6	3	5	10	4	7	5	40

Integrating Ranks Between Stations

Intermediate Depth (fm)	Avg. Sum of Ranks	
45	28.5	***
55	31	***
70	30	***
90	37.5	
112.5	38	
137.5	29.5	***
175	28.5	***
212.5	38	
237.5	43	

Figure 4. Swath distance for tows 1, 2, and 3, taken near a transect, showing the distance allotted to each tow had it actually been taken along the transect.

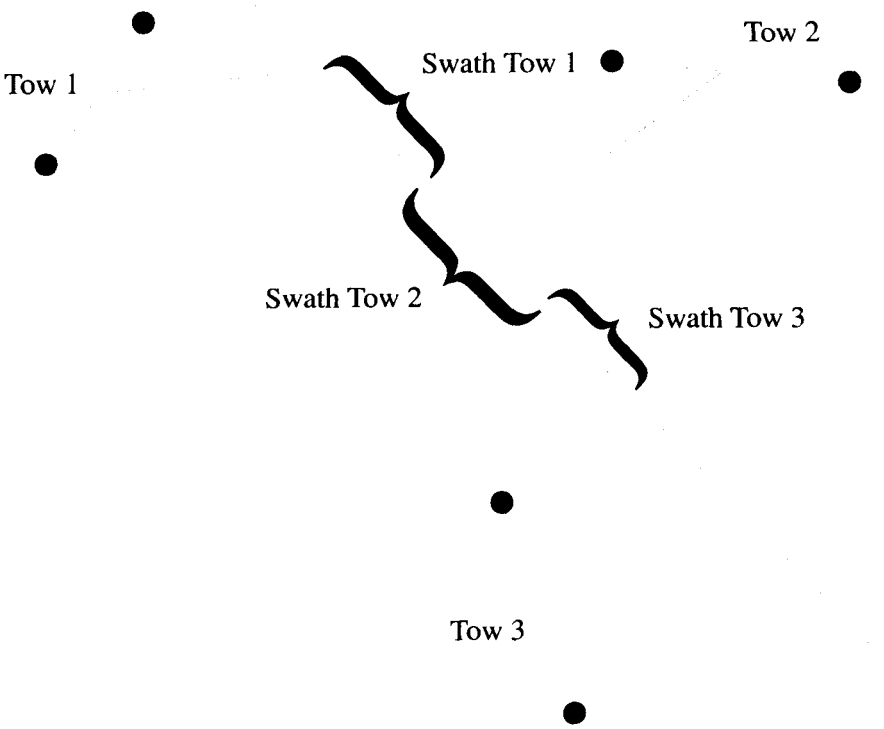


Figure 5a. Catches of American lobster in each tow along the two transects. Catch is recorded in kg caught/swept area (km^2). Depth is the average depth at which each tow was made (in meters). Tow numbers indicate the sampling sequence during the cruise. Tows are ordered shallowest to deepest along the x-axis.

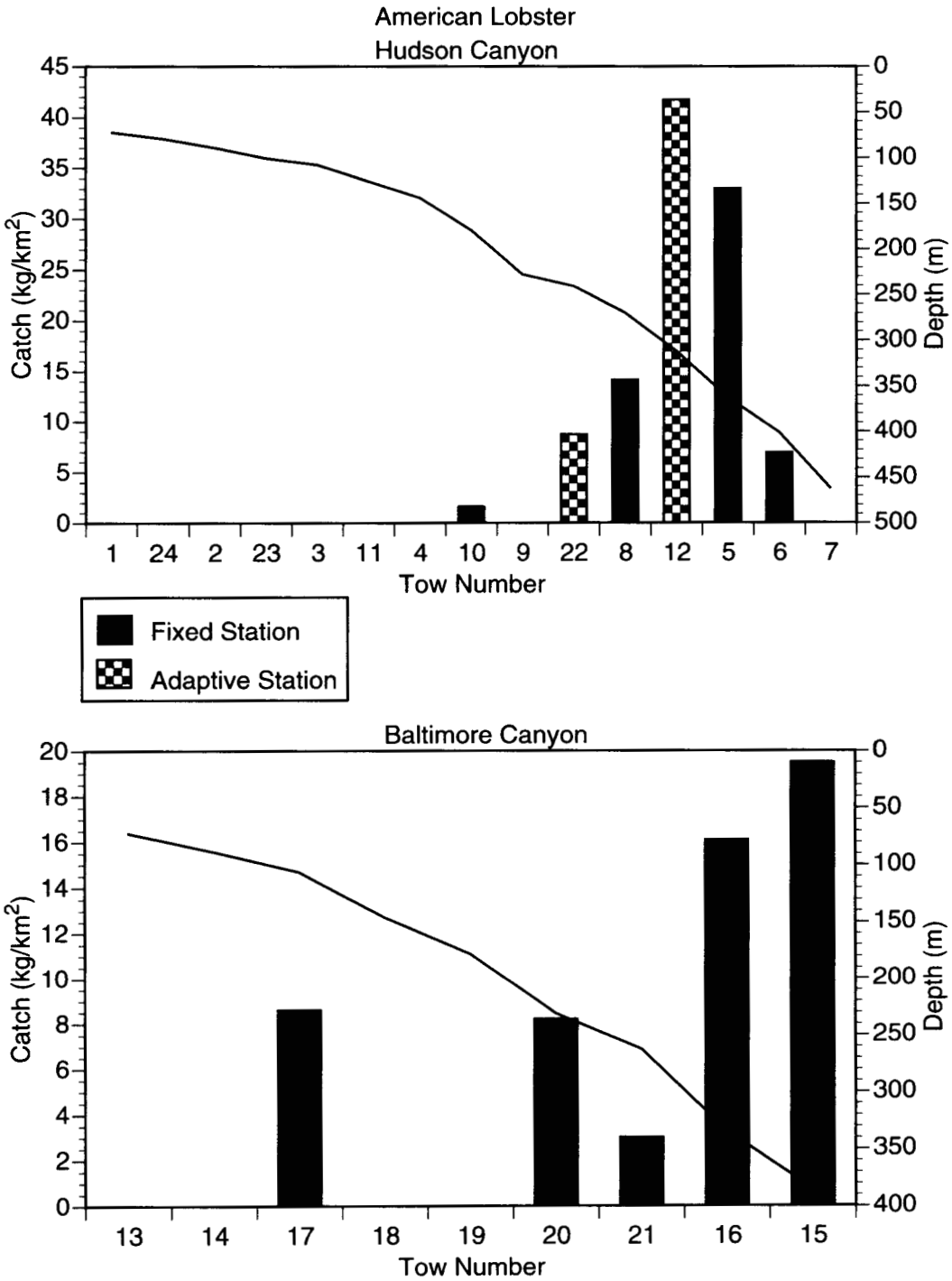


Figure 5b. Projected abundance of American lobster along the transect with each tow representing the projected abundance for the distance along the transect. Tow numbers indicate the sampling sequence during the cruise. Tows are ordered shallowest to deepest along the x-axis.

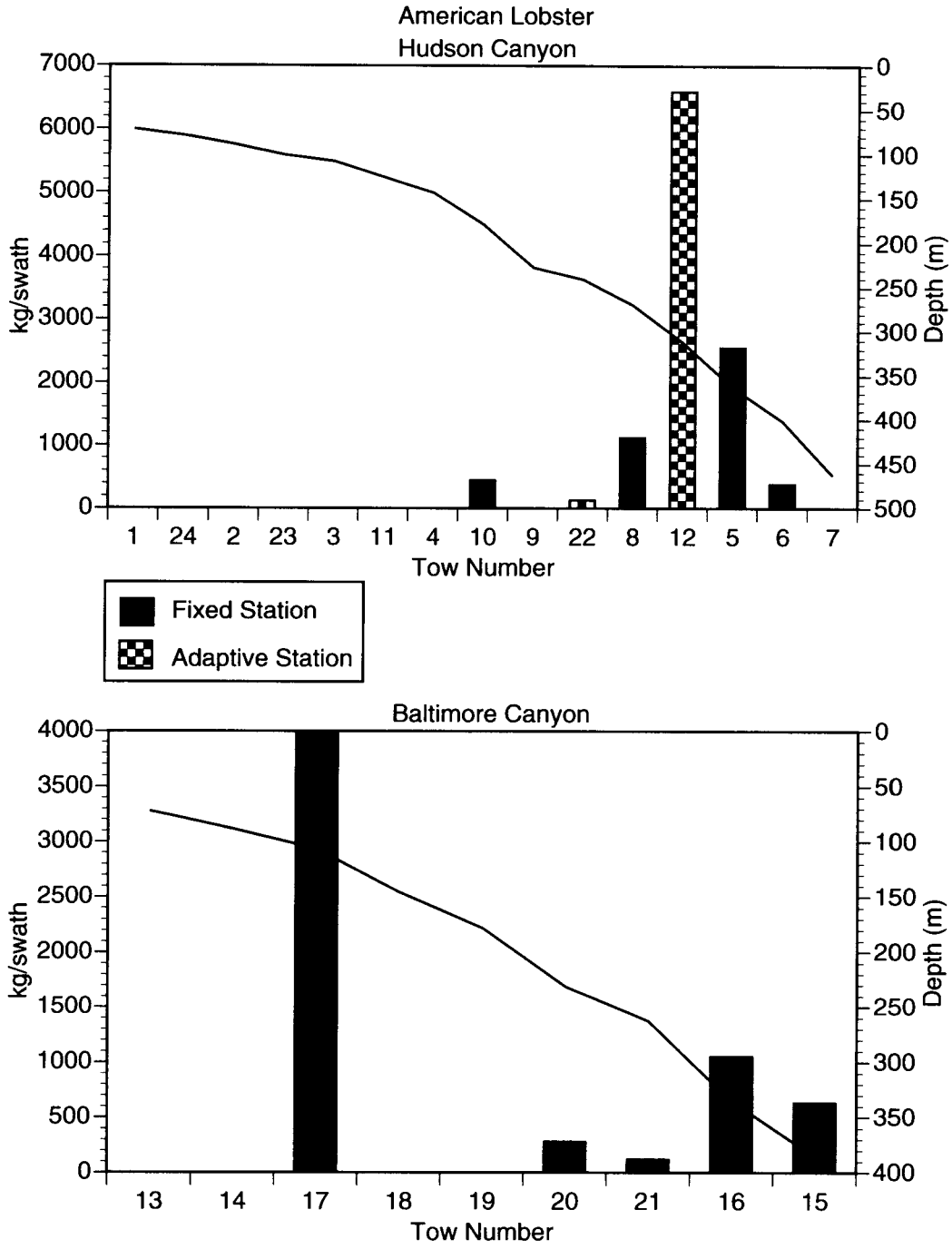


Figure 6a. Catches of black sea bass in each tow along the two transects. Catch is recorded in kg caught/swept area (km^2). Depth is the average depth at which each tow was made (in meters). Tow numbers indicate the sampling sequence during the cruise. Tows are ordered shallowest to deepest along the x-axis.

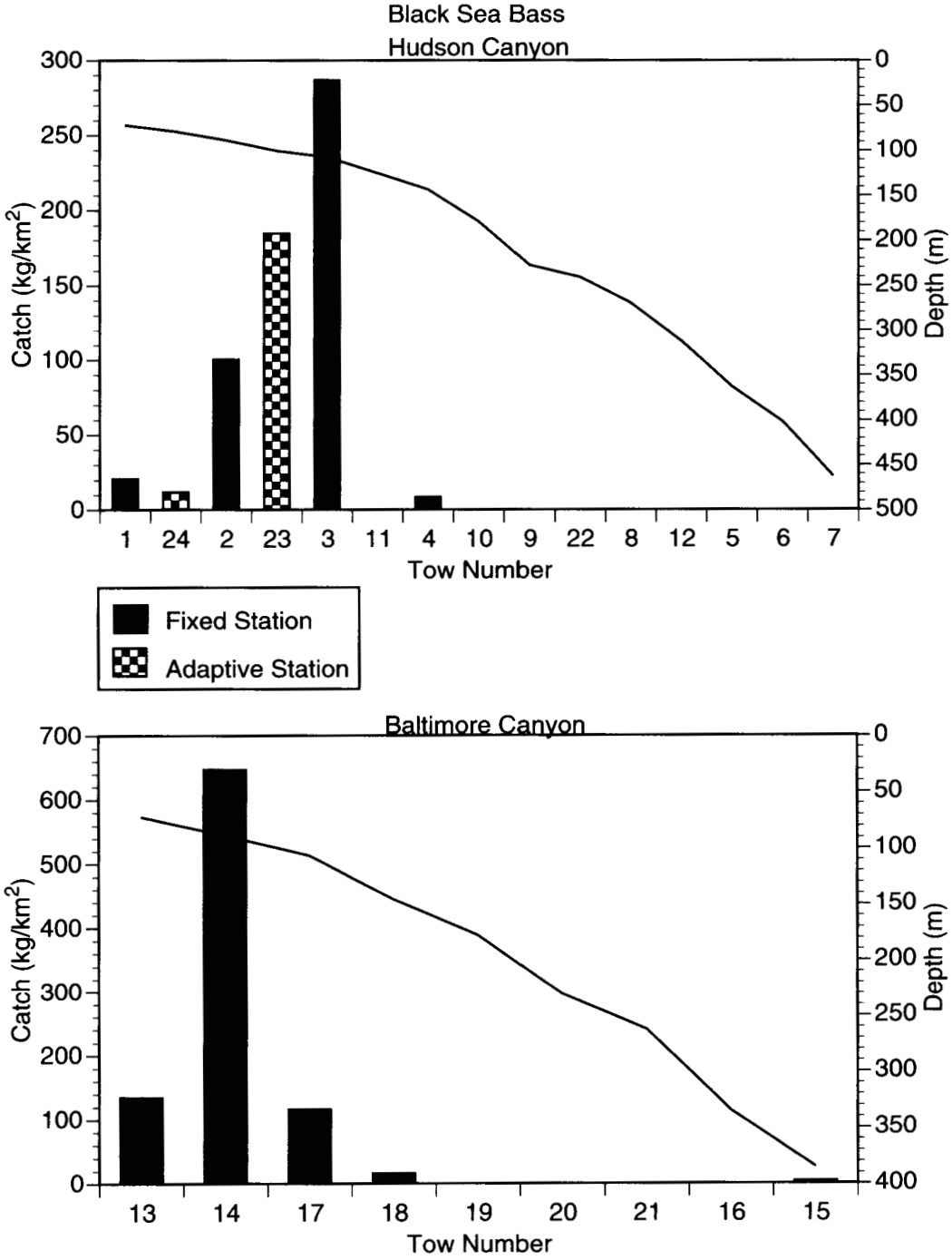


Figure 6b. Projected abundance of black sea bass along the transect with each tow representing the projected abundance for the distance along the transect. Tow numbers indicate the sampling sequence during the cruise. Tows are ordered shallowest to deepest along the x-axis.

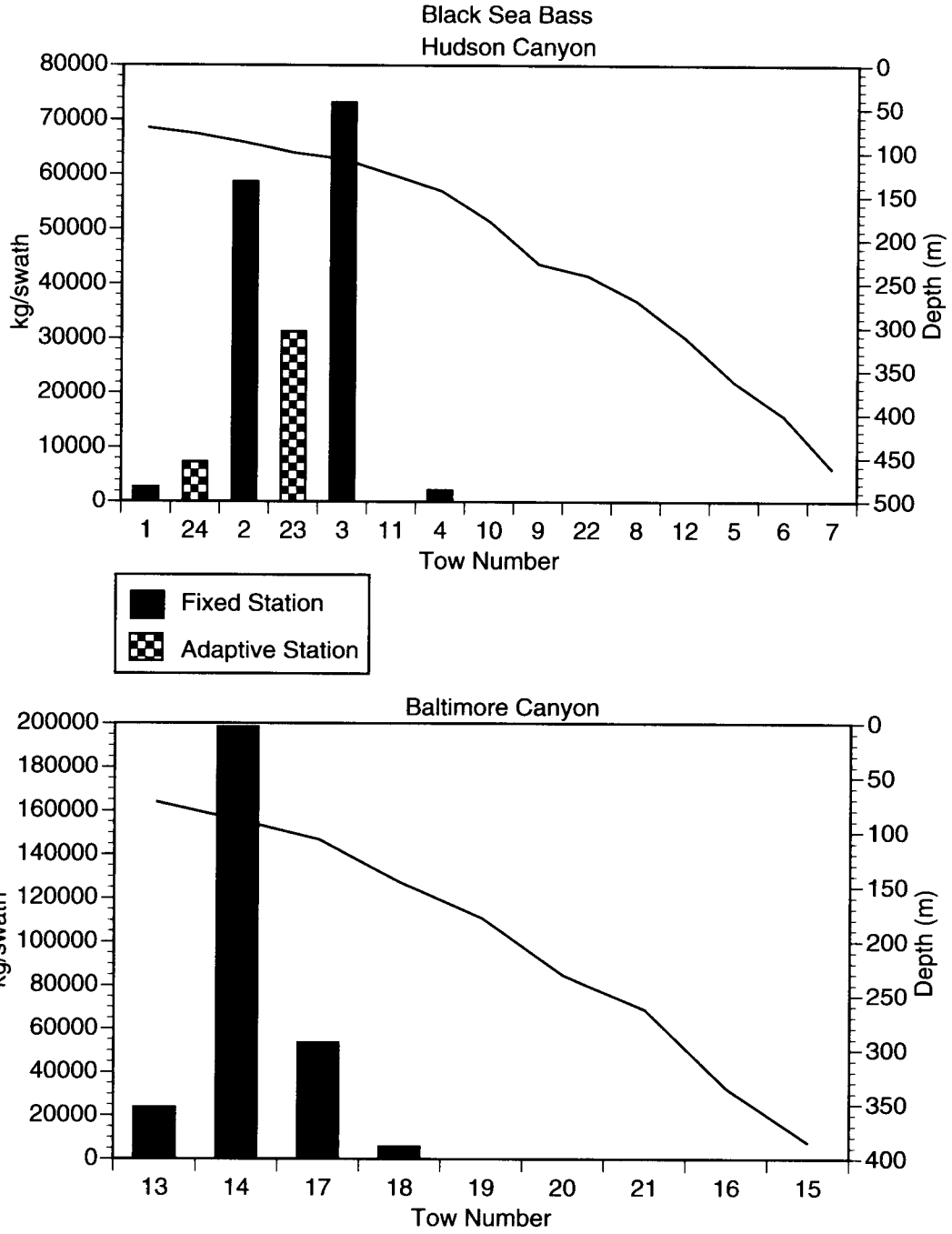


Figure 7a. Catches of butterfish in each tow along the two transects. Catch is recorded in kg caught/swept area (km^2). Depth is the average depth at which each tow was made (in meters). Tow numbers indicate the sampling sequence during the cruise. Tows are ordered shallowest to deepest along the x-axis.

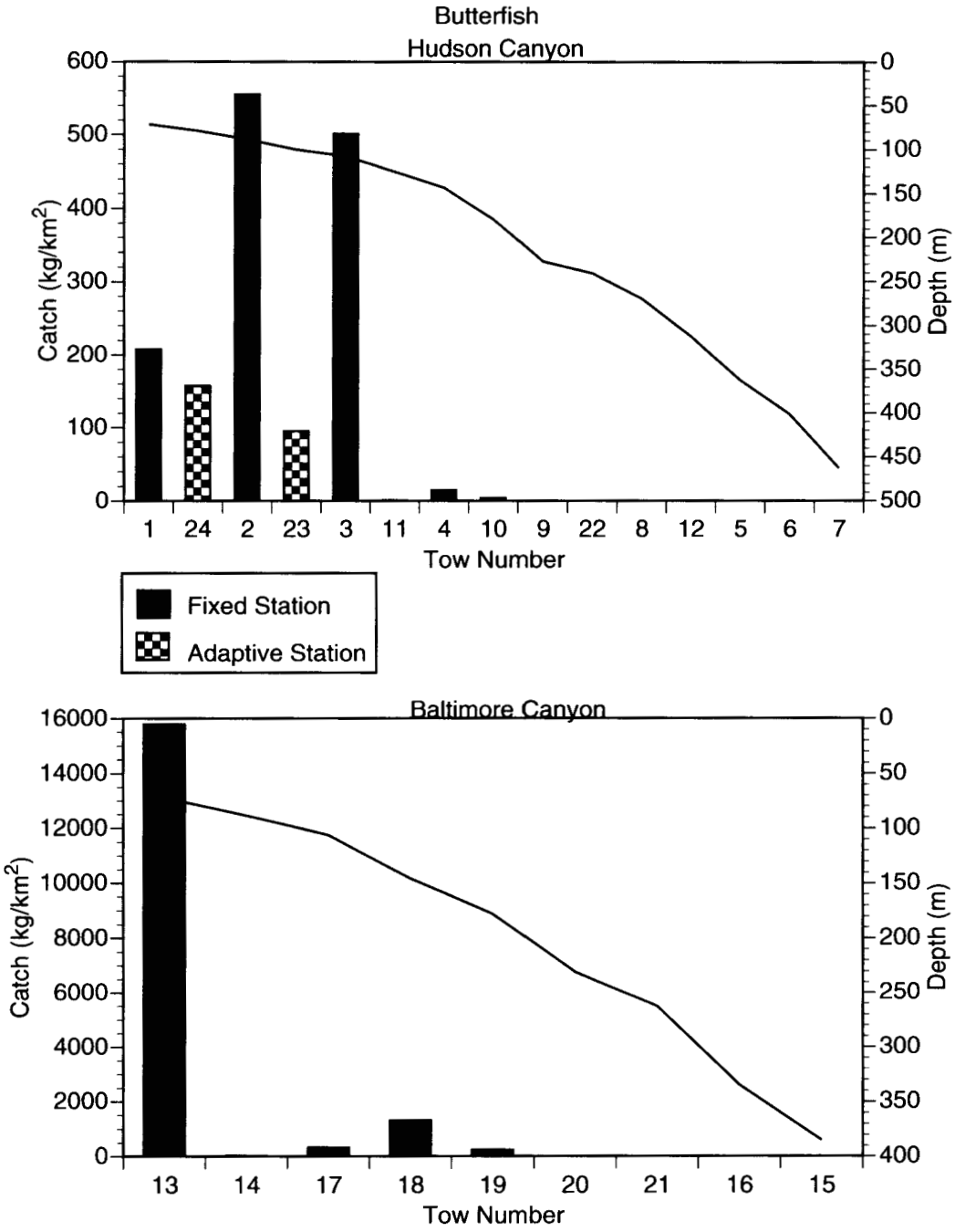


Figure 7b. Projected abundance of butterfish along the transect with each tow representing the projected abundance for the distance along the transect. Tow numbers indicate the sampling sequence during the cruise. Tows are ordered shallowest to deepest along the x-axis.

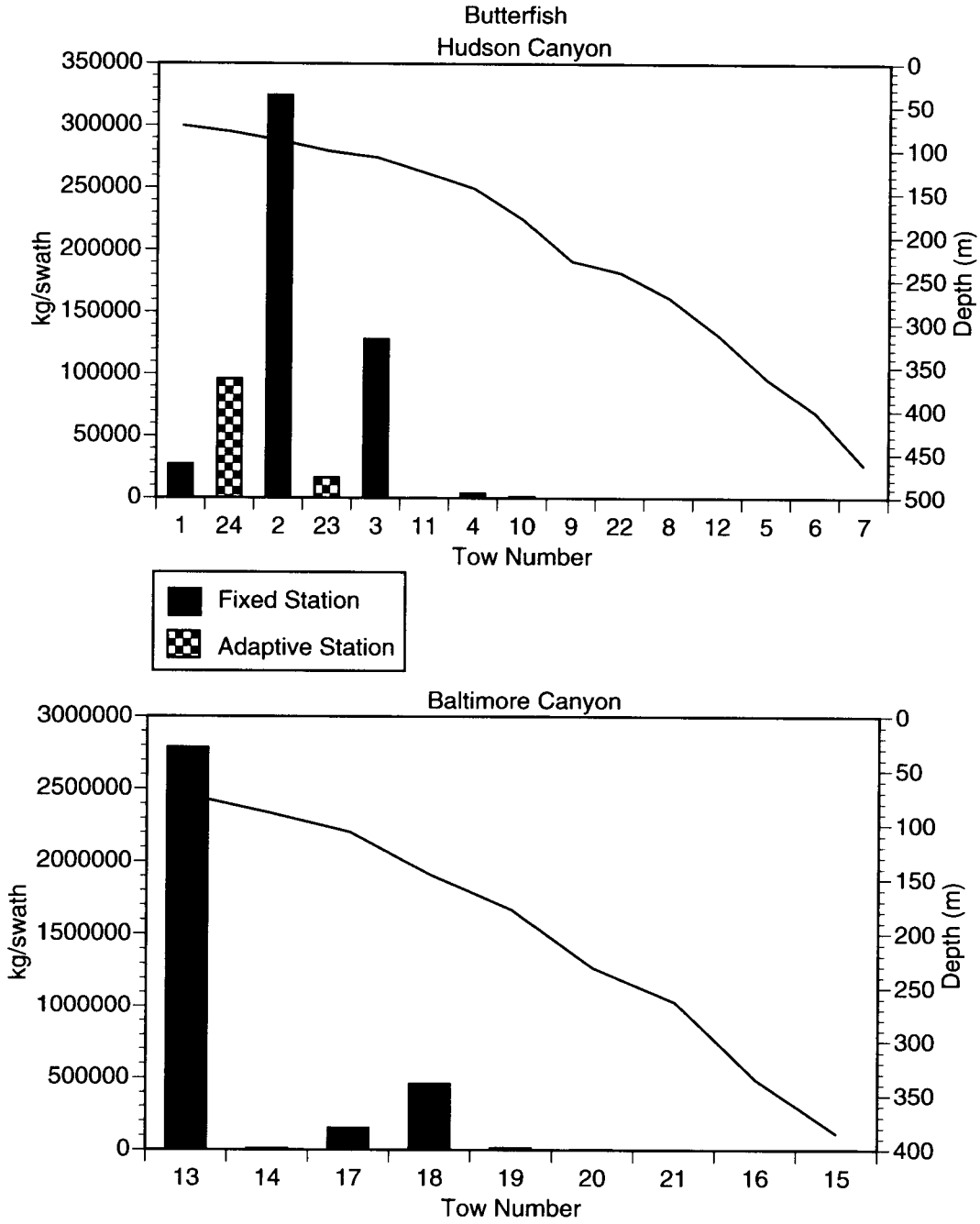


Figure 8a. Catches of deepsea red crab in each tow along the two transects. Catch is recorded in kg caught/swept area (km^2). Depth is the average depth at which each tow was made (in meters). Tow numbers indicate the sampling sequence during the cruise. Tows are ordered shallowest to deepest along the x-axis.

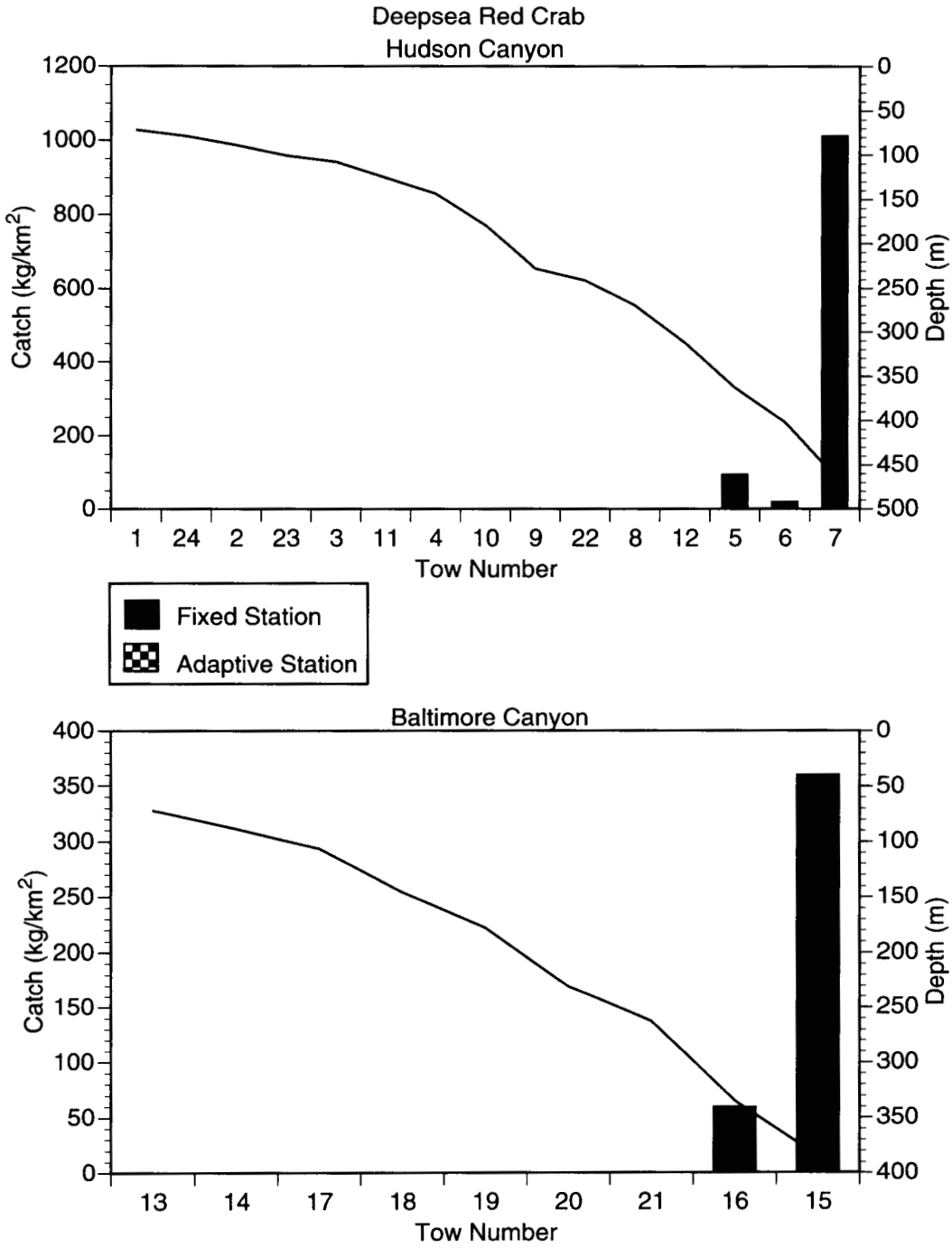


Figure 8b. Projected abundance of deepsea red crab along the transect with each tow representing the projected abundance for the distance along the transect. Tow numbers indicate the sampling sequence during the cruise. Tows are ordered shallowest to deepest along the x-axis.

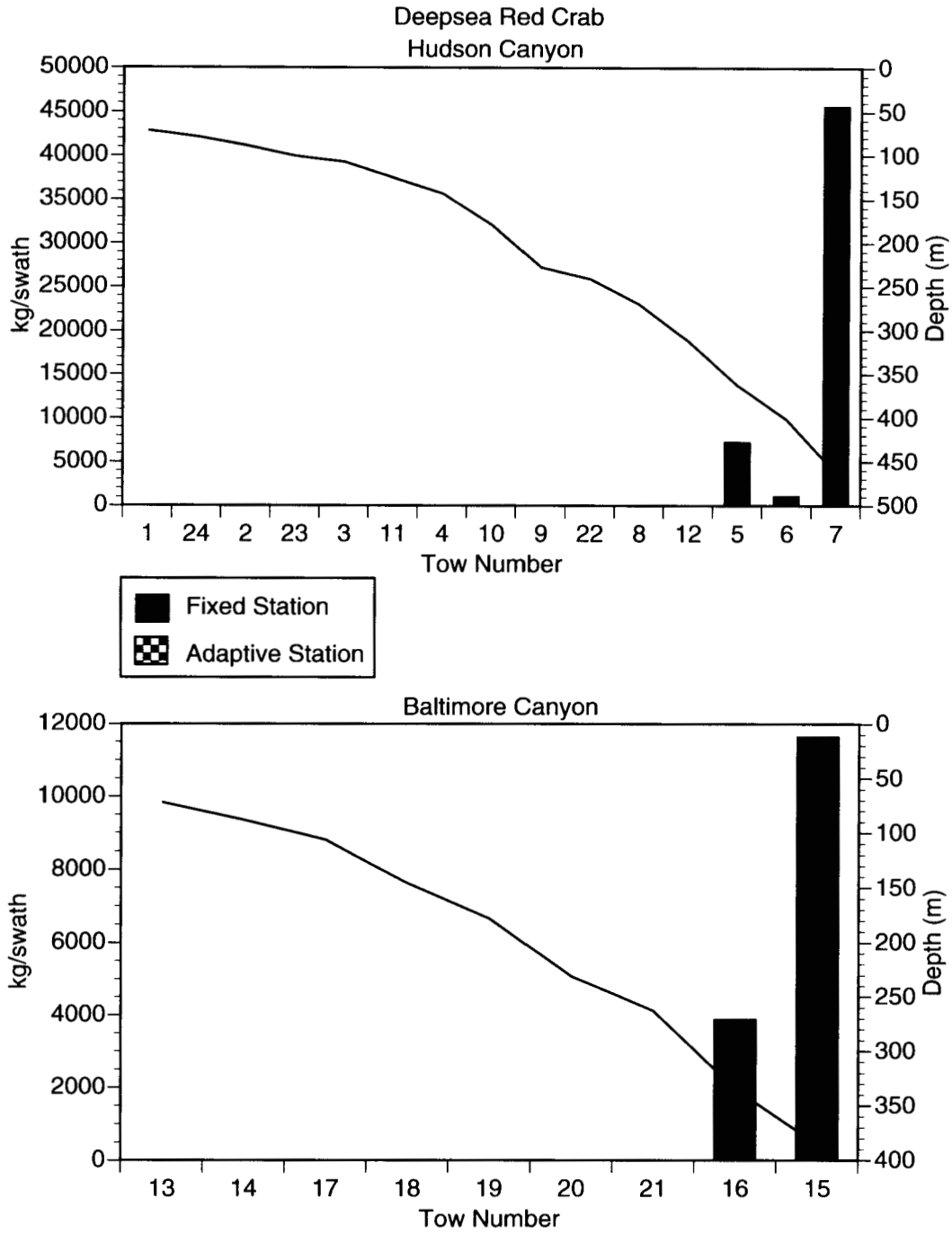


Figure 9a. Catches of fourspot flounder in each tow along the two transects. Catch is recorded in kg caught/swept area (km^2). Depth is the average depth at which each tow was made (in meters). Tow numbers indicate the sampling sequence during the cruise. Tows are ordered shallowest to deepest along the x-axis.

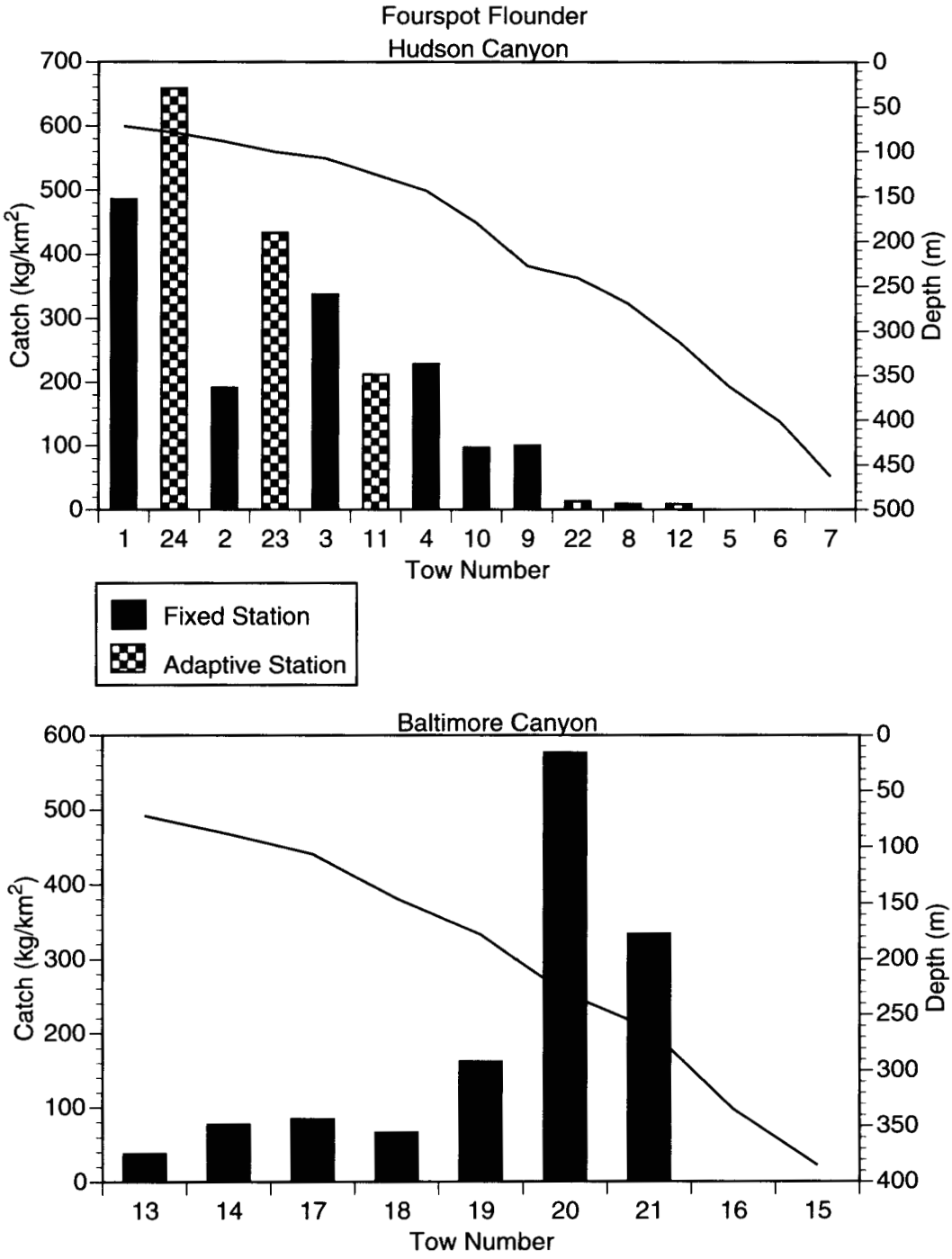
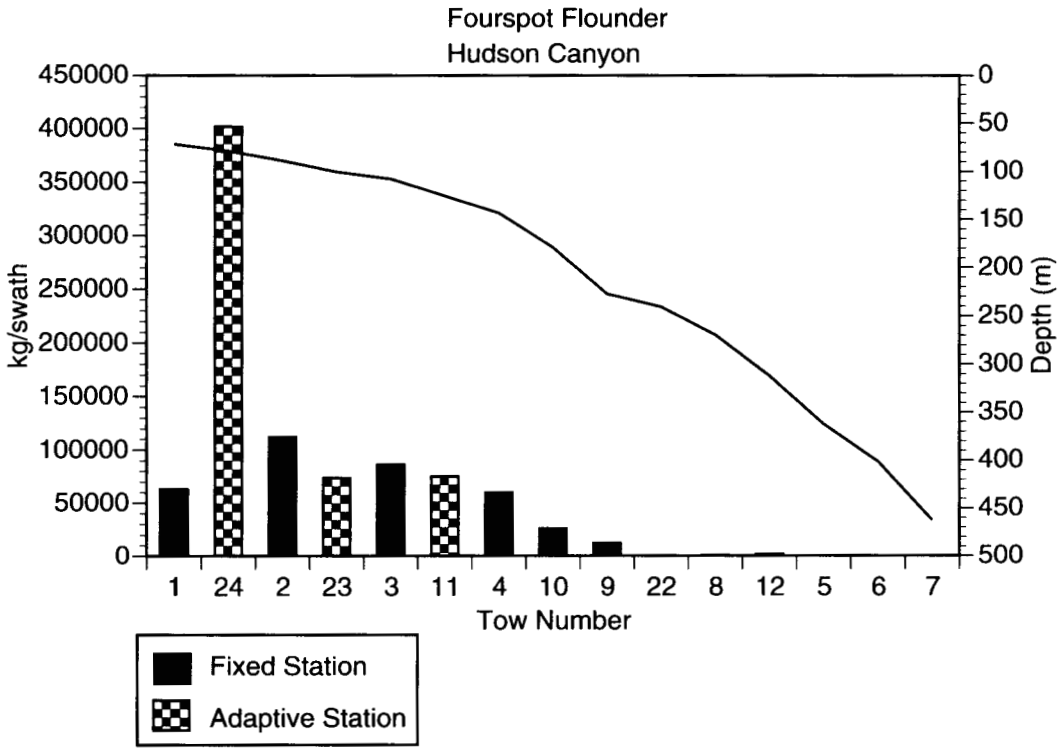


Figure 9b. Projected abundance of fourspot flounder along the transect with each tow representing the projected abundance for the distance along the transect. Tow numbers indicate the sampling sequence during the cruise. Tows are ordered shallowest to deepest along the x-axis.



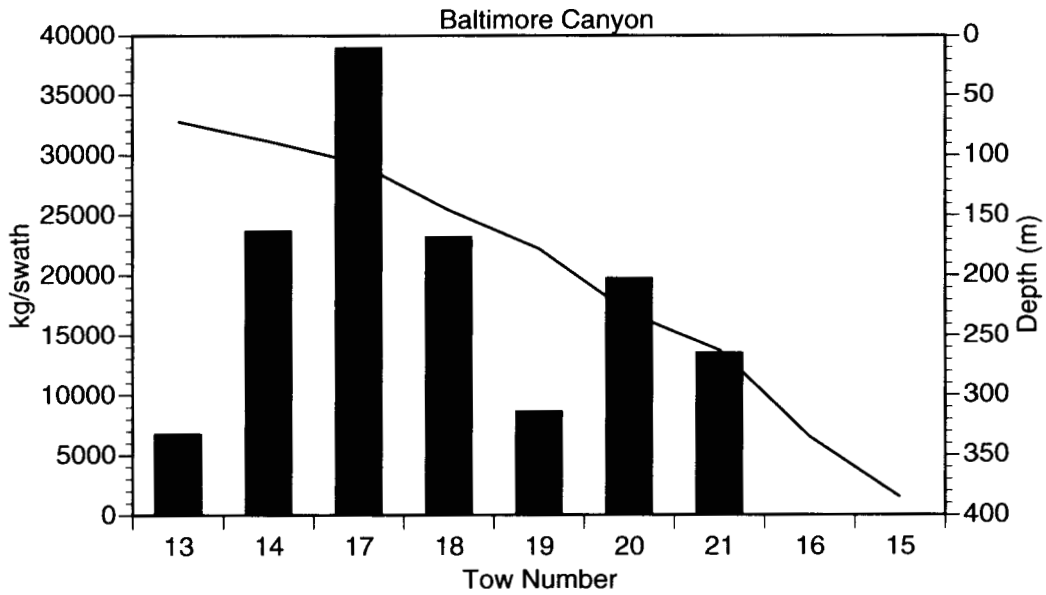


Figure 10a. Catches of *Illex* squid in each tow along the two transects. Catch is recorded in kg caught/swept area (km^2). Depth is the average depth at which each tow was made (in meters). Tow numbers indicate the sampling sequence during the cruise. Tows are ordered shallowest to deepest along the x-axis.

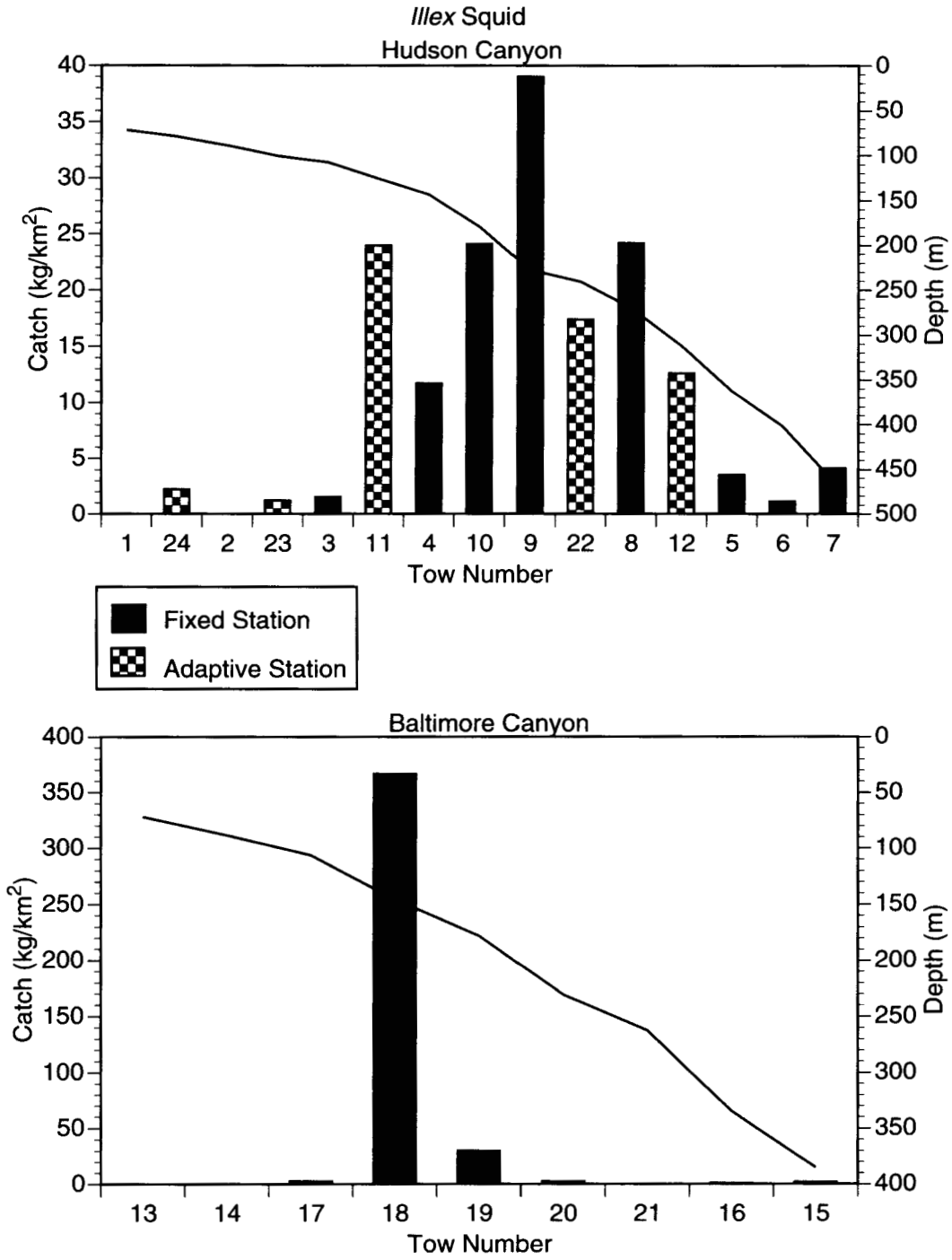
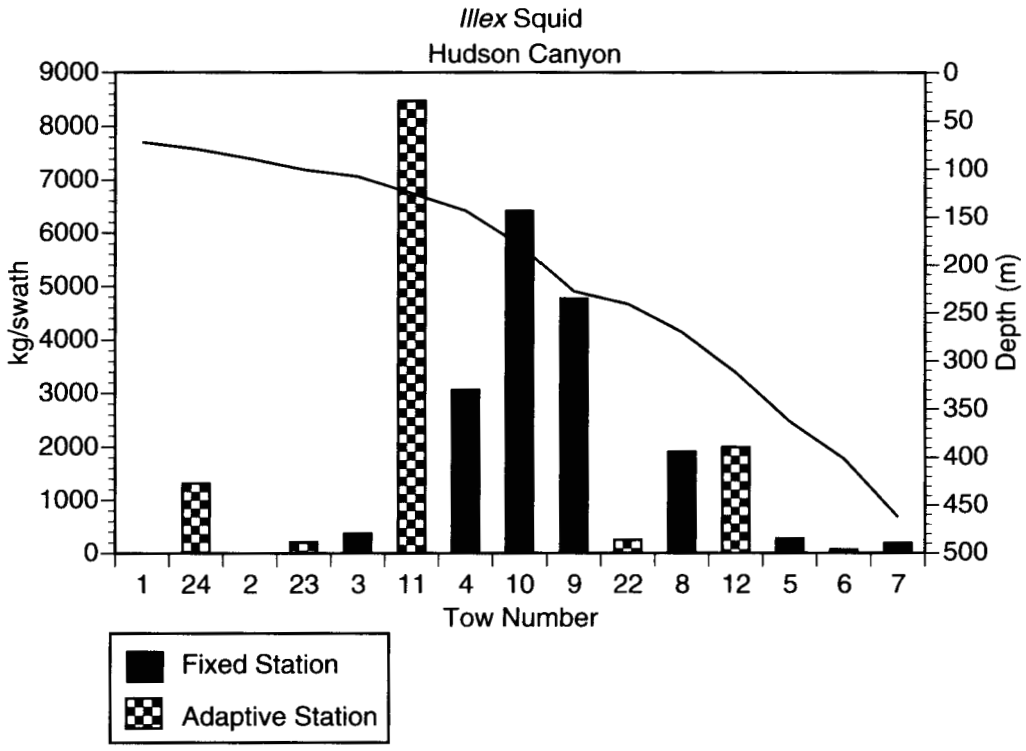


Figure 10b. Projected abundance of *Illex* squid along the transect with each tow representing the projected abundance for the distance along the transect. Tow numbers indicate the sampling sequence during the cruise. Tows are ordered shallowest to deepest along the x-axis.



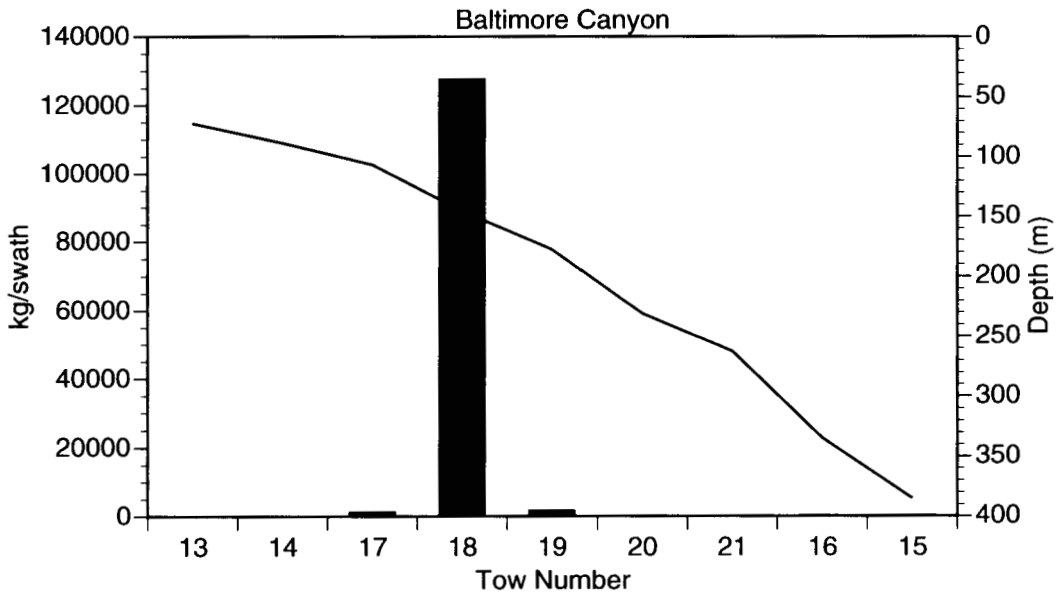


Figure 11a. Catches of little skate in each tow along the two transects. Catch is recorded in kg caught/swept area (km^2). Depth is the average depth at which each tow was made (in meters). Tow numbers indicate the sampling sequence during the cruise. Tows are ordered shallowest to deepest along the x-axis.

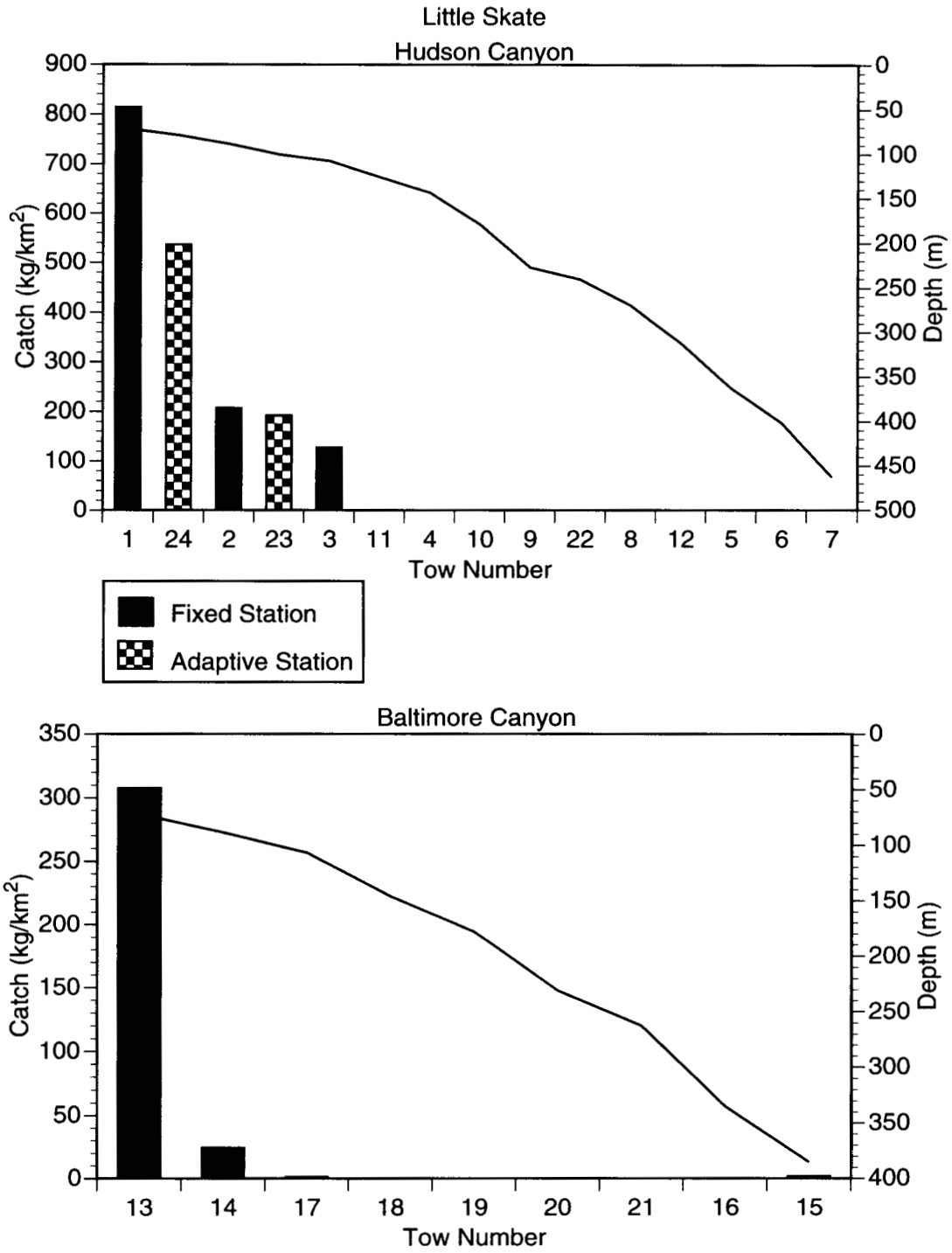


Figure 11b. Projected abundance of little skate along the transect with each tow representing the projected abundance for the distance along the transect. Tow numbers indicate the sampling sequence during the cruise. Tows are ordered shallowest to deepest along the x-axis.

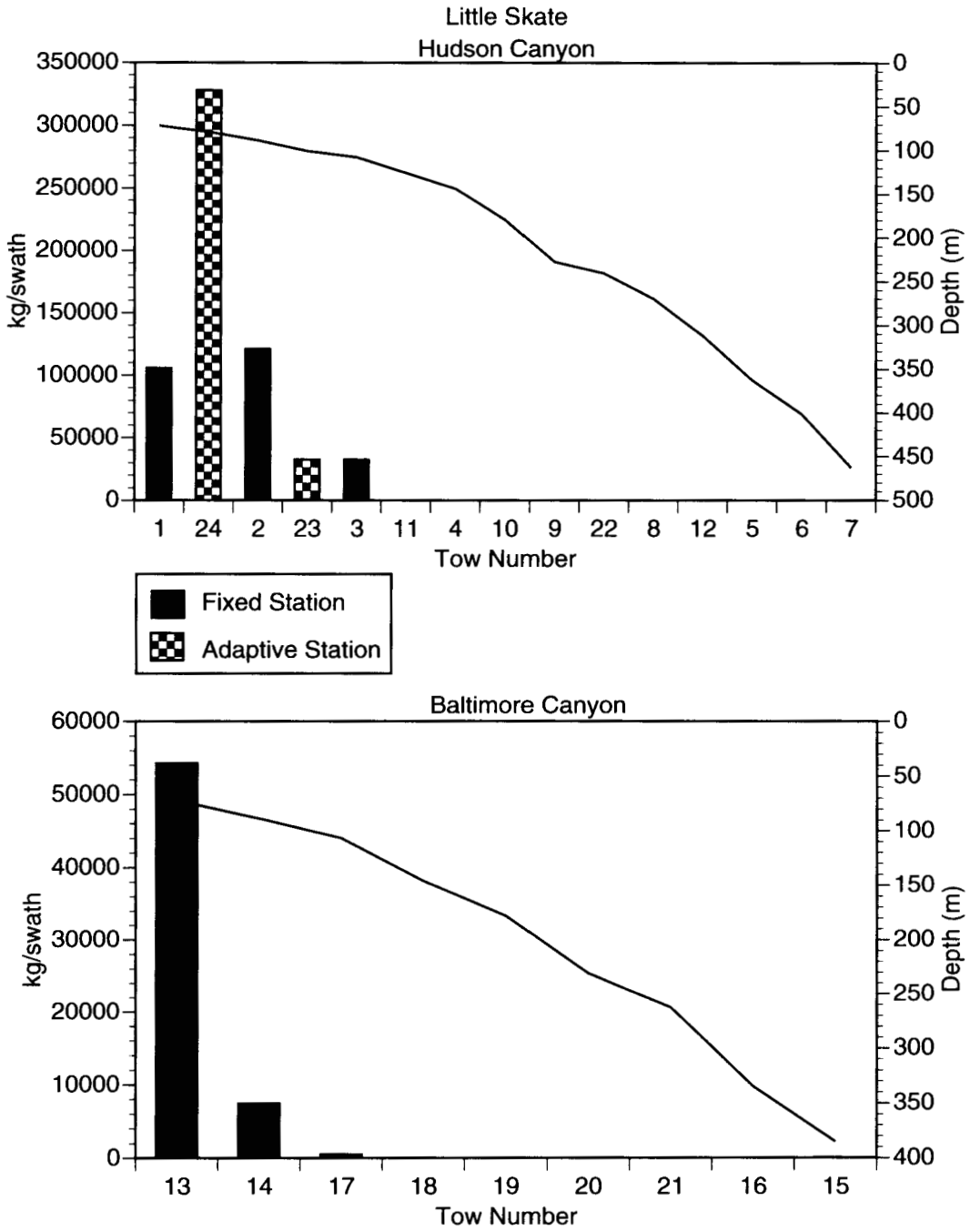
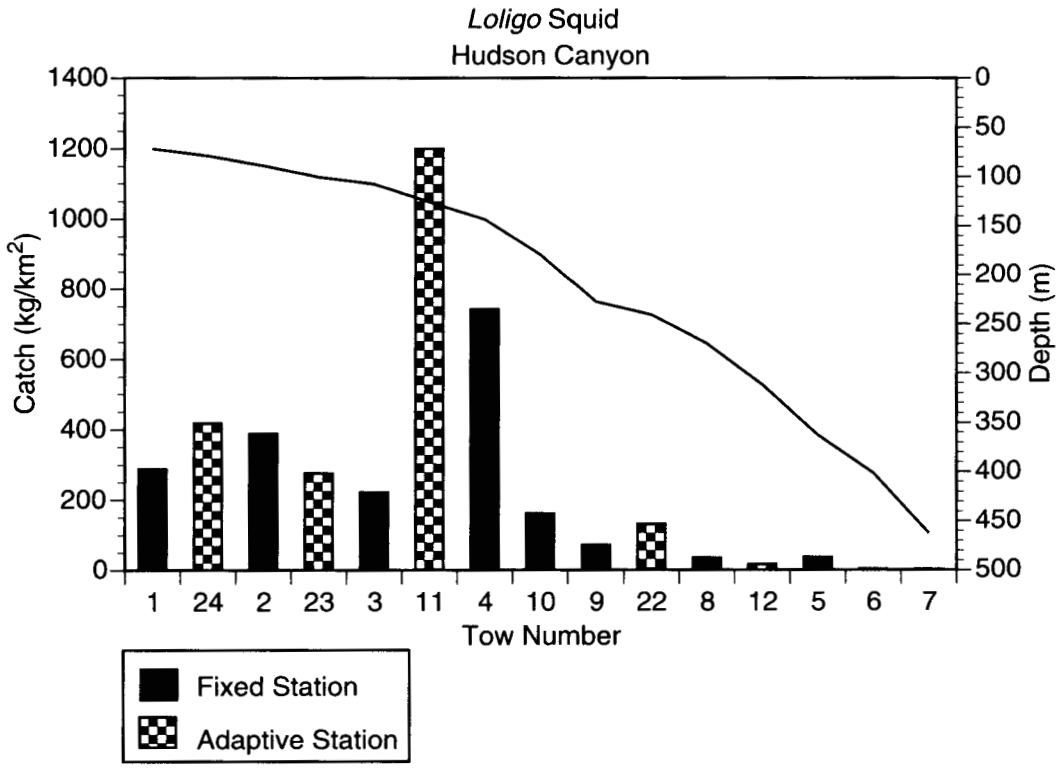


Figure 12a. Catches of *Loligo* squid in each tow along the two transects. Catch is recorded in kg caught/swept area (km^2). Depth is the average depth at which each tow was made (in meters). Tow numbers indicate the sampling sequence during the cruise. Tows are ordered shallowest to deepest along the x-axis.



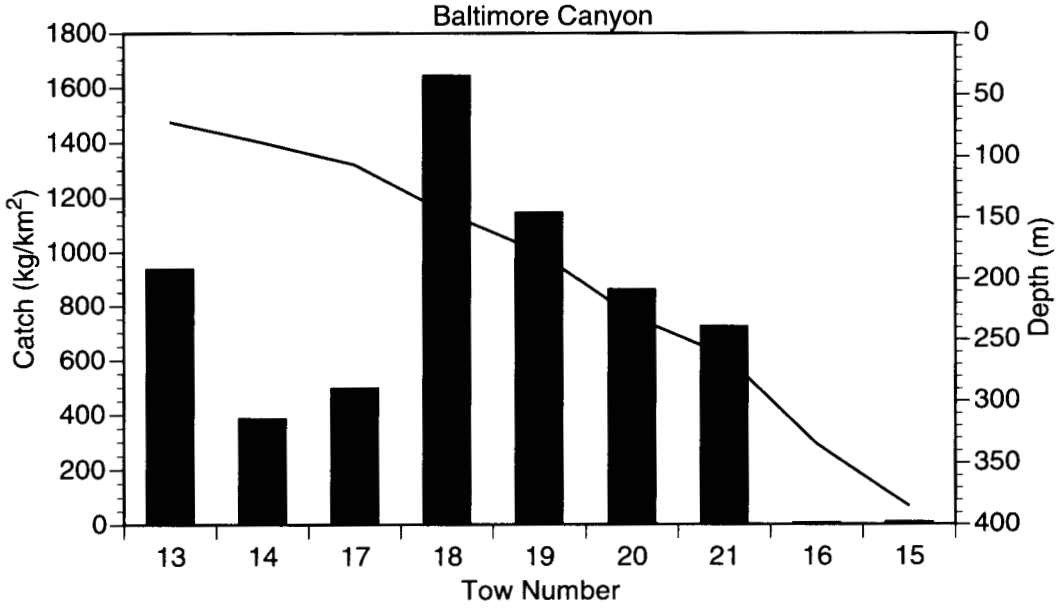


Figure 12b. Projected abundance of *Loligo* squid along the transect with each tow representing the projected abundance for the distance along the transect. Tow numbers indicate the sampling sequence during the cruise. Tows are ordered shallowest to deepest along the x-axis.

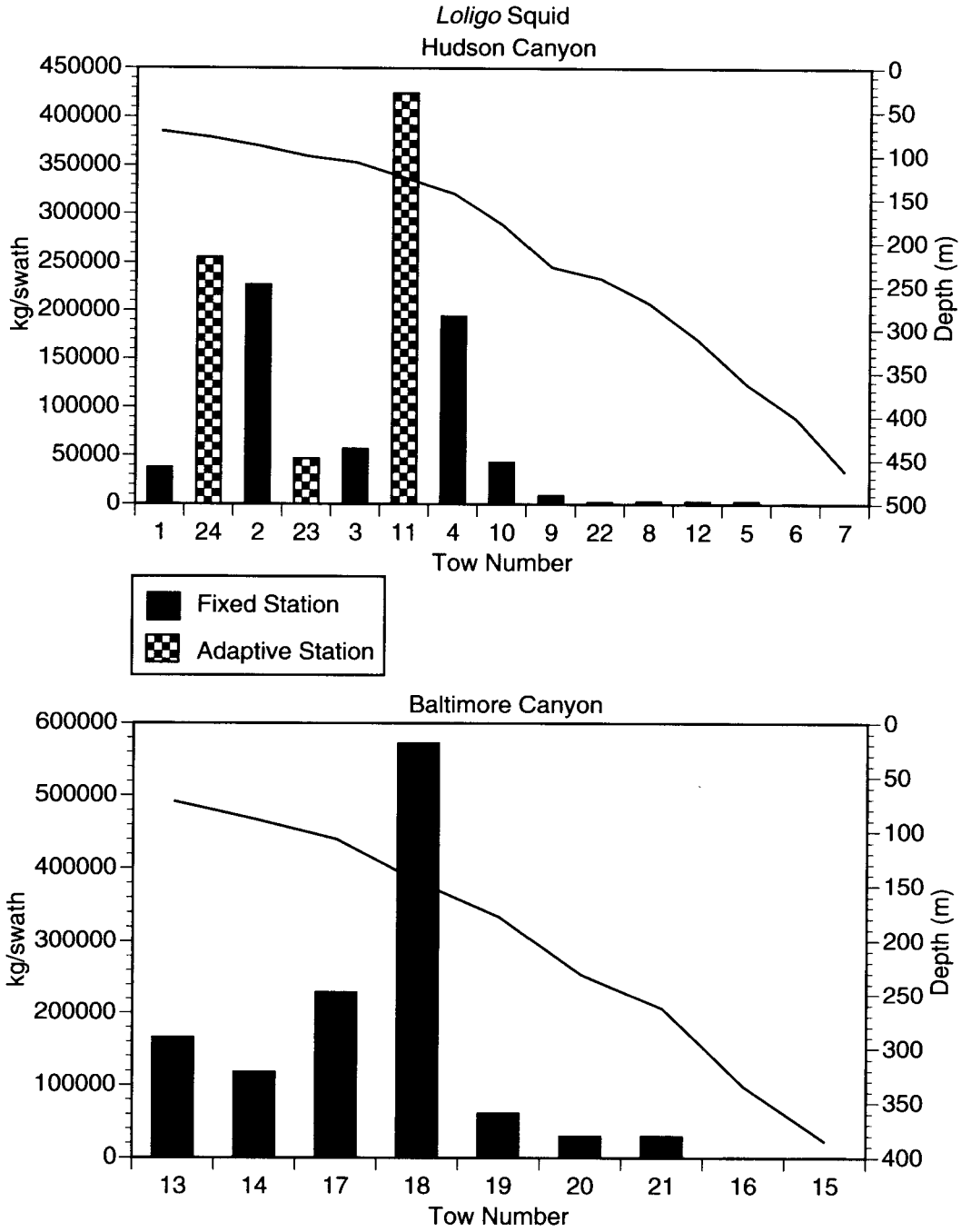


Figure 13a. Catches of monkfish in each tow along the two transects. Catch is recorded in kg caught/swept area (km^2). Depth is the average depth at which each tow was made (in meters). Tow numbers indicate the sampling sequence during the cruise. Tows are ordered shallowest to deepest along the x-axis.

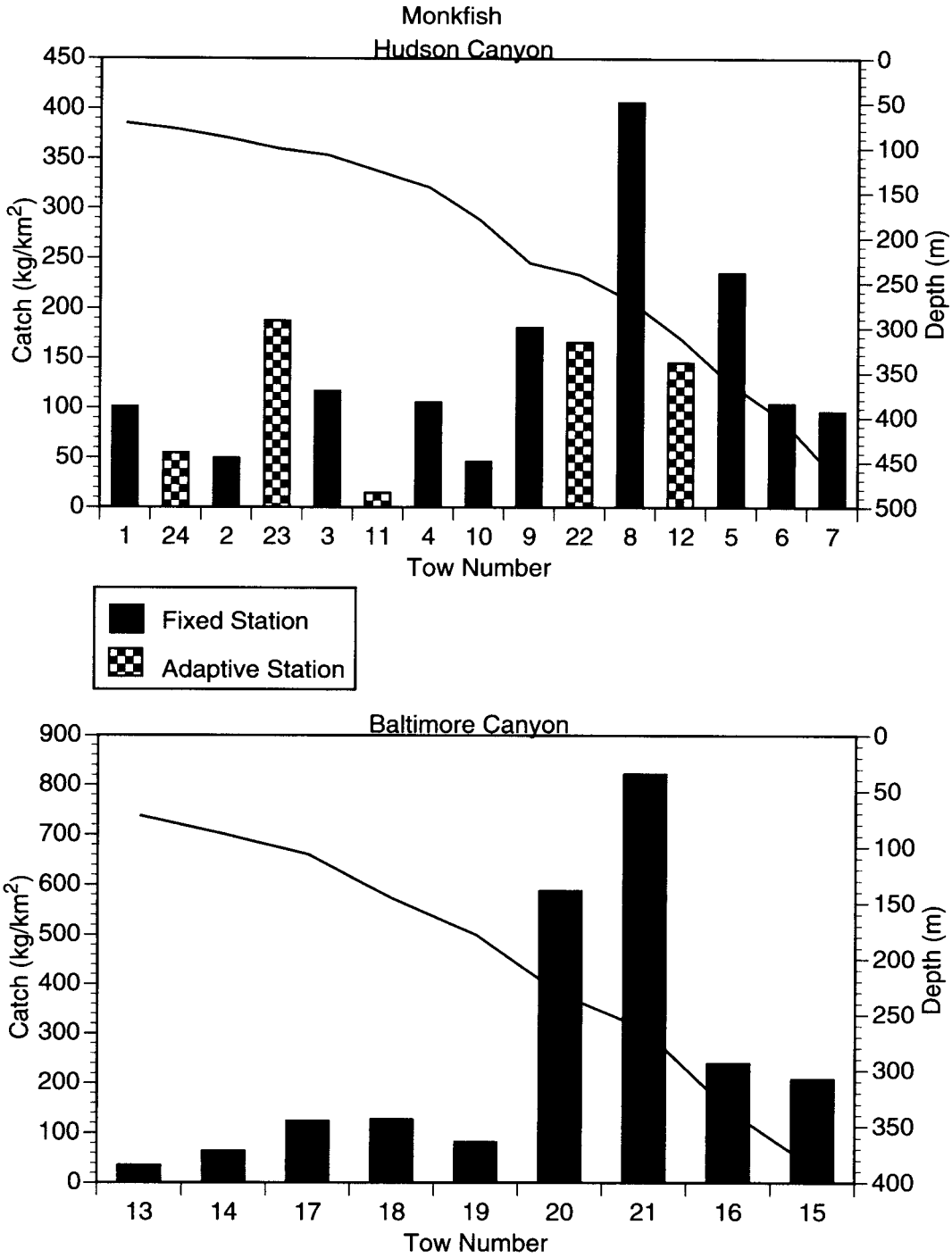


Figure 13b. Projected abundance of monkfish along the transect with each tow representing the projected abundance for the distance along the transect. Tow numbers indicate the sampling sequence during the cruise. Tows are ordered shallowest to deepest along the x-axis.

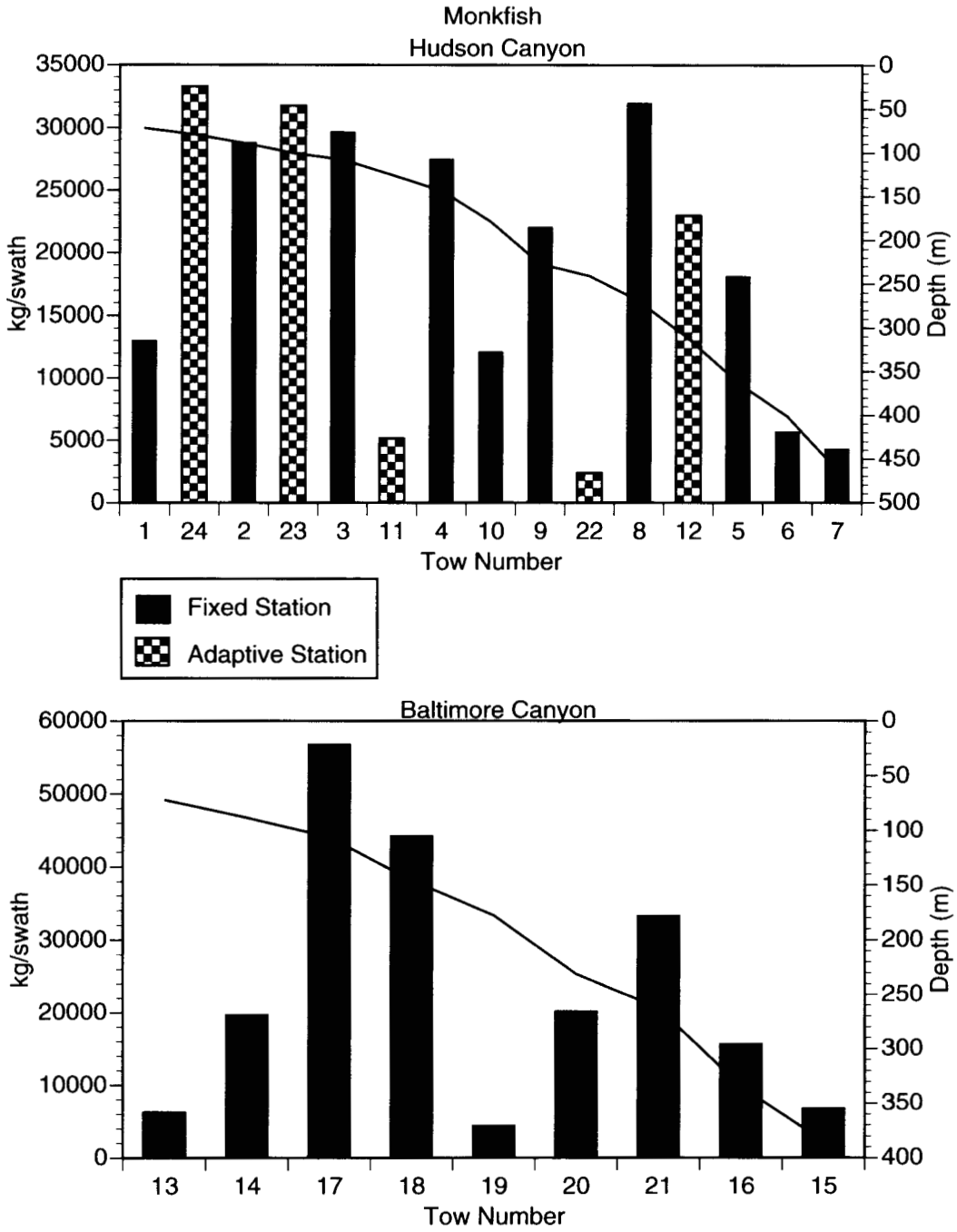


Figure 14a. Catches of northern sea robin in each tow along the two transects. Catch is recorded in kg caught/swept area (km²). Depth is the average depth at which each tow was made (in meters). Tow numbers indicate the sampling sequence during the cruise. Tows are ordered shallowest to deepest along the x-axis.

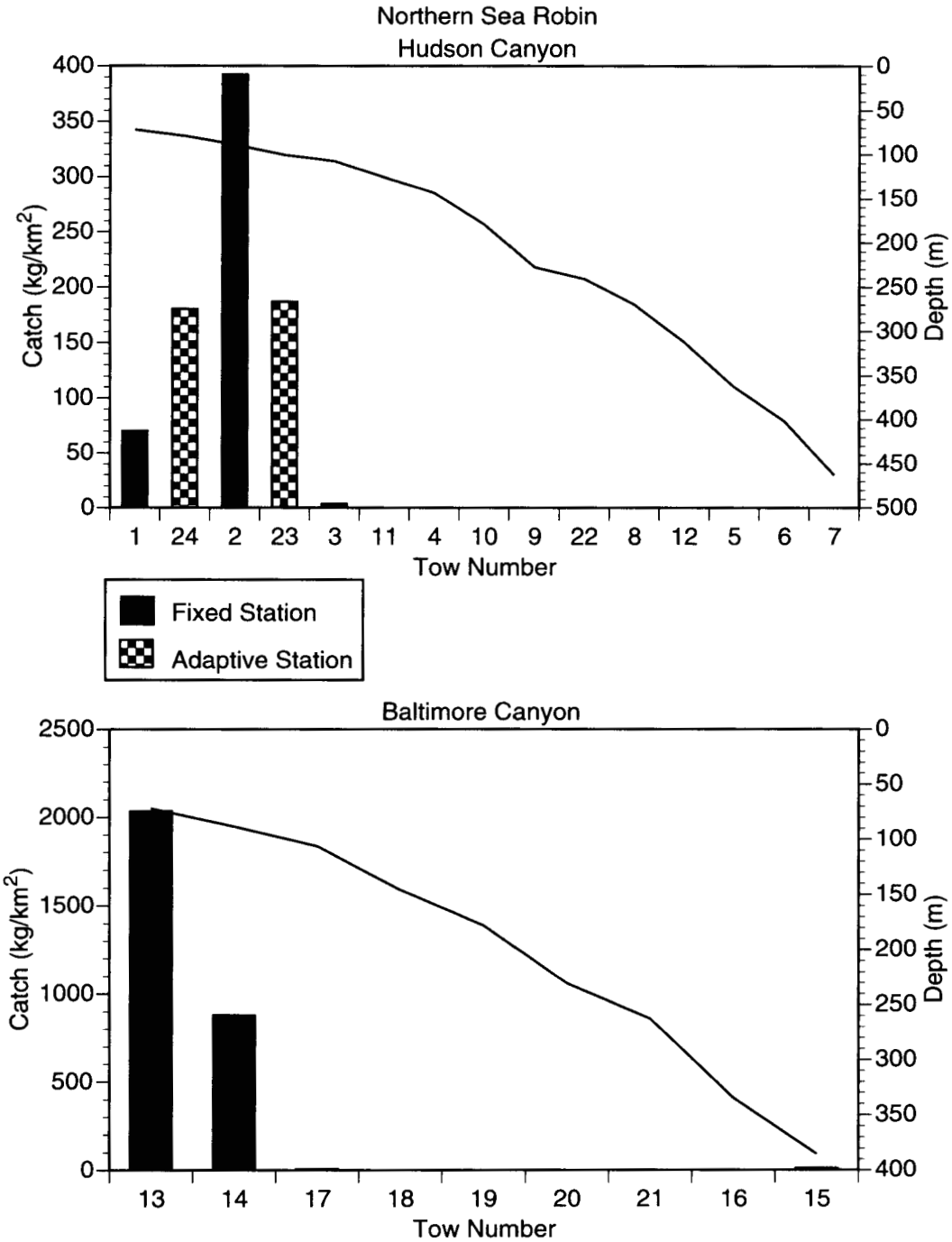


Figure 14b. Projected abundance of northern sea robin along the transect with each tow representing the projected abundance for the distance along the transect. Tow numbers indicate the sampling sequence during the cruise. Tows are ordered shallowest to deepest along the x-axis.

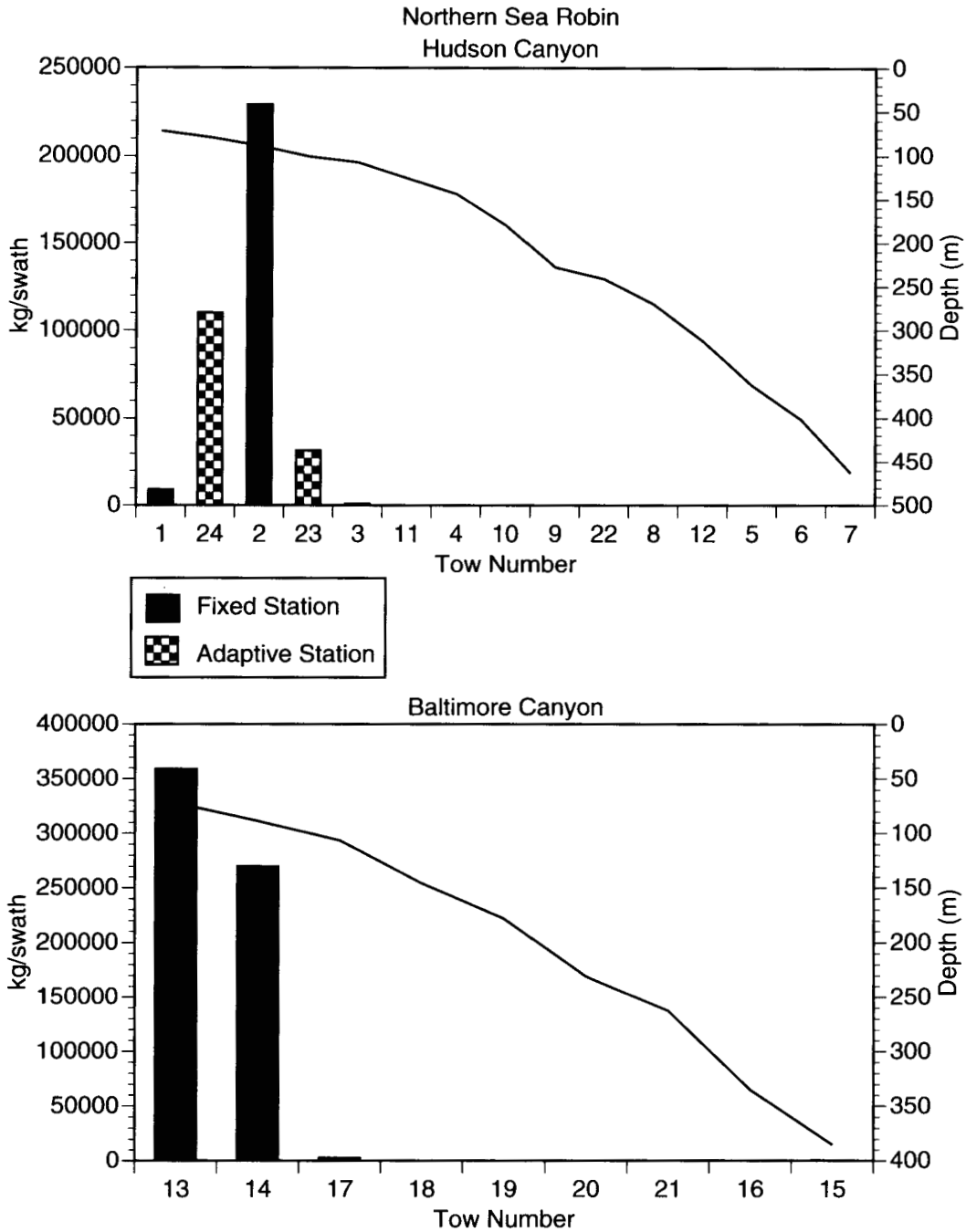
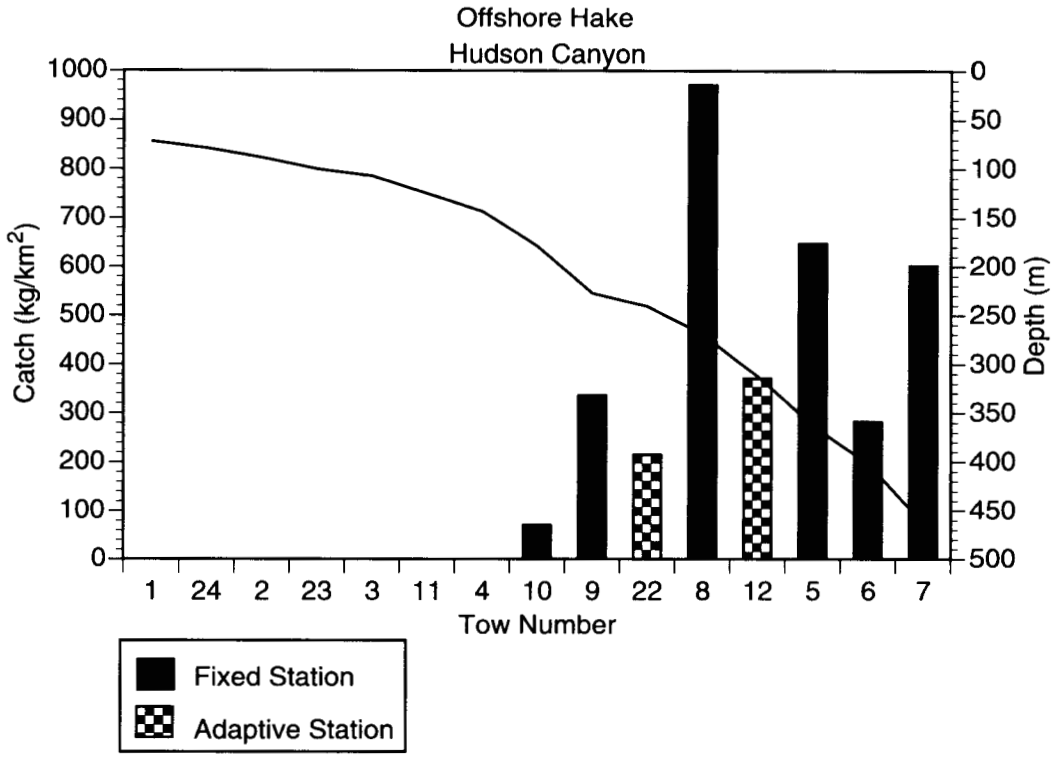


Figure15a. Catches of offshore hake in each tow along the two transects. Catch is recorded in kg caught/swept area (km^2). Depth is the average depth at which each tow was made (in meters). Tow numbers indicate the sampling sequence during the cruise. Tows are ordered shallowest to deepest along the x-axis.



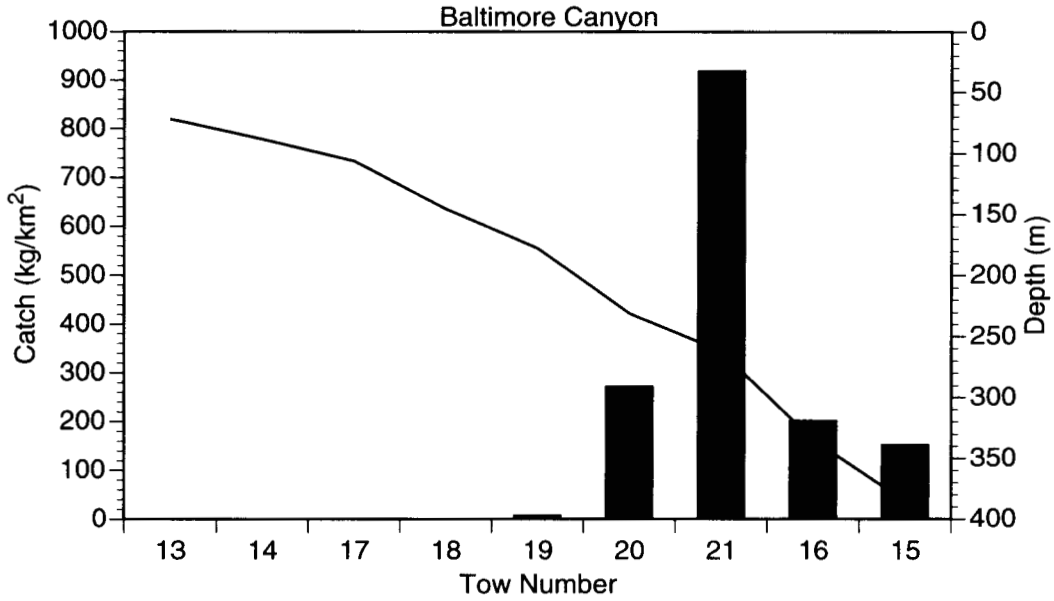


Figure 15b. Projected abundance of offshore hake along the transect with each tow representing the projected abundance for the distance along the transect. Tow numbers indicate the sampling sequence during the cruise. Tows are ordered shallowest to deepest along the x-axis.

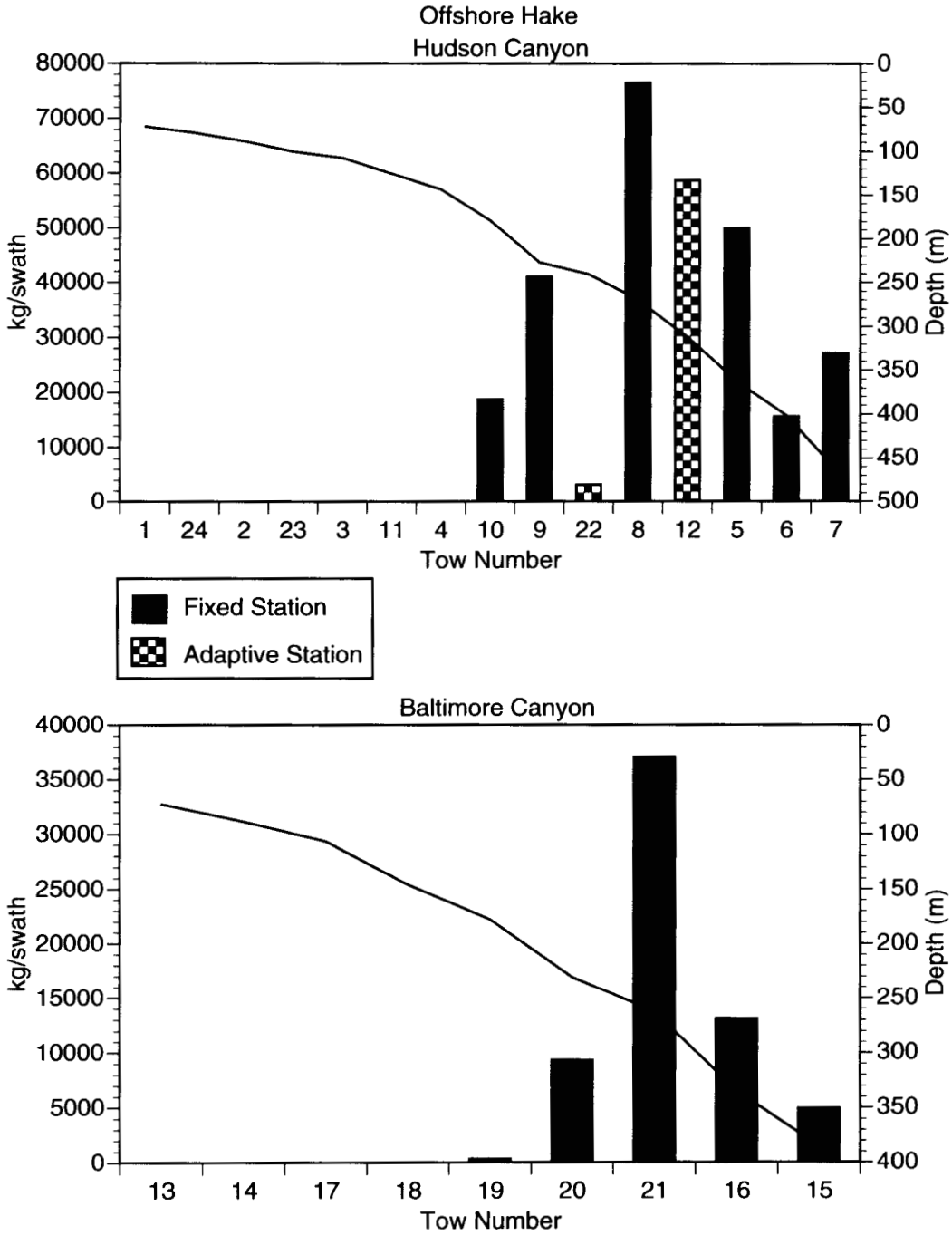


Figure 16a. Catches of scup in each tow along the two transects. Catch is recorded in kg caught/swept area (km^2). Depth is the average depth at which each tow was made (in meters). Tow numbers indicate the sampling sequence during the cruise. Tows are ordered shallowest to deepest along the x-axis.

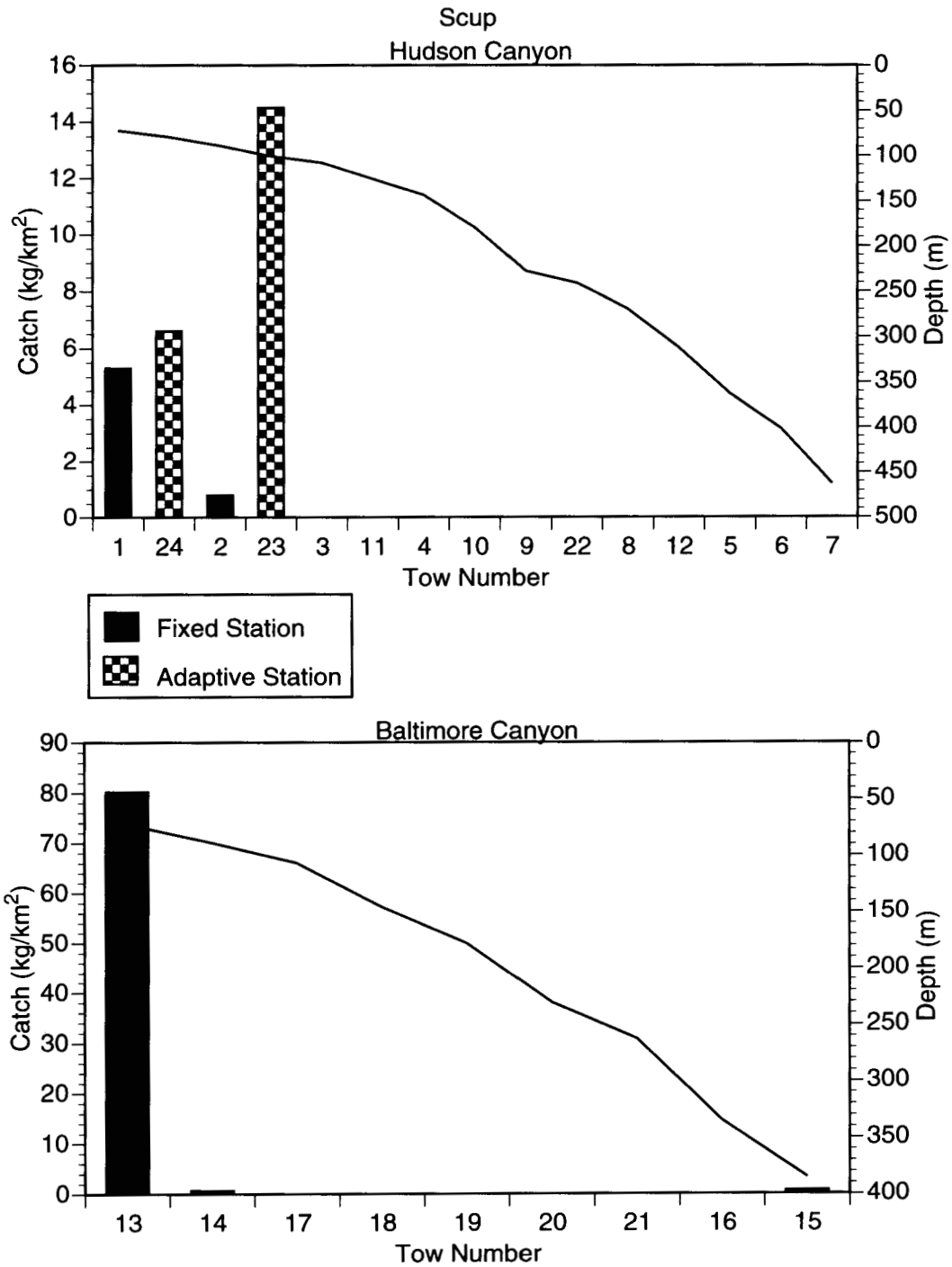


Figure 16b. Projected abundance of scup along the transect with each tow representing the projected abundance for the distance along the transect. Tow numbers indicate the sampling sequence during the cruise. Tows are ordered shallowest to deepest along the x-axis.

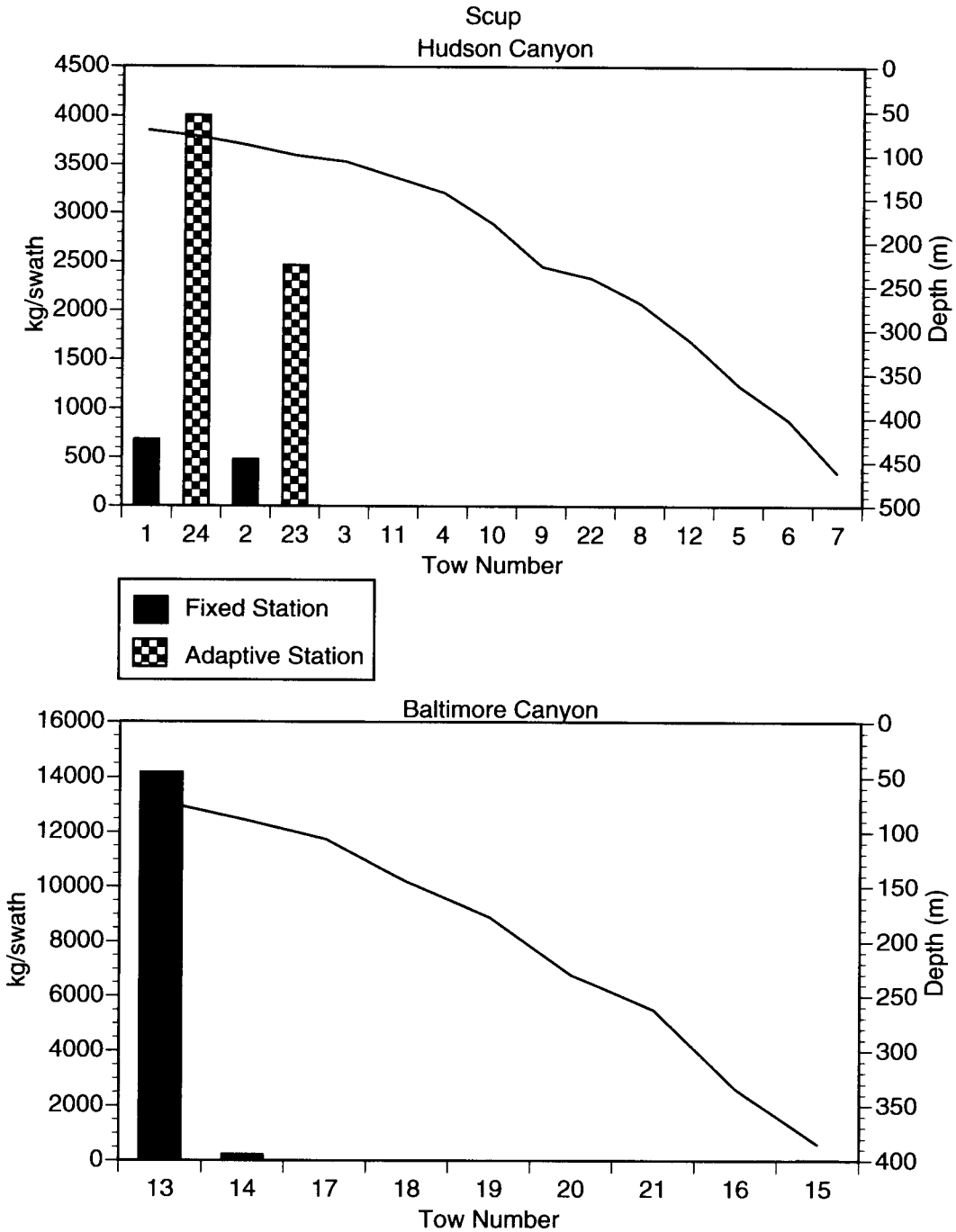


Figure 17a. Catches of silver hake in each tow along the two transects. Catch is recorded in kg caught/swept area (km^2). Depth is the average depth at which each tow was made (in meters). Tow numbers indicate the sampling sequence during the cruise. Tows are ordered shallowest to deepest along the x-axis.

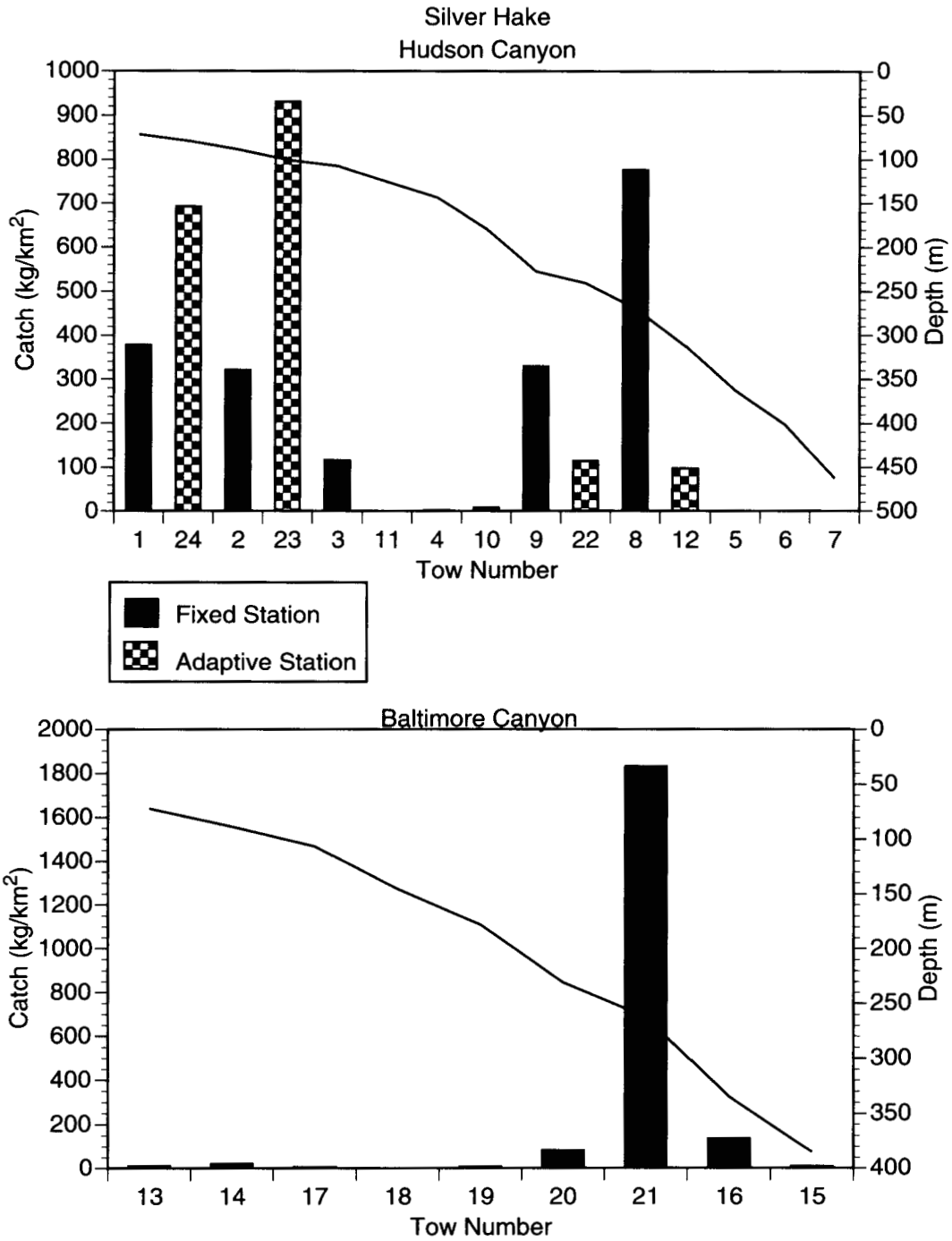


Figure 17b. Projected abundance of silver hake along the transect with each tow representing the projected abundance for the distance along the transect. Tow numbers indicate the sampling sequence during the cruise. Tows are ordered shallowest to deepest along the x-axis.

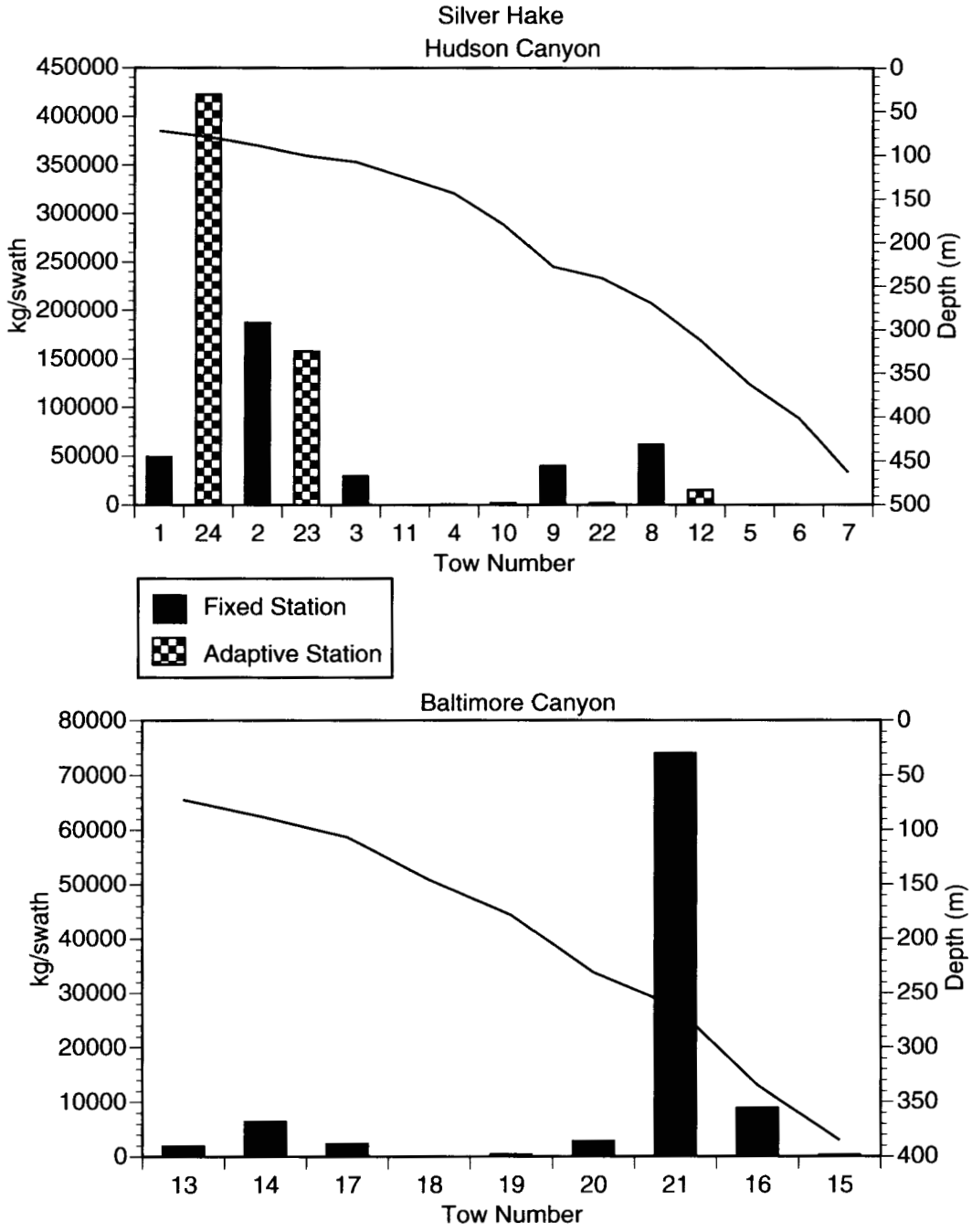


Figure 18a. Catches of female spiny dogfish in each tow along the two transects. Catch is recorded in kg caught/swept area (km^2). Depth is the average depth at which each tow was made (in meters). Tow numbers indicate the sampling sequence during the cruise. Tows are ordered shallowest to deepest along the x-axis.

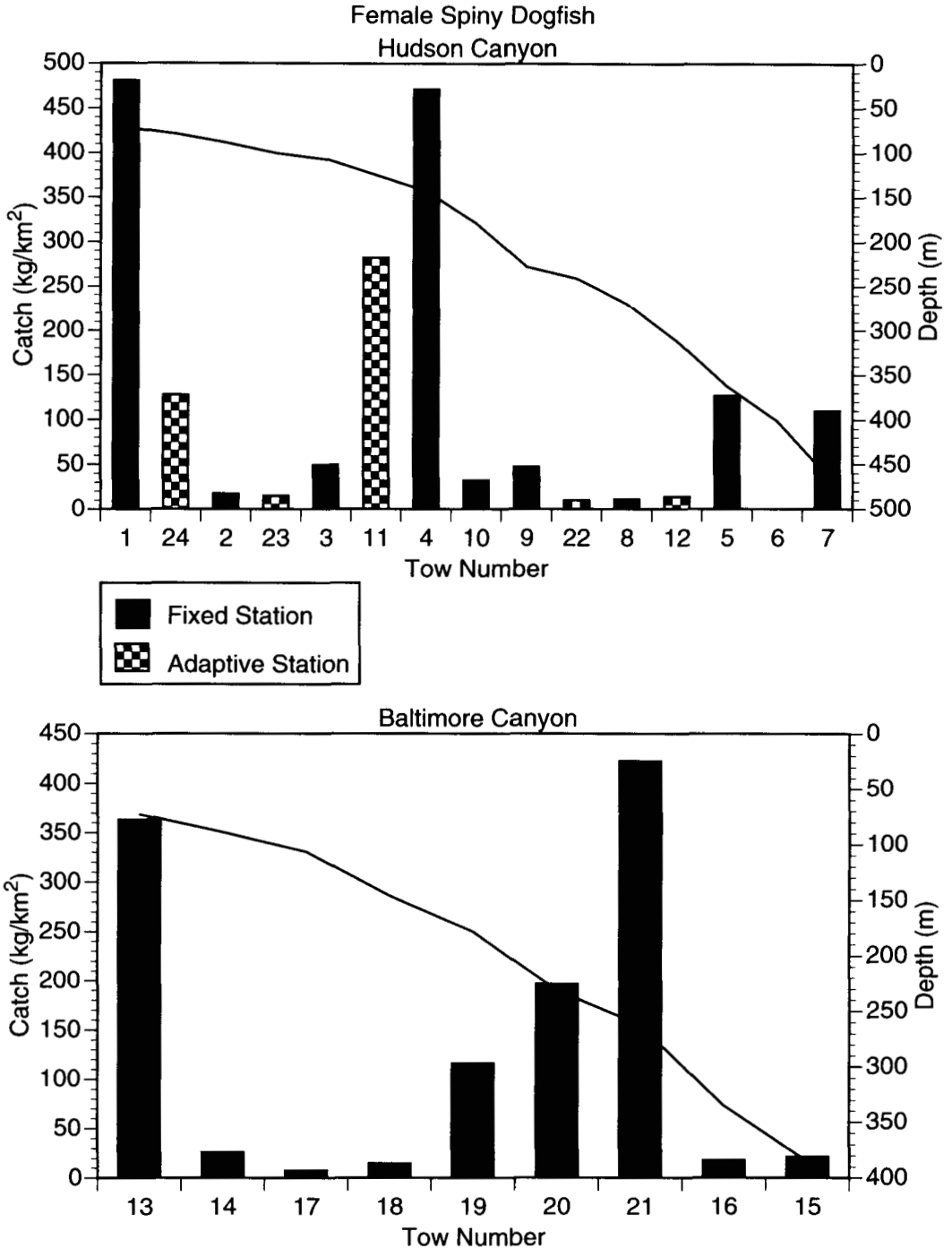


Figure 18b. Projected abundance of female spiny dogfish along the transect with each tow representing the projected abundance for the distance along the transect. Tow numbers indicate the sampling sequence during the cruise. Tows are ordered shallowest to deepest along the x-axis.

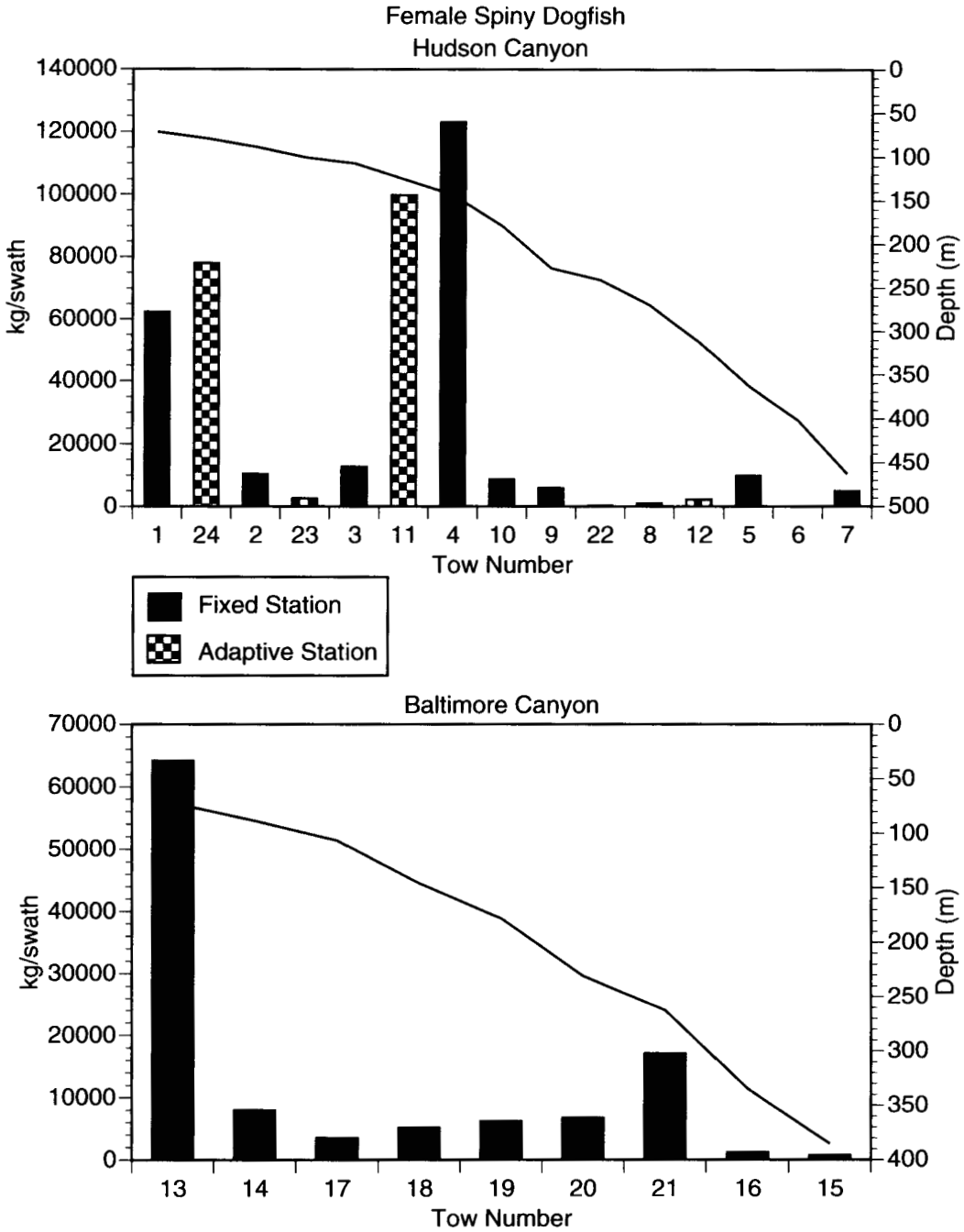


Figure 19a. Catches of male spiny dogfish in each tow along the two transects. Catch is recorded in kg caught/swept area (km^2). Depth is the average depth at which each tow was made (in meters). Tow numbers indicate the sampling sequence during the cruise. Tows are ordered shallowest to deepest along the x-axis.

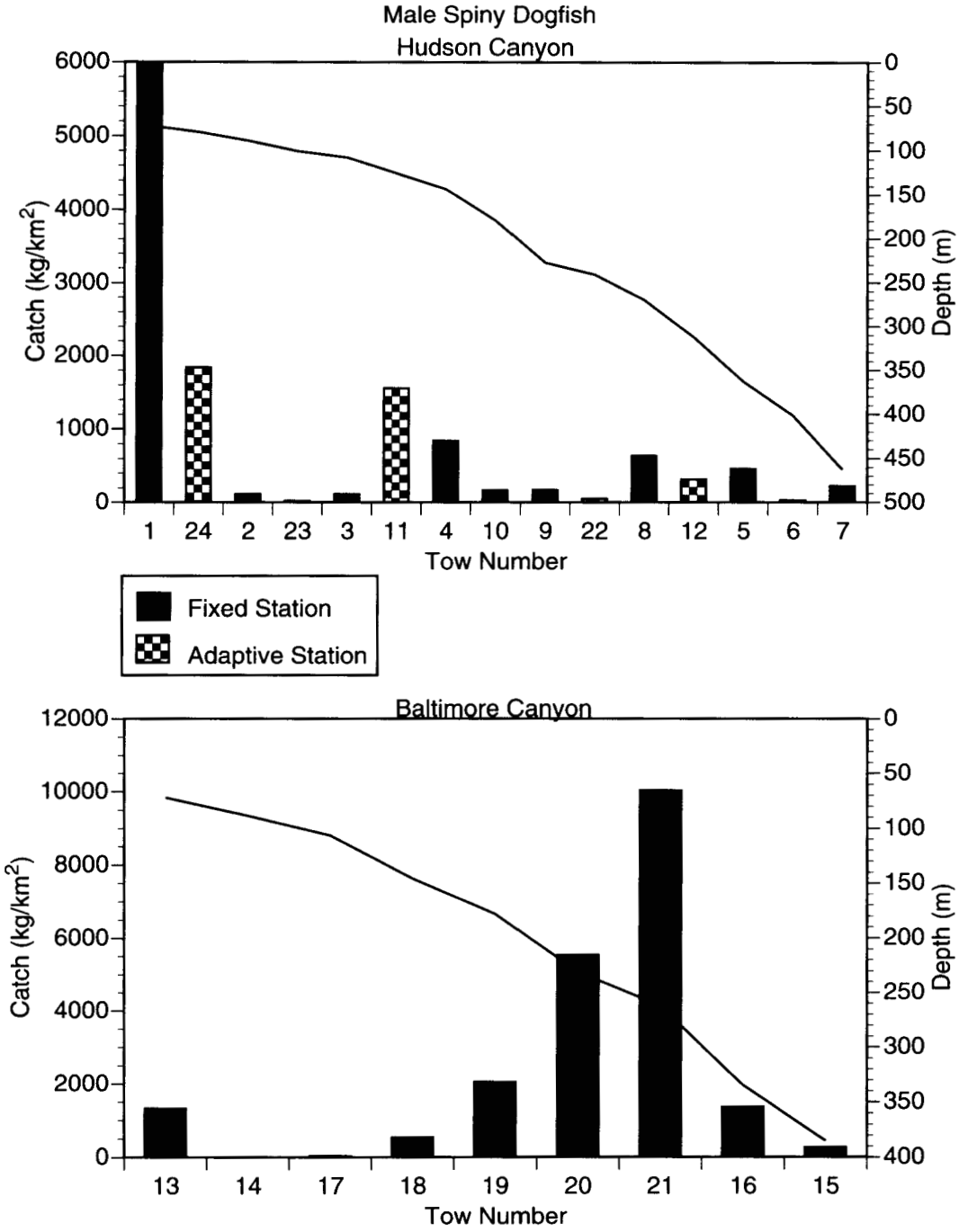


Figure 19b. Projected abundance of male spiny dogfish along the transect with each tow representing the projected abundance for the distance along the transect. Tow numbers indicate the sampling sequence during the cruise. Tows are ordered shallowest to deepest along the x-axis.

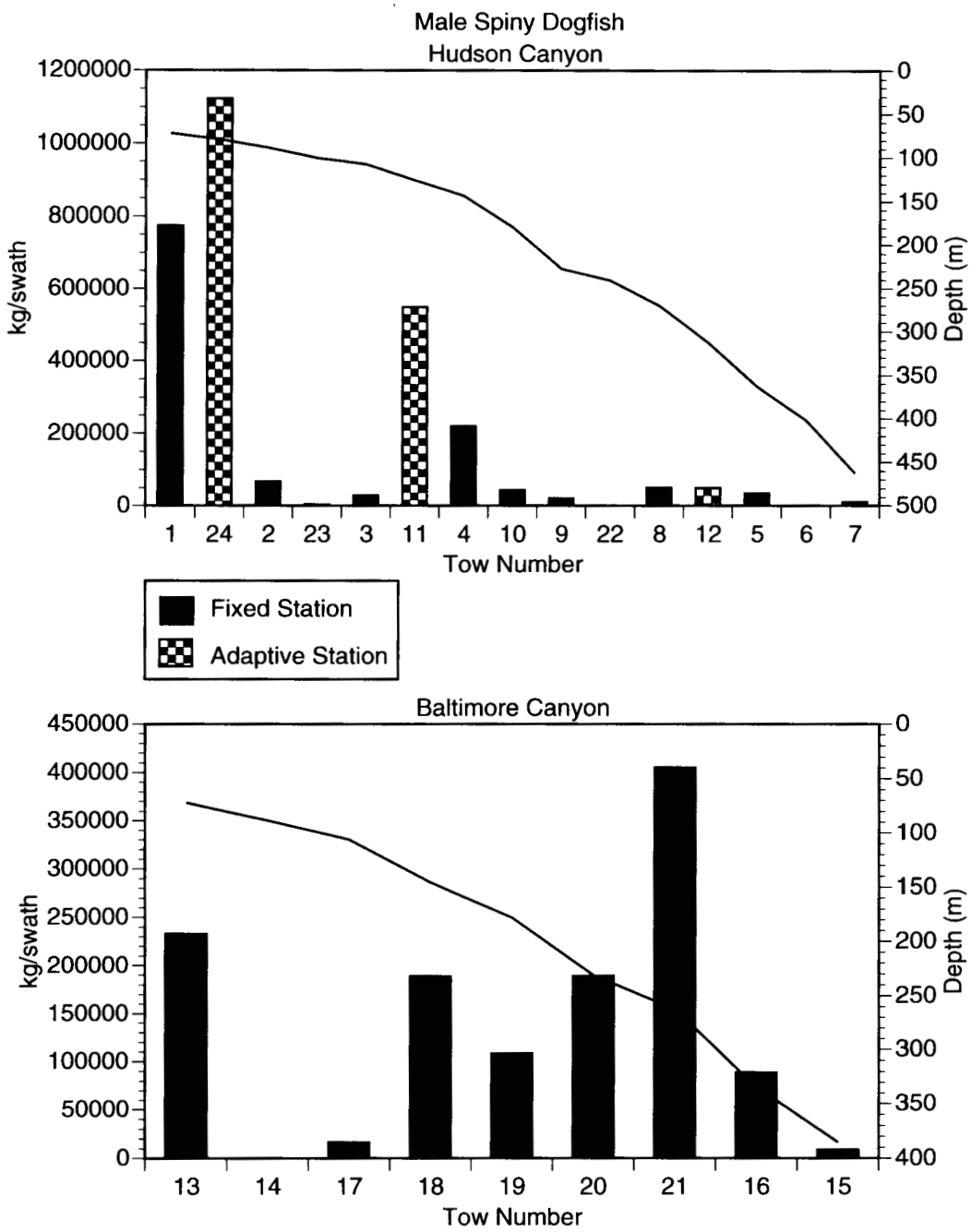


Figure 20a. Catches of spotted hake in each tow along the two transects. Catch is recorded in kg caught/swept area (km^2). Depth is the average depth at which each tow was made (in meters). Tow numbers indicate the sampling sequence during the cruise. Tows are ordered shallowest to deepest along the x-axis.

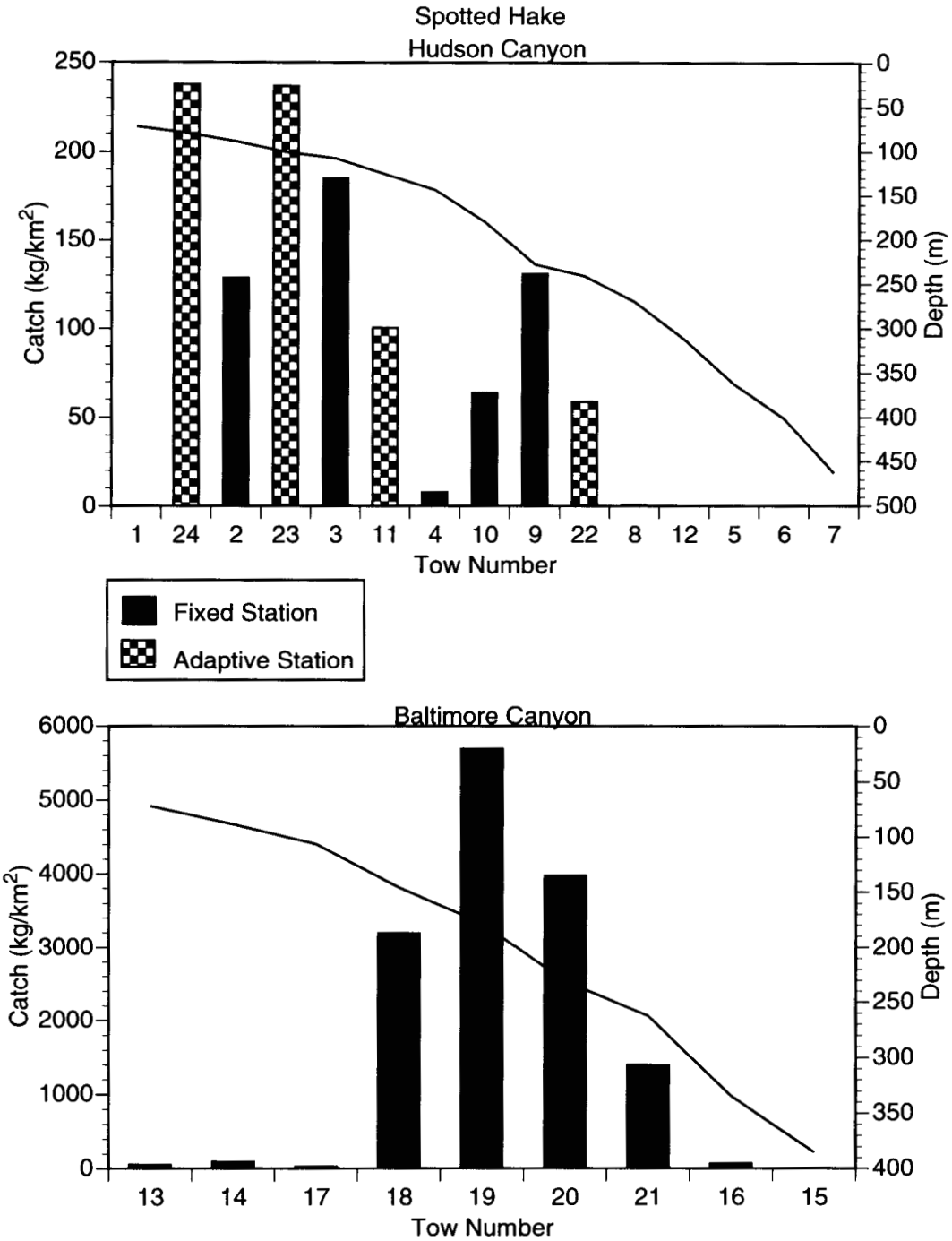


Figure 20b. Projected abundance of spotted hake along the transect with each tow representing the projected abundance for the distance along the transect. Tow numbers indicate the sampling sequence during the cruise. Tows are ordered shallowest to deepest along the x-axis.

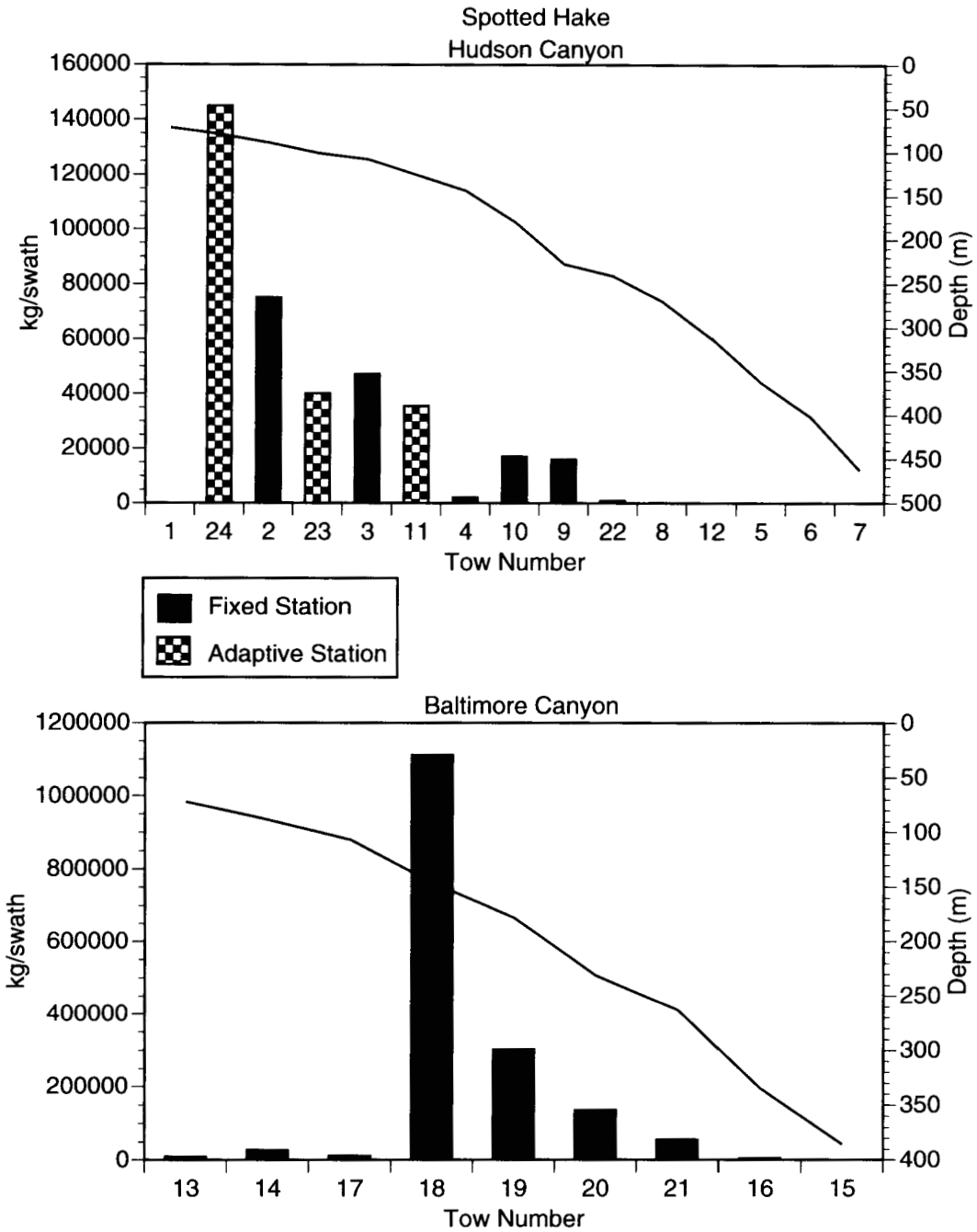


Figure 21a. Catches of striped sea robin in each tow along the two transects. Catch is recorded in kg caught/swept area (km^2). Depth is the average depth at which each tow was made (in meters). Tow numbers indicate the sampling sequence during the cruise. Tows are ordered shallowest to deepest along the x-axis.

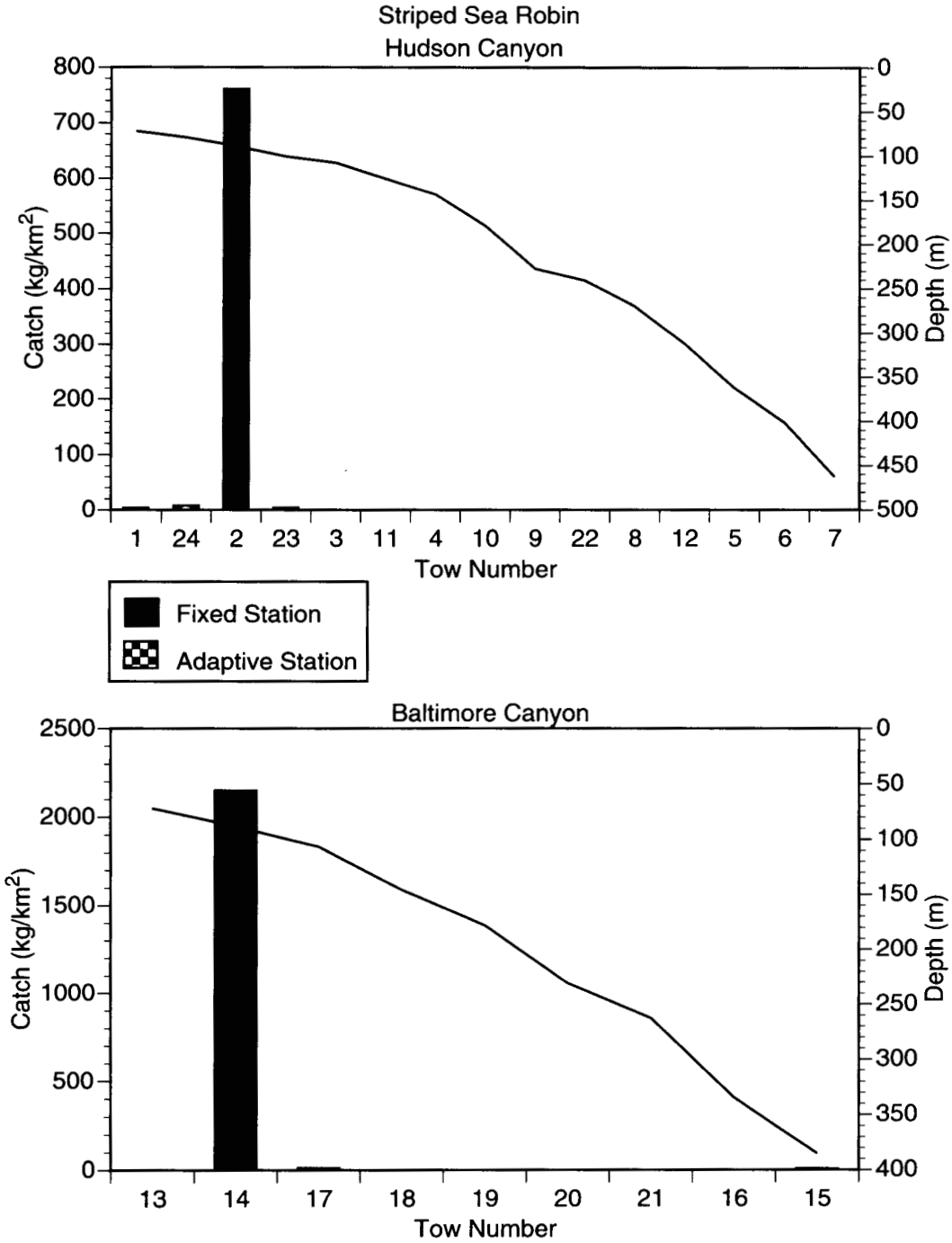


Figure 21b. Projected abundance of striped sea robin along the transect with each tow representing the projected abundance for the distance along the transect. Tow numbers indicate the sampling sequence during the cruise. Tows are ordered shallowest to deepest along the x-axis.

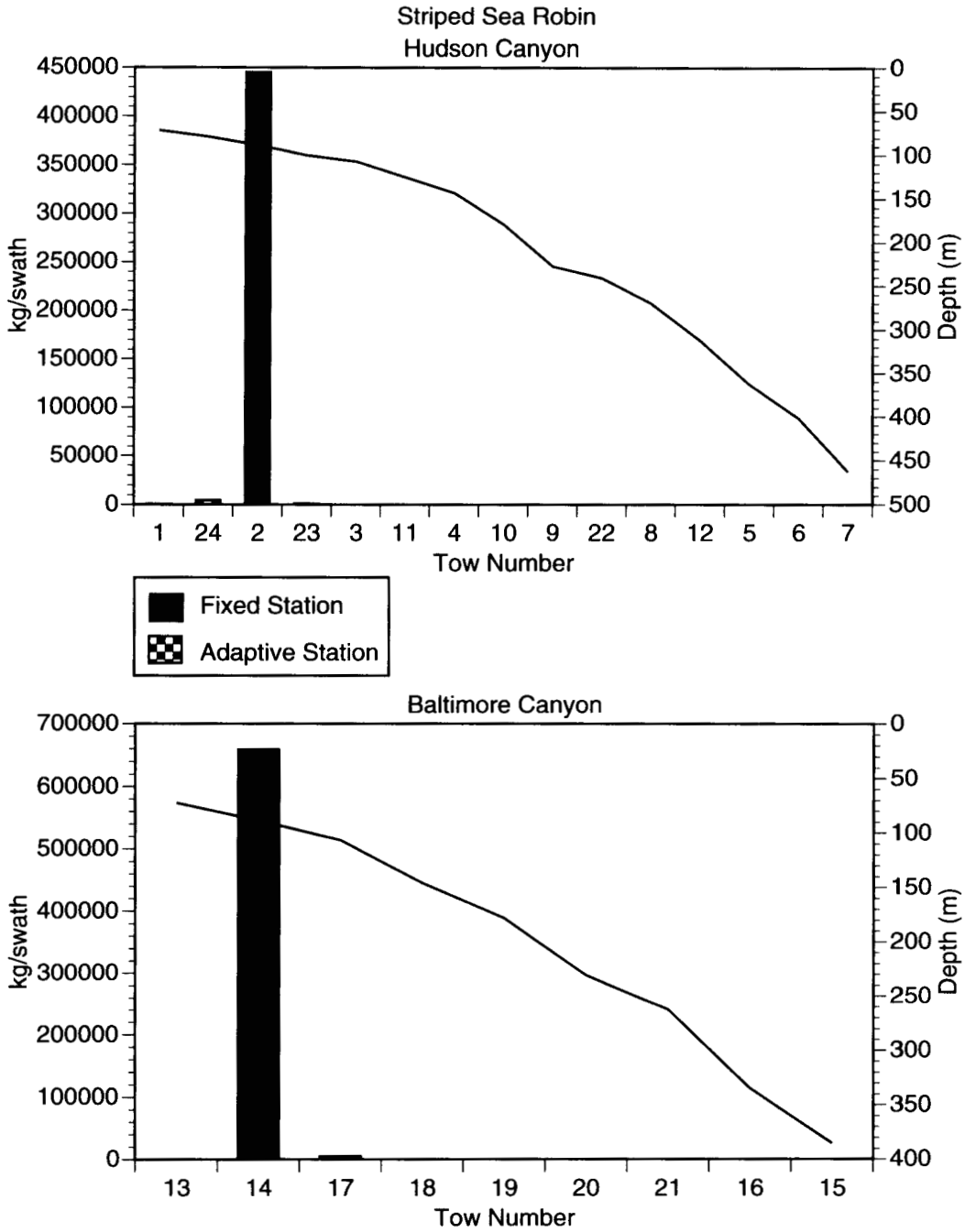


Figure 22a. Catches of summer flounder in each tow along the two transects. Catch is recorded in kg caught/swept area (km^2). Depth is the average depth at which each tow was made (in meters). Tow numbers indicate the sampling sequence during the cruise. Tows are ordered shallowest to deepest along the x-axis.

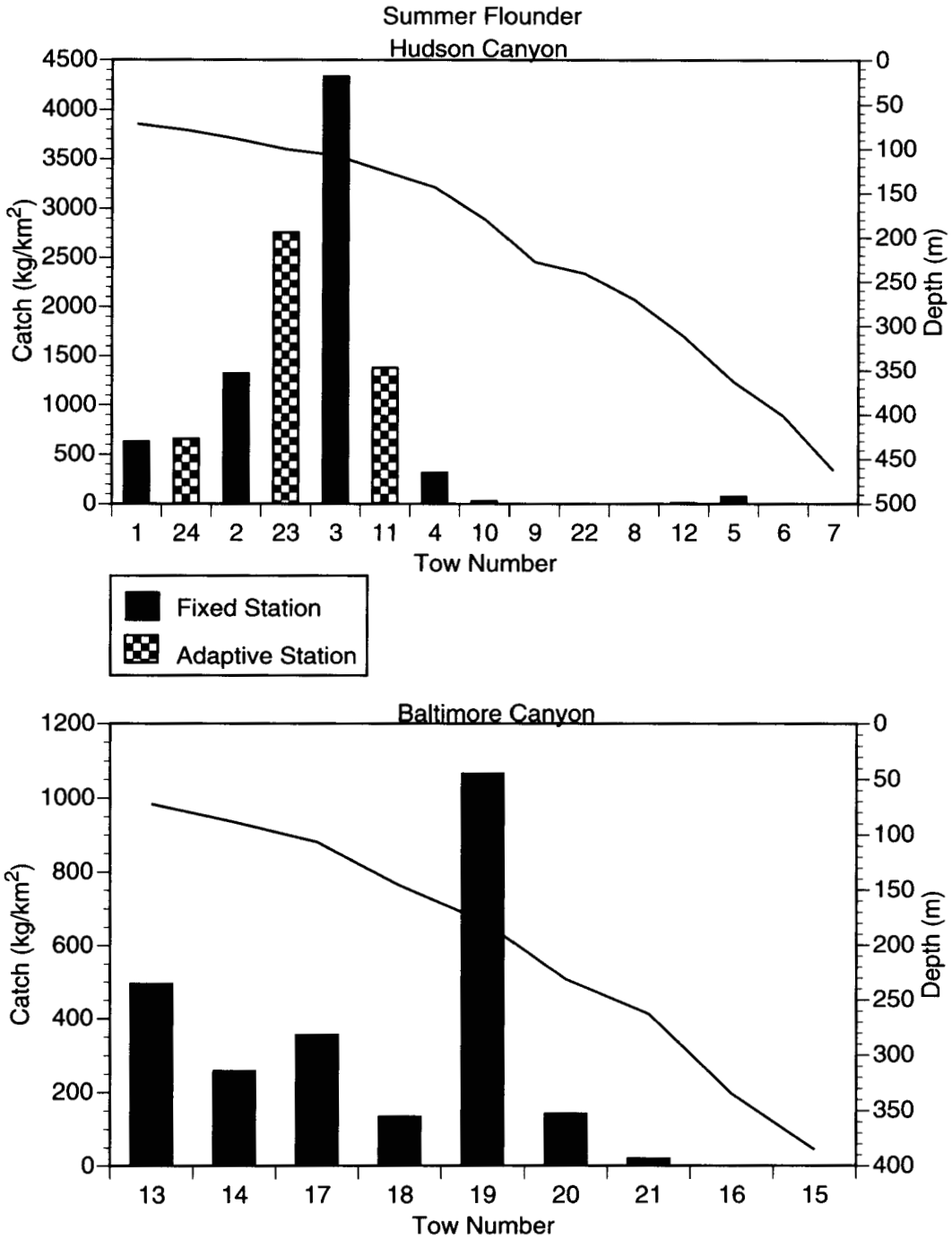


Figure 22b. Projected abundance of summer flounder along the transect with each tow representing the projected abundance for the distance along the transect. Tow numbers indicate the sampling sequence during the cruise. Tows are ordered shallowest to deepest along the x-axis.

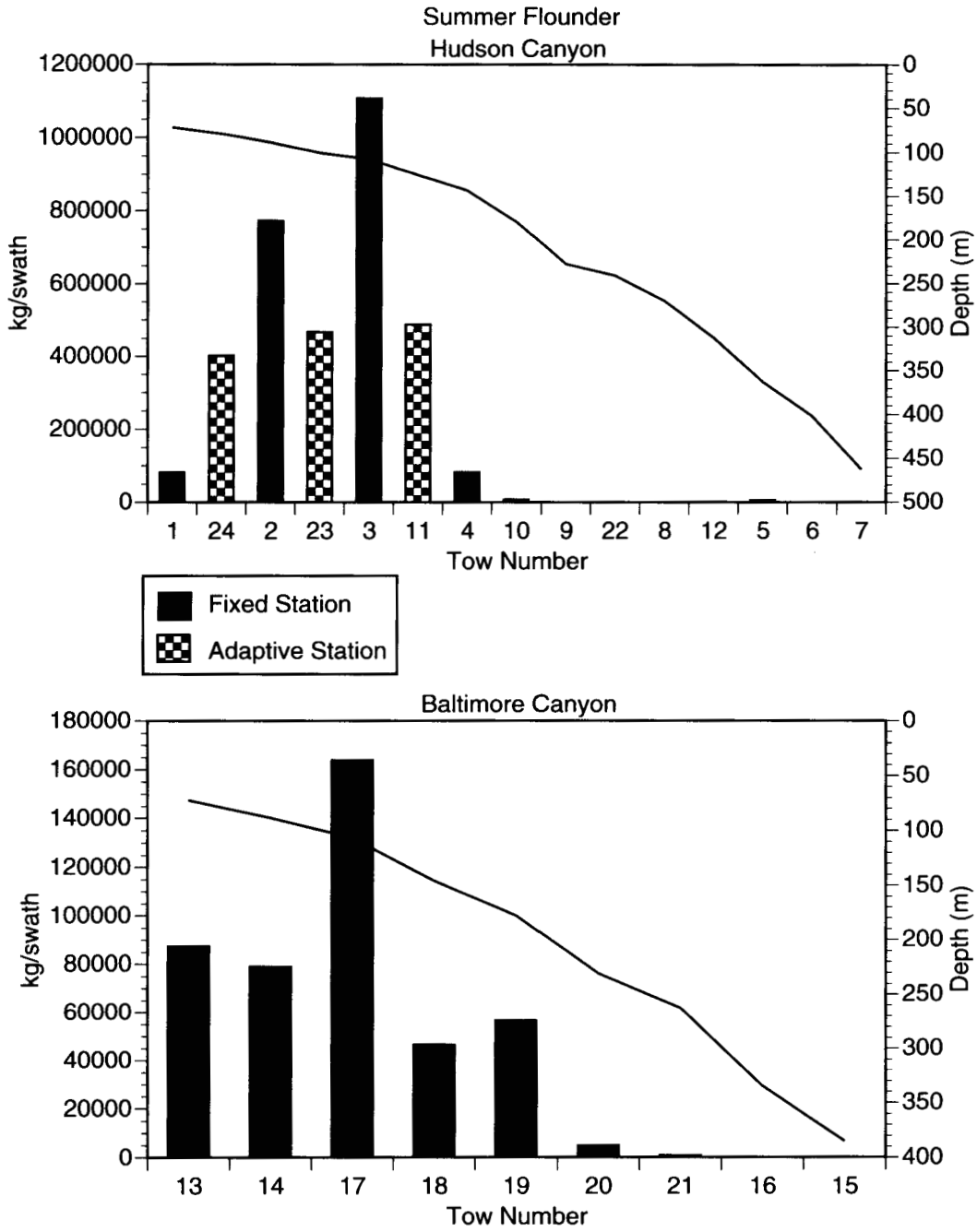


Figure 23a. Catches of tilefish in each tow along the two transects. Catch is recorded in kg caught/swept area (km^2). Depth is the average depth at which each tow was made (in meters). Tow numbers indicate the sampling sequence during the cruise. Tows are ordered shallowest to deepest along the x-axis.

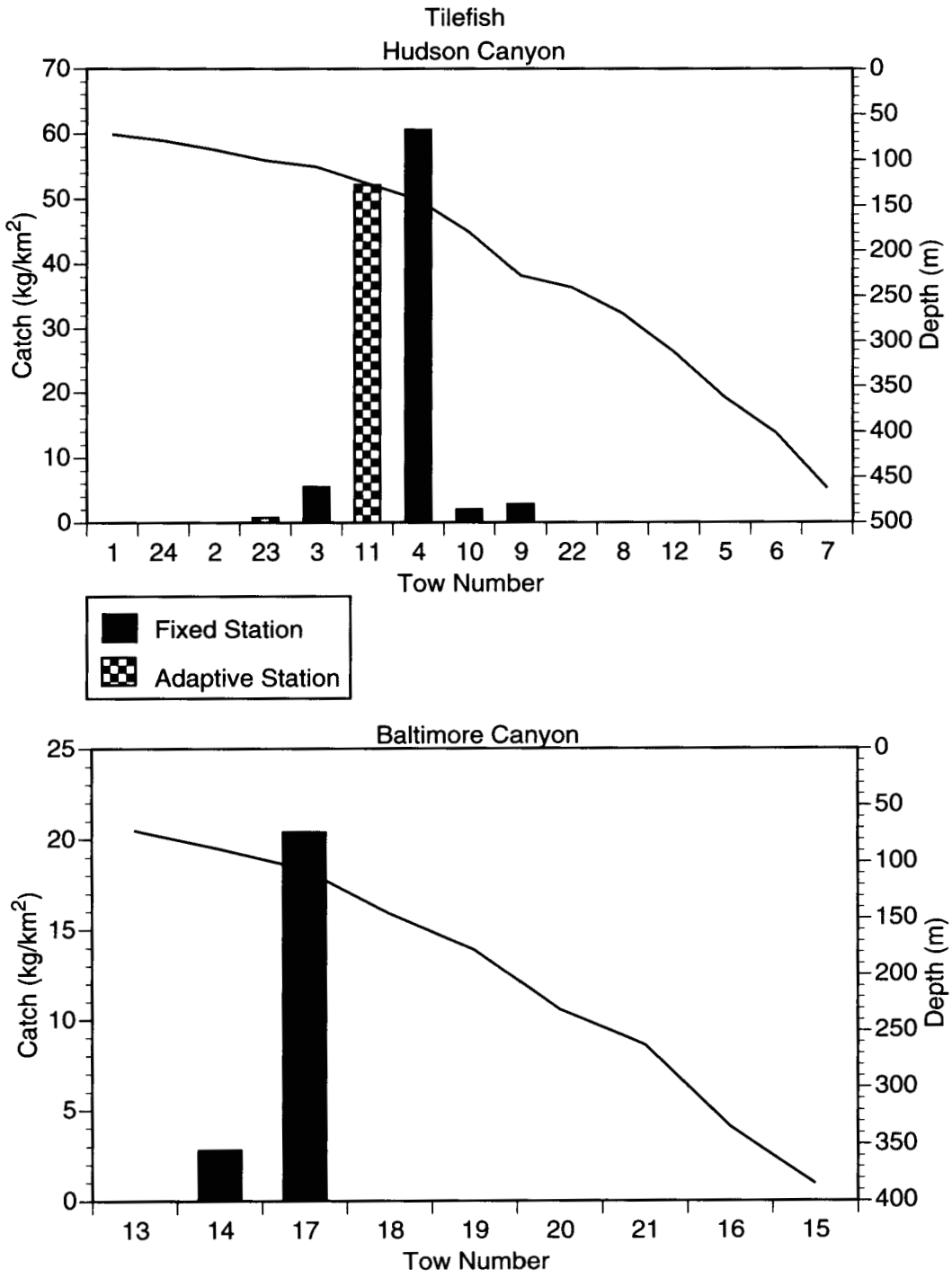


Figure 23b. Projected abundance of tilefish along the transect with each tow representing the projected abundance for the distance along the transect. Tow numbers indicate the sampling sequence during the cruise. Tows are ordered shallowest to deepest along the x-axis.

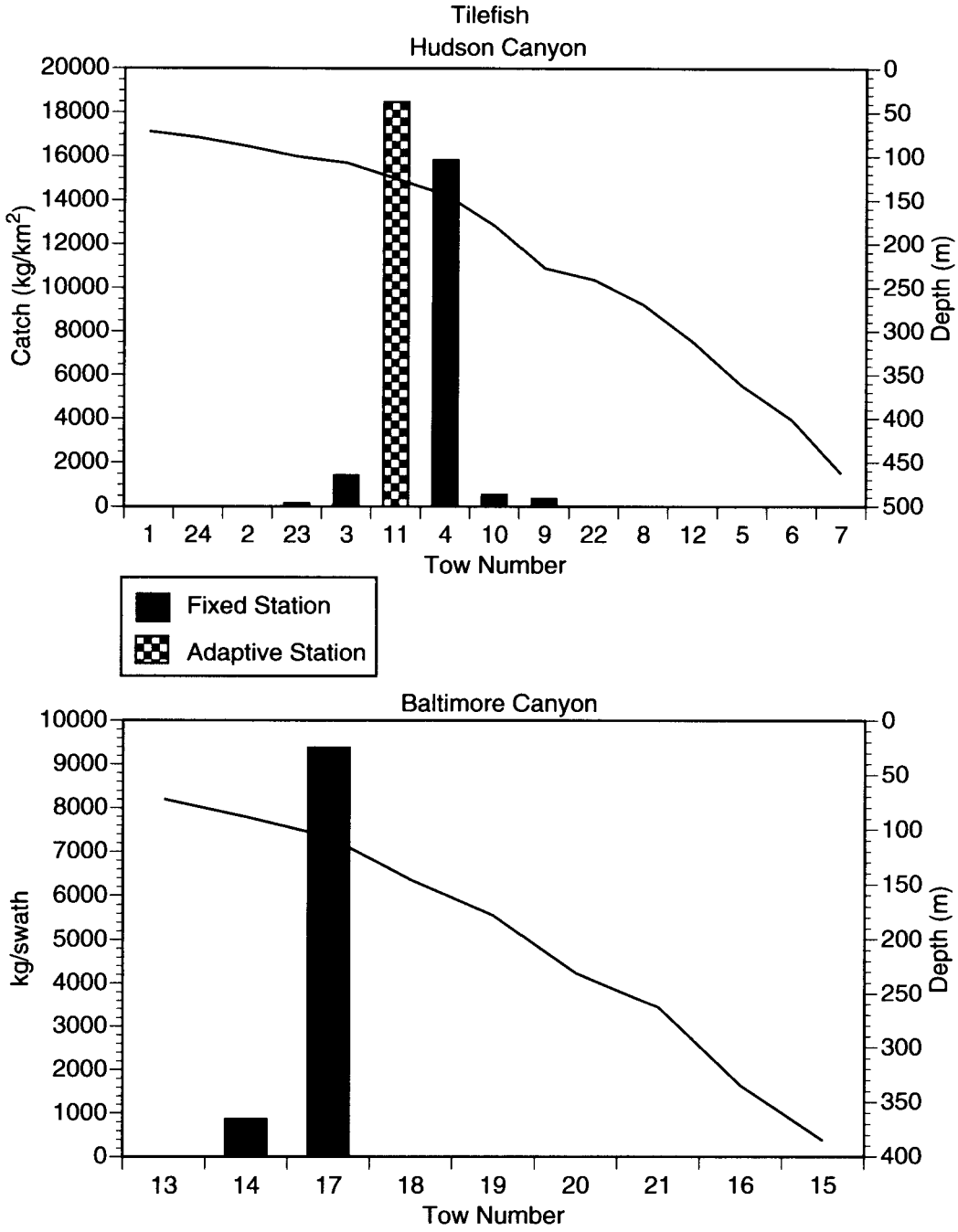


Figure 24a. Catches of witch flounder in each tow along the two transects. Catch is recorded in kg caught/swept area (km^2). Depth is the average depth at which each tow was made (in meters). Tow numbers indicate the sampling sequence during the cruise. Tows are ordered shallowest to deepest along the x-axis.

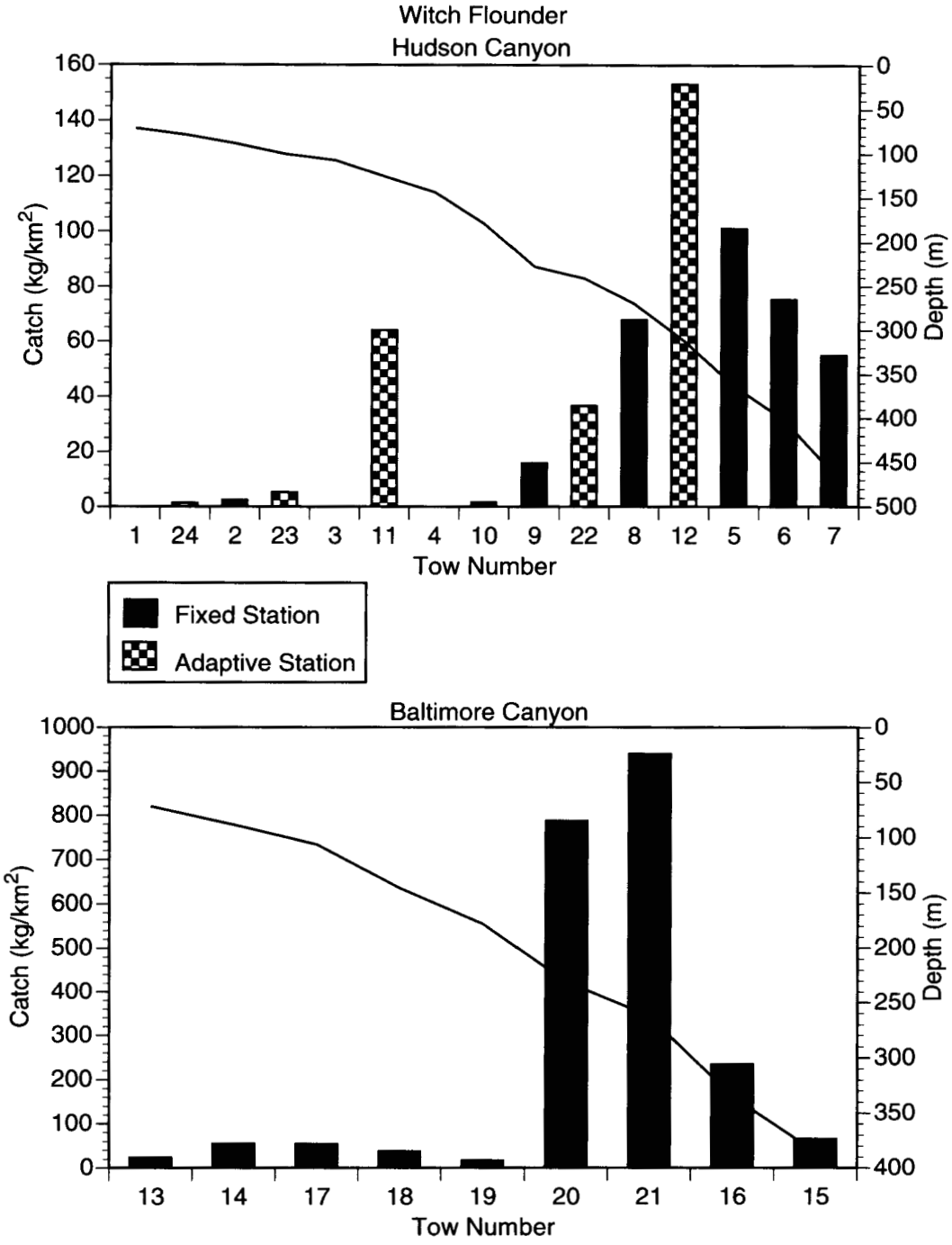


Figure 24b. Projected abundance of witch flounder along the transect with each tow representing the projected abundance for the distance along the transect. Tow numbers indicate the sampling sequence during the cruise. Tows are ordered shallowest to deepest along the x-axis.

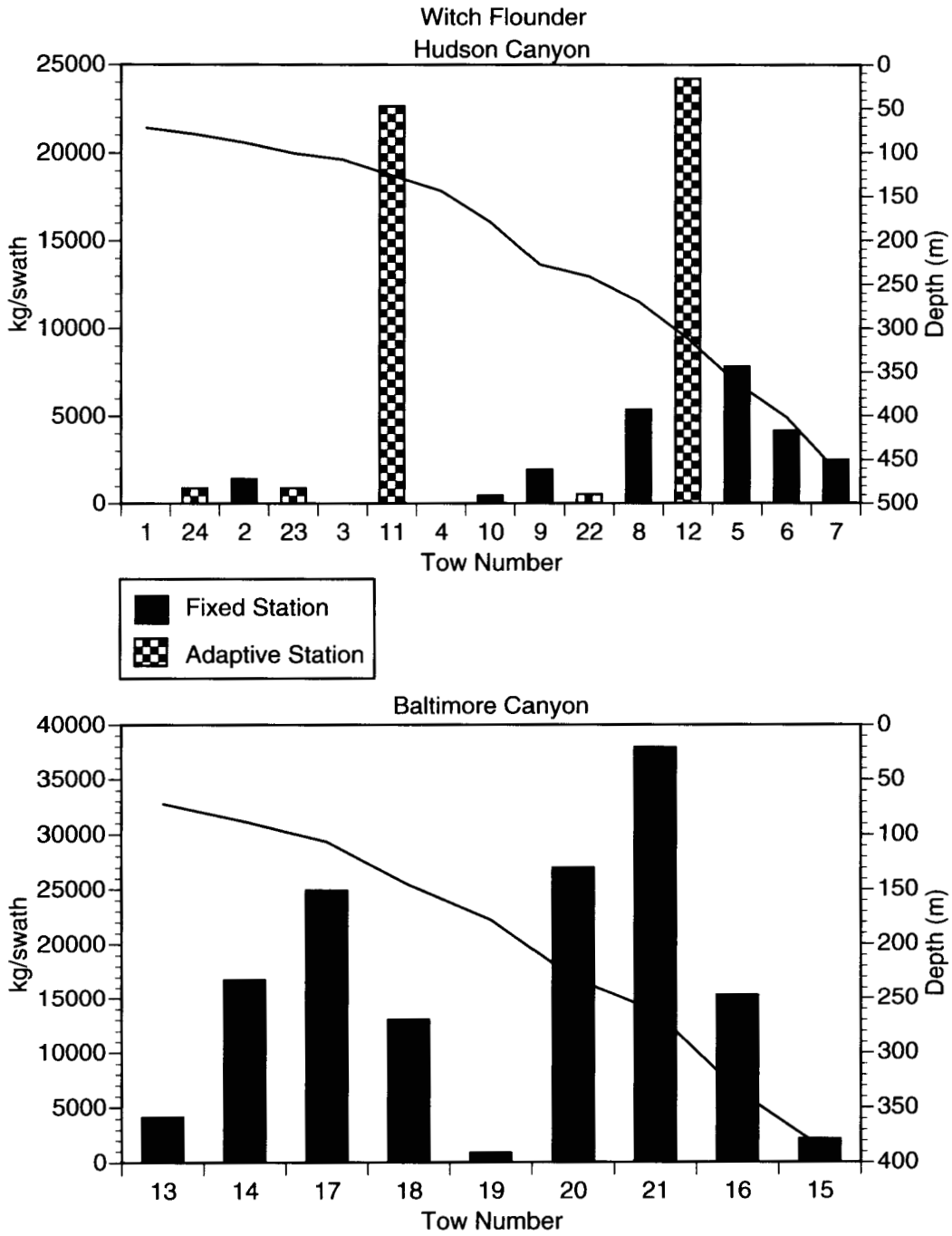
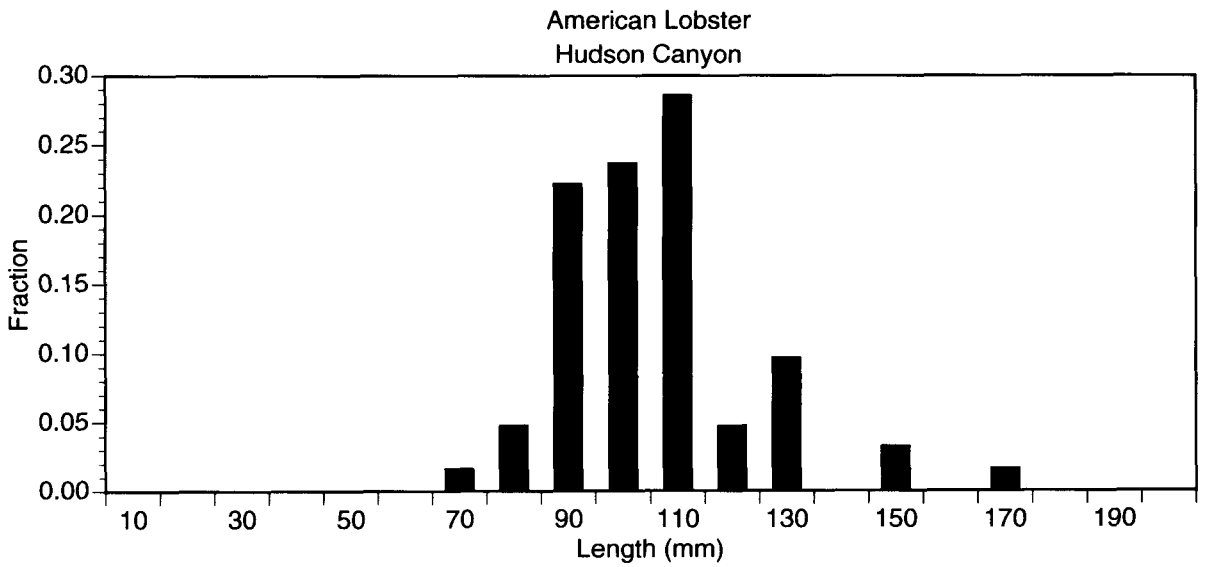


Figure 25a. Cumulative size-frequency distribution of American lobster across all tows. Tow size frequencies were corrected to the number caught per size class per km^2 swept area. The swept area-normalized abundances were then summed across all tows for each transect.



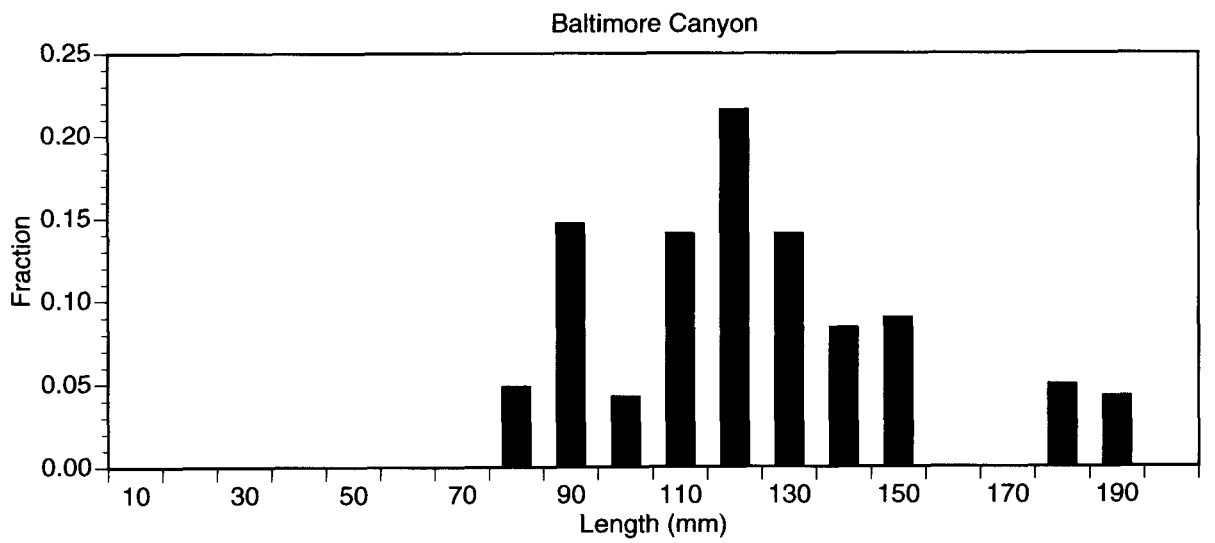
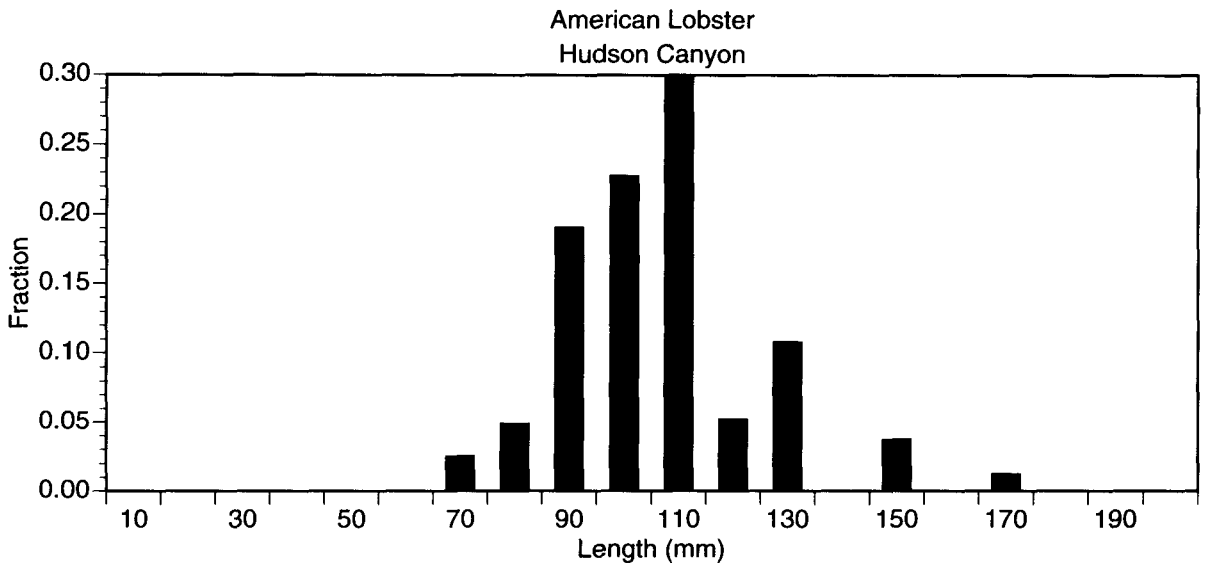


Figure 25b. Cumulative size-frequency distribution of American lobster across all tows. Tow size frequencies were corrected to the number caught per size class per km^2 swept area. Tows were then normalized to swath distance along the transect and the abundances were summed across all tows for each transect.



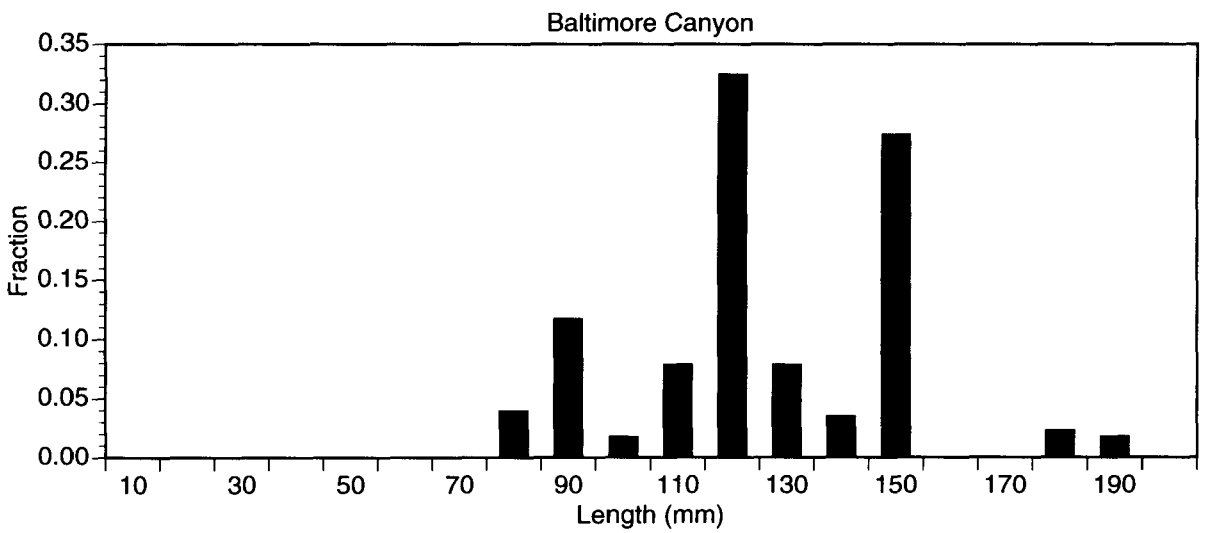


Figure 26a. Cumulative size-frequency distribution of barndoor skate across all tows. Tow size frequencies were corrected to the number caught per size class per km^2 swept area. The swept area-normalized abundances were then summed across all tows for each transect.

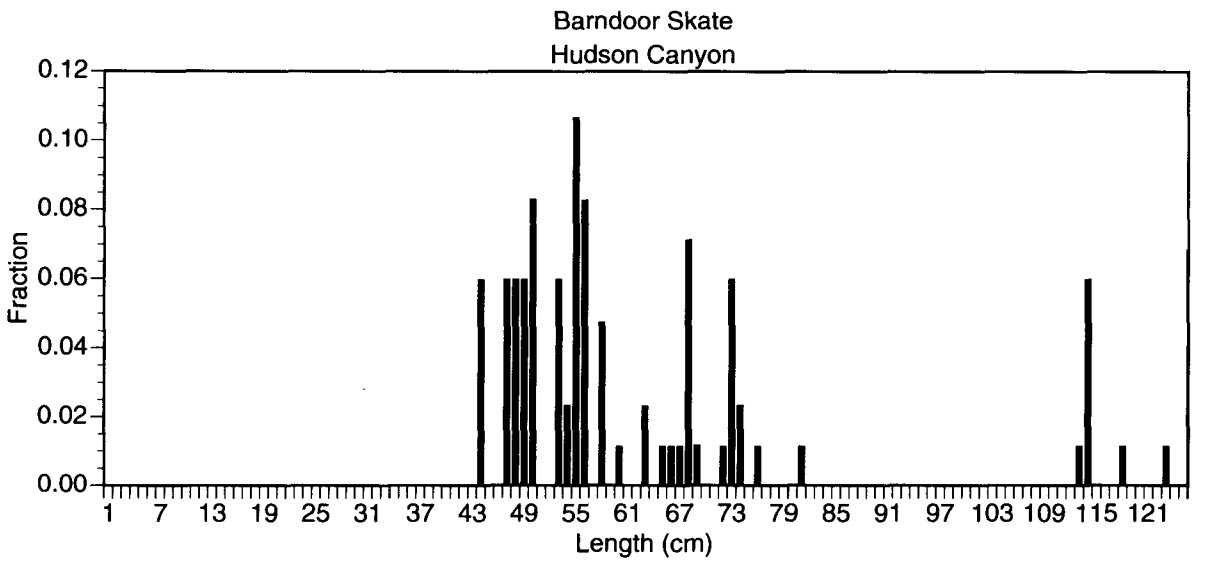


Figure 26b. Cumulative size-frequency distribution of barndoor skate across all tows. Tow size frequencies were corrected to the number caught per size class per km^2 swept area. Tows were then normalized to swath distance along the transect and the abundances were summed across all tows for each transect.

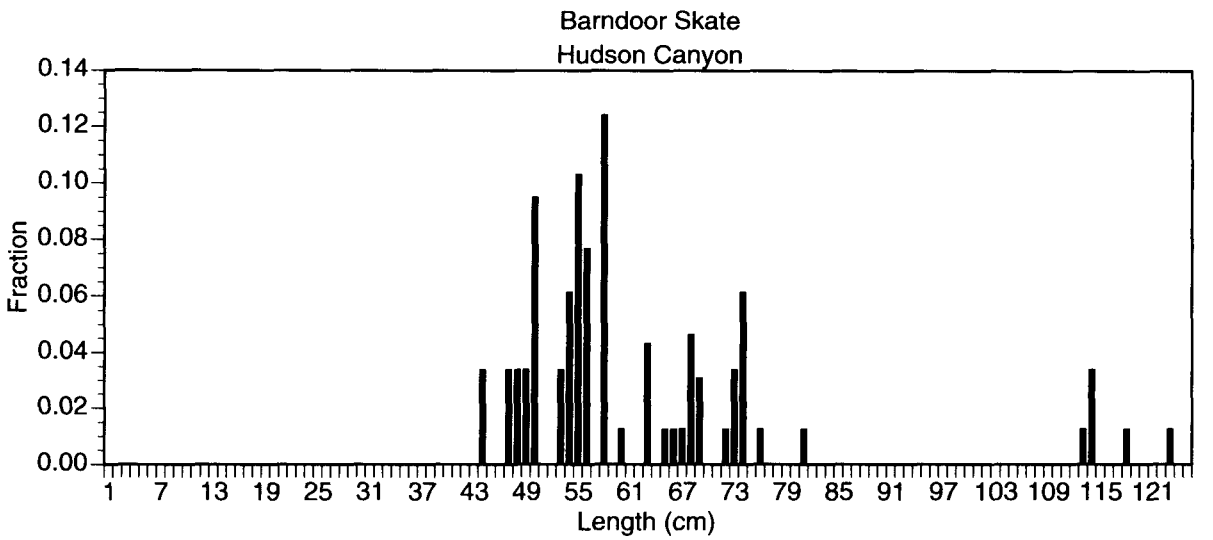
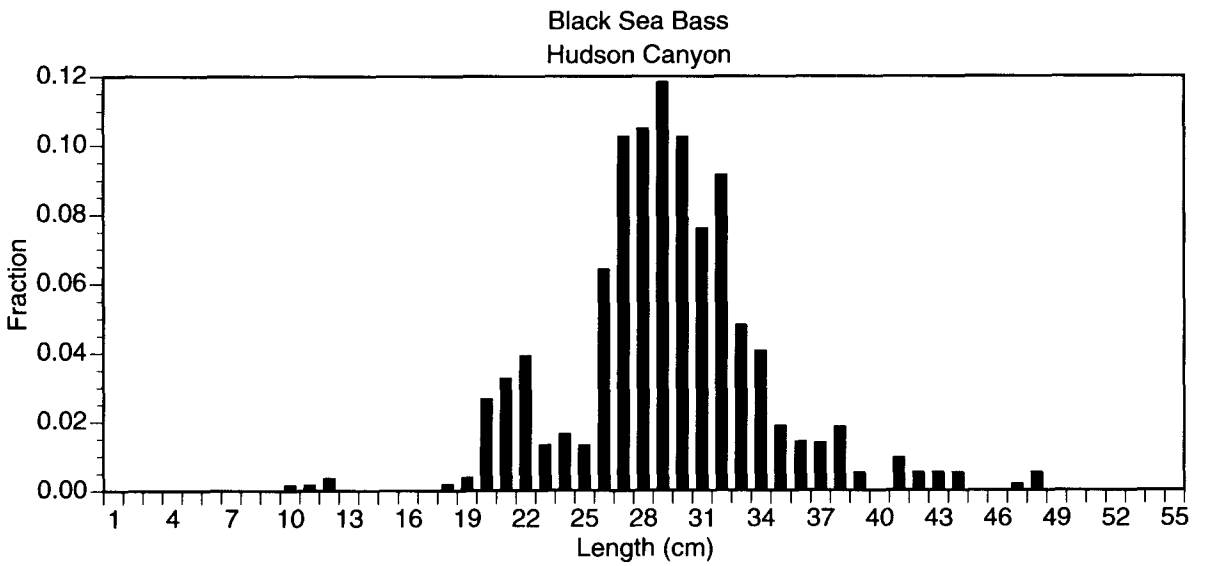


Figure 27a. Cumulative size-frequency distribution of black sea bass across all tows. Tow size frequencies were corrected to the number caught per size class per km^2 swept area. The swept area-normalized abundances were then summed across all tows for each transect.



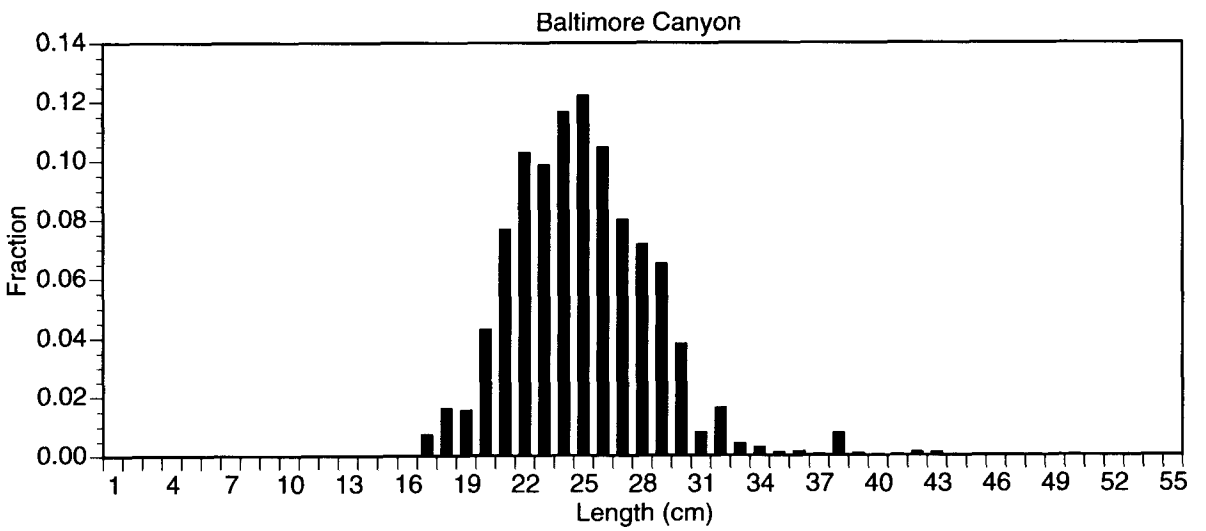
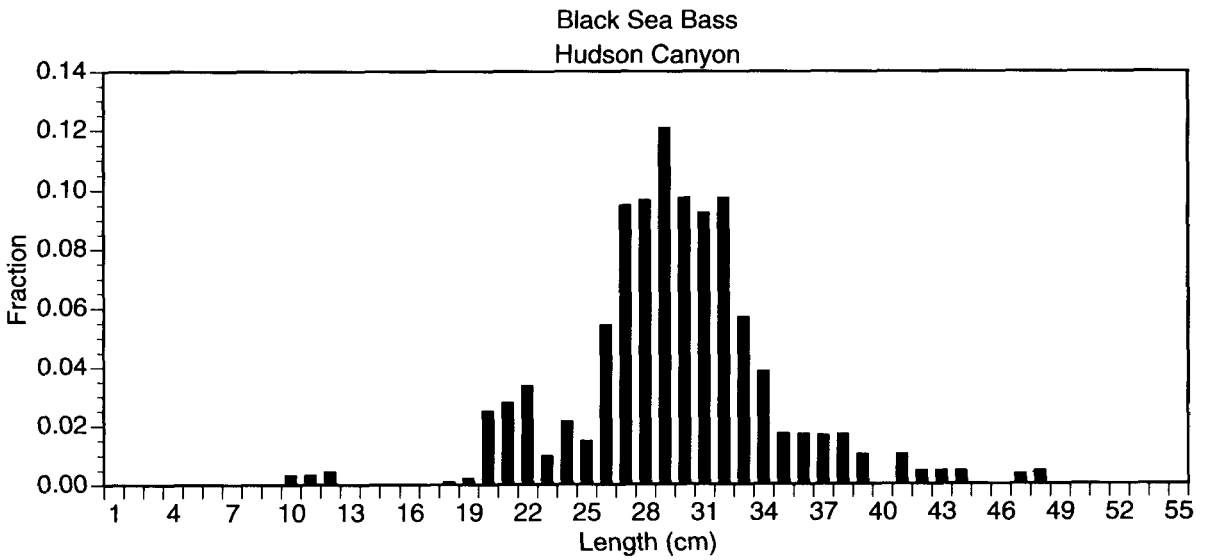


Figure 27b. Cumulative size-frequency distribution of black sea bass across all tows. Tow size frequencies were corrected to the number caught per size class per km^2 swept area. Tows were then normalized to swath distance along the transect and the abundances were summed across all tows for each transect.



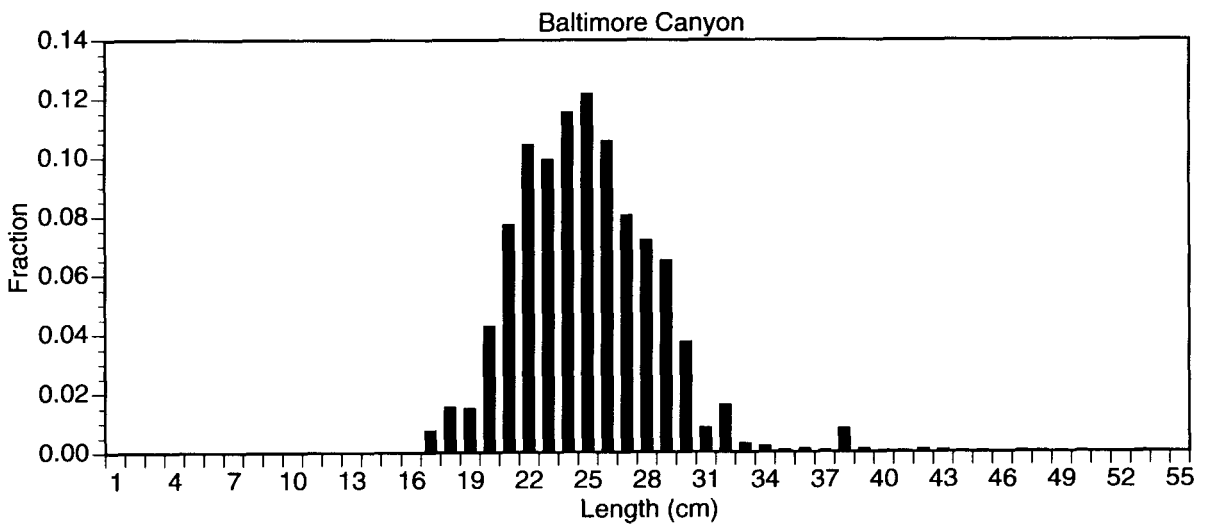


Figure 28a. Cumulative size-frequency distribution of clearnose skate across all tows. Tow size frequencies were corrected to the number caught per size class per km² swept area. The swept area-normalized abundances were then summed across all tows for each transect.

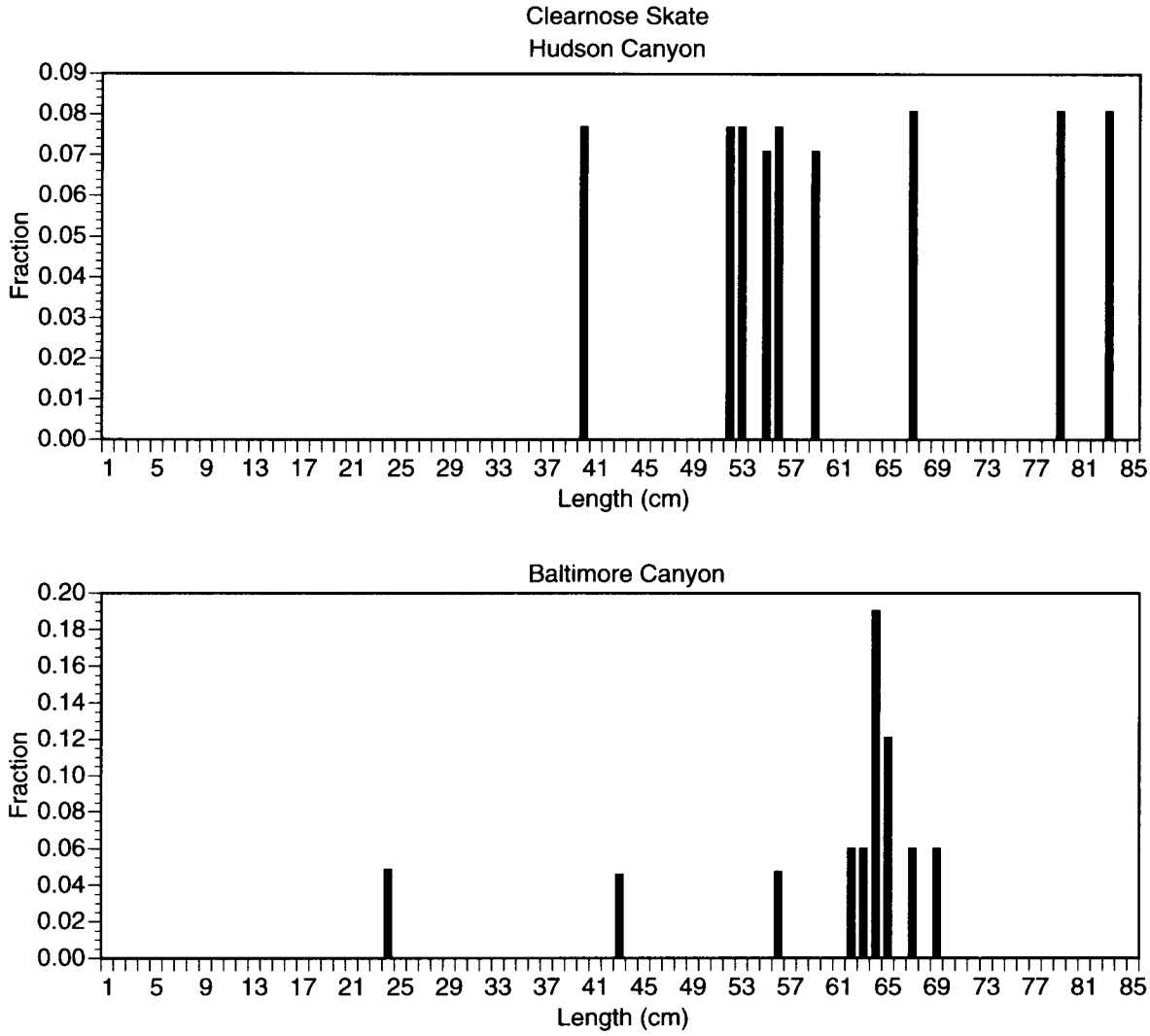
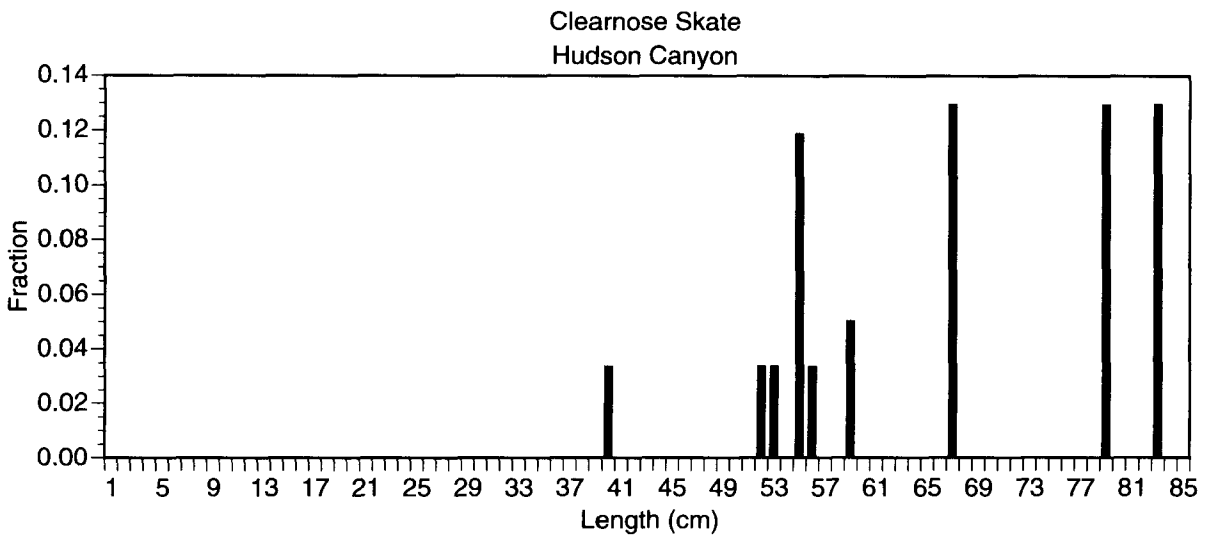


Figure 28b. Cumulative size-frequency distribution of clearnose skate across all tows. Tow size frequencies were corrected to the number caught per size class per km^2 swept area. Tows were then normalized to swath distance along the transect and the abundances were summed across all tows for each transect.



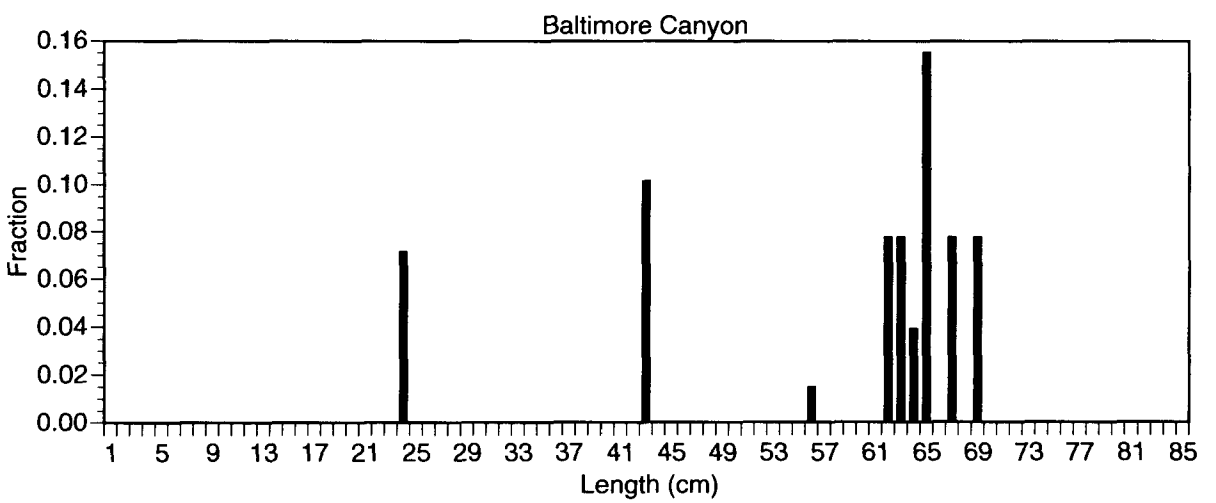
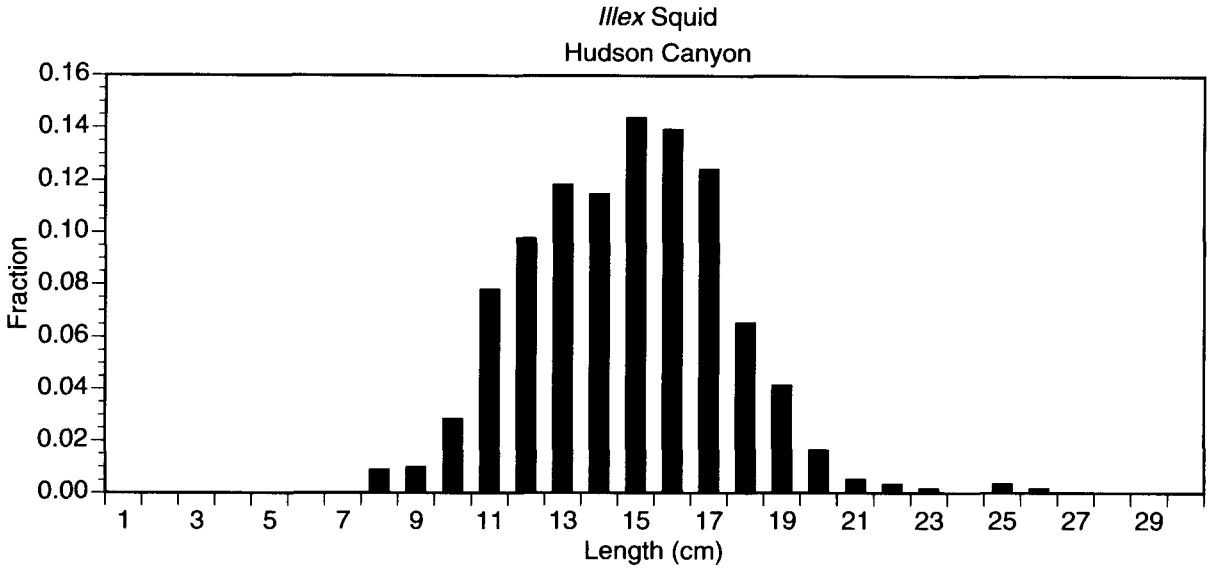


Figure 29a. Cumulative size-frequency distribution of *Illex* squid across all tows. Tow size frequencies were corrected to the number caught per size class per km^2 swept area. The swept area-normalized abundances were then summed across all tows for each transect.



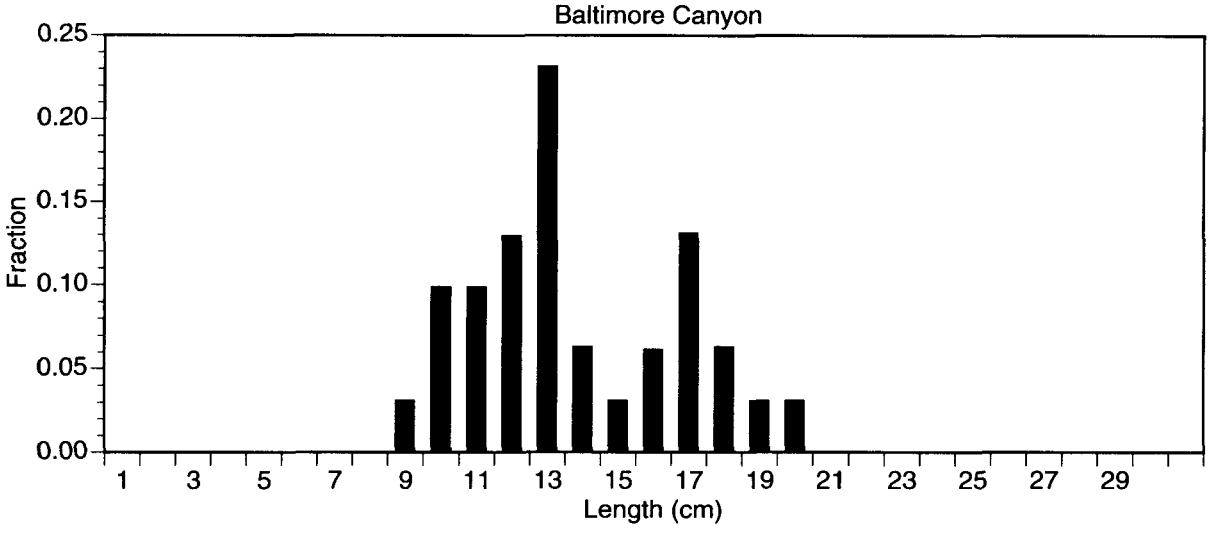
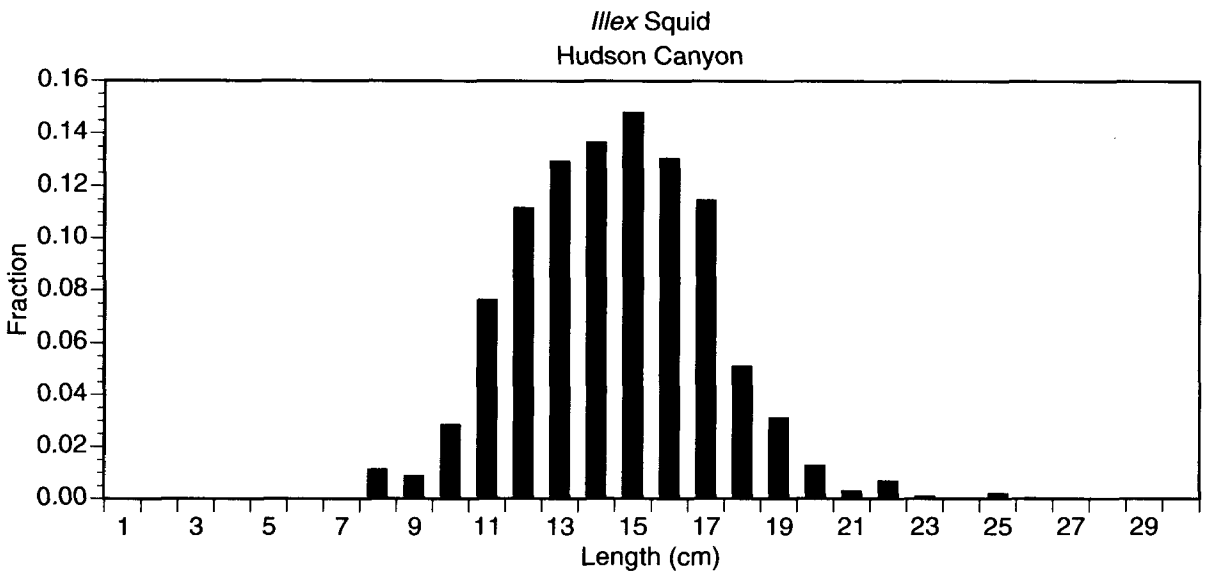


Figure 29b. Cumulative size-frequency distribution of *Illex* squid across all tows. Tow size frequencies were corrected to the number caught per size class per km^2 swept area. Tows were then normalized to swath distance along the transect and the abundances were summed across all tows for each transect.



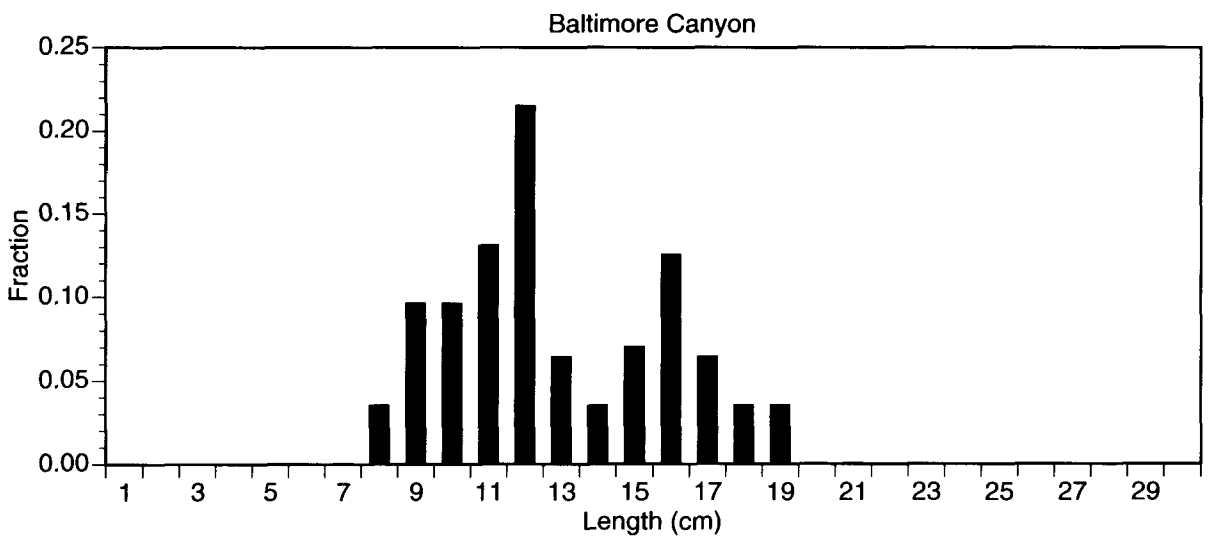
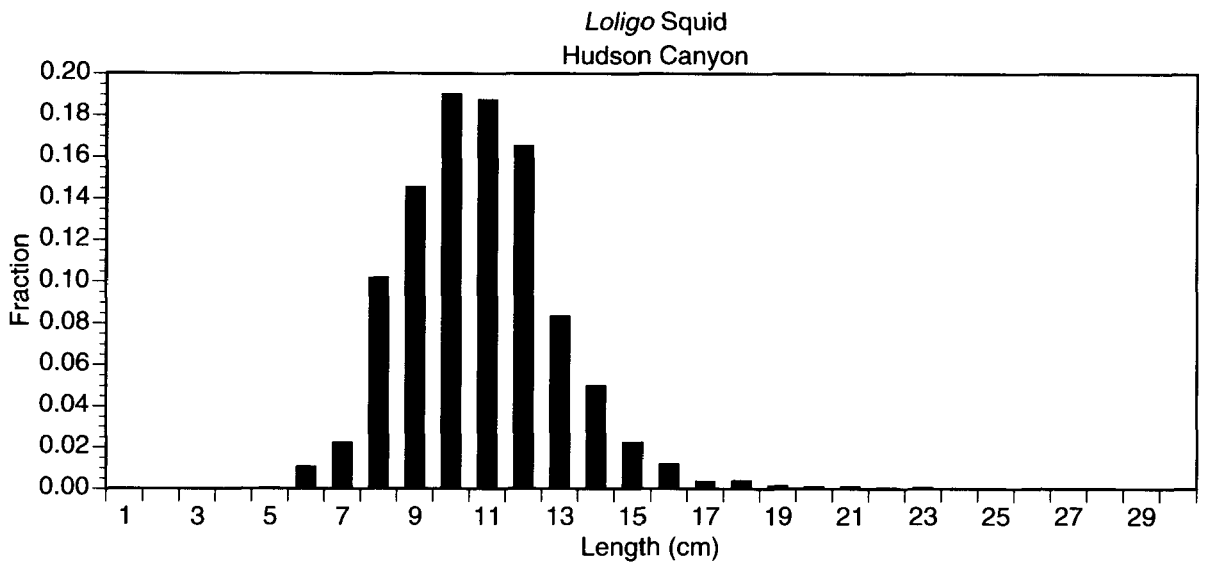


Figure 30a. Cumulative size-frequency distribution of *Loligo* squid across all tows. Tow size frequencies were corrected to the number caught per size class per km^2 swept area. The swept area-normalized abundances were then summed across all tows for each transect.



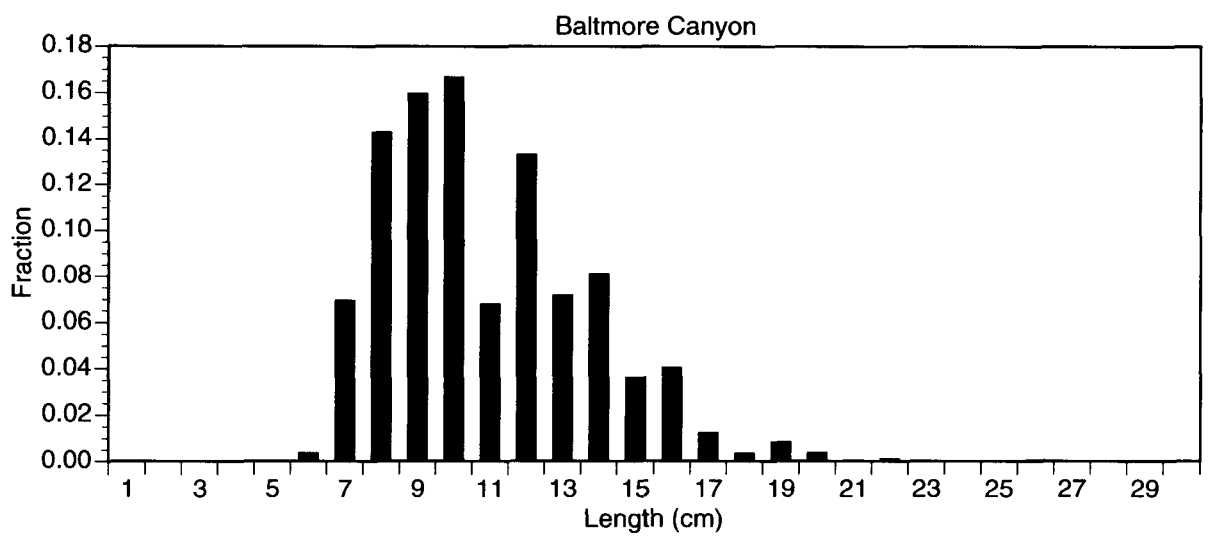
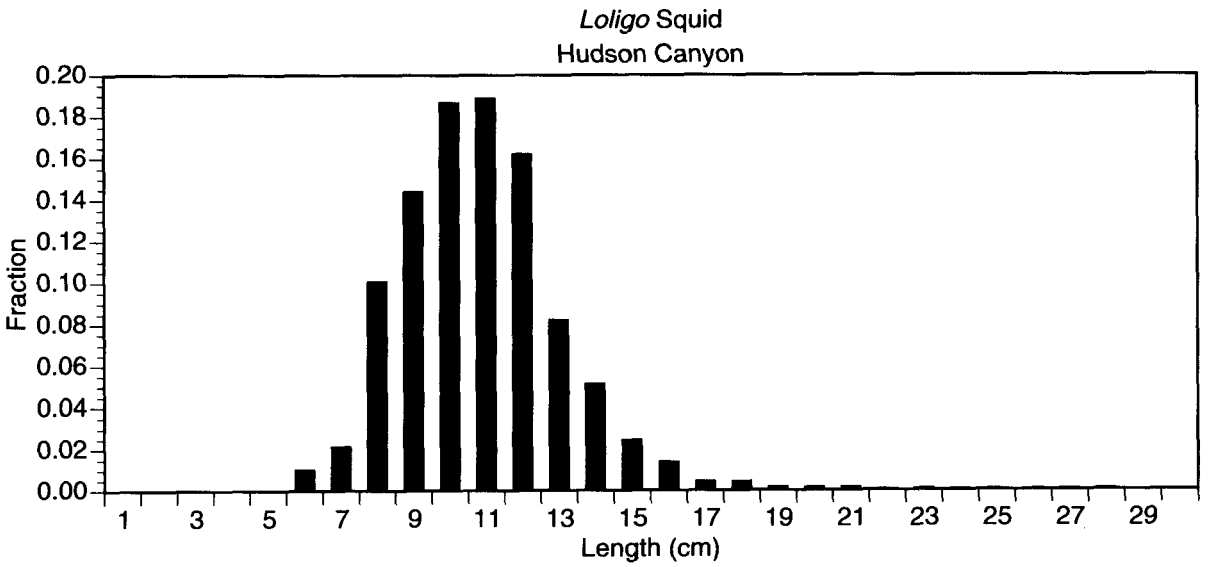


Figure 30b. Cumulative size-frequency distribution of *Loligo* squid across all tows. Tow size frequencies were corrected to the number caught per size class per km^2 swept area. Tows were then normalized to swath distance along the transect and the abundances were summed across all tows for each transect.



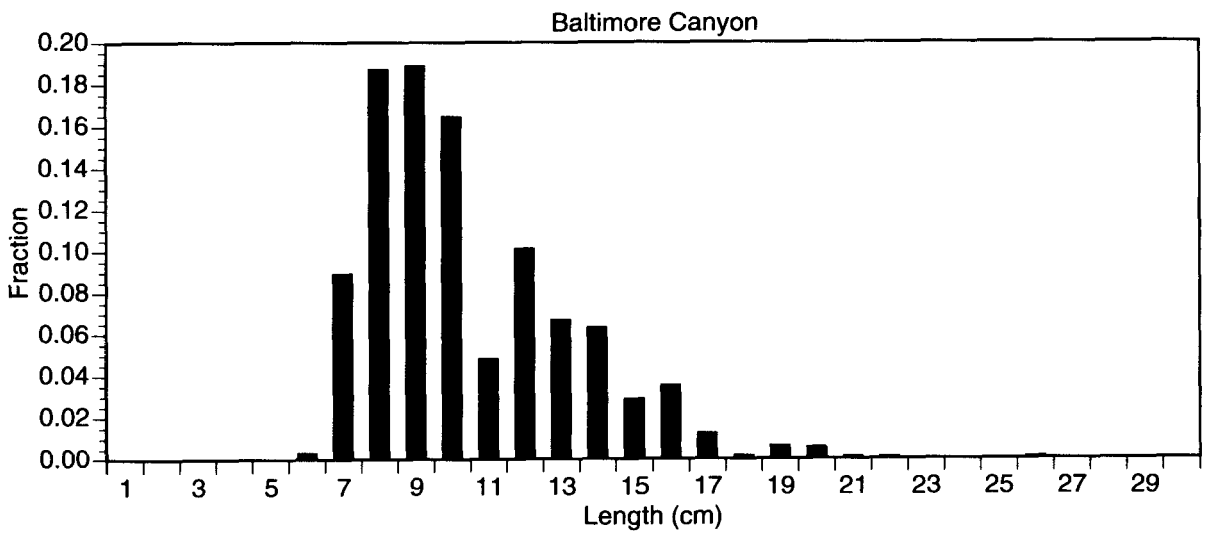
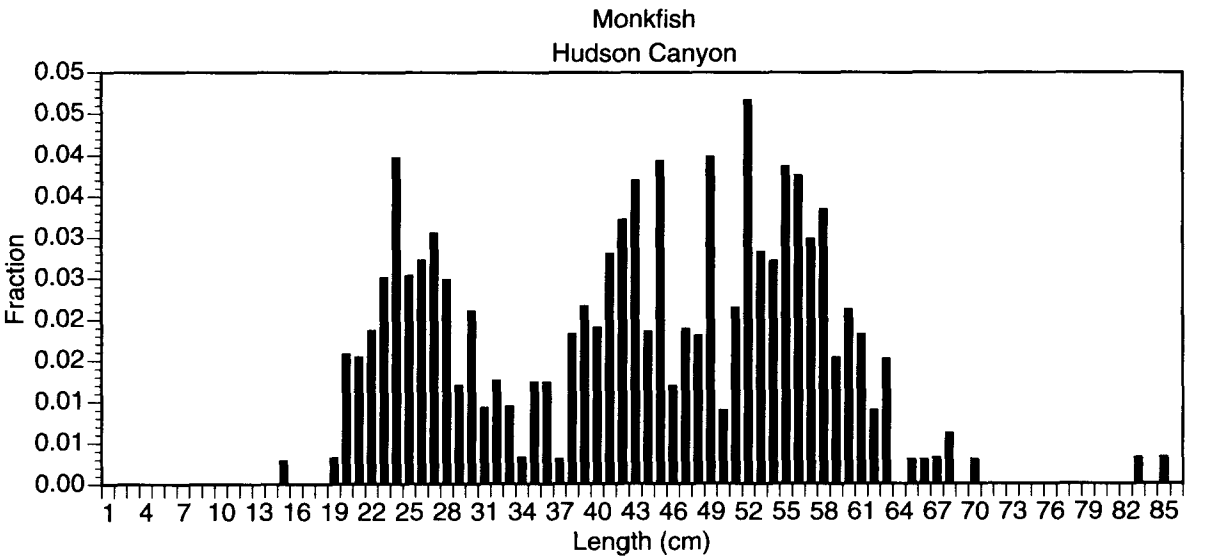


Figure 31a. Cumulative size-frequency distribution of monkfish across all tows. Tow size frequencies were corrected to the number caught per size class per km^2 swept area. The swept area-normalized abundances were then summed across all tows for each transect.



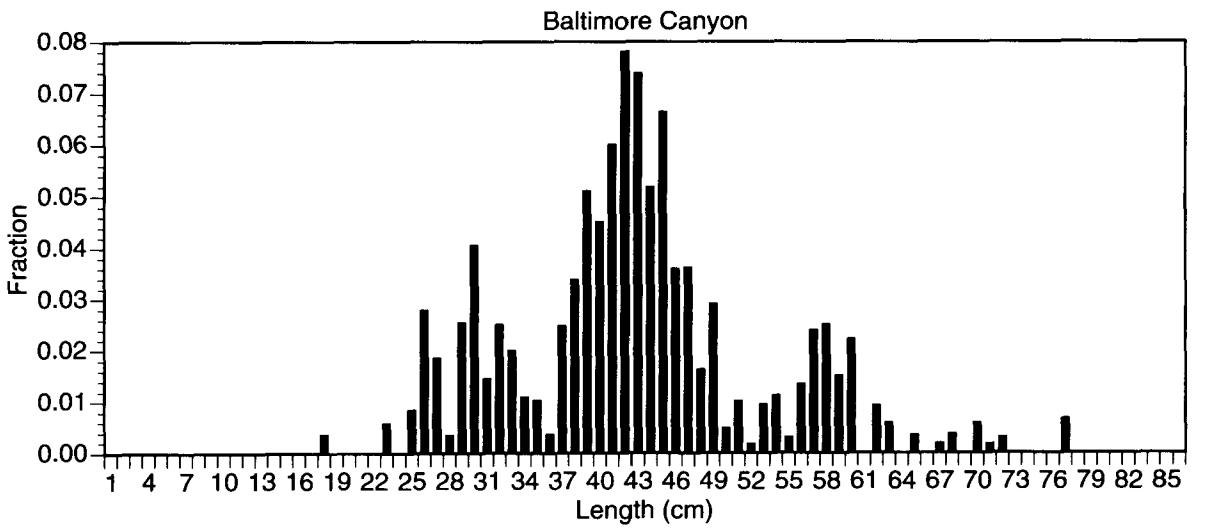
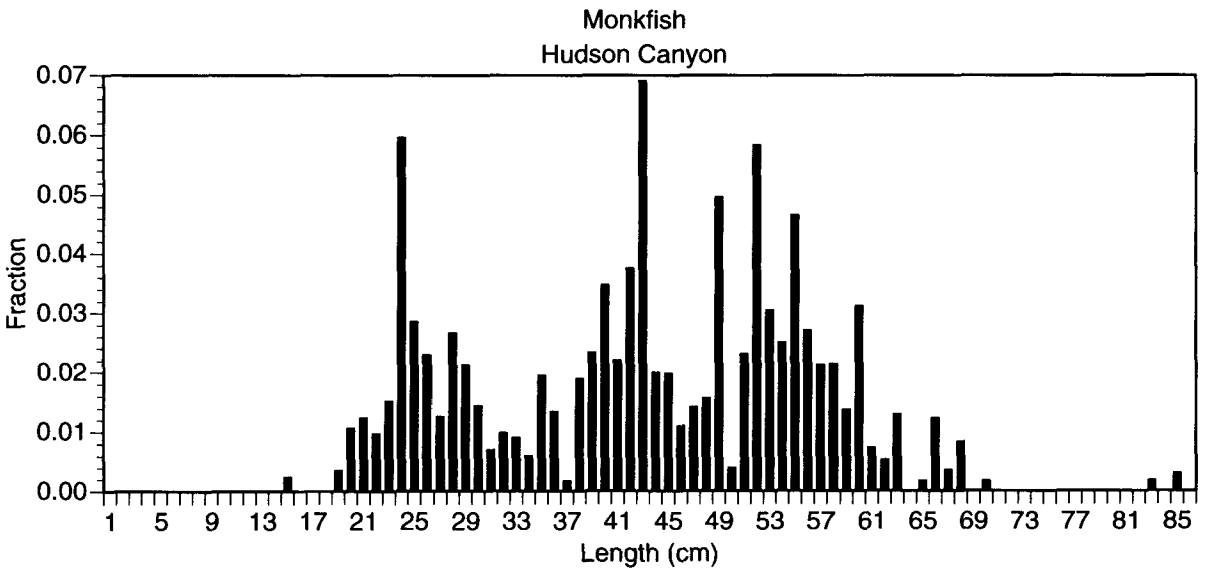


Figure 31b. Cumulative size-frequency distribution of monkfish across all tows. Tow size frequencies were corrected to the number caught per size class per km^2 swept area. Tows were then normalized to swath distance along the transect and the abundances were summed across all tows for each transect.



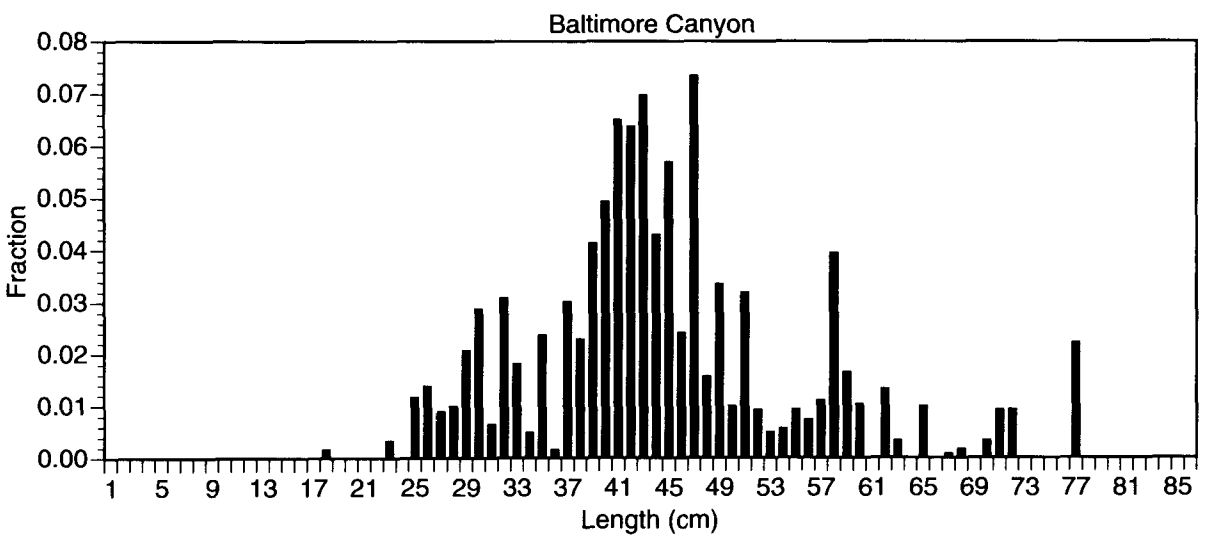


Figure 32a. Cumulative size-frequency distribution of offshore hake across all tows. Tow size frequencies were corrected to the number caught per size class per km^2 swept area. The swept area-normalized abundances were then summed across all tows for each transect.

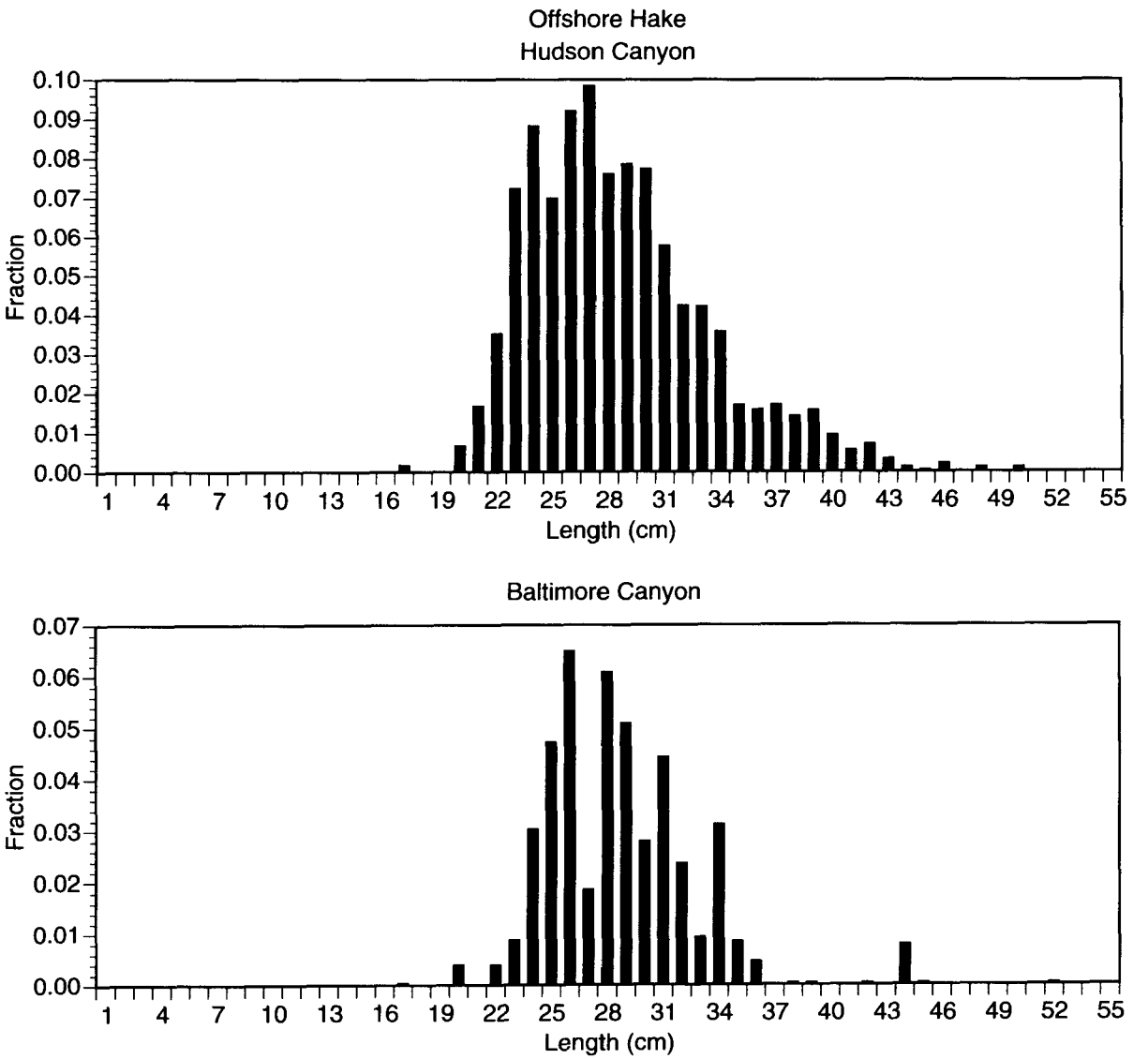


Figure 32b. Cumulative size-frequency distribution of offshore hake across all tows. Tow size frequencies were corrected to the number caught per size class per km^2 swept area. Tows were then normalized to swath distance along the transect and the abundances were summed across all tows for each transect.

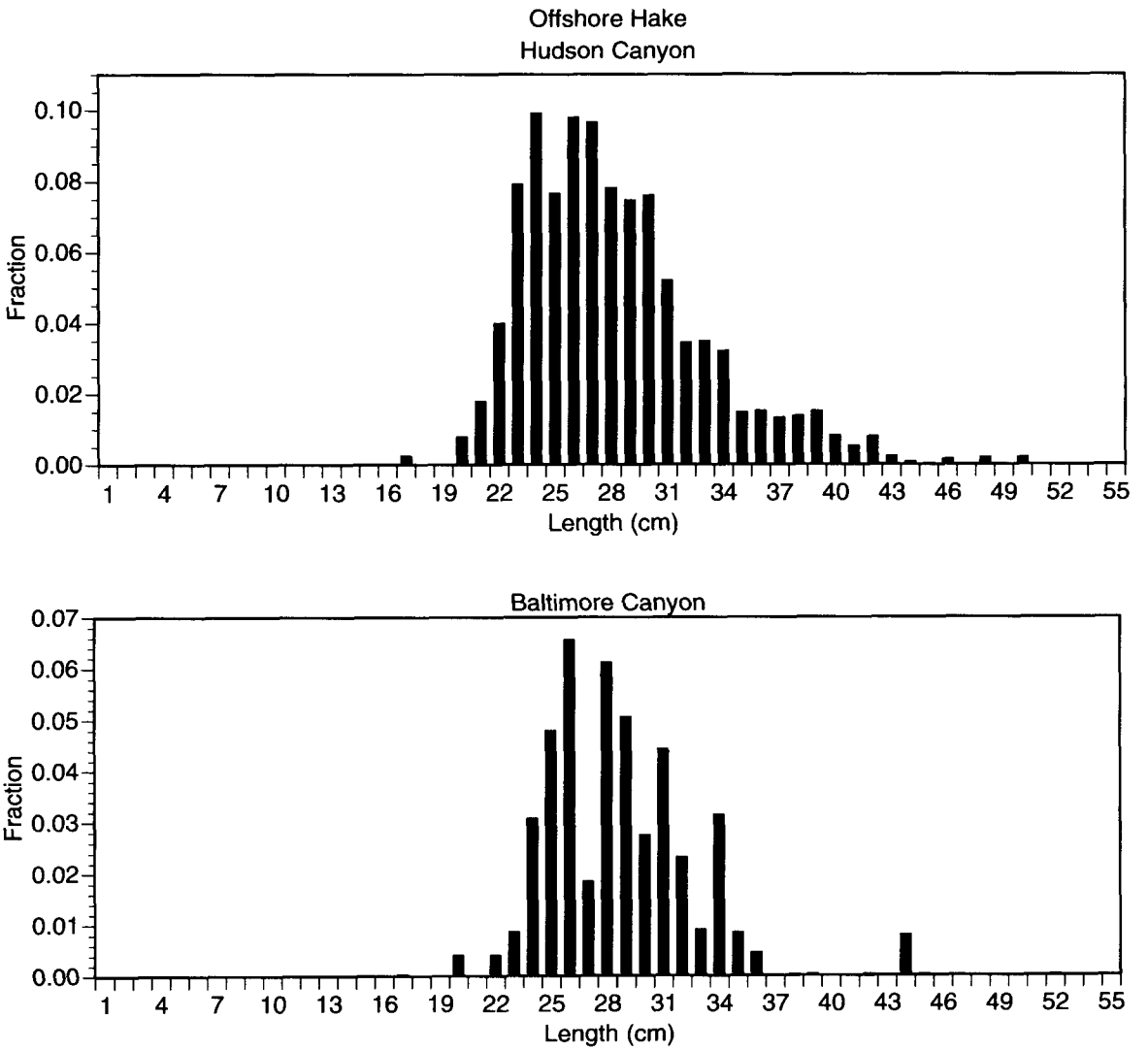
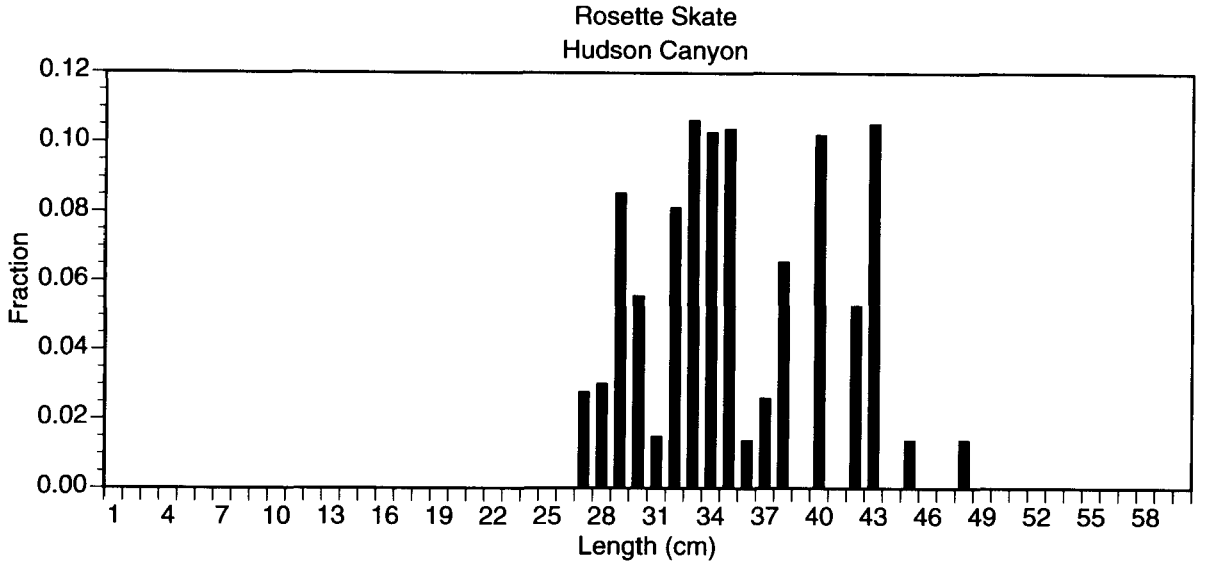


Figure 33a. Cumulative size-frequency distribution of rosette skates across all tows. Tow size frequencies were corrected to the number caught per size class per km^2 swept area. The swept area-normalized abundances were then summed across all tows for each transect.



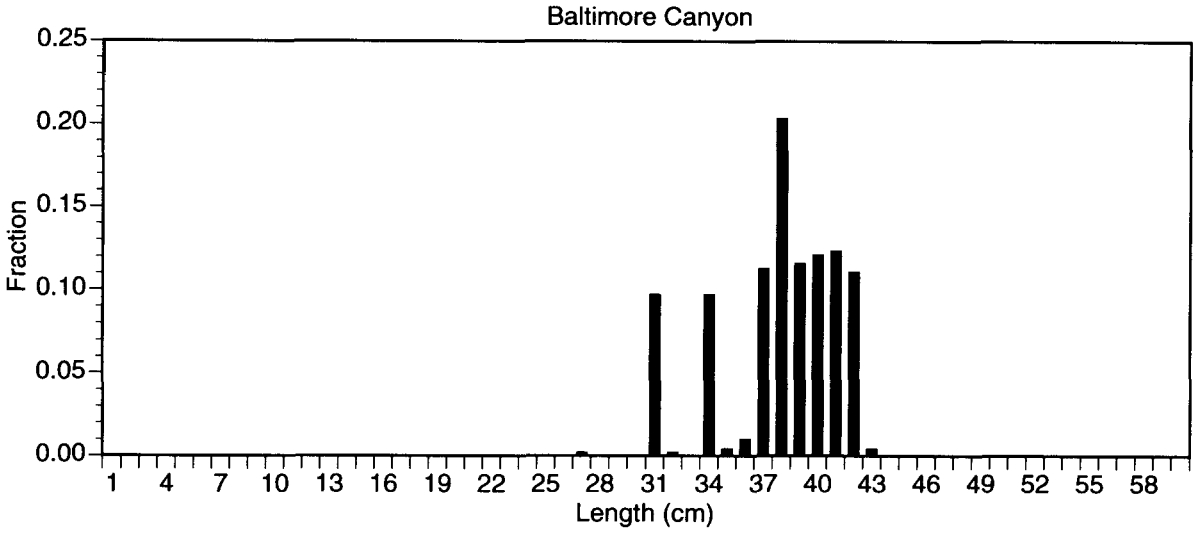
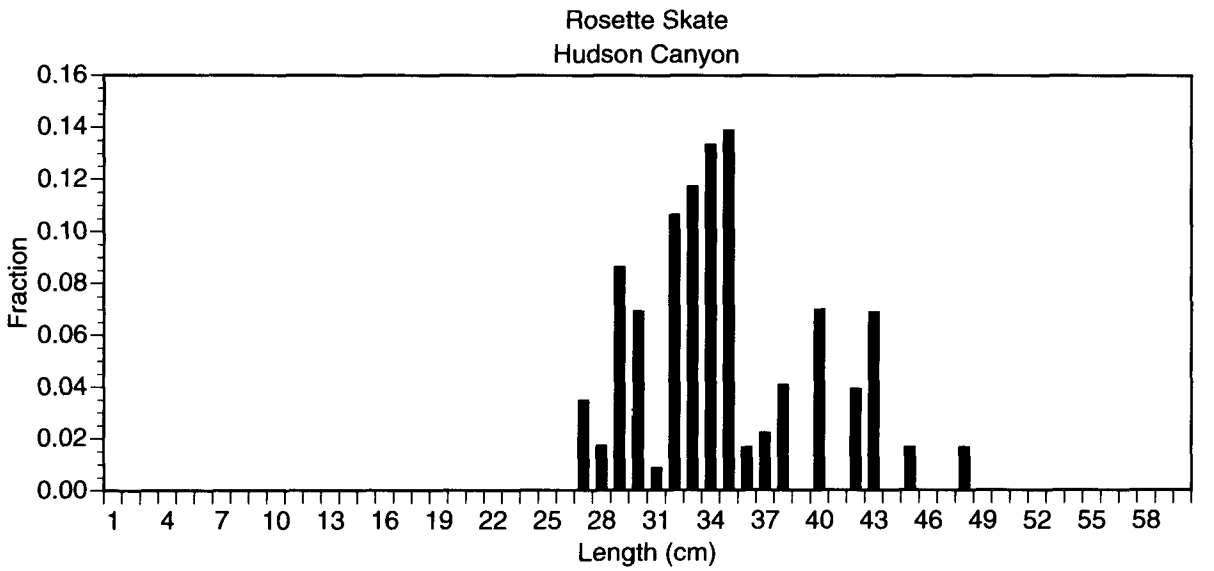


Figure 33b . Cumulative size-frequency distribution of rosette skate across all tows. Tow size frequencies were corrected to the number caught per size class per km^2 swept area. Tows were then normalized to swath distance along the transect and the abundances were summed across all tows for each transect.



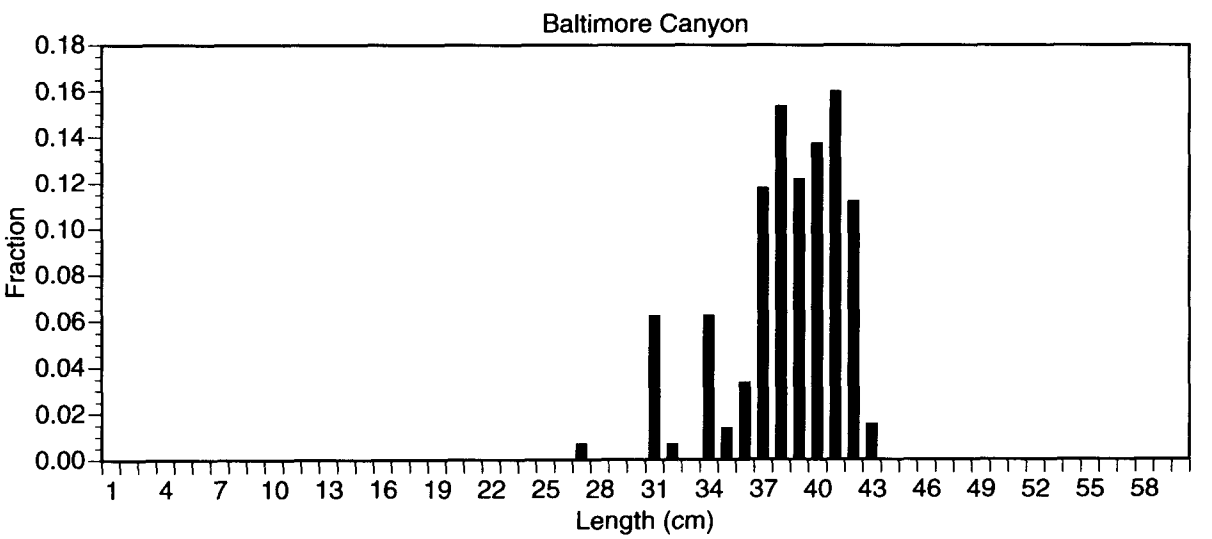


Figure 34a. Cumulative size-frequency distribution of scup across all tows. Tow size frequencies were corrected to the number caught per size class per km^2 swept area. The swept area-normalized abundances were then summed across all tows for each transect.

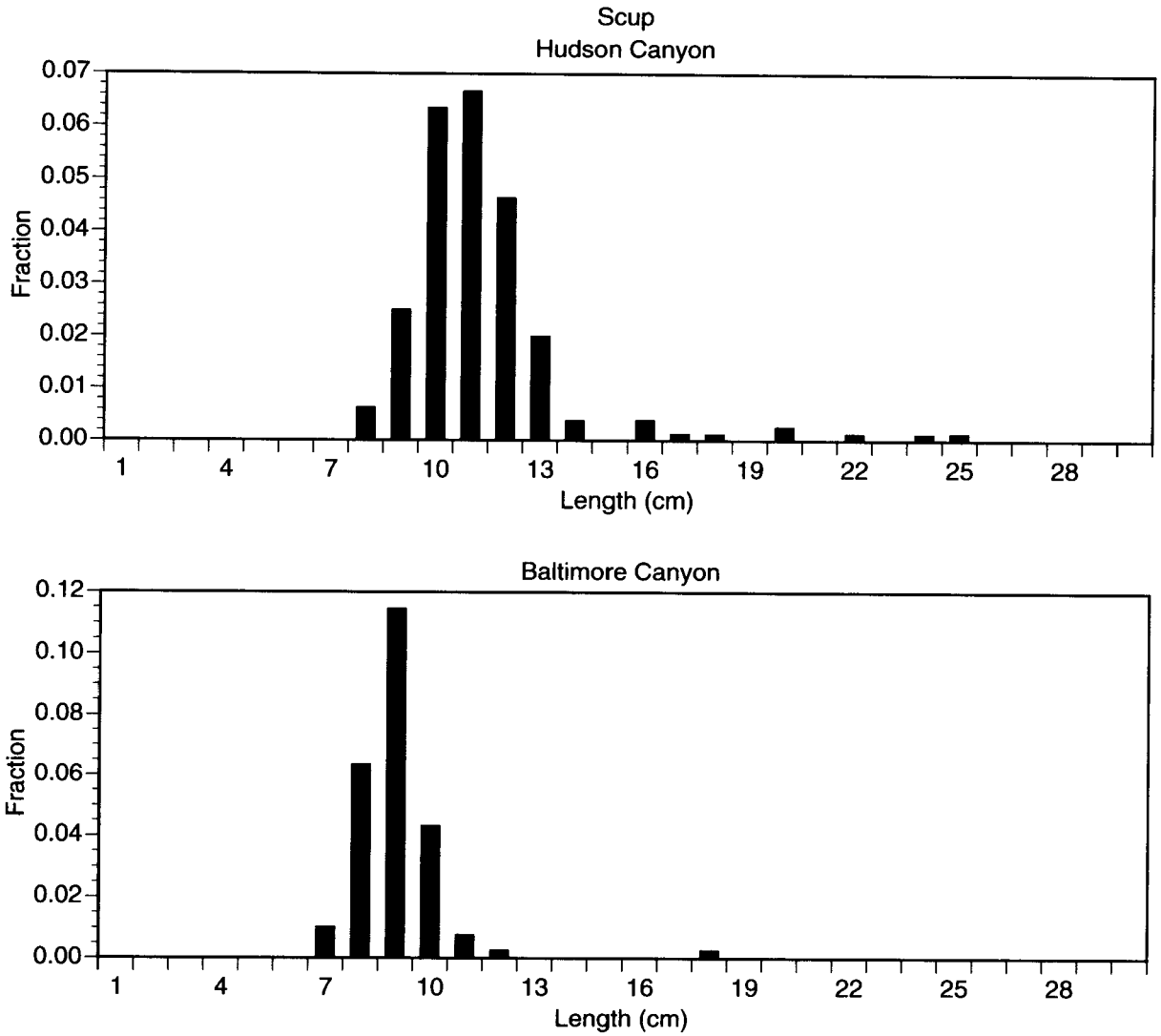


Figure 34b. Cumulative size-frequency distribution of scup across all tows. Tow size frequencies were corrected to the number caught per size class per km^2 swept area. Tows were then normalized to swath distance along the transect and the abundances were summed across all tows for each transect.

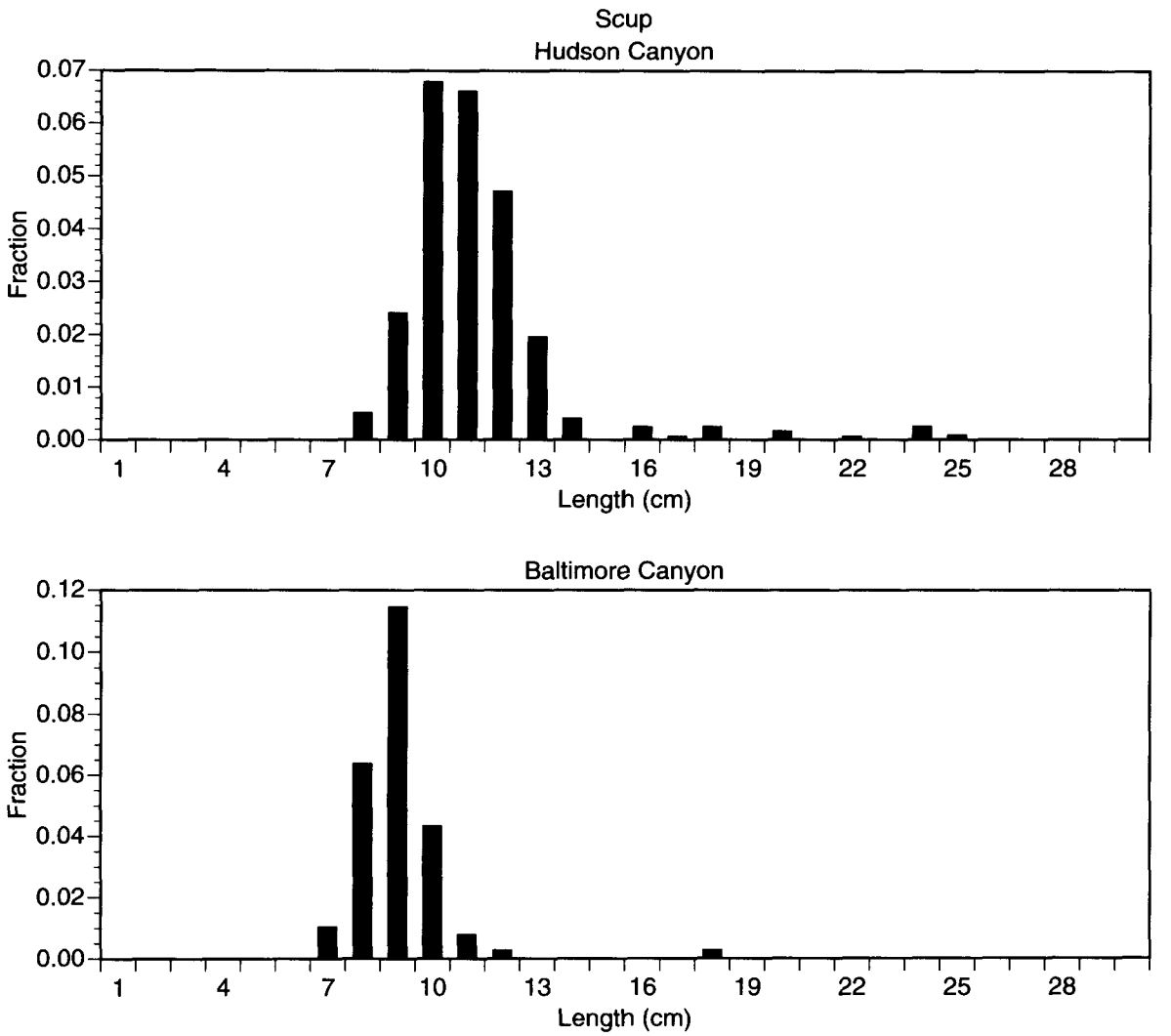
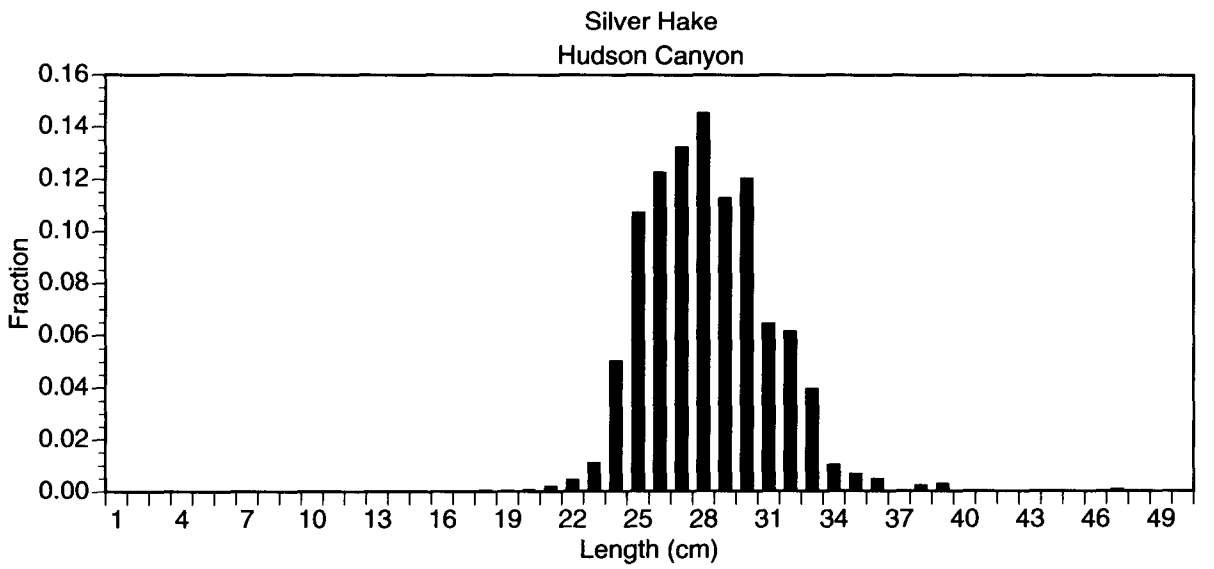


Figure 35a. Cumulative size-frequency distribution of silver hake across all tows. Tow size frequencies were corrected to the number caught per size class per km^2 swept area. The swept area-normalized abundances were then summed across all tows for each transect.



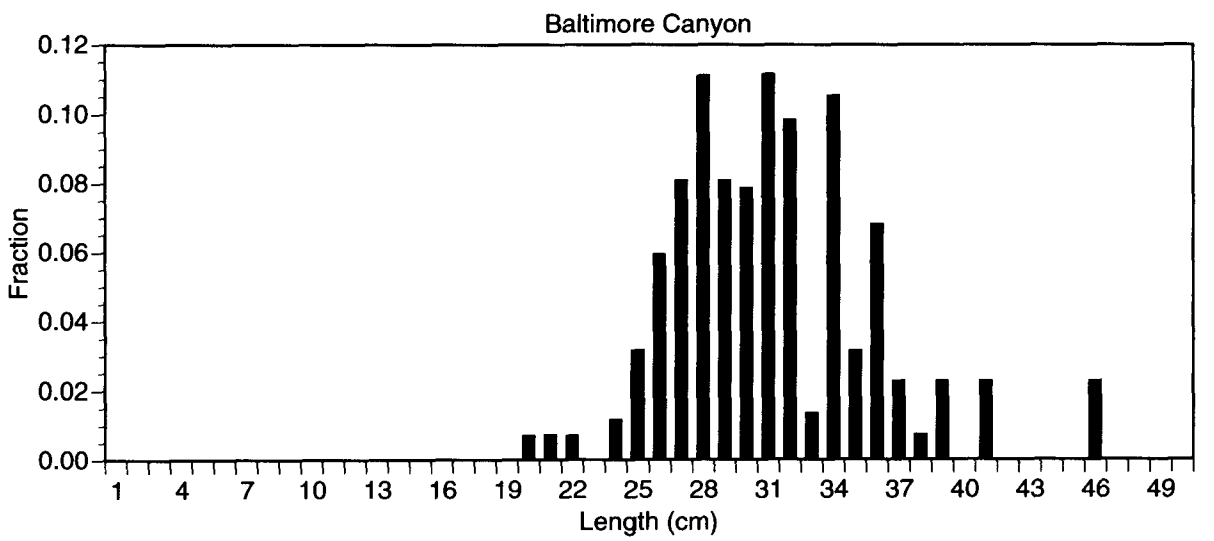
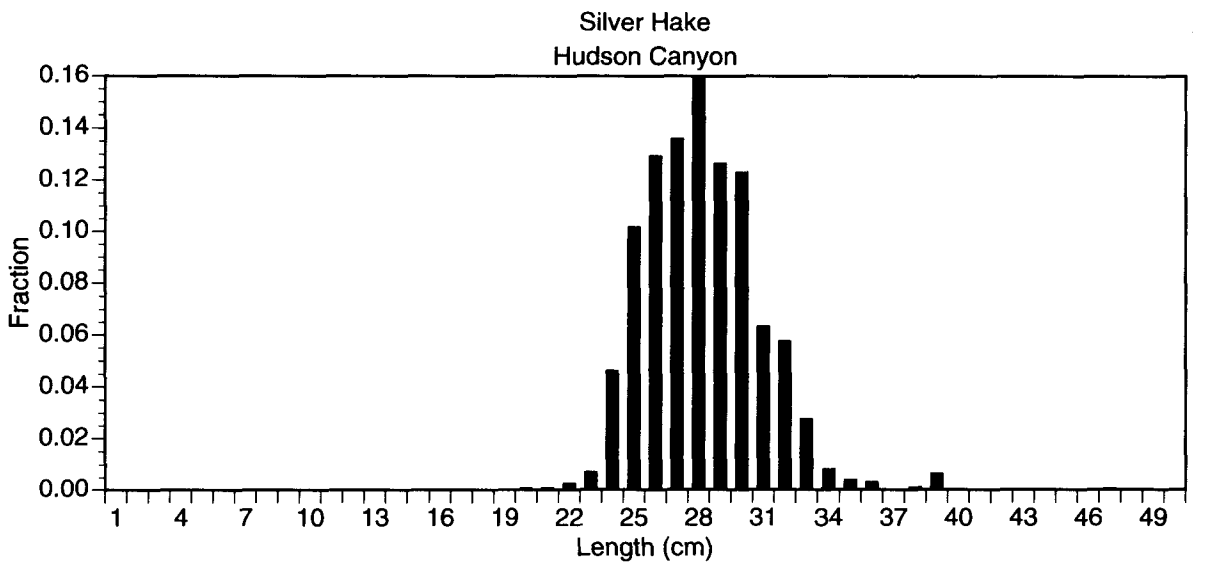


Figure 35b. Cumulative size-frequency distribution of silver hake across all tows. Tow size frequencies were corrected to the number caught per size class per km^2 swept area. Tows were then normalized to swath distance along the transect and the abundances were summed across all tows for each transect.



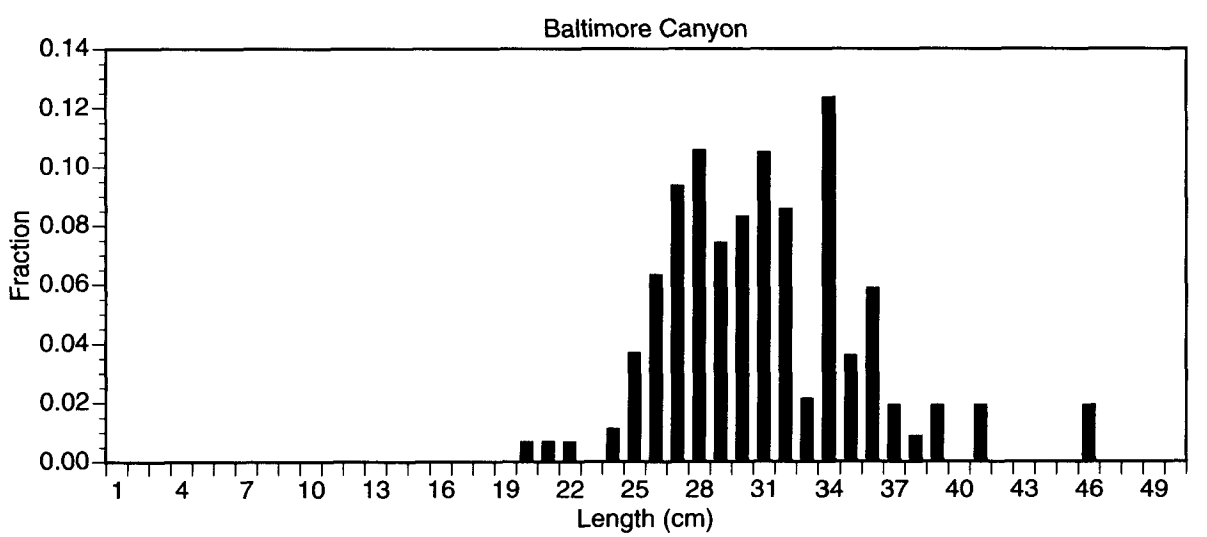
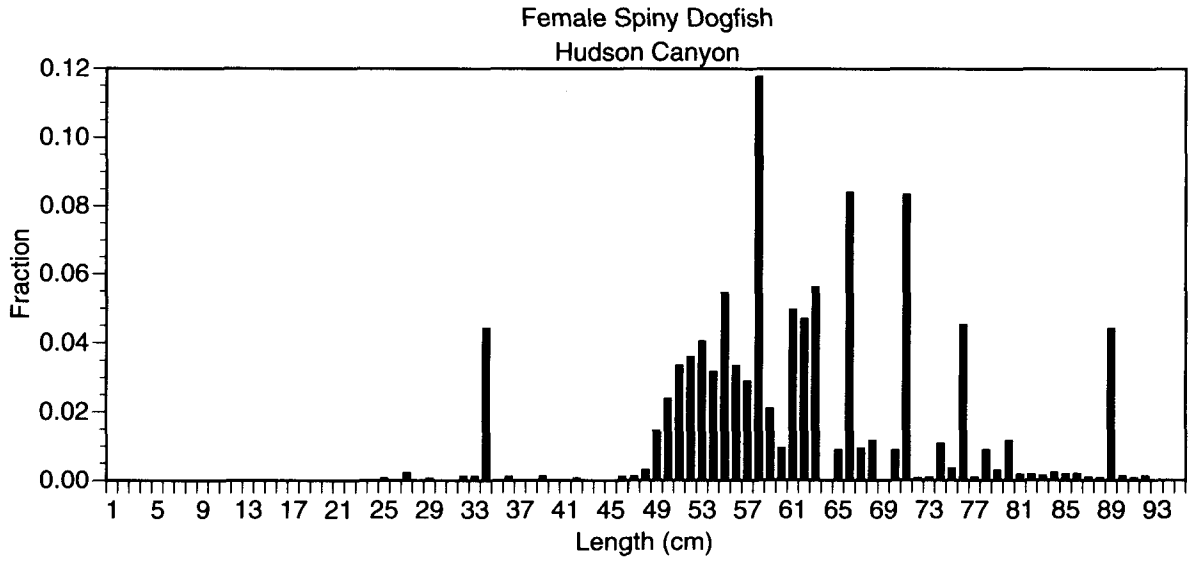


Figure 36a. Cumulative size-frequency distribution of female spiny dogfish across all tows. Tow size frequencies were corrected to the number caught per size class per km^2 swept area. The swept area-normalized abundances were then summed across all tows for each transect. Spiny dogfish < 36 cm roughly corresponds to a pup less than one year old.



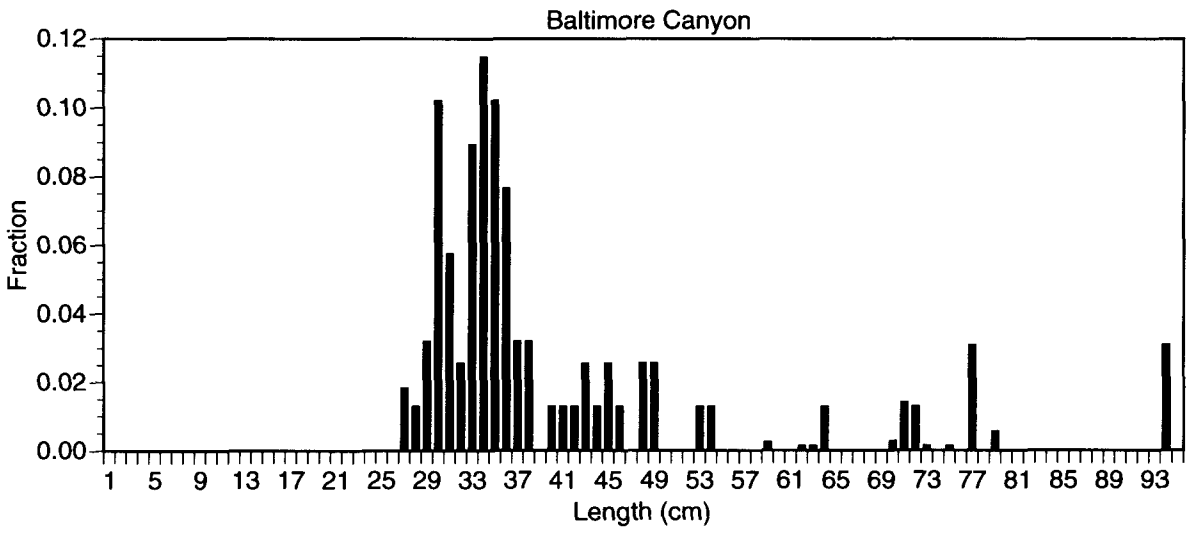


Figure 36b. Cumulative size-frequency distribution of female spiny dogfish across all tows. Tow size frequencies were corrected to the number caught per size class per km^2 swept area. Tows were then normalized to swath distance along the transect and the abundances were summed across all tows for each transect. Spiny dogfish < 36 cm roughly corresponds to a pup less than one year old.

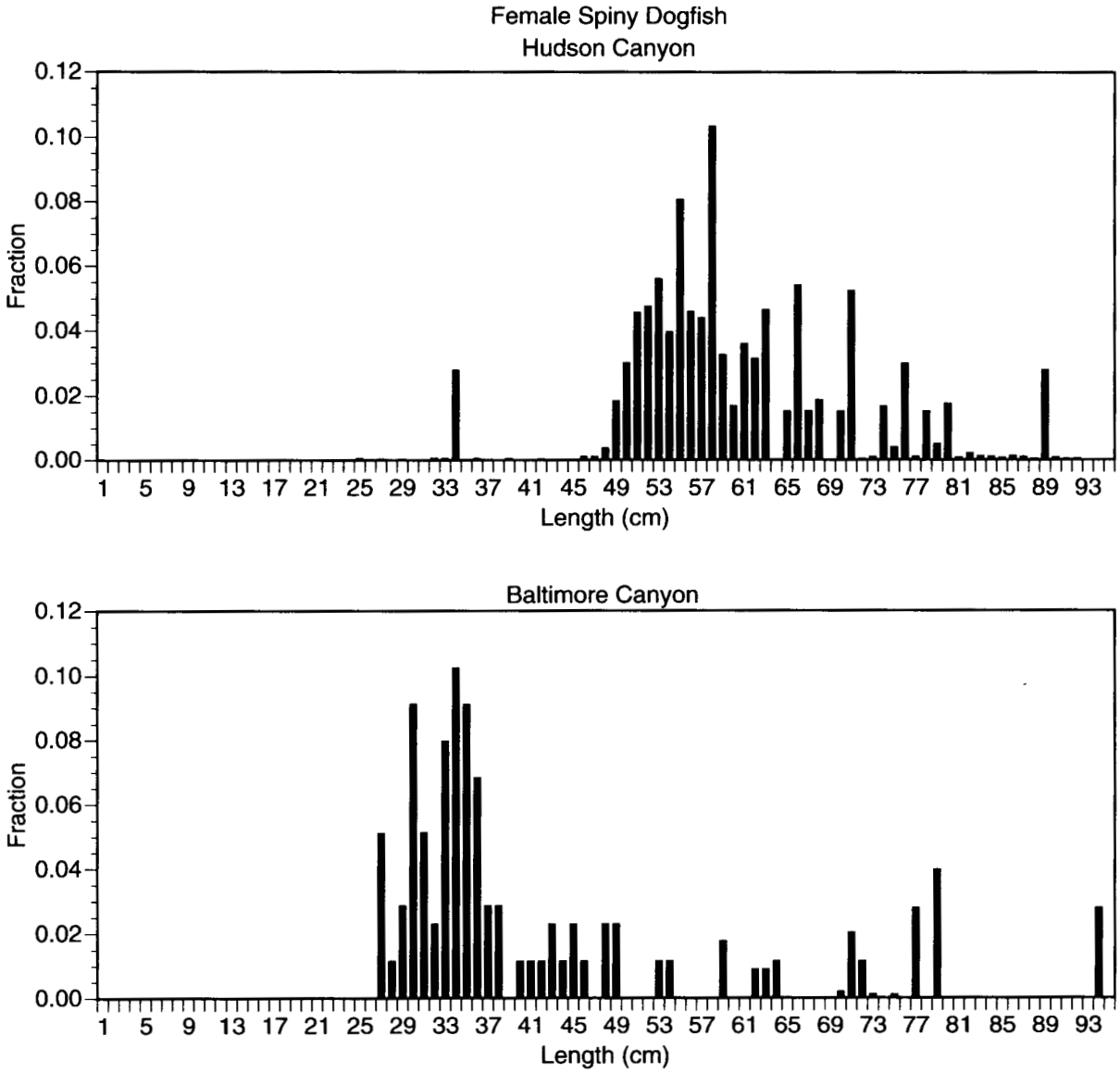
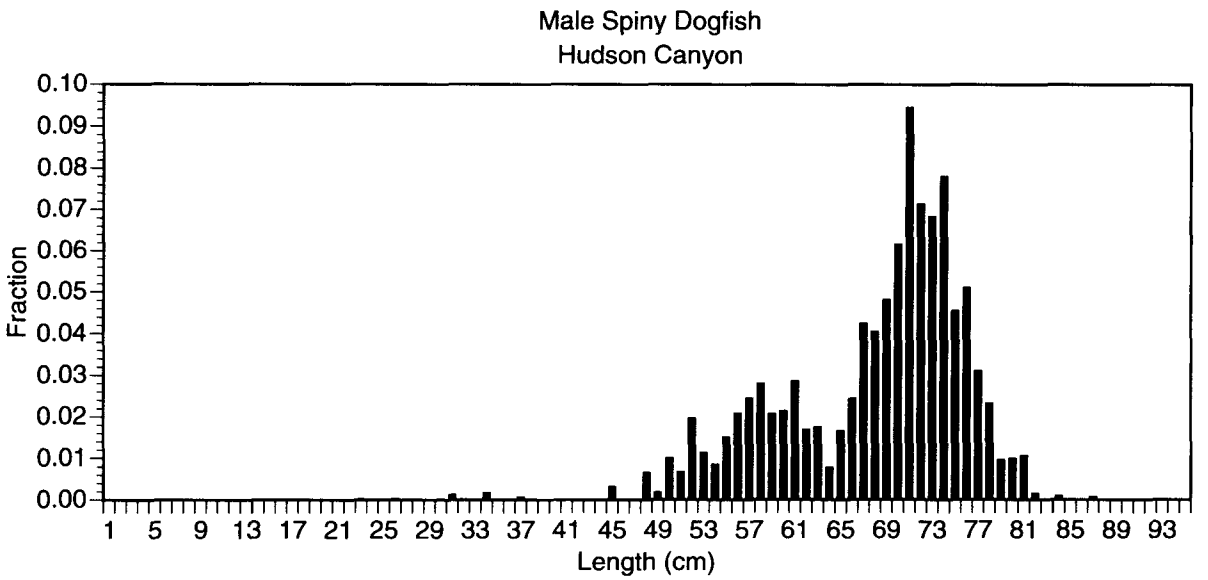


Figure 37a. Cumulative size-frequency distribution of male spiny dogfish across all tows. Tow size frequencies were corrected to the number caught per size class per km^2 swept area. The swept area-normalized abundances were then summed across all tows for each transect. Spiny dogfish < 36 cm roughly corresponds to a pup less than one year old.



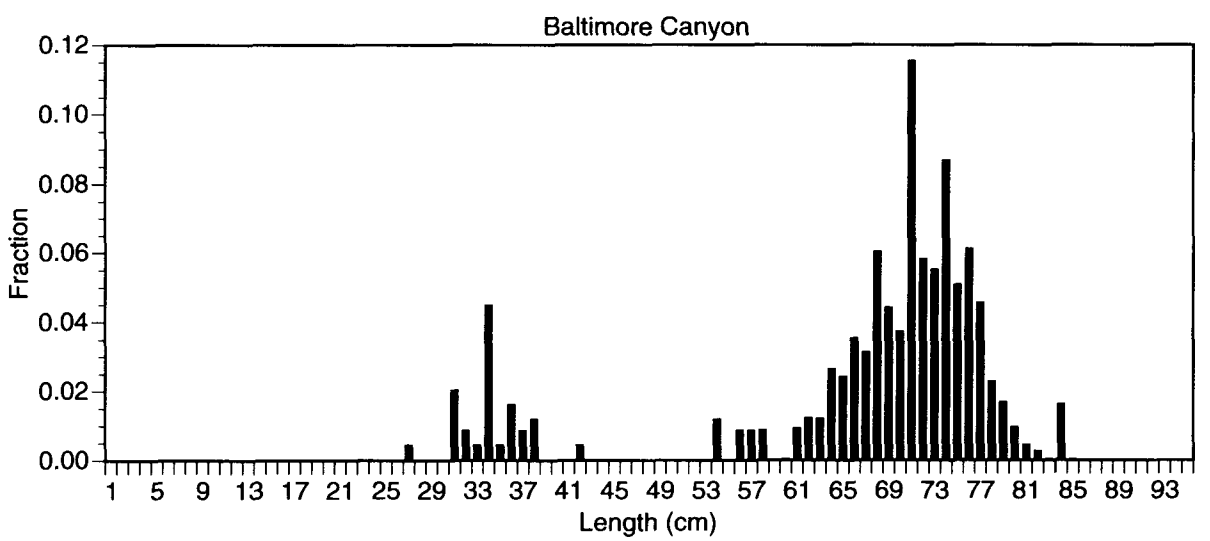


Figure 37b. Cumulative size-frequency distribution of male spiny dogfish across all tows. Tow size frequencies were corrected to the number caught per size class per km^2 swept area. Tows were then normalized to swath distance along the transect and the abundances were summed across all tows for each transect. Spiny dogfish < 36 cm roughly corresponds to a pup less than one year old.

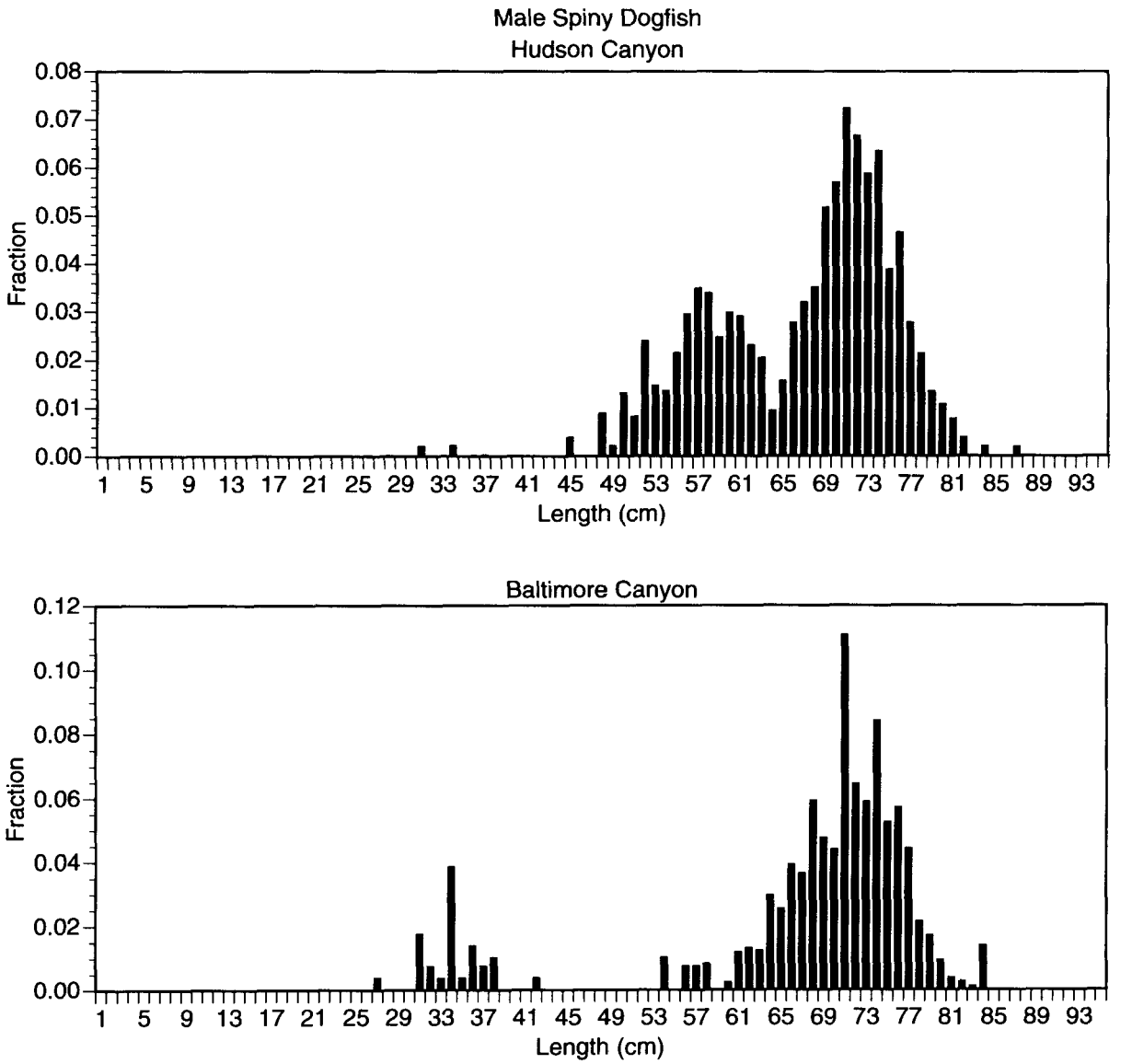
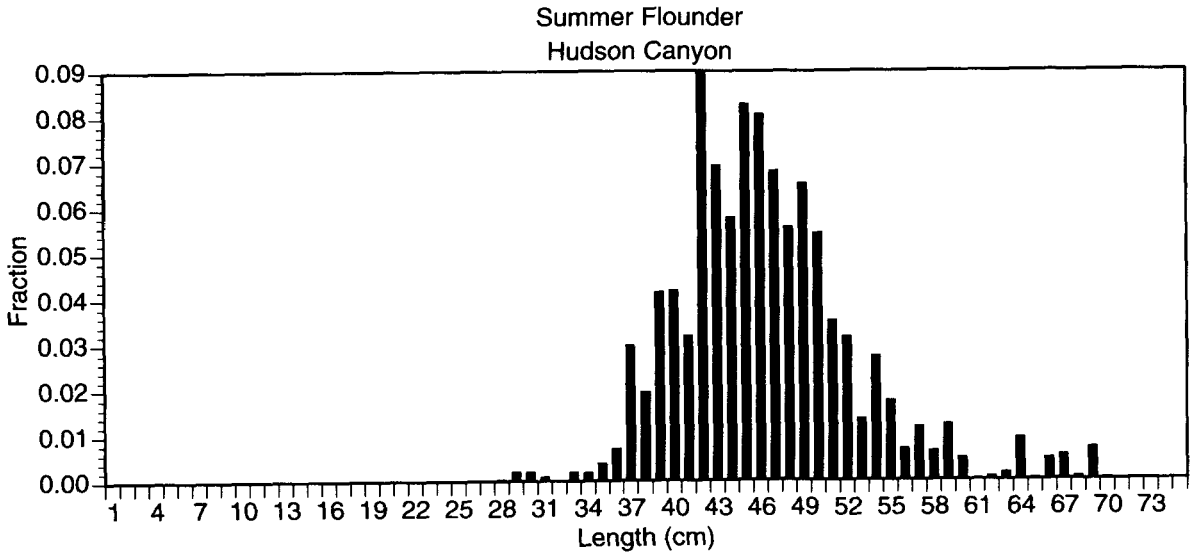


Figure 38a. Cumulative size-frequency distribution of summer flounder across all tows. Tow size frequencies were corrected to the number caught per size class per km^2 swept area. The swept area-normalized abundances were then summed across all tows for each transect.



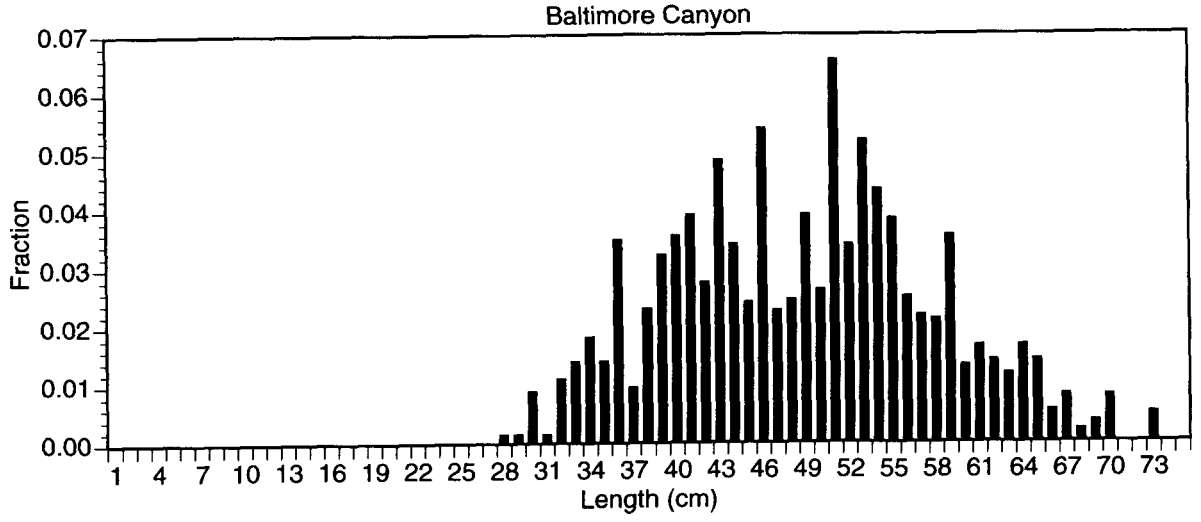
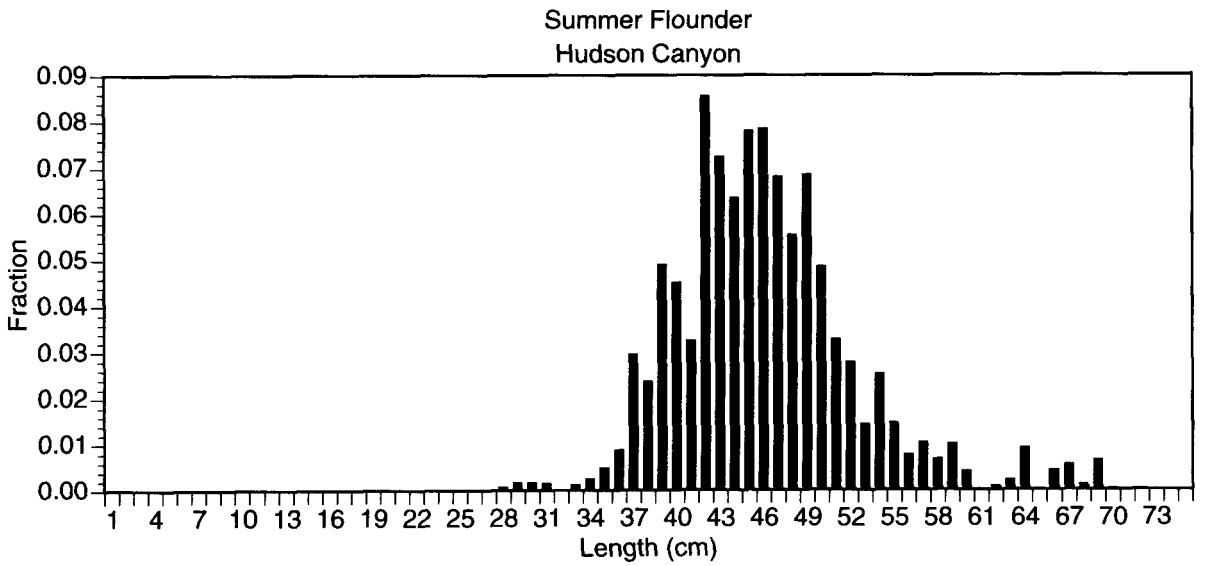


Figure 38b. Cumulative size-frequency distribution of summer flounder across all tows. Tow size frequencies were corrected to the number caught per size class per km^2 swept area. Tows were then normalized to swath distance along the transect and the abundances were summed across all tows for each transect.



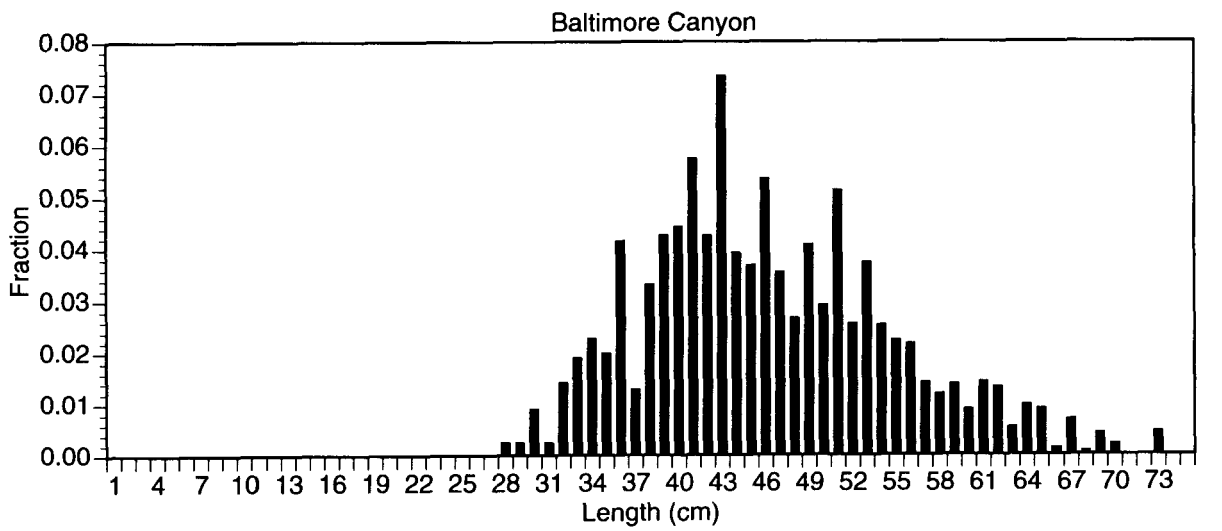


Figure 39a. Cumulative size-frequency distribution of thorny skate across all tows. Tow size frequencies were corrected to the number caught per size class per km^2 swept area. The swept area-normalized abundances were then summed across all tows for each transect.

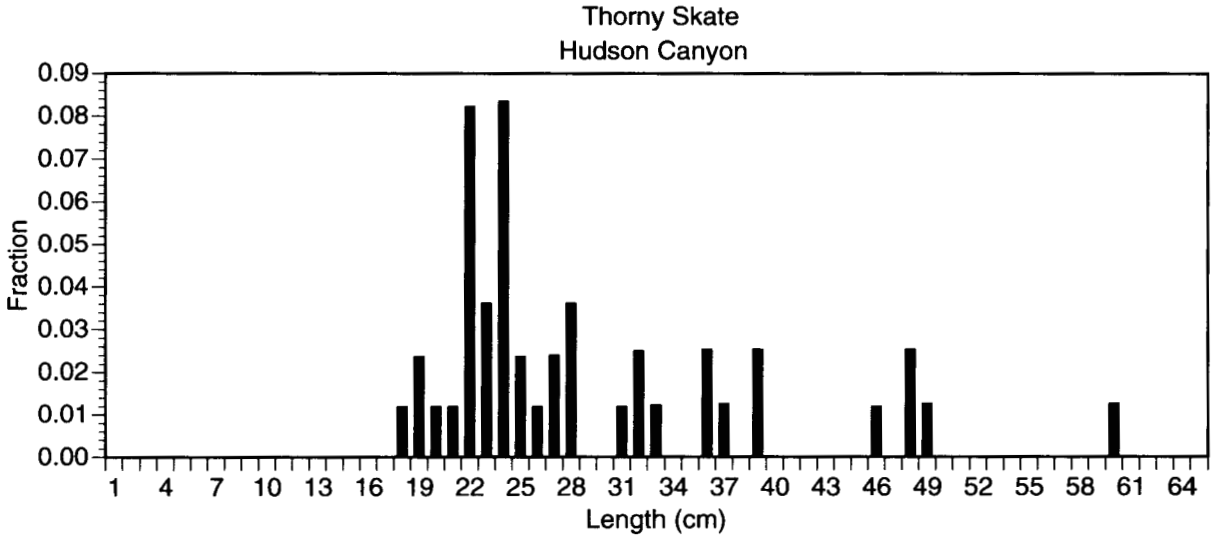


Figure 39b. Cumulative size-frequency distribution of thorny skate across all tows. Tow size frequencies were corrected to the number caught per size class per km^2 swept area. Tows were then normalized to swath distance along the transect and the abundances were summed across all tows for each transect.

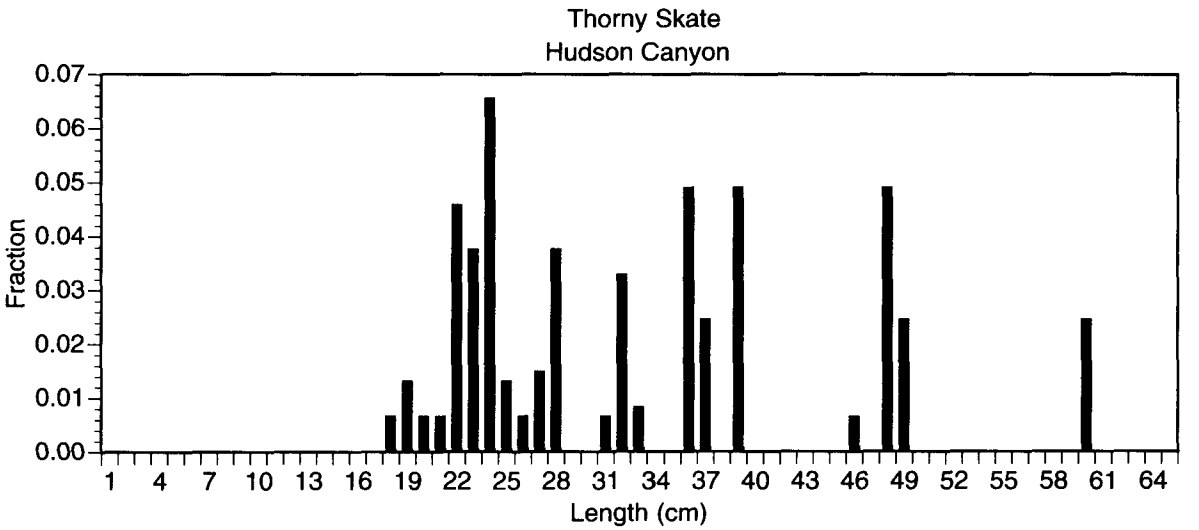


Figure 40. Cumulative size frequency, by tow, for black sea bass, for tows with ≥ 20 measured individuals.

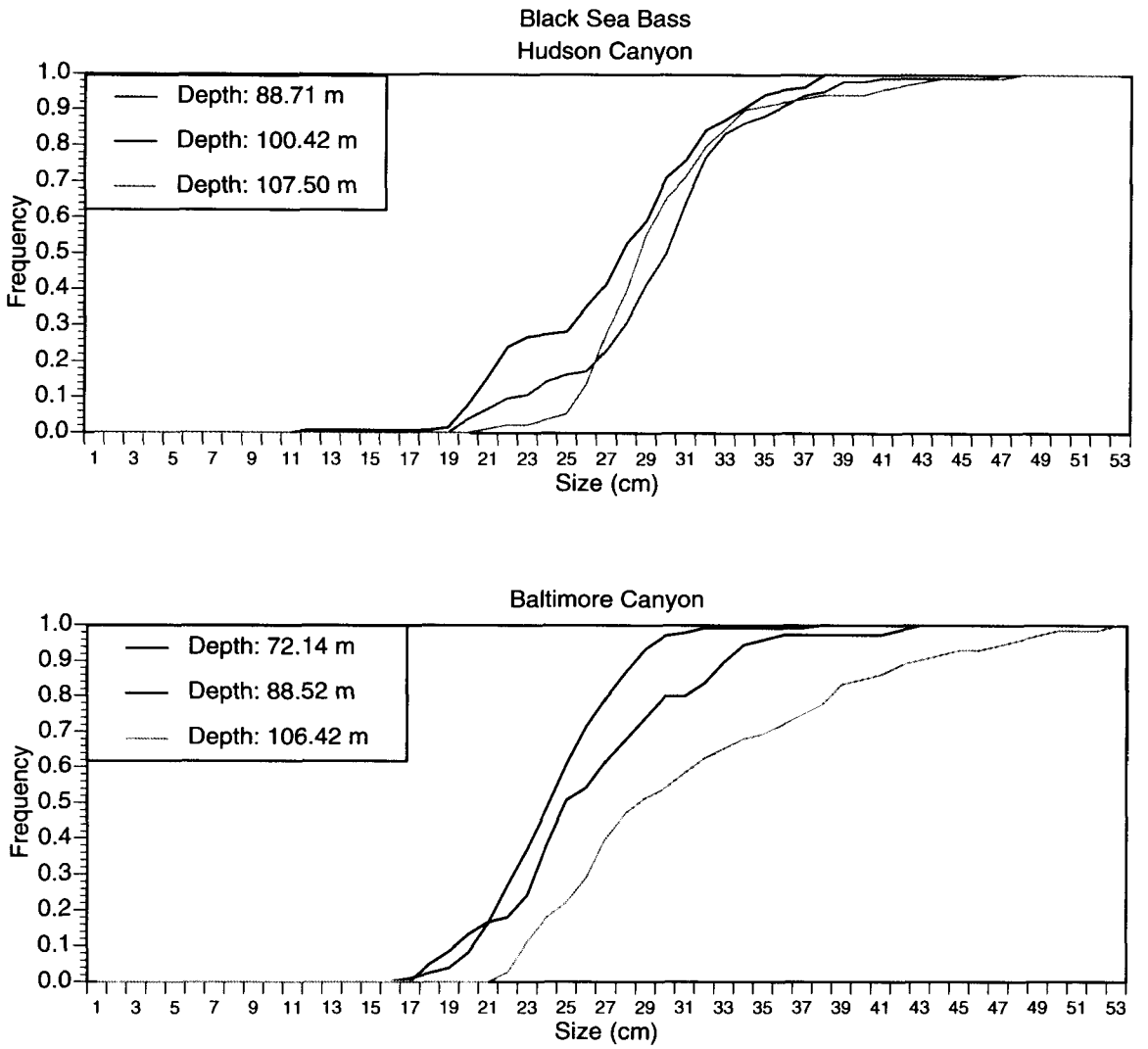


Figure 41. Cumulative size frequency, by tow, for *Illex* squid, for tows with ≥ 20 measured individuals.

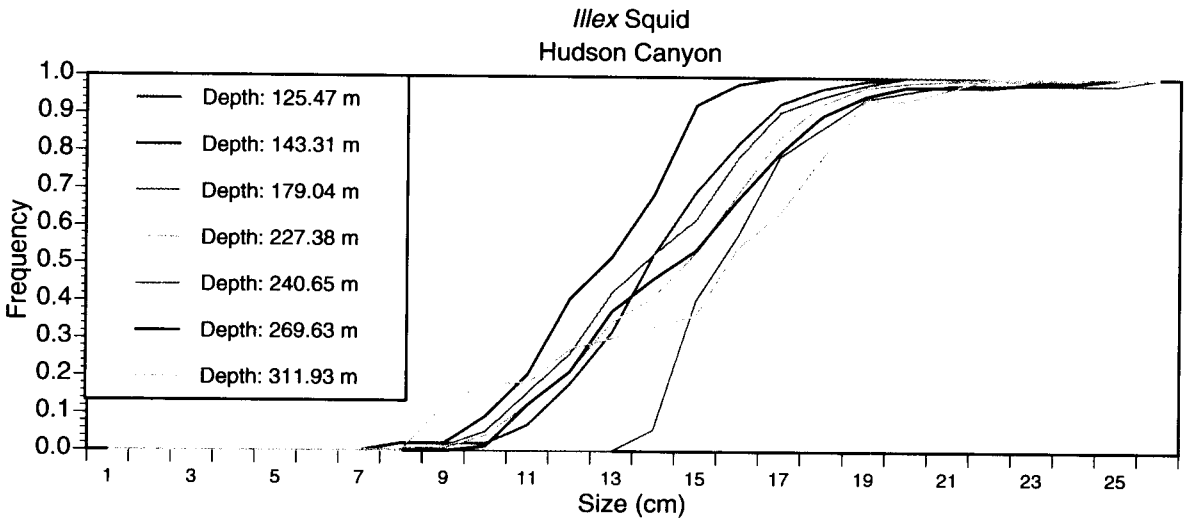


Figure 42. Cumulative size frequency, by tow, for *Loligo* squid, for tows with ≥ 20 measured individuals.

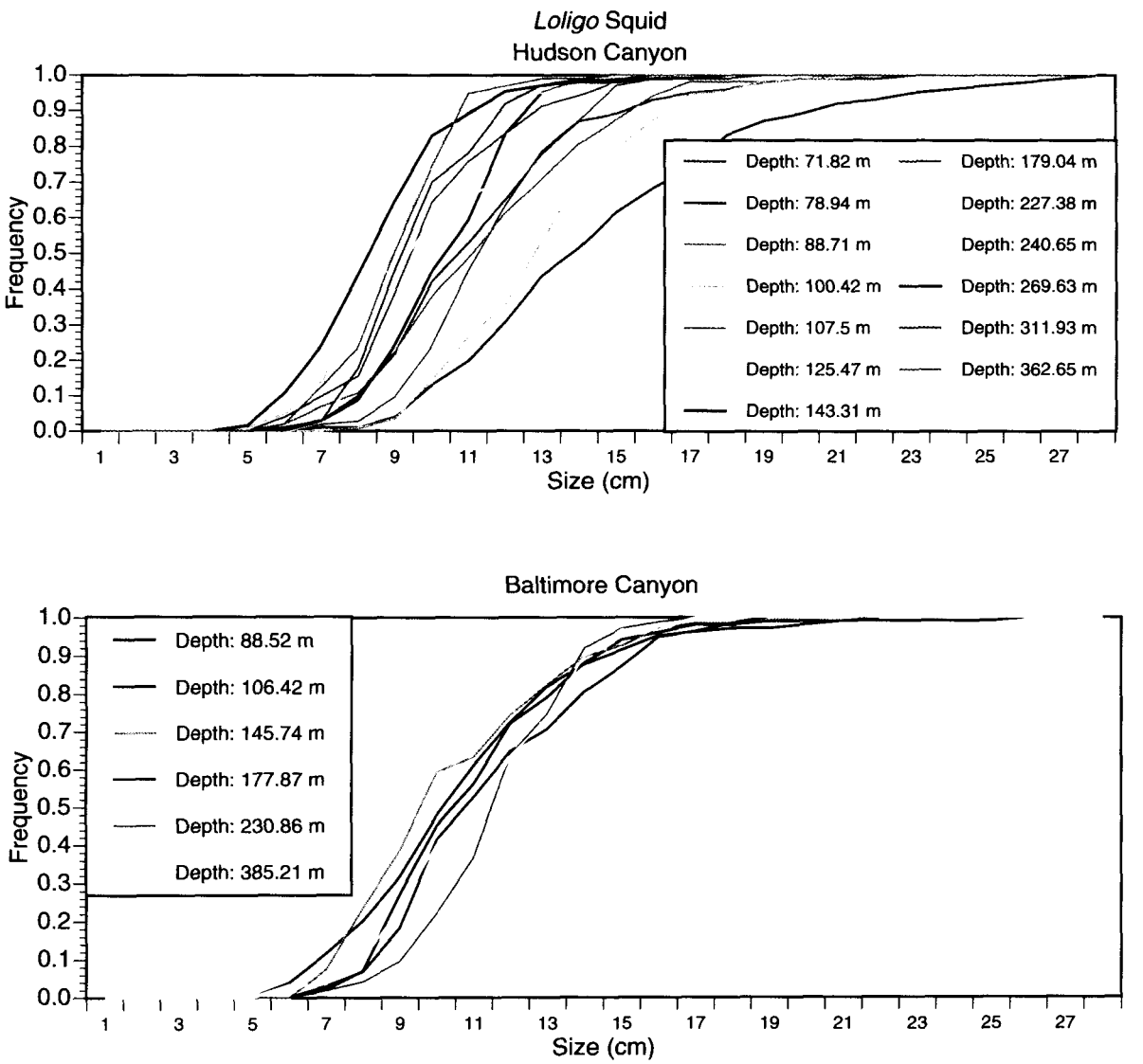
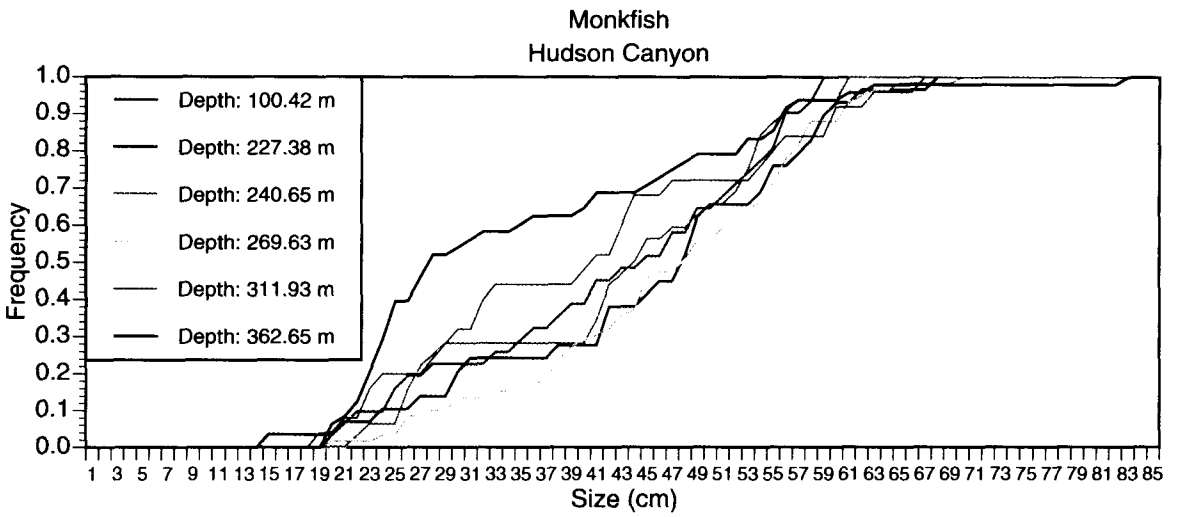


Figure 43. Cumulative size frequency, by tow, for monkfish, for tows with ≥ 20 measured individuals.



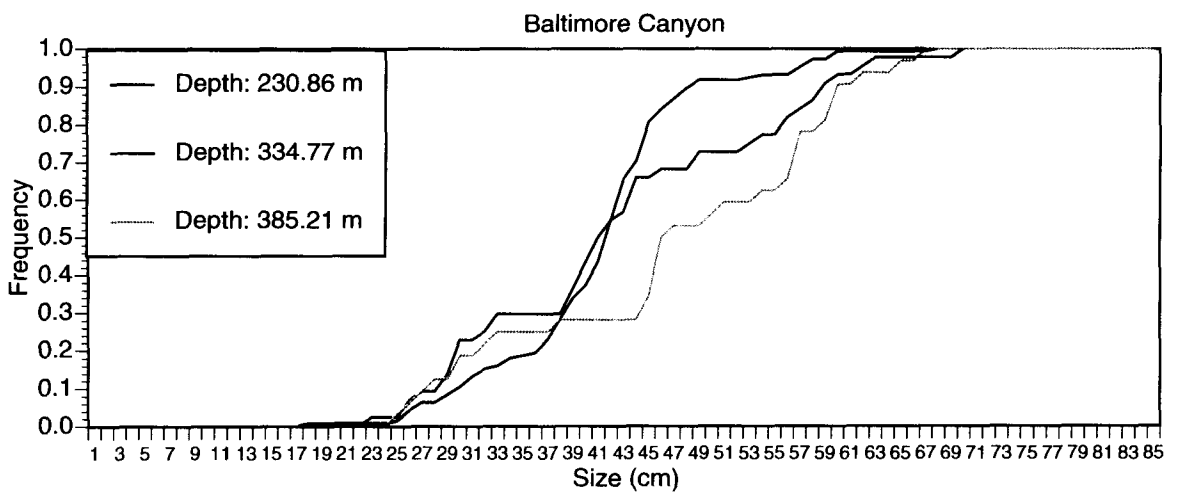
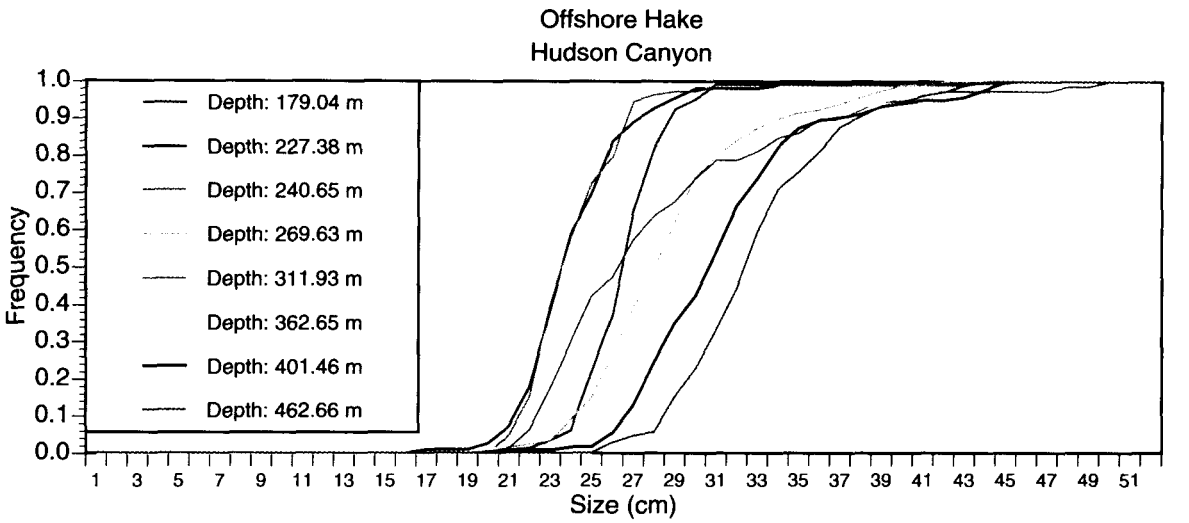


Figure 44. Cumulative size frequency, by tow, for offshore hake, for tows with ≥ 20 measured individuals.



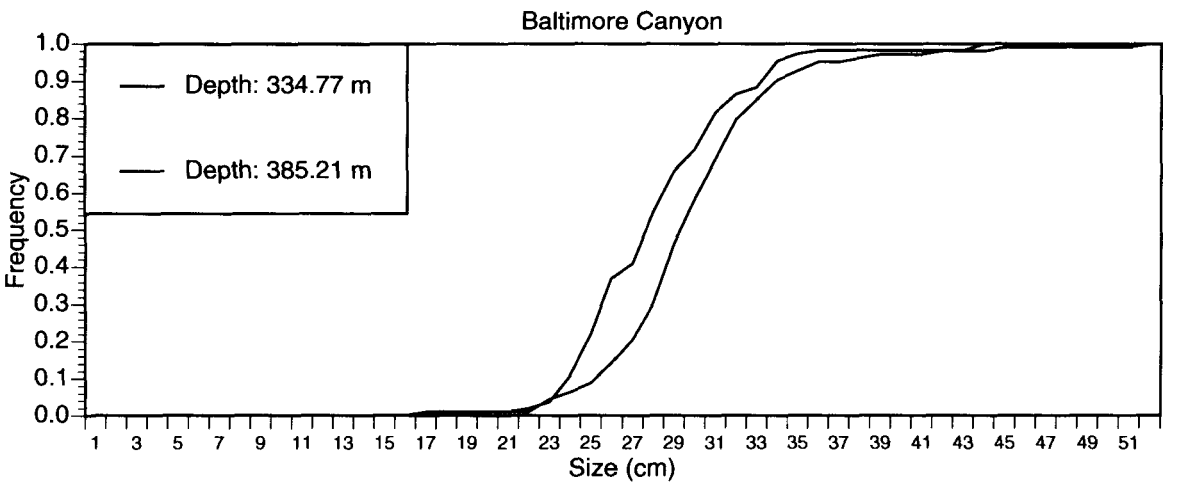
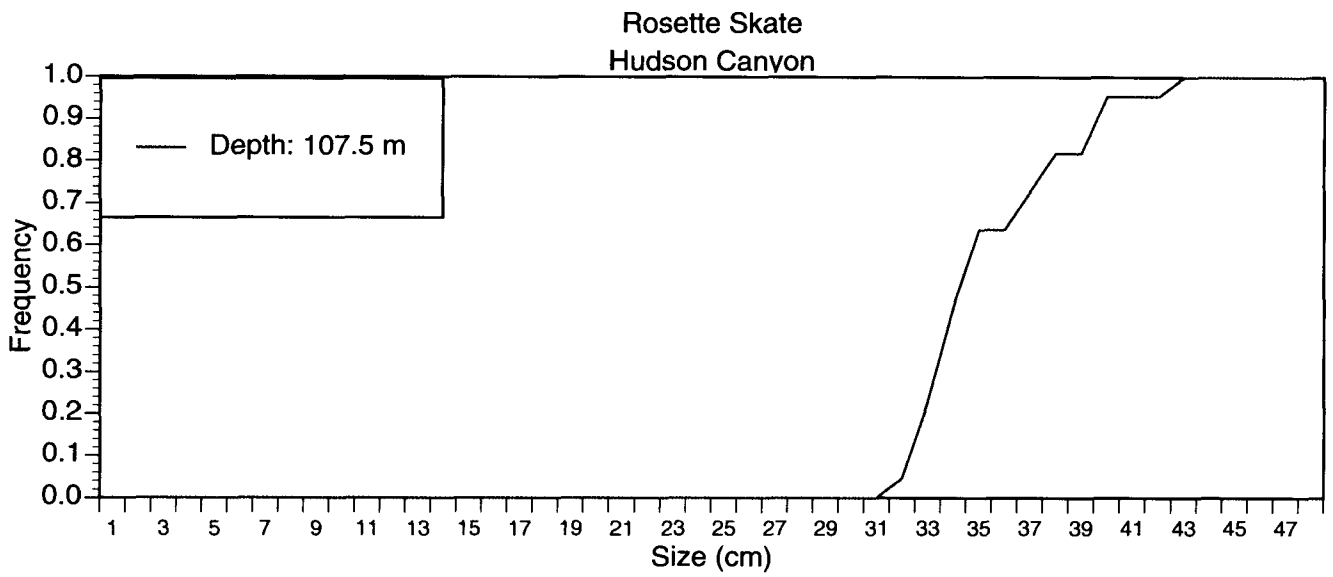


Figure 45. Cumulative size frequency, by tow, for rosette skate, for tows with ≥ 20 measured individuals.



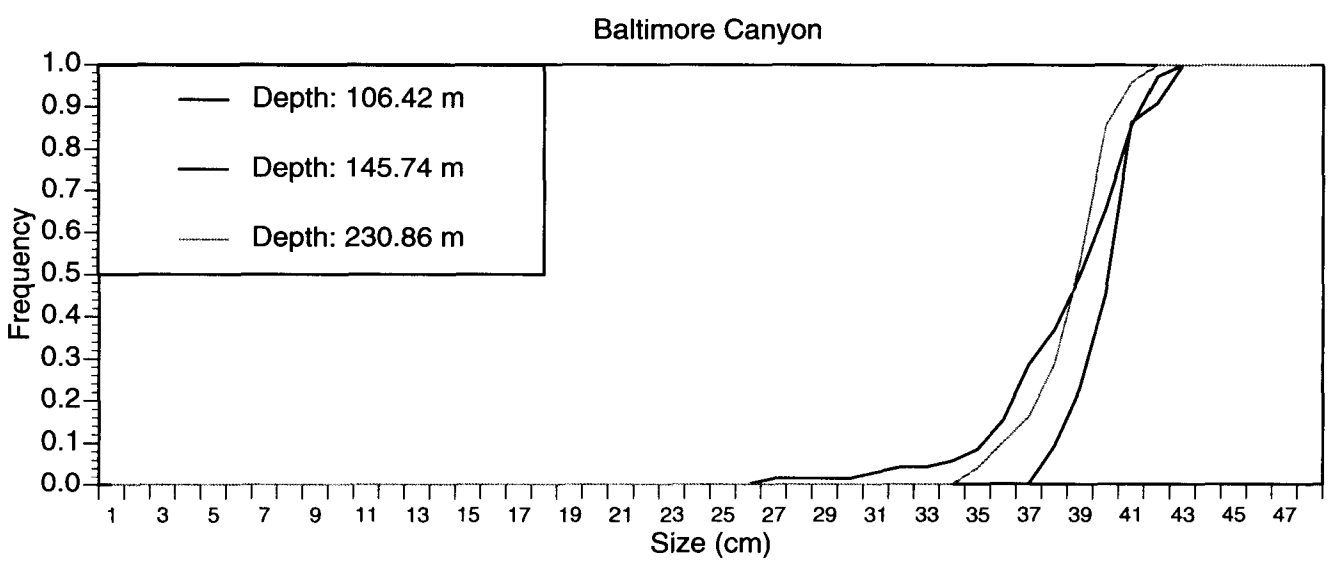
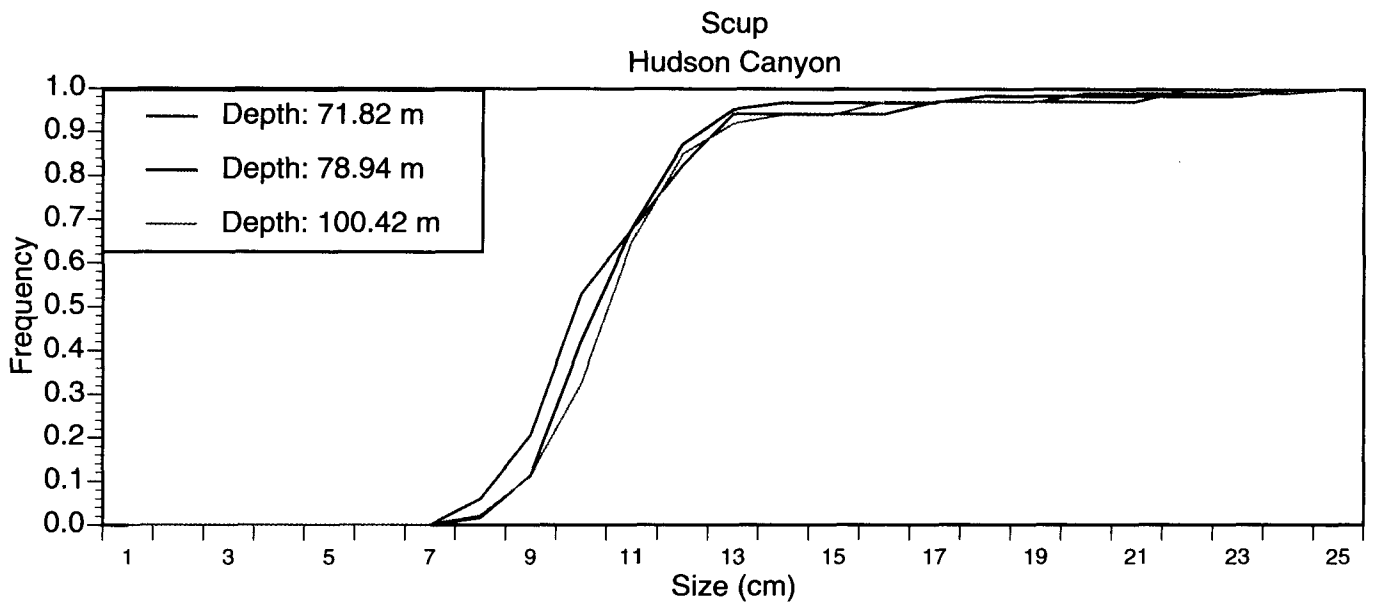


Figure 46. Cumulative size frequency, by tow, for scup, for tows with ≥ 20 measured individuals.



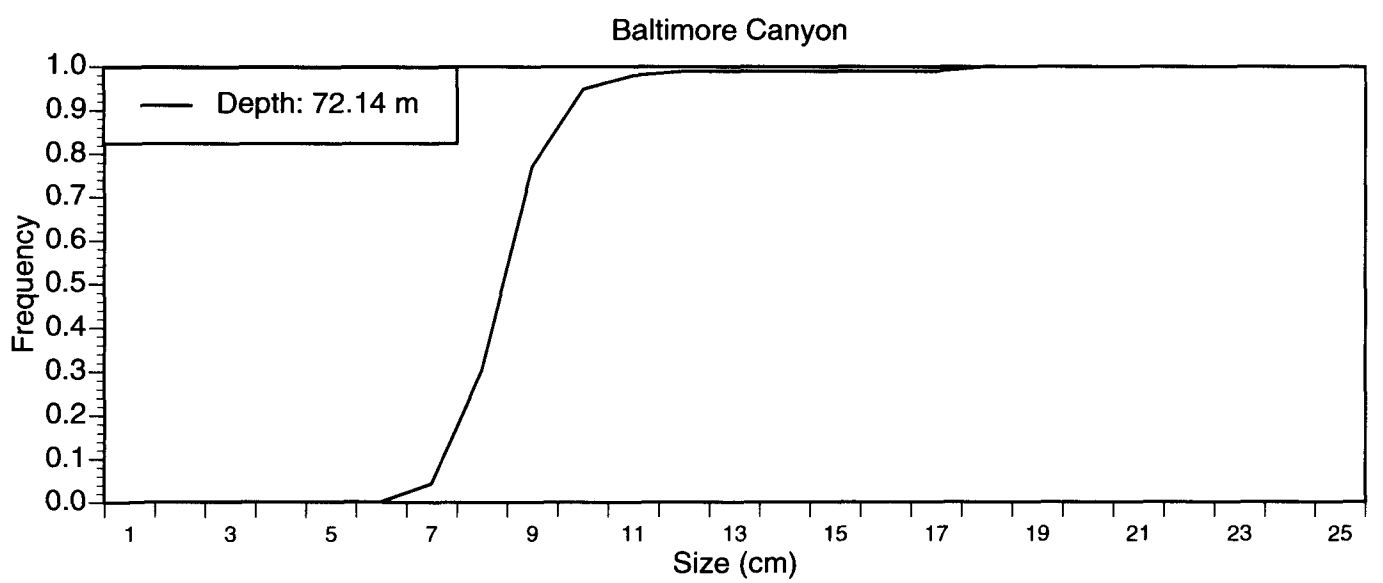
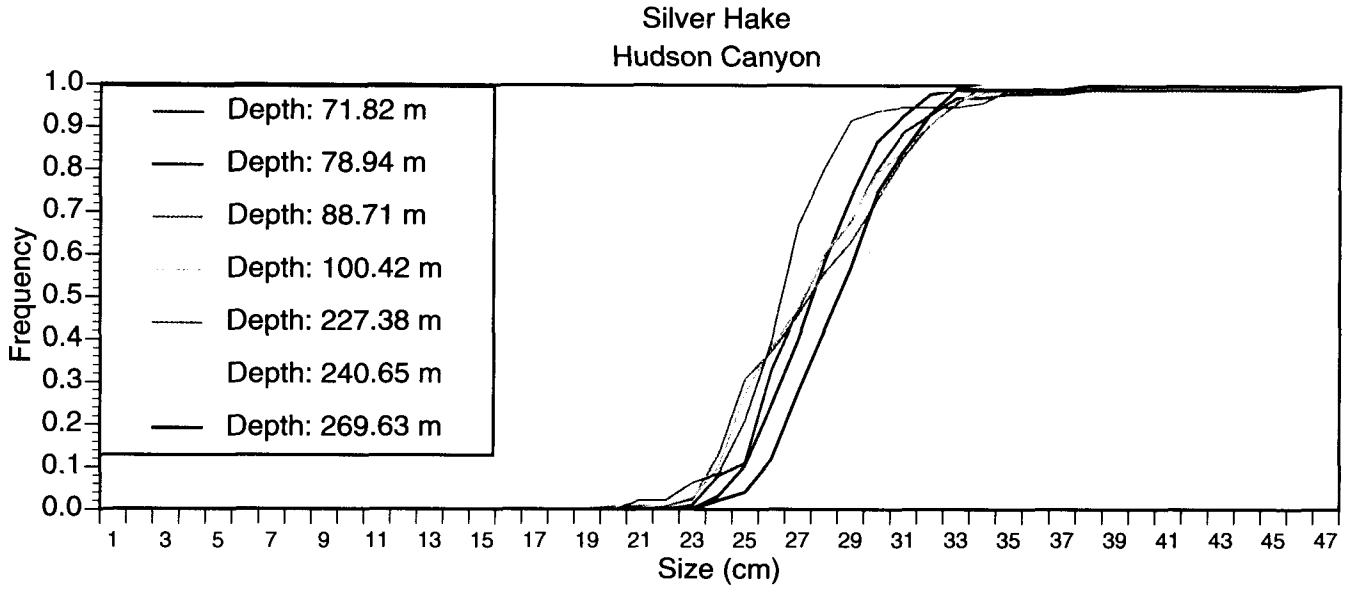


Figure 47. Cumulative size frequency, by tow, for silver hake, for tows with ≥ 20 measured individuals.



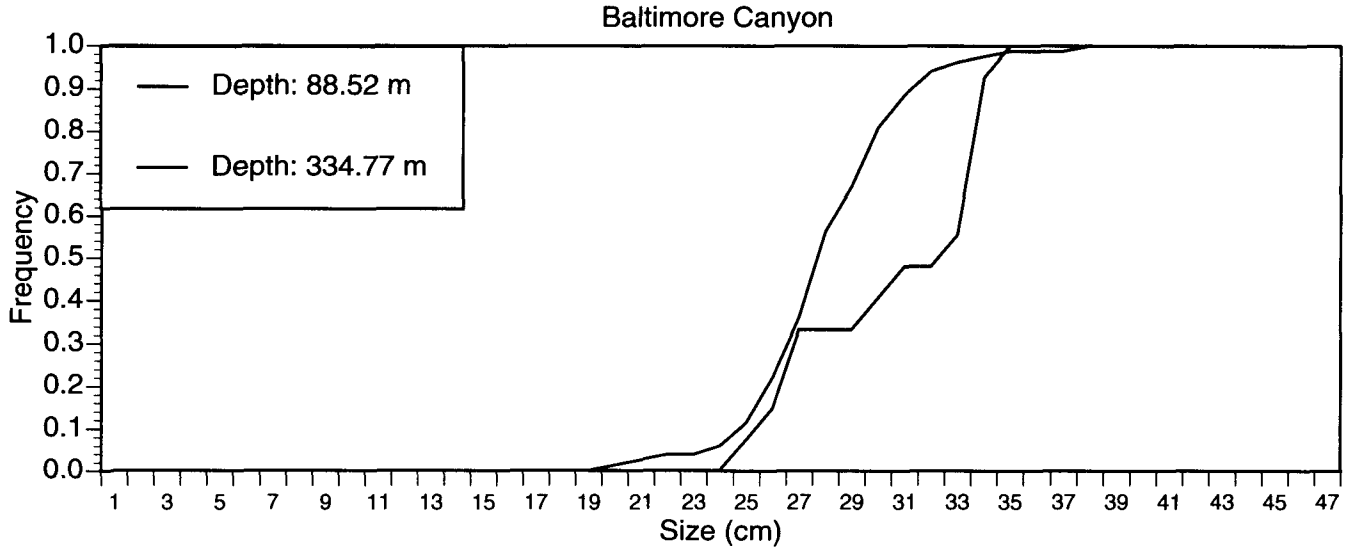
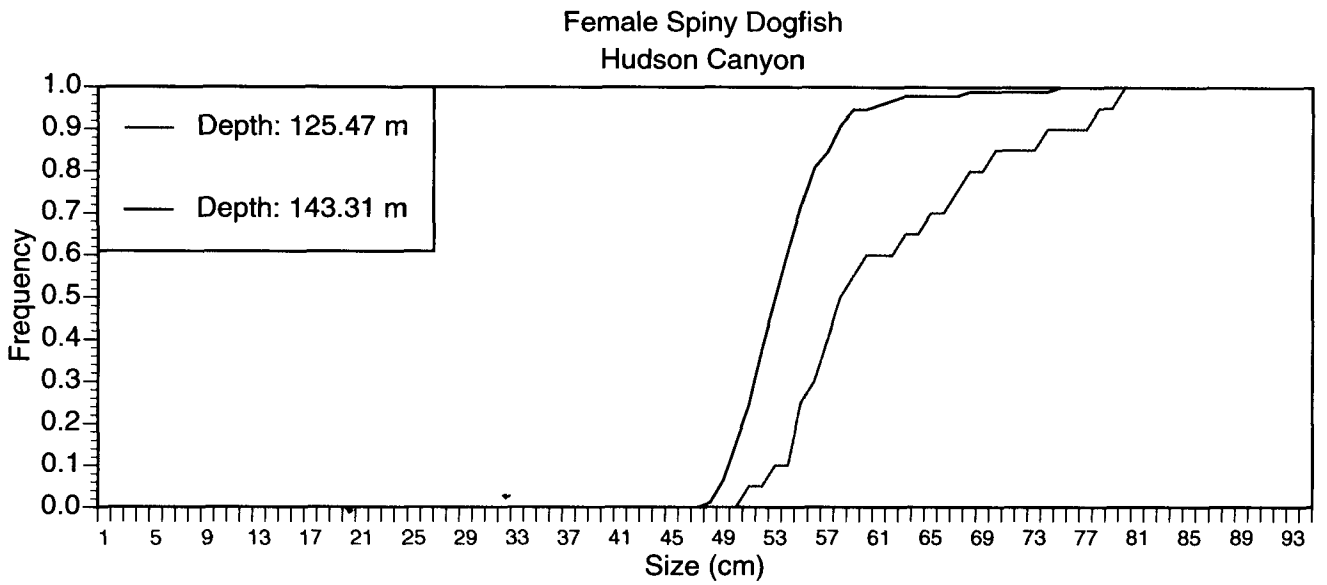


Figure 48. Cumulative size frequency, by tow, for female spiny dogfish, for tows with ≥ 20 measured individuals.



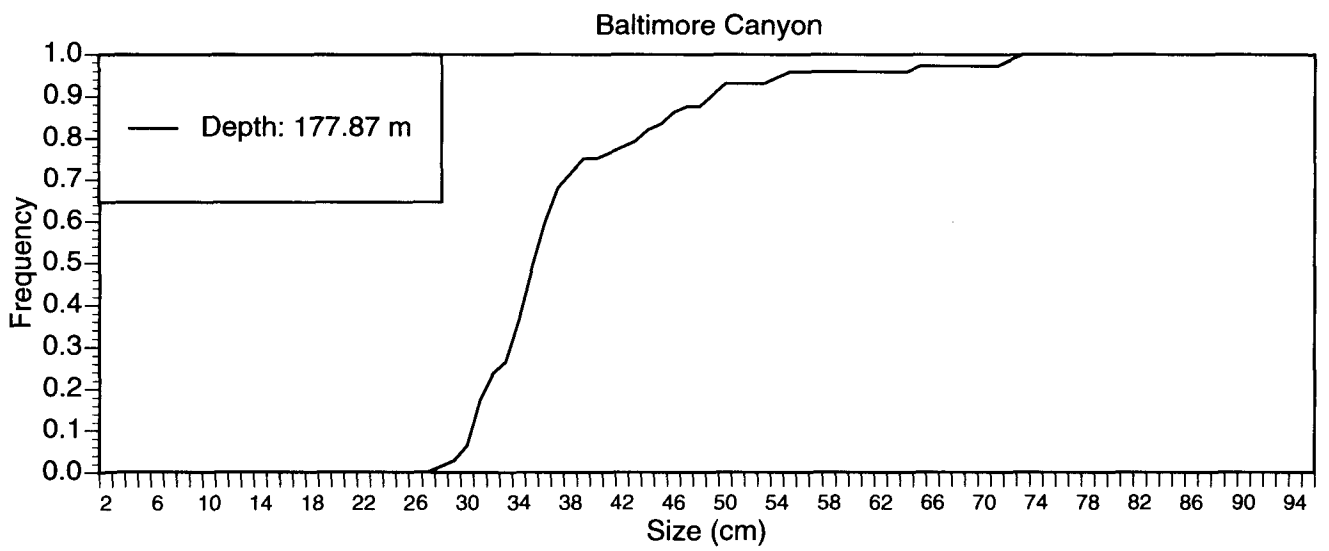
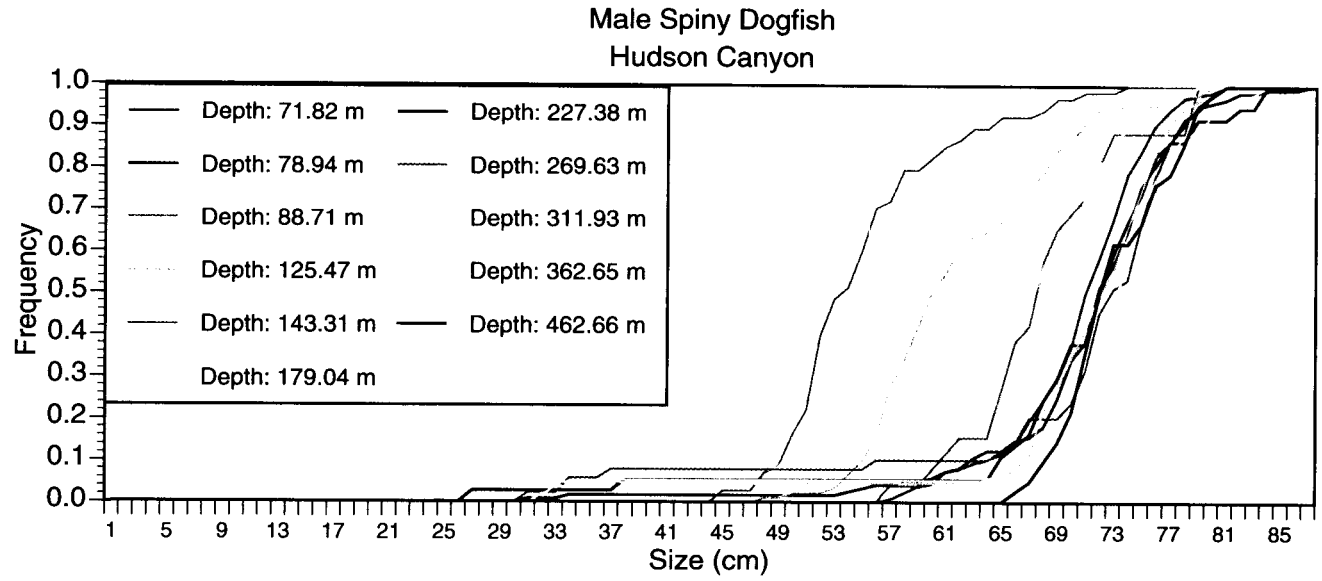


Figure 49. Cumulative size frequency, by tow, for male spiny dogfish, for tows with ≥ 20 measured individuals.



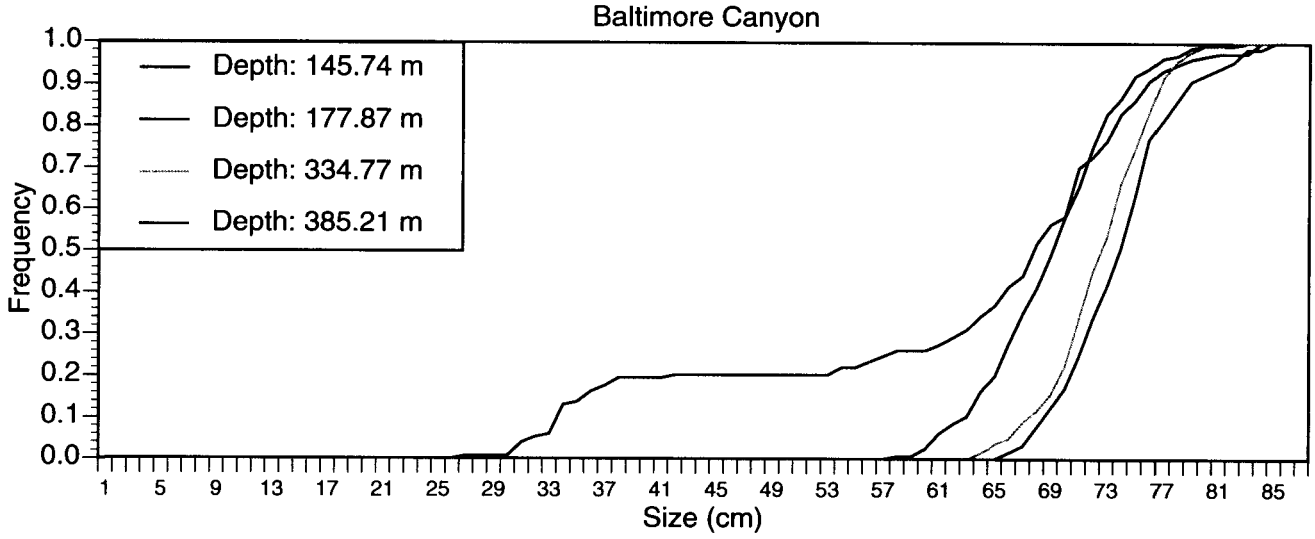
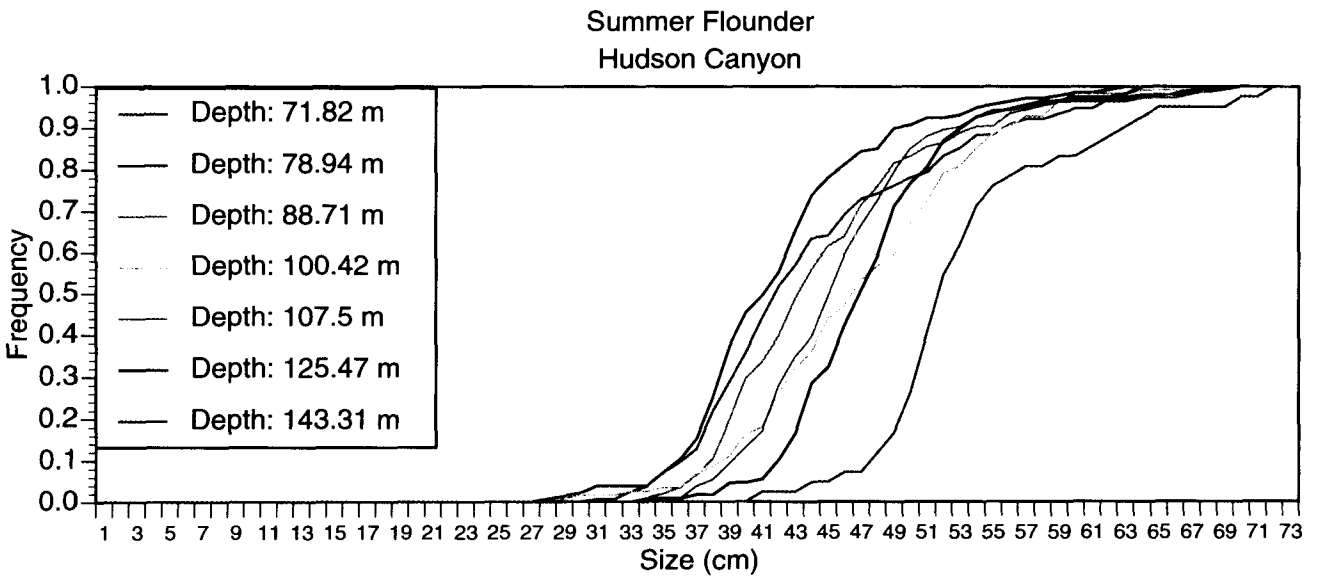


Figure 50. Cumulative size frequency, by tow, for summer flounder, for tows with ≥ 20 measured individuals.



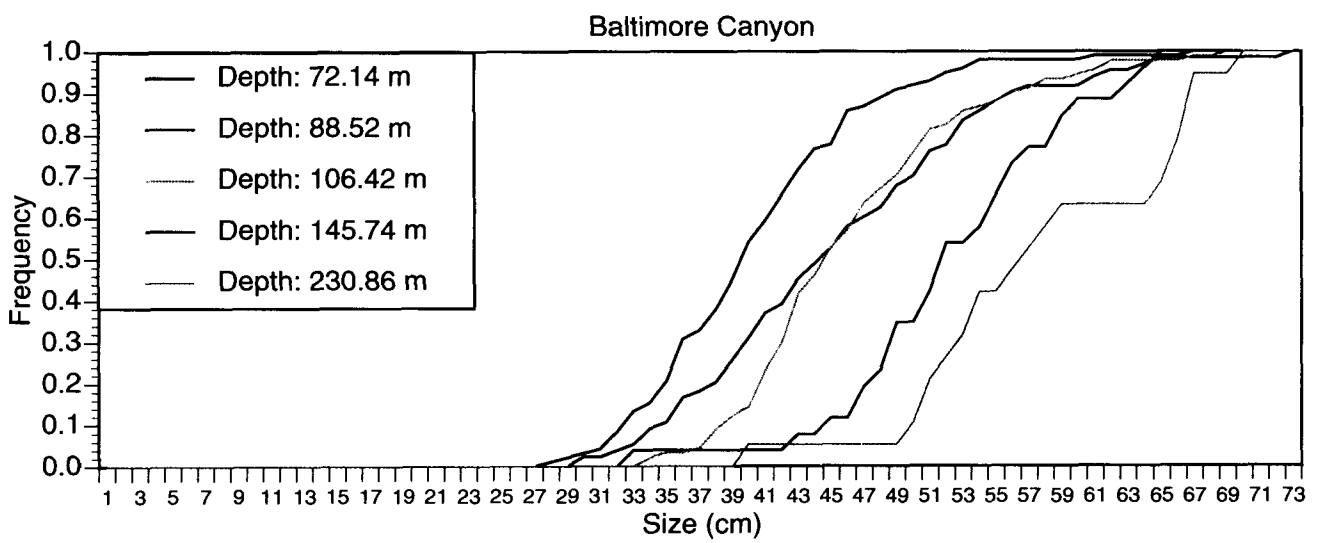


Figure 51. Cumulative size frequency, by tow, for thorny skate, for tows with ≥ 20 measured individuals.

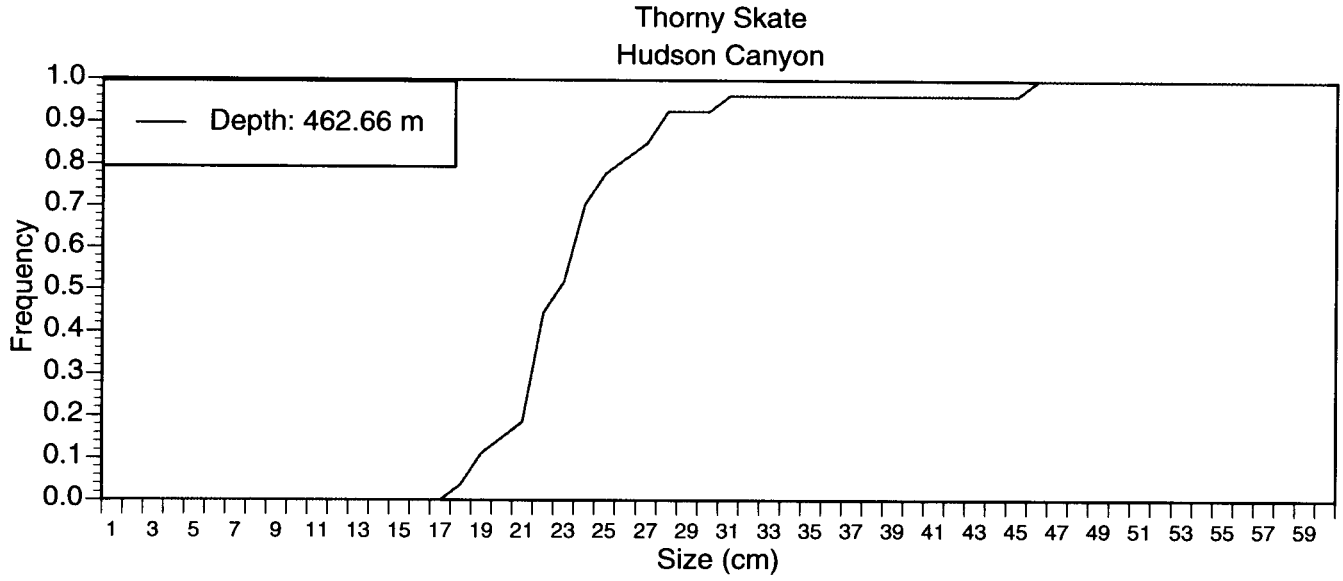
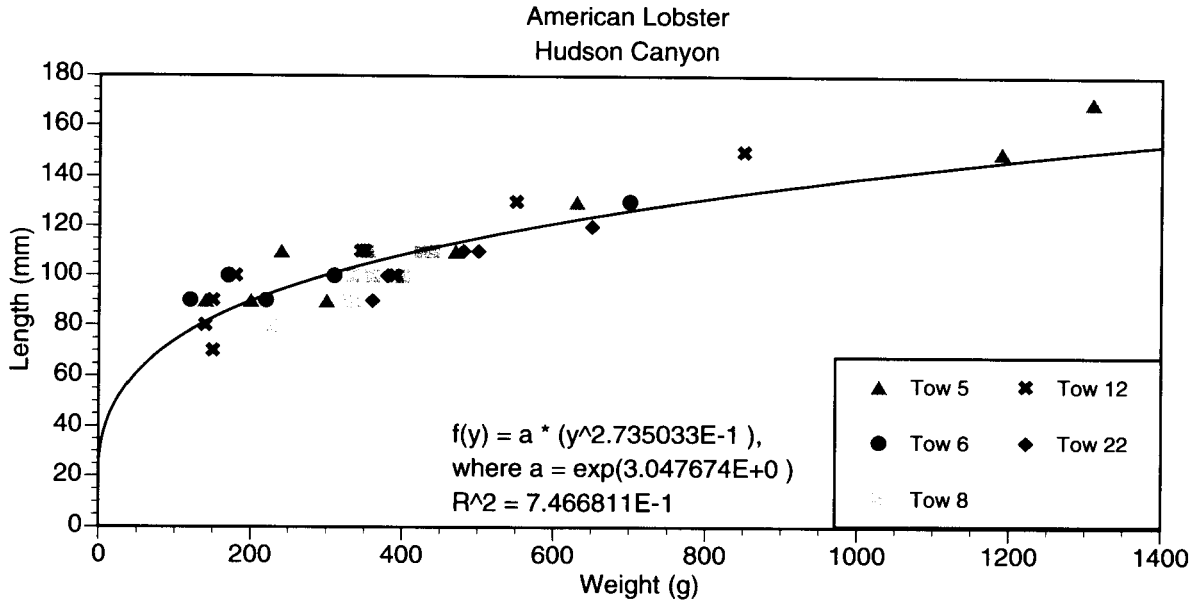


Figure 52. Relationship between length and weight for American lobster caught during January 2004. f(y)=length, y=weight.



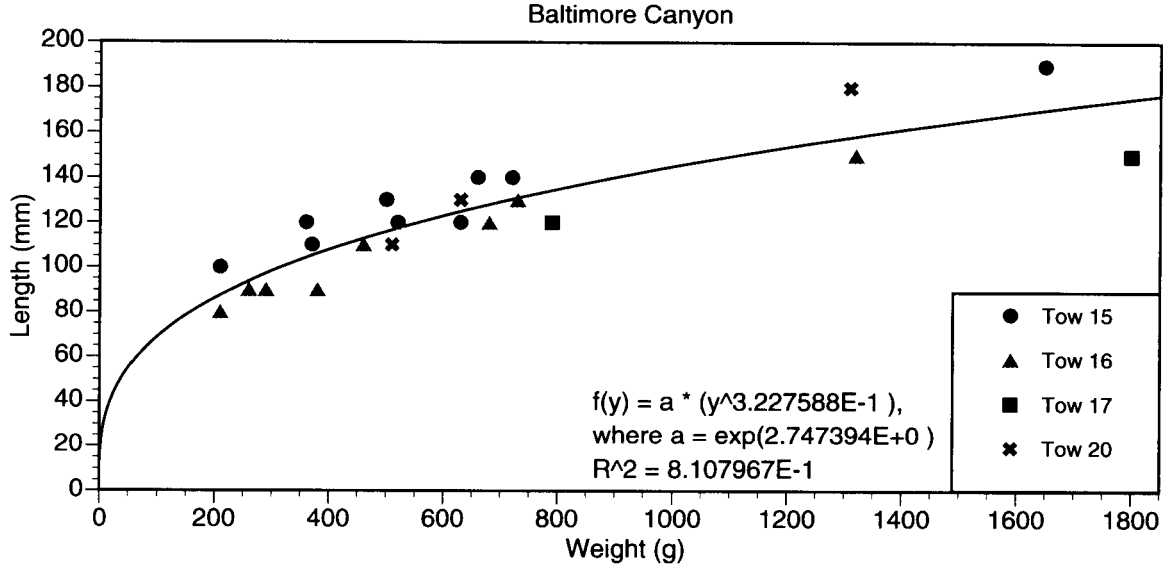
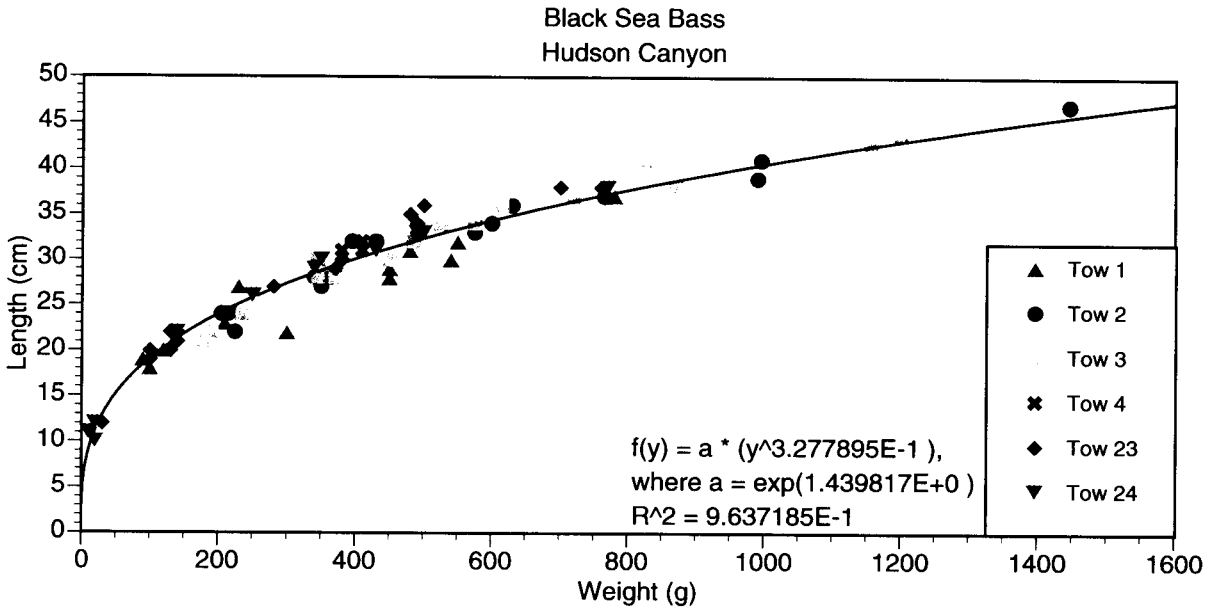


Figure 53. Relationship between length and weight for black sea bass caught during January 2004. f(y)=length, y=weight.



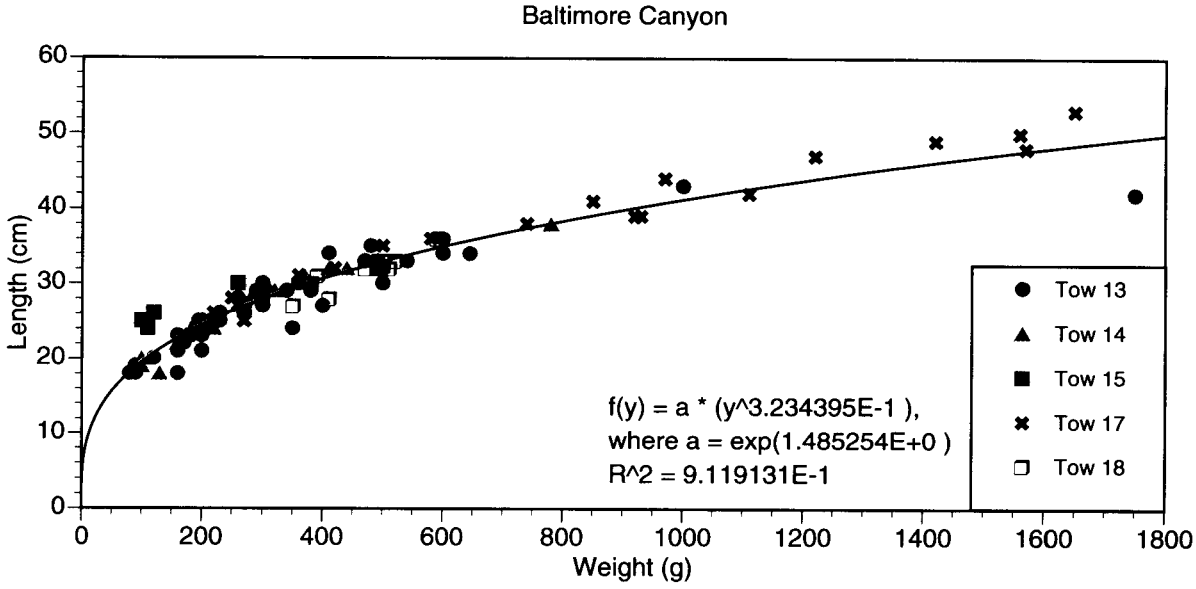
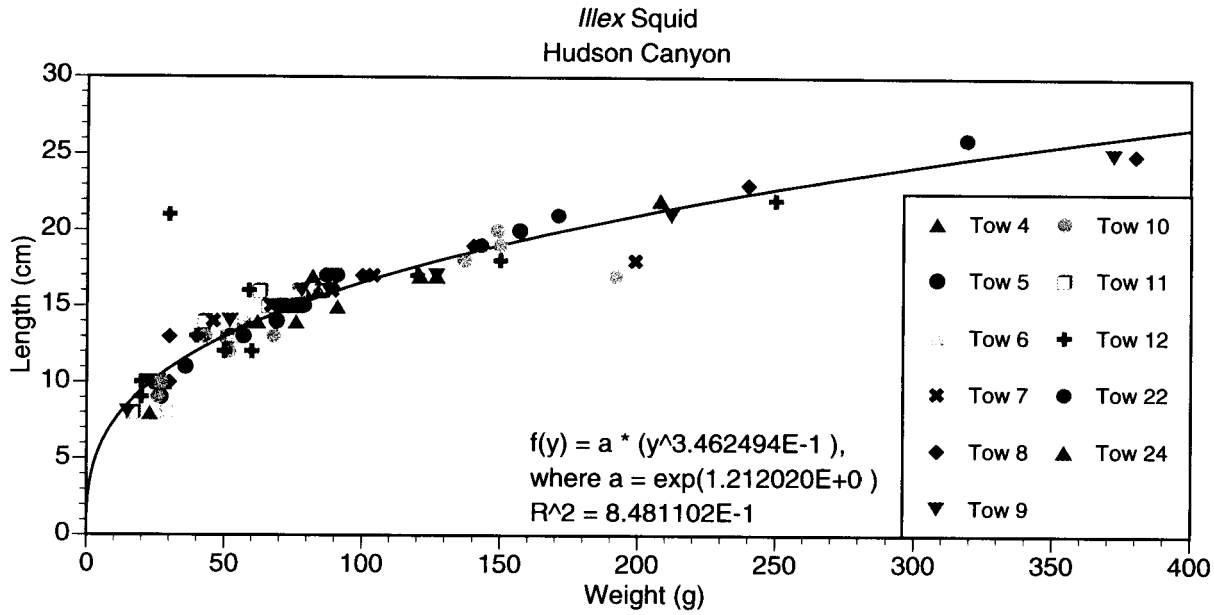


Figure 54. Relationship between length and weight for *Illex* squid caught during January 2004. f(y)=length, y=weight.



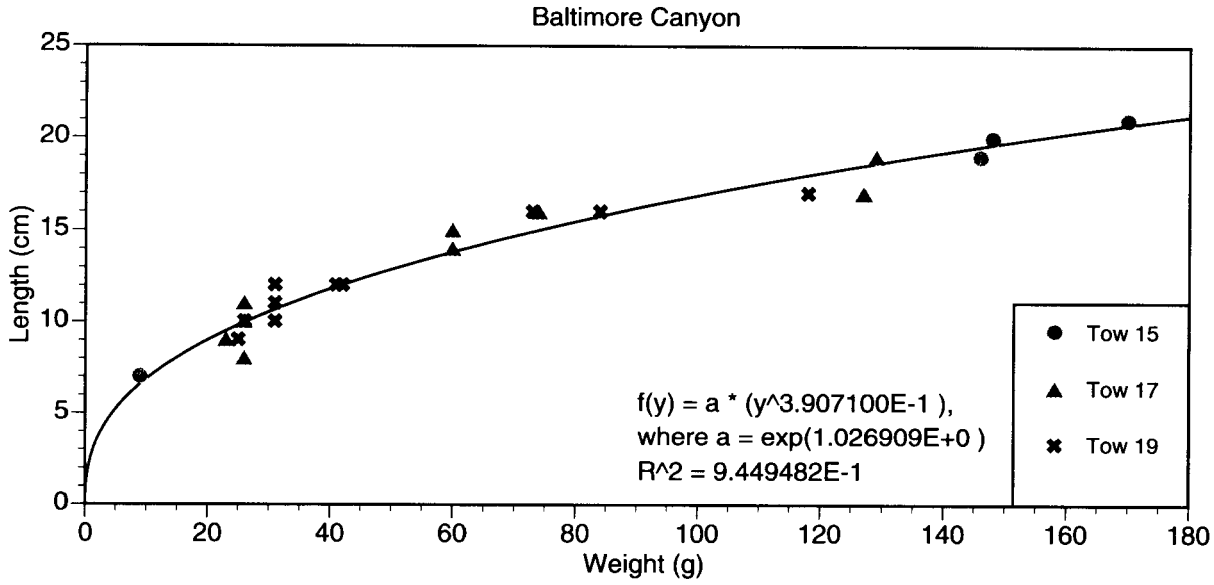
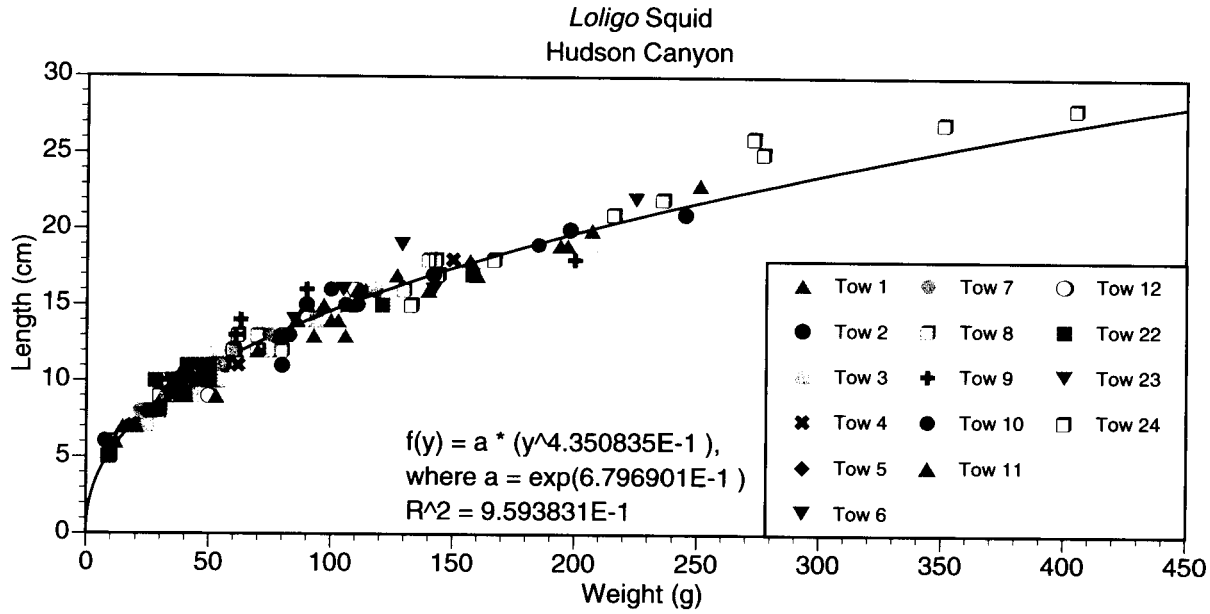


Figure 55. Relationship between length and weight for *Loligo* squid caught during January 2004. f(y)=length, y=weight.



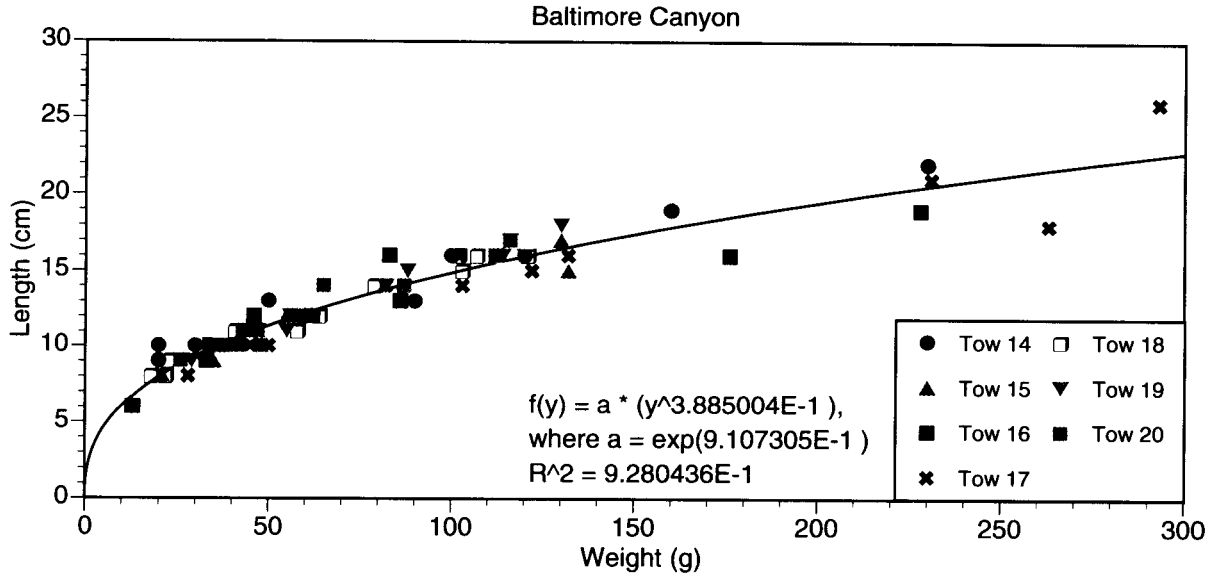
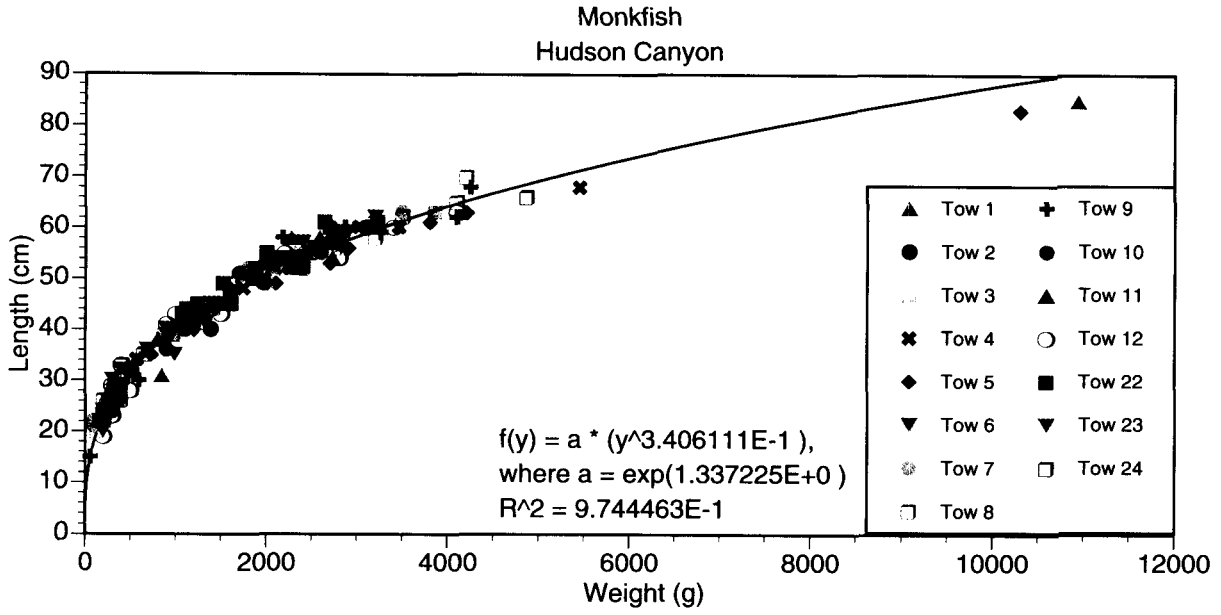


Figure 56. Relationship between length and weight for monkfish caught during January 2004. f(y)=length, y=weight.



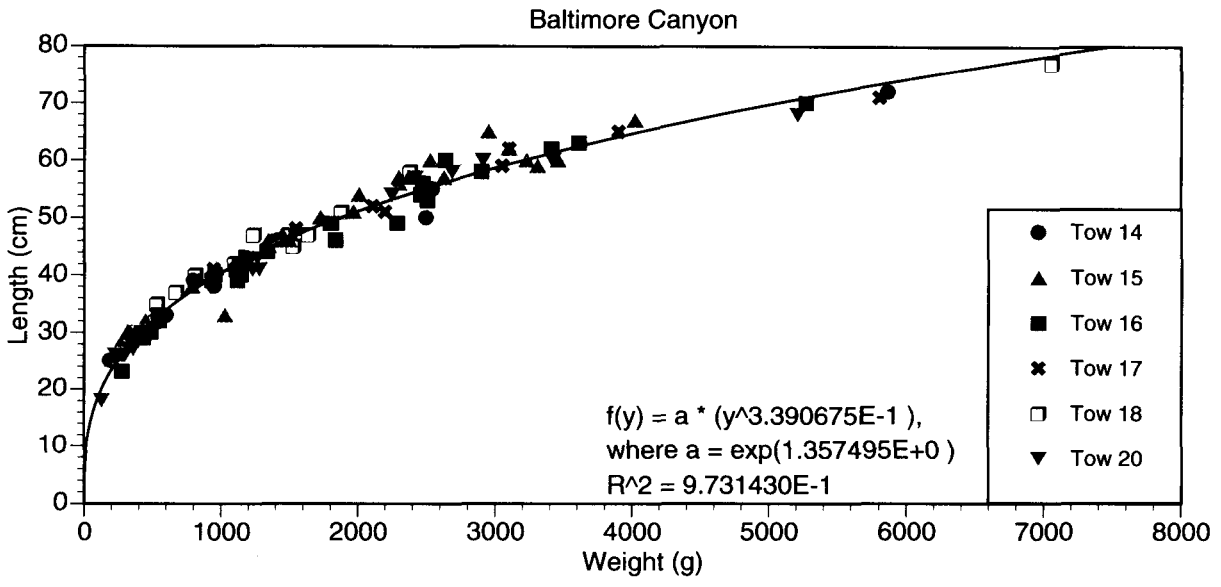
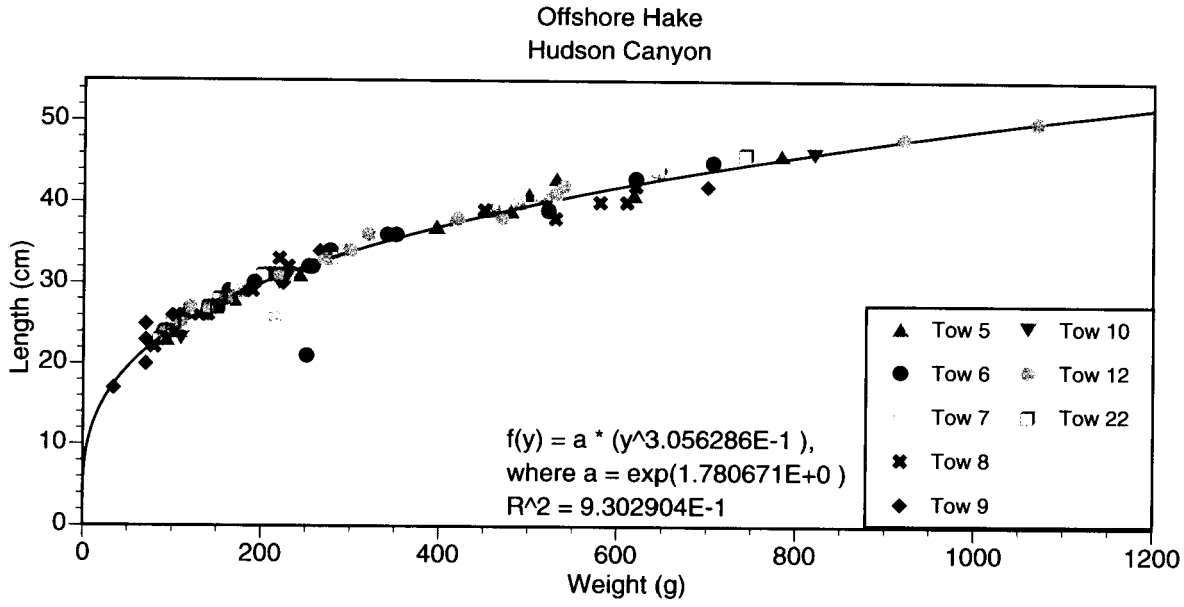


Figure 57. Relationship between length and weight for offshore hake caught during January 2004. f(y)=length, y=weight.



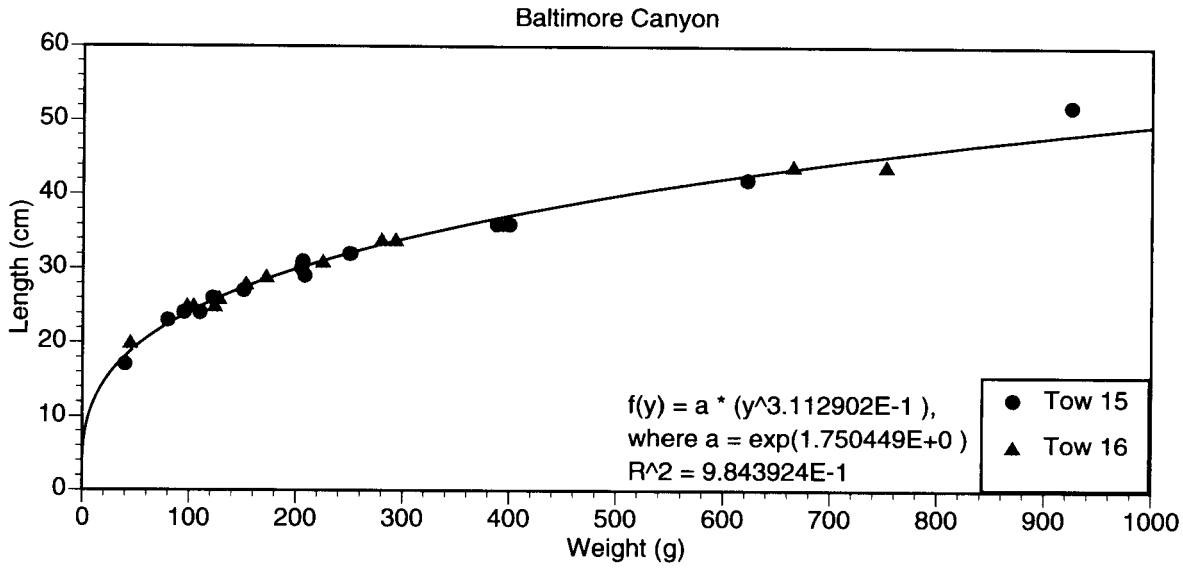
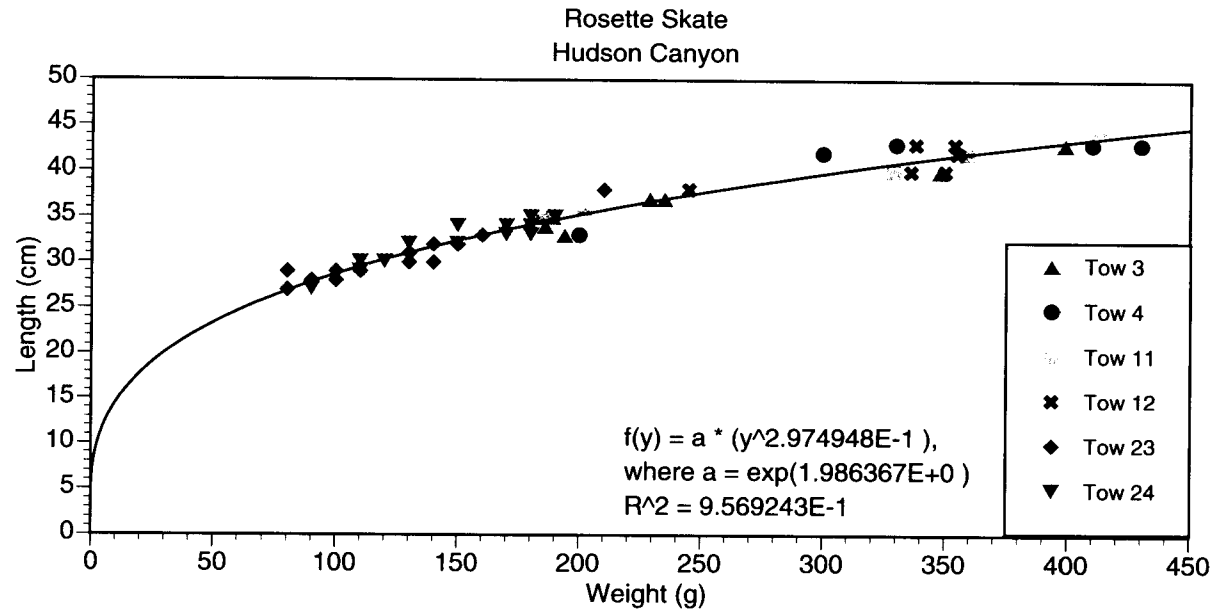


Figure 58. Relationship between length and weight for rosette skates caught during January 2004. f(y)=length, y=weight.



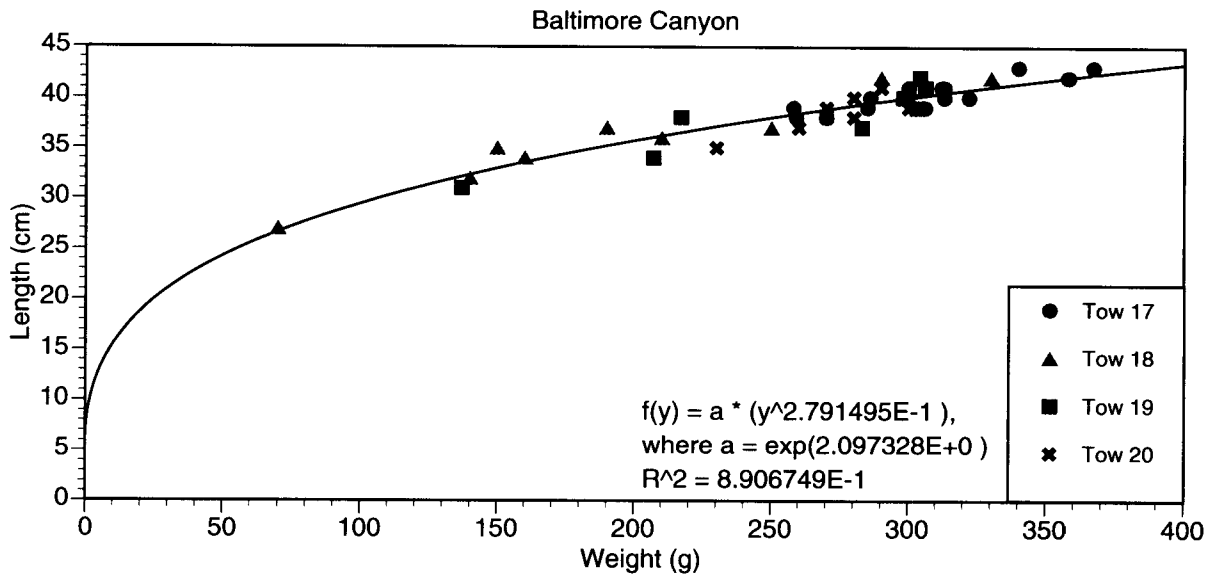
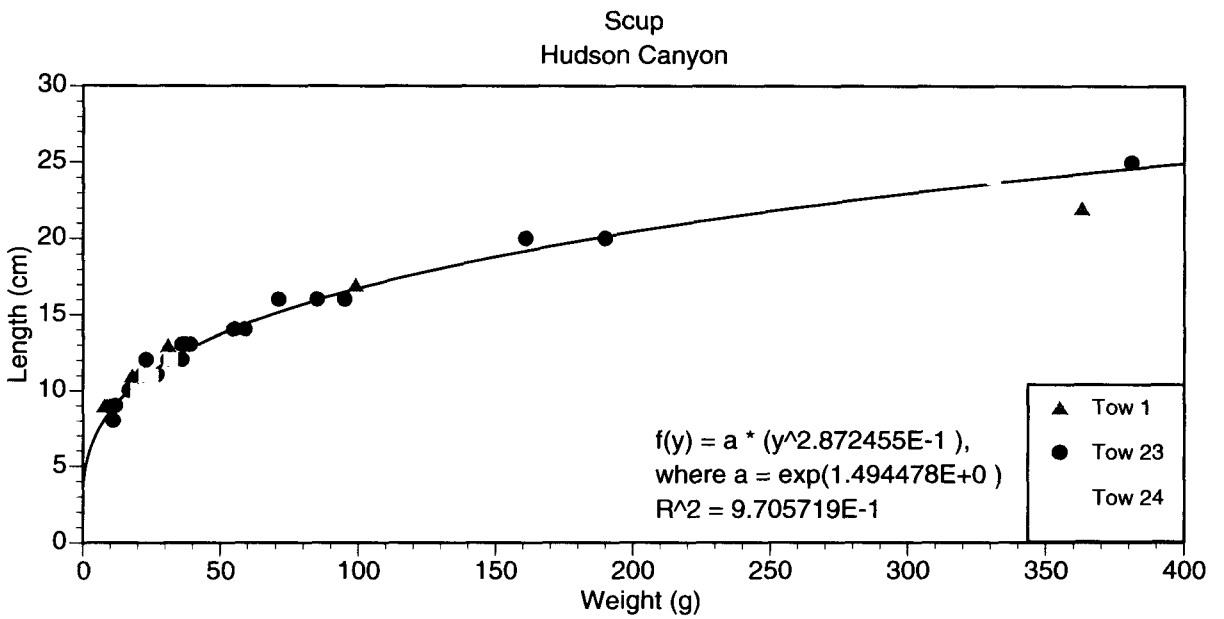


Figure 59. Relationship between length and weight for scup caught during January 2004. f(y)=length, y=weight.



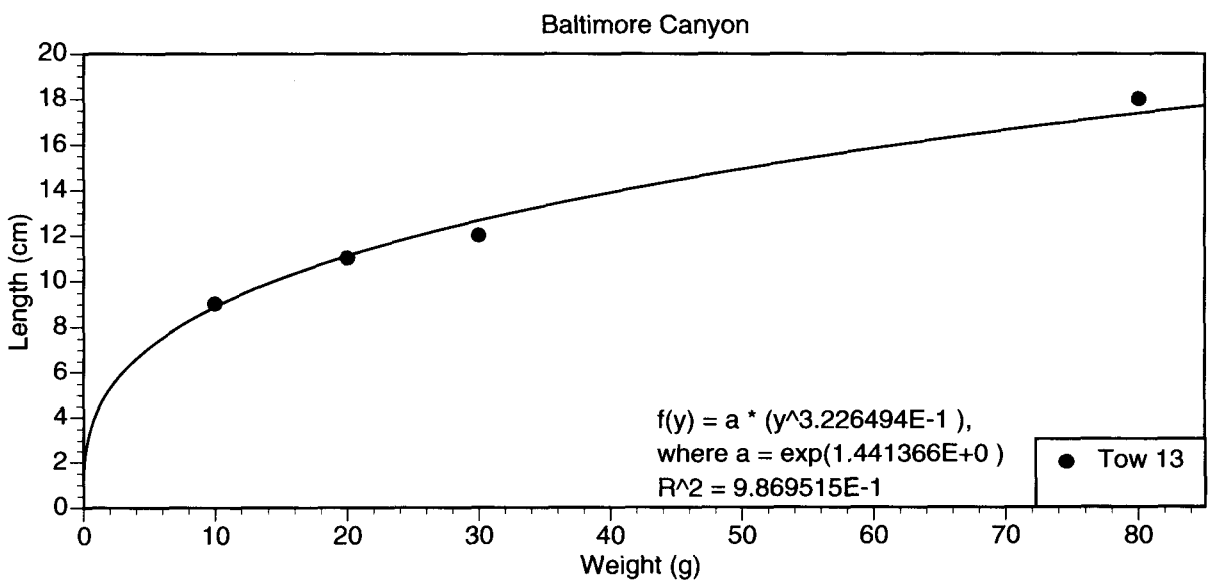
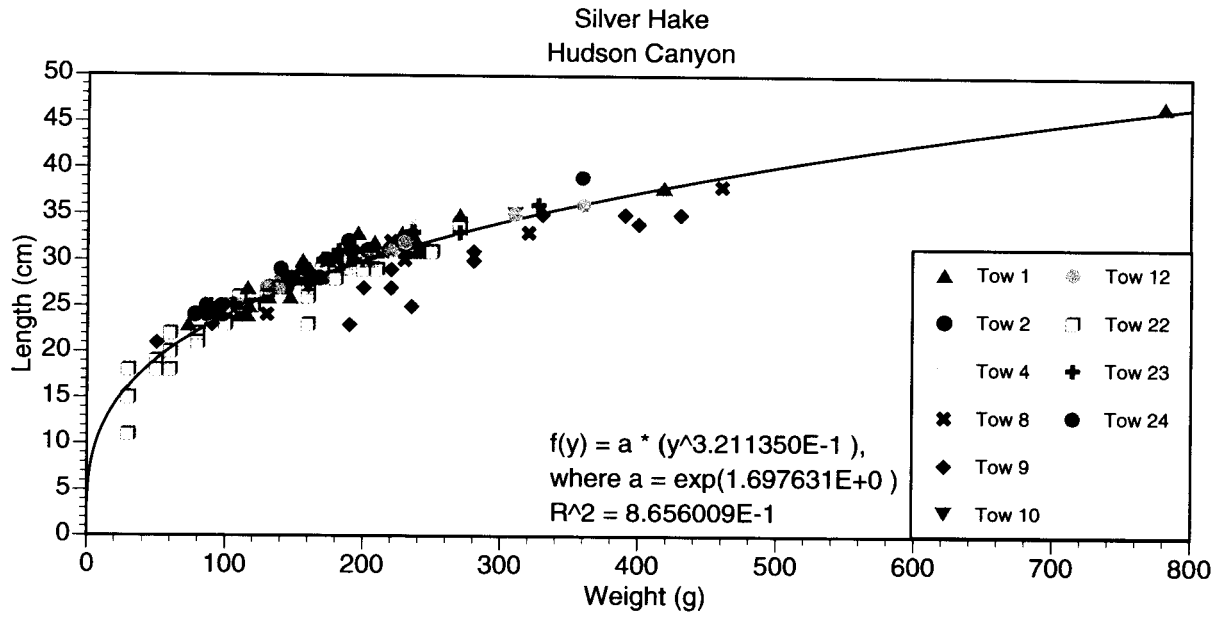


Figure 60. Relationship between length and weight for silver hake caught during January 2004. f(y)=length, y=weight.



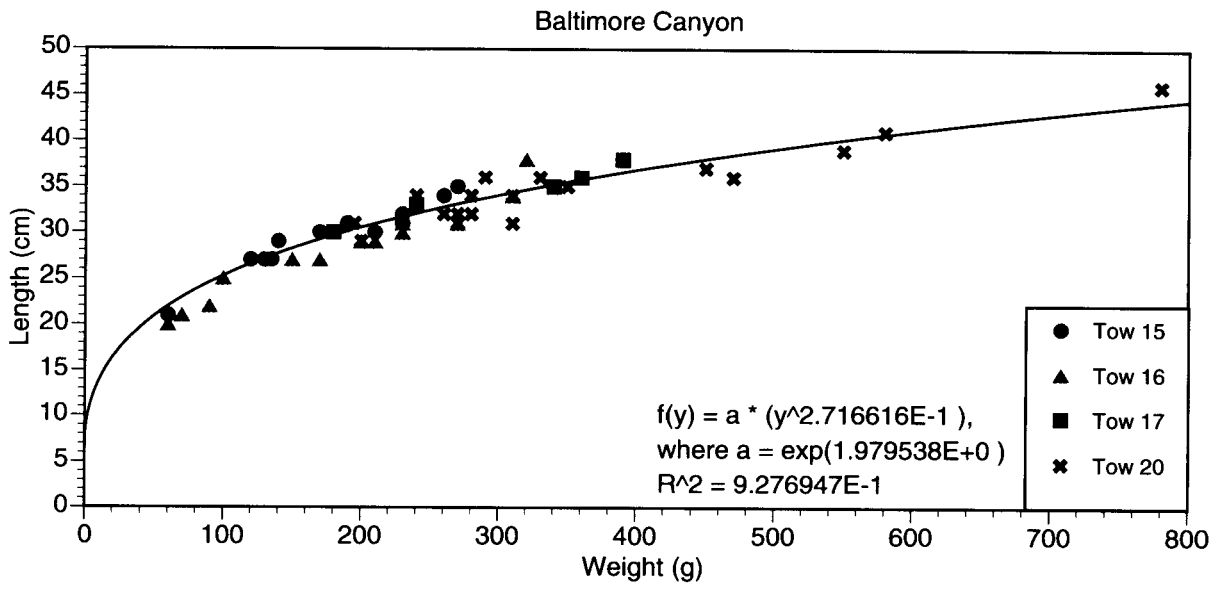
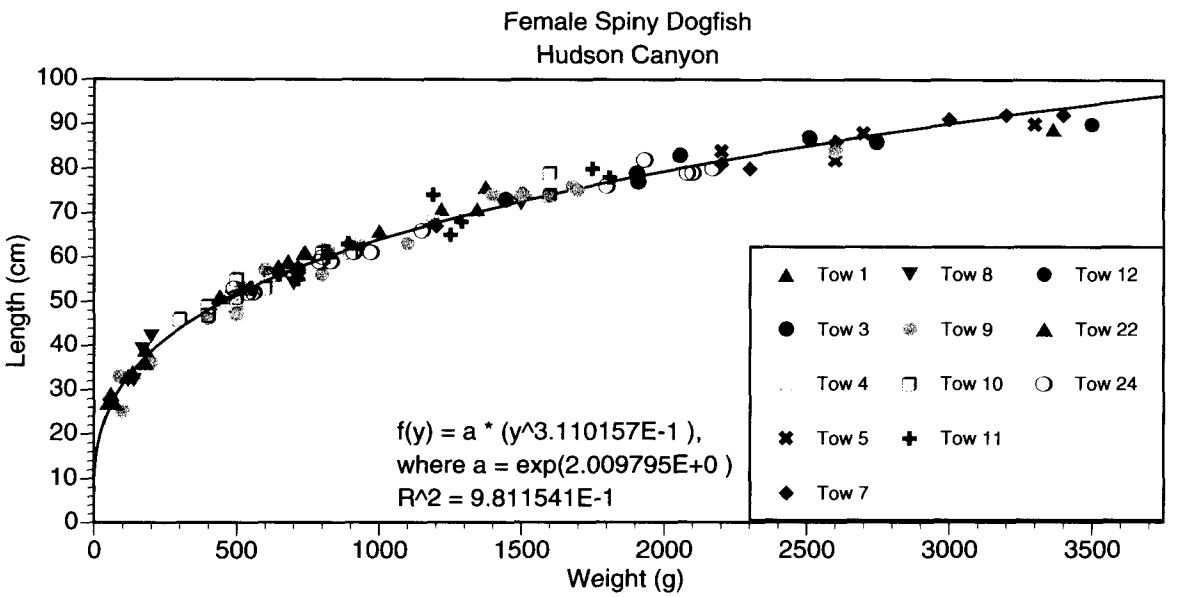


Figure 61. Relationship between length and weight for female spiny dogfish caught during January 2004. f(y)=length, y=weight.



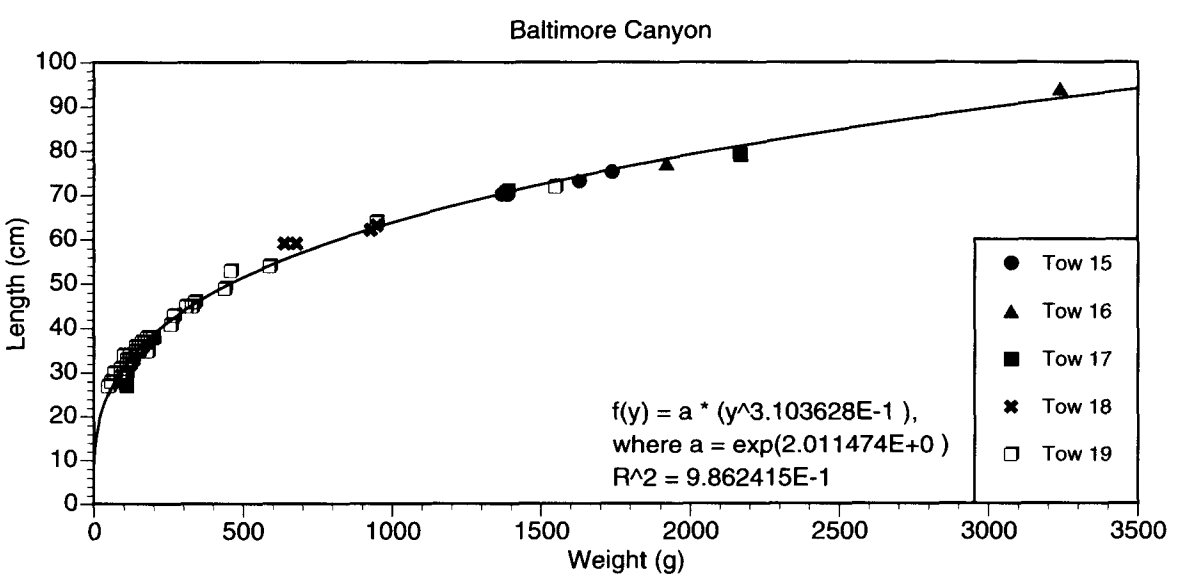
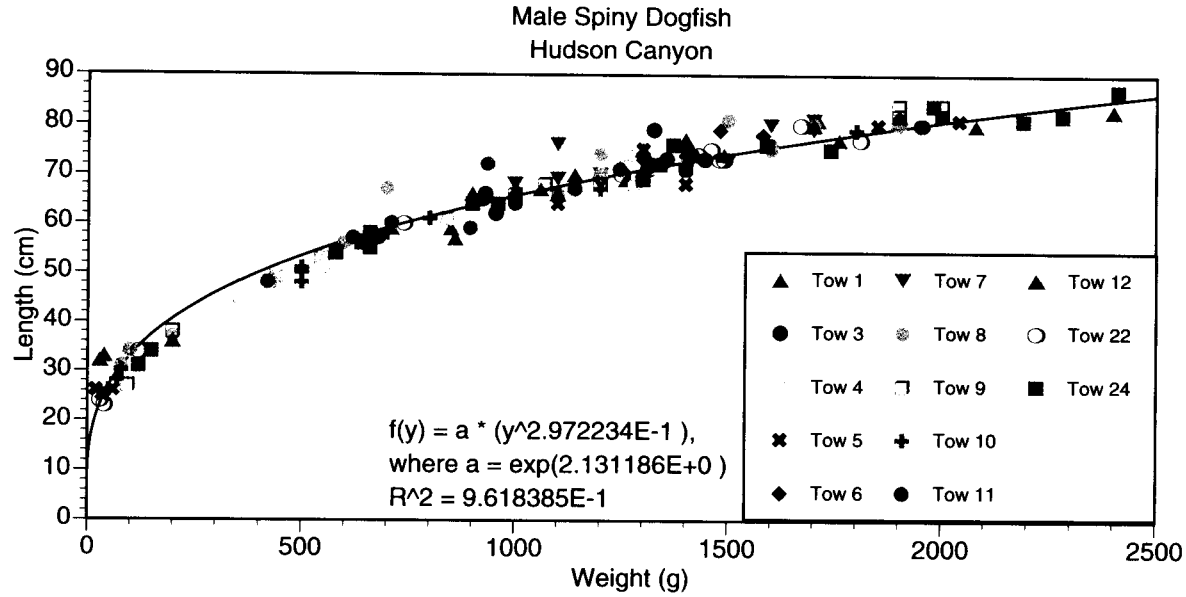


Figure 62. Relationship between length and weight for male spiny dogfish caught during January 2004. f(y)=length, y=weight.



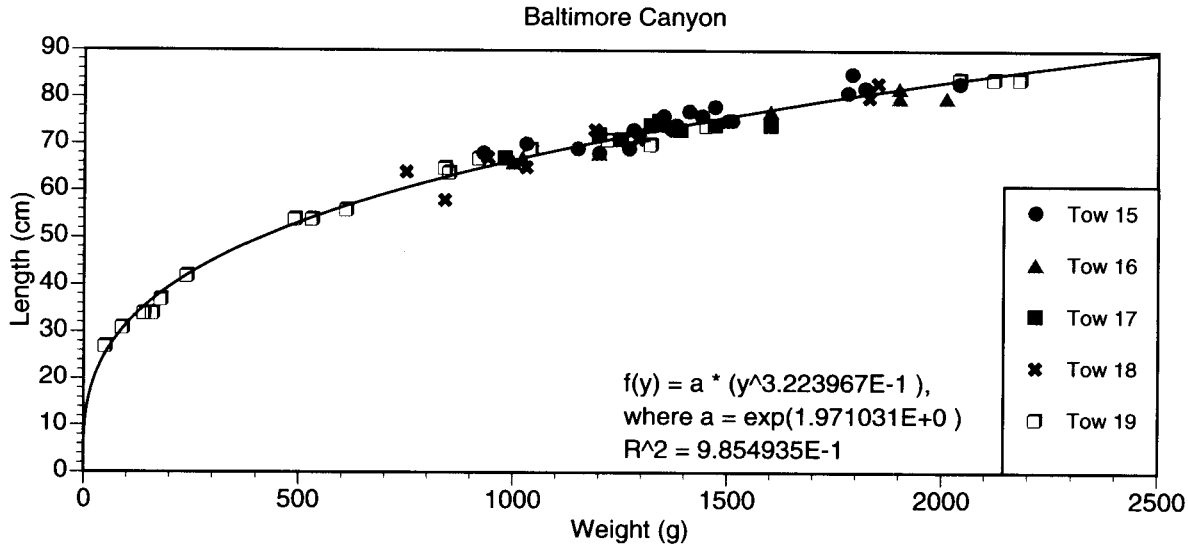
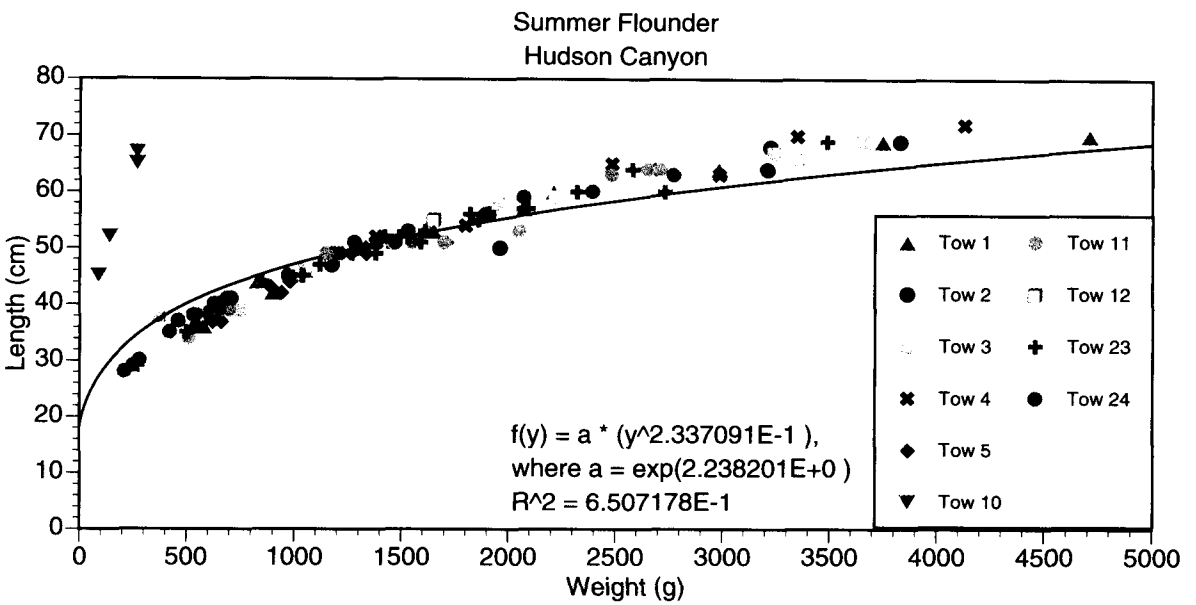


Figure 63. Relationship between length and weight for summer flounder caught during January 2004. f(y)=length, y=weight.



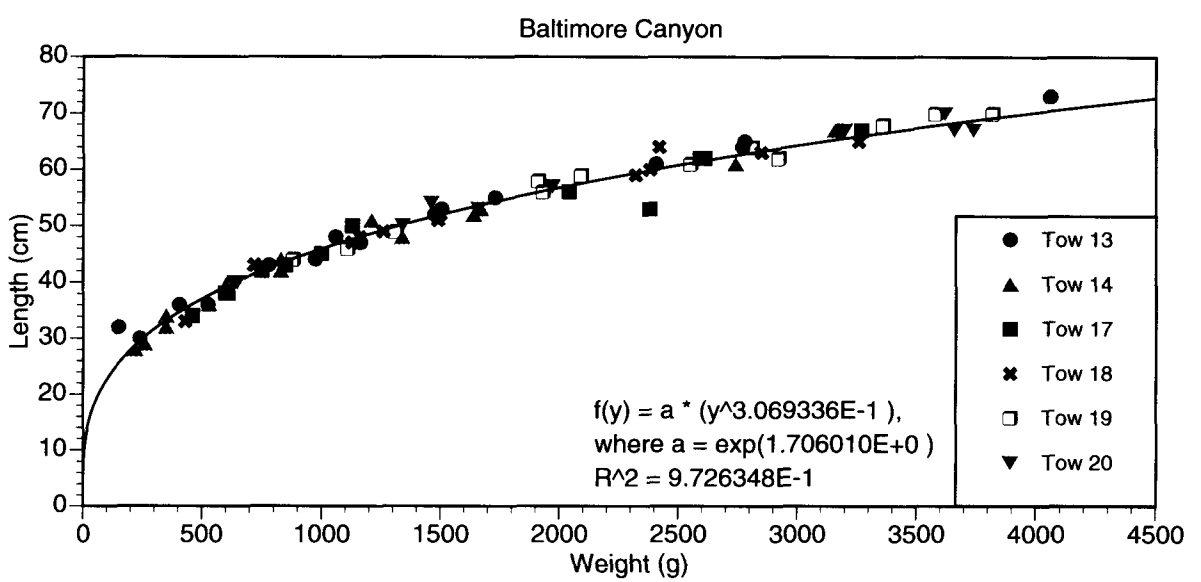


Figure 64a. Comparison of sampling performance data and temperature data from the May 2003 and January 2004 surveys. A slope of 1 (solid line) is expected if there is no change in the sampling performance for temperature, scope and depth.

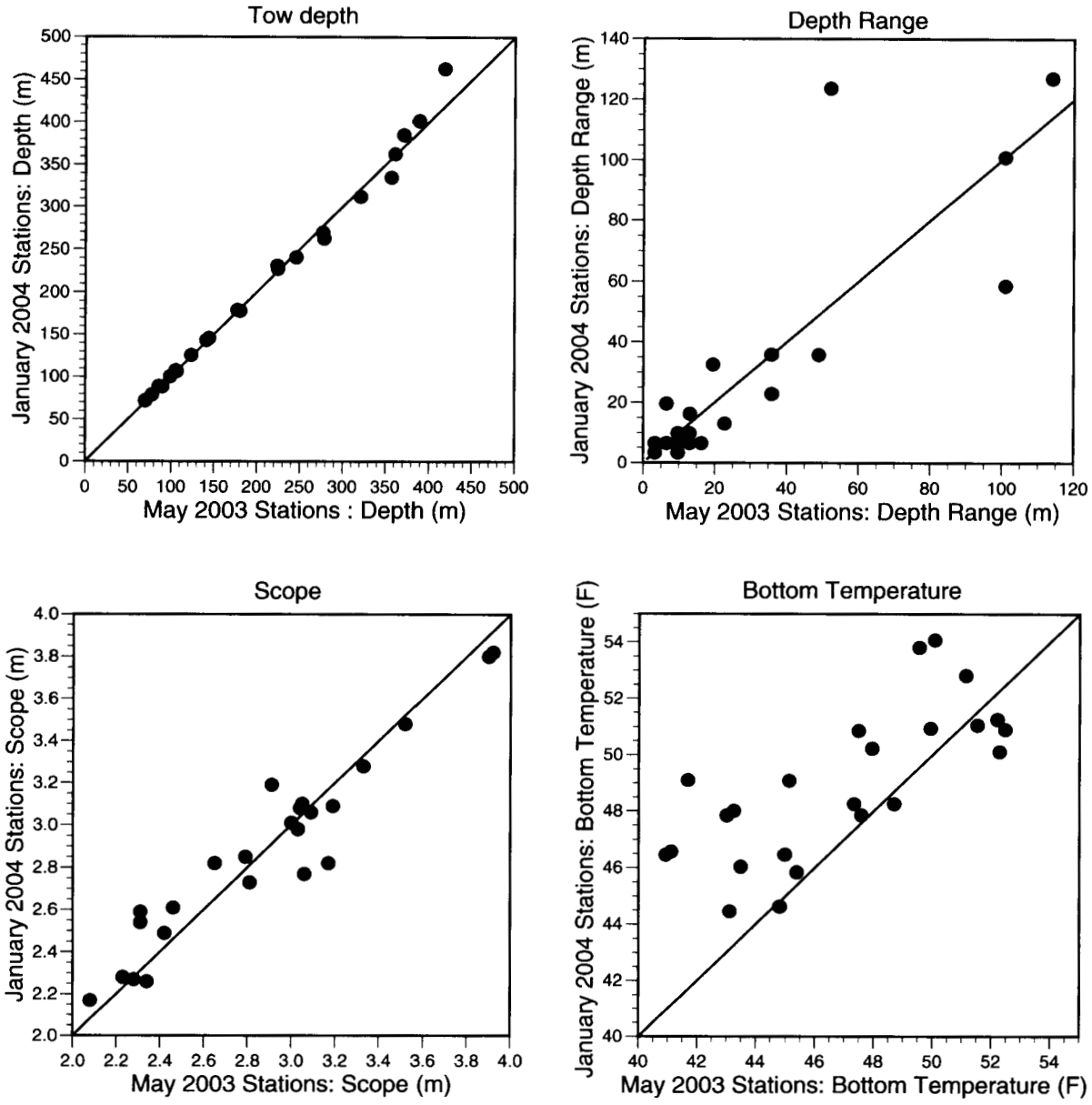


Figure 64b. Comparison of sampling performance data from the May 2003 and January 2004 surveys. A random distribution of points within a narrow two-dimensional field is expected if a change in sampling performace occurred.

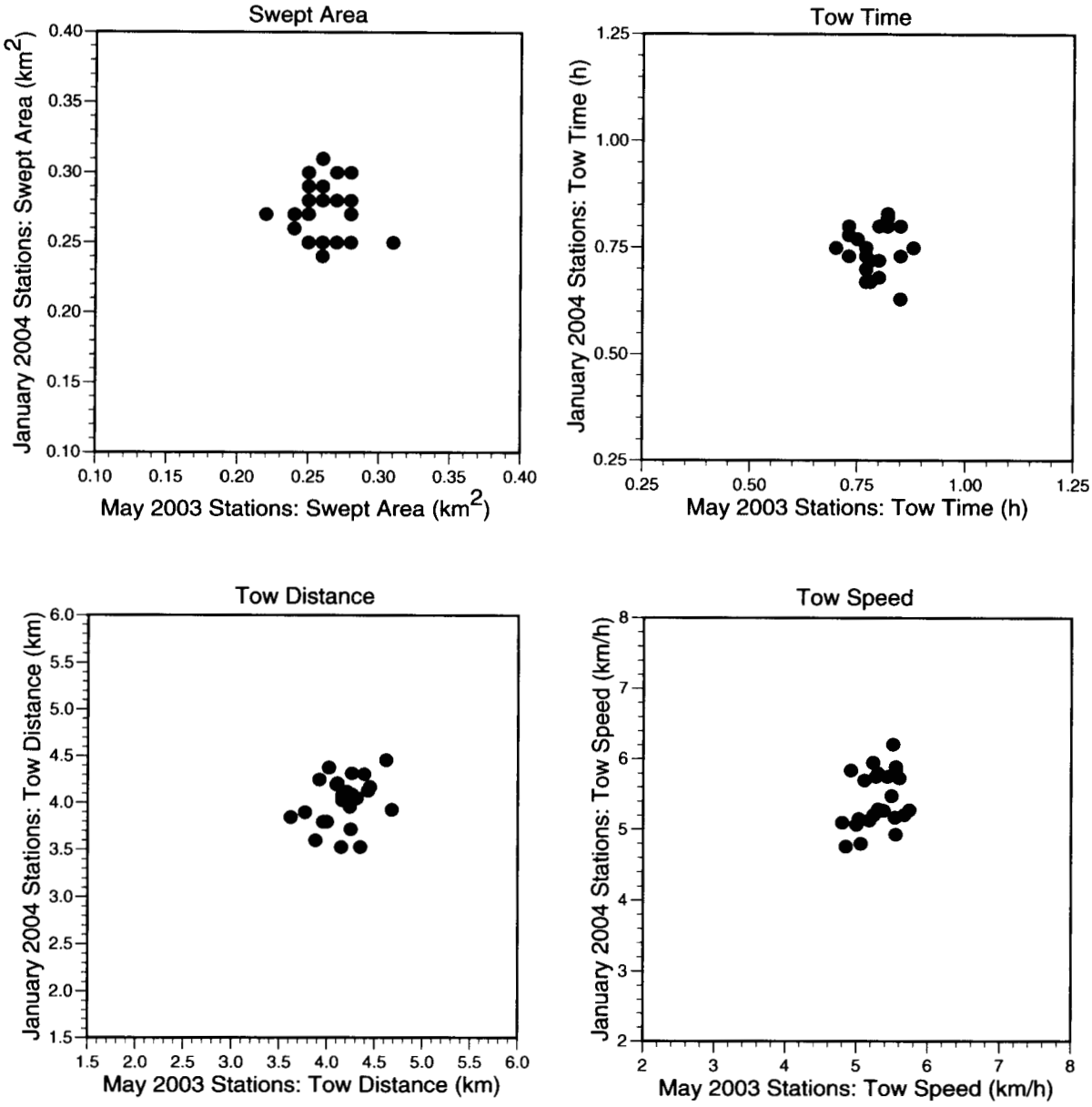


Figure 65. Changes in scope and depth range that occurred as tow depth increased during the January 2004 survey.

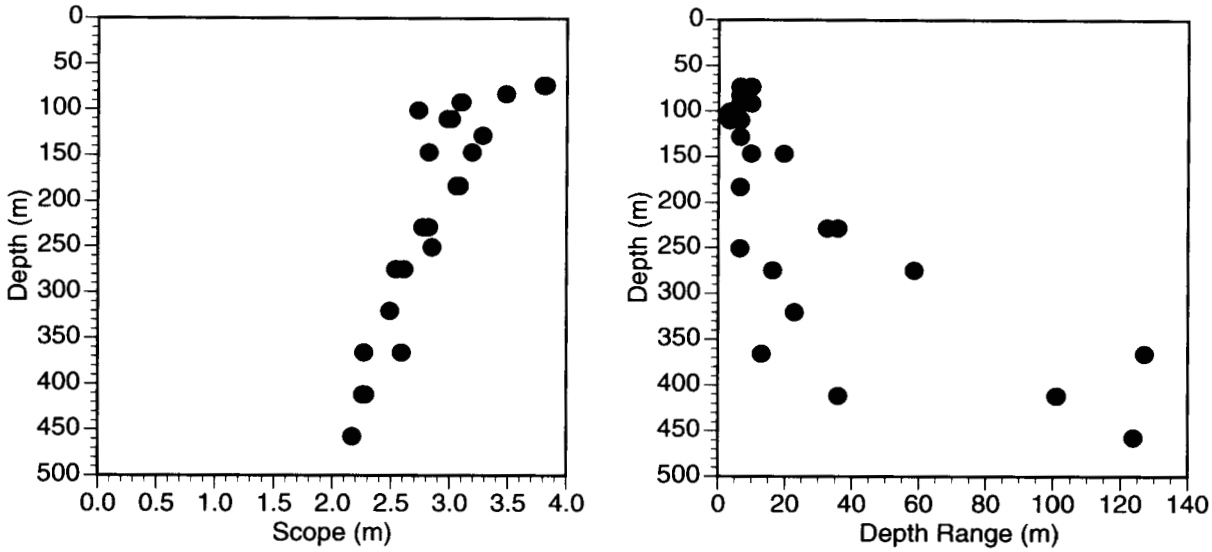


Figure 66a. Comparison of changes in depths for the 20th, 50th and 80th percentiles of cumulative catch during the March and May 2003 and January 2004 surveys. To calculate the percentiles, swath area catch (Figures 5b-24b) was cumulated from the shallowest to the deepest station on each transect. The 20th percentile, for example, is the depth where the cumulative catch curve reached 20% of the total catch.

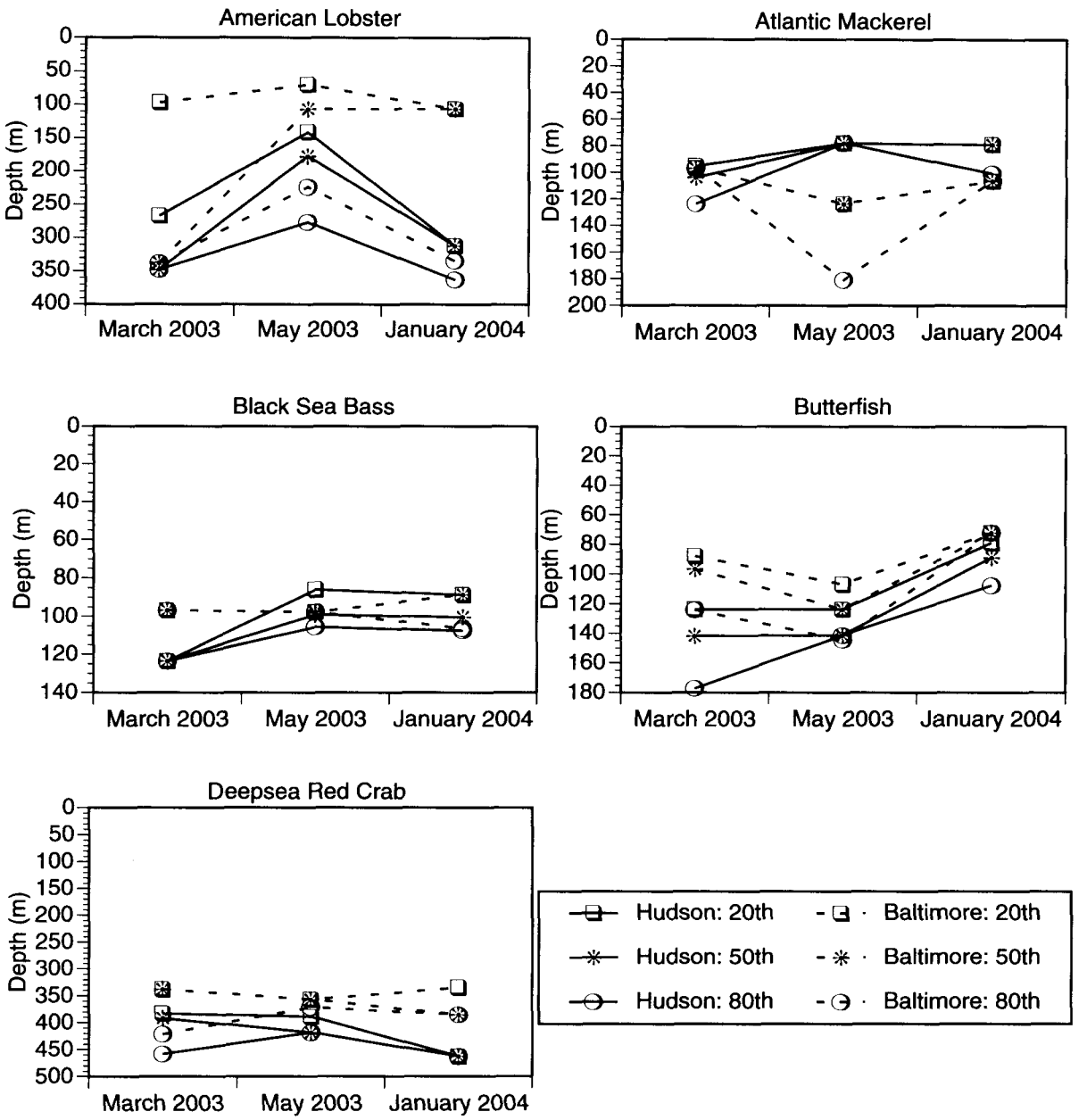


Figure 66b. Comparison of changes in depths for the 20th, 50th and 80th percentiles of cumulative catch during the March and May 2003 and January 2004 surveys. To calculate the percentiles, swath area catch (Figures 5b-24b) was cumulated from the shallowest to the deepest station on each transect. The 20th percentile, for example, is the depth where the cumulative catch curve reached 20% of the total catch.

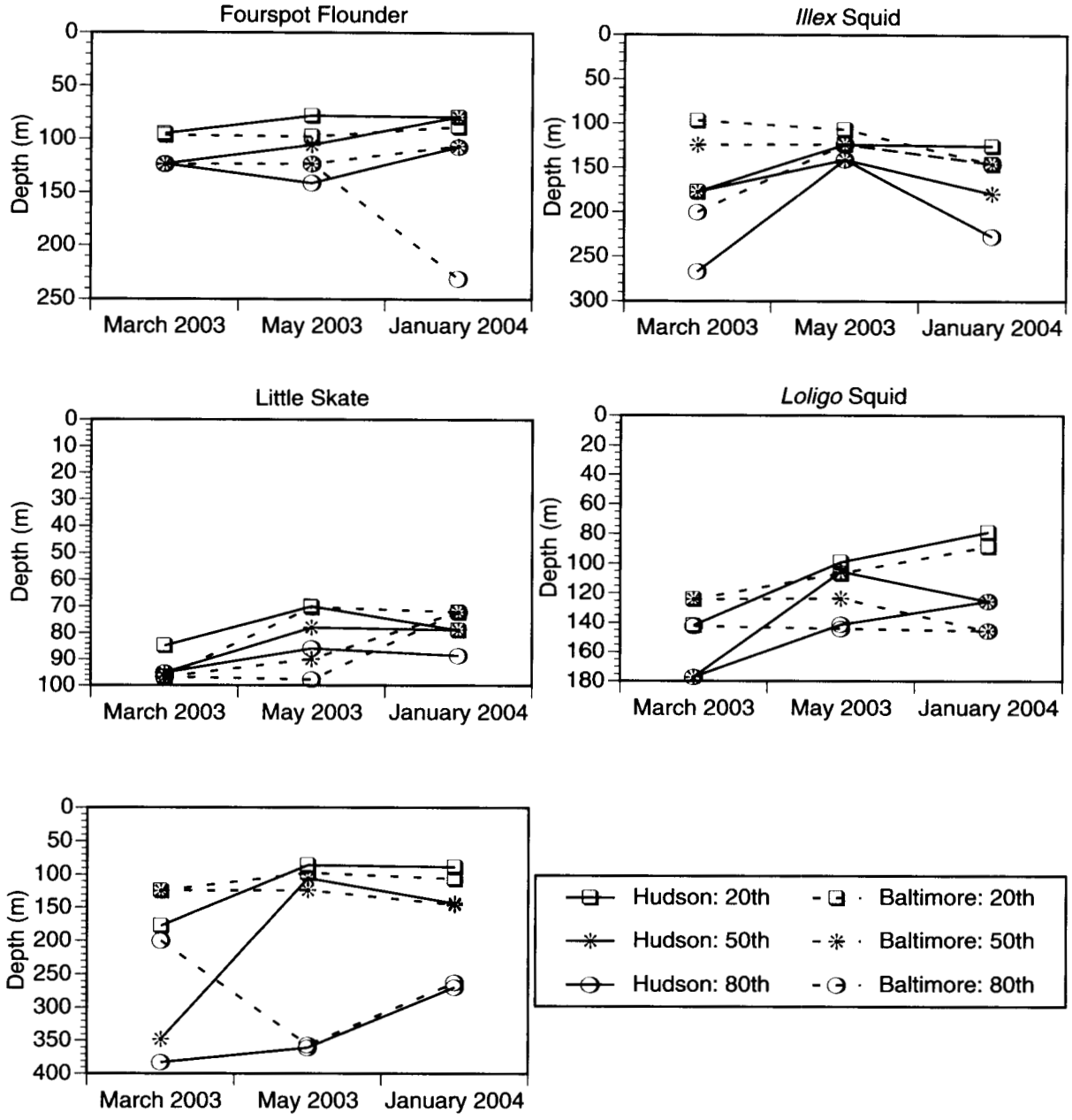


Figure 66c. Comparison of changes in depths for the 20th, 50th and 80th percentiles of cumulative catch during the March and May 2003 and January 2004 surveys. To calculate the percentiles, swath area catch (Figures 5b-24b) was cumulated from the shallowest to the deepest station on each transect. The 20th percentile, for example, is the depth where the cumulative catch curve reached 20% of the total catch.

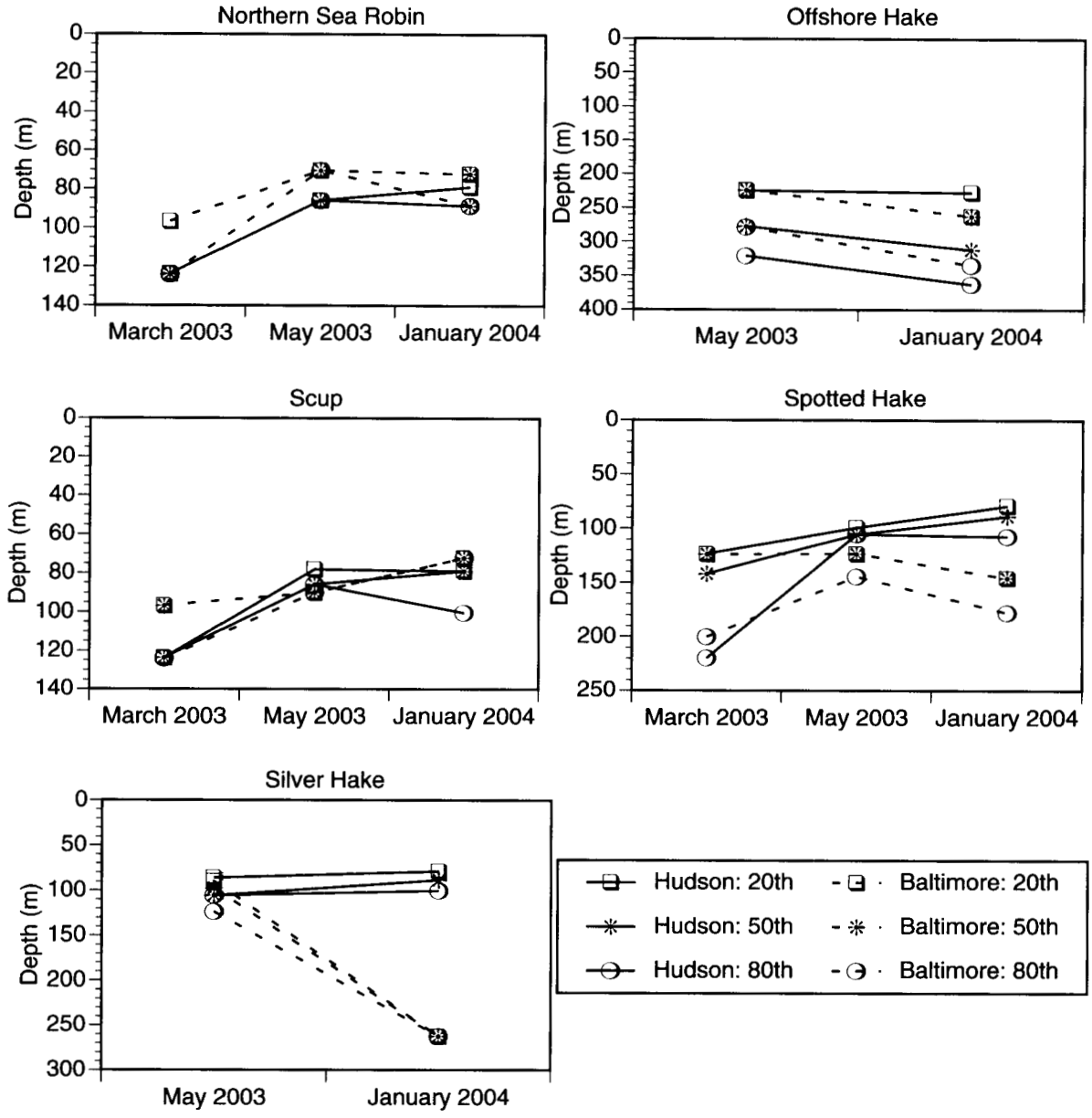
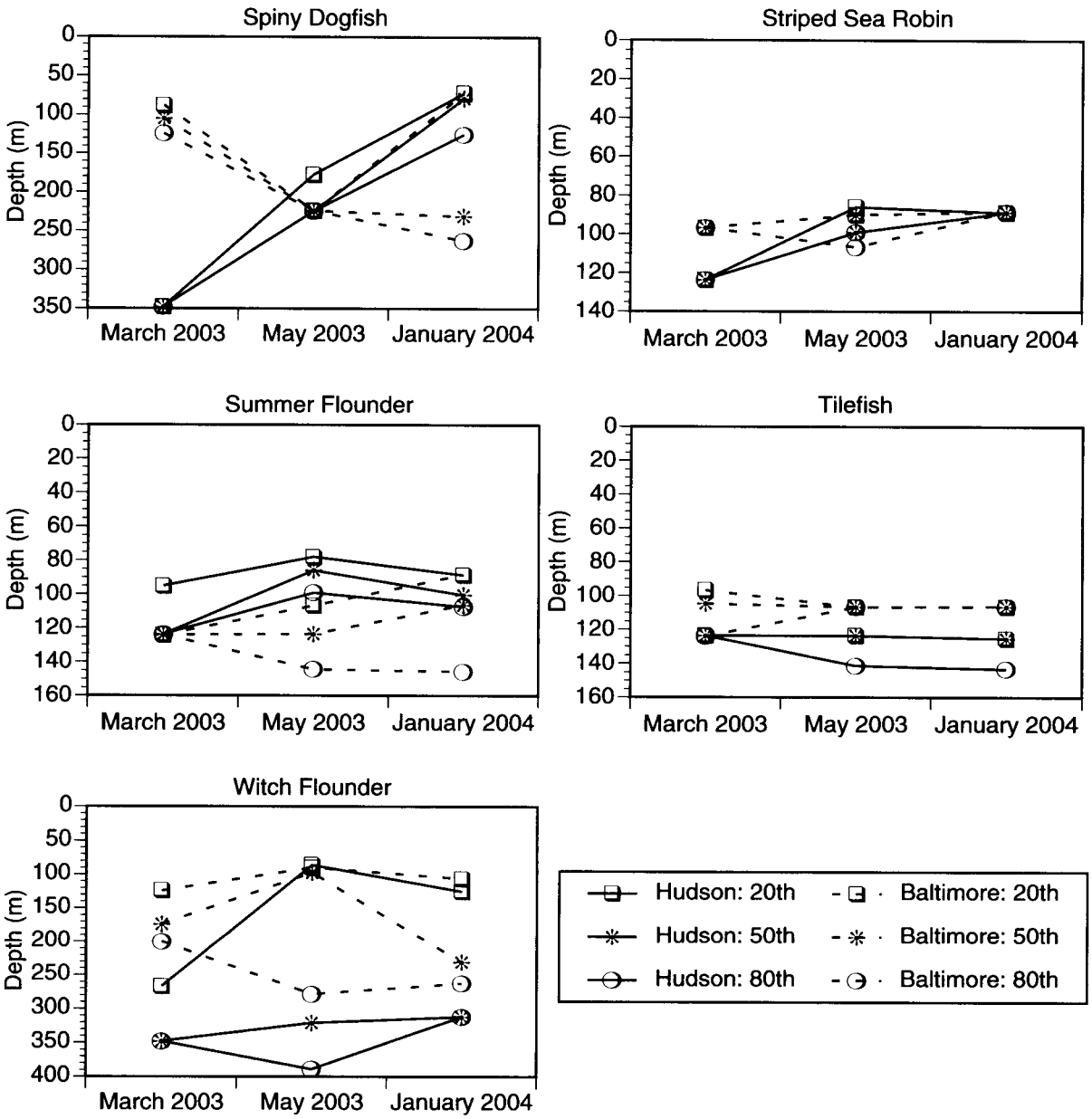



Figure 66d. Comparison of changes in depths for the 20th, 50th and 80th percentiles of cumulative catch during the March and May 2003 and January 2004 surveys. To calculate the percentiles, swath area catch (Figures 5b-24b) was cumulated from the shallowest to the deepest station on each transect. The 20th percentile, for example, is the depth where the cumulative catch curve reached 20% of the total catch.