

Figure 2-3. Completed sampling schedule for 1997.

period, sampled biweekly, from the middle of July to early October. The final sampling effort was designed to collect all life stages of bay anchovy.

The allocation of sampling effort among regions and strata is given in Table 2-3. During 1997, 3,567 ichthyoplankton samples (including 141 striped bass otolith aging samples) were scheduled for collection and 3,567 samples were collected, accounting for 100 percent of the scheduled total.

Two gear types were used to sample the shoal, channel, and bottom strata in the LRS: a 1.0-m<sup>2</sup> Tucker trawl (Figure 2-4) to sample the channel strata, an epibenthic sled-mounted 1.0-m<sup>2</sup> net similar in design to the Tucker trawl (Figure 2-5) to sample the bottom strata, and both gear types to sample the shoal strata. Table 2-4 presents design specifications for the sampling gear.

Both gear types were towed against the prevailing current for 5 minutes. The tow started with the remote opening of the net and terminated with its remote closing. If the river depth was 20 ft or less, an open set and retrieval of the net was allowed. The tow speed for the trawl was approximately 0.9 m/second; for the epibenthic sled-mounted net, approximately 1.0 m/second. An electronic flowmeter mounted along the side of the research vessel and equipped with an on-deck readout display was used to establish and maintain tow speed. A calibrated digital flowmeter mounted in the center of the net mouth was used to calculate the volume of water filtered for each sample.

Following net washing and sample concentration in the codend bucket, the samples were examined for yearling and older fish. All of these fish were identified, enumerated, and returned to the Hudson River estuary. Special care was taken for sturgeon and for marked and tagged fish. After yearling and older fish were removed, the remaining sample was placed in container(s) so that the sample occupied no more than 25 percent of the container volume. The containers were filled with 10 percent formalin.

*In situ* measurements of water temperature (°C), dissolved oxygen (mg/L), and specific conductance (microsiemen/cm at 25°C) were taken with calibrated meters at fixed river mile and strata stations in conjunction with the biological sampling. Physical/chemical sampling locations, by river mile and strata, are presented in Table 2-5 for the 1997 LRS. Physical/chemical measurements were recorded from surface, mid-depth, and bottom water depth at channel stations and from the surface and bottom water depth at shoal stations. During the 22 collection weeks of the 1997 LRS, 3,413 samples were scheduled, with 3,418 samples actually collected, accounting for over 100 percent of the scheduled total.

Ichthyoplankton samples collected for striped bass otolith aging were handled in the same manner as regularly scheduled LRS samples except that the preservative was 95 percent ethanol. Within 48 hours, the samples were drained and placed in fresh 95 percent ethanol.

### **2.2.2 Laboratory Methods**

In 1997, approximately 70 percent of the regular LRS samples were scheduled for analysis. Selection of samples for laboratory analysis began with the grouping of all samples according to river run, region, and strata. Based on these groupings, samples were selected based on one of the following criteria:

1. If there were less than 6 samples in the group, then all were selected for analysis.
2. If there were between 6 and 12 samples in the group, then 50 percent of the samples were randomly selected for analysis.

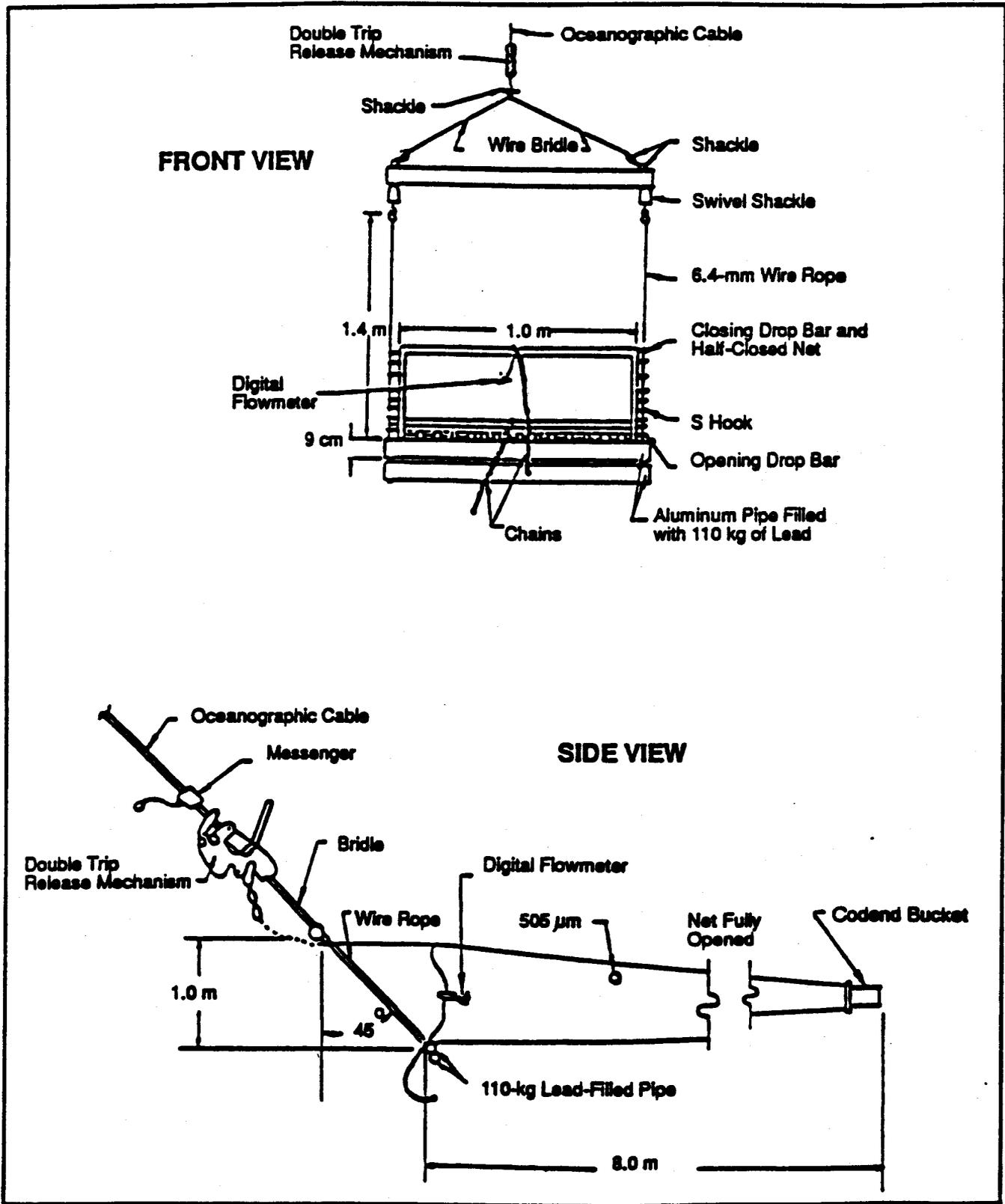


Figure 2-4. Design and dimensions of 1.0-m<sup>2</sup> Tucker trawl.

TABLE 2-3 SUMMARY OF 1997 SAMPLE COLLECTION INFORMATION BY RIVER REGION AND STRATUM FOR THE LONGITUDINAL RIVER ICHTHYOPLANKTON SURVEY

Region	4-Week Period from 10 MAR to 4 APR			3-Week Period from 7 APR to 25 APR			3-Week Period from 28 APR to 16 MAY		
	Shoal Sled	Channel Trawl	Bottom Sled	Shoal Sled	Channel Trawl	Bottom Sled	Shoal Sled	Channel Trawl	Bottom Sled
Battery	-	10	10	-	18	24	-	18	18
Yonkers	4	4	12	6	15	21	6	15	21
Tappan Zee	6	4	12	18	12	12	18	12	13
Croton-Haverstraw	6	4	12	12	9	12	12	9	12
Indian Point	4	4	12	6	12	12	6	6	18
West Point	-	10	10	-	15	15	-	1	18
Cornwall	4	4	8	9	9	9	9	5	23
Poughkeepsie	-	-	-	-	9	9	-	-	30
Hyde Park	-	-	-	-	21	9	-	-	27
Kingston	-	-	-	-	18	24	-	21	18
Saugerties	-	-	-	-	18	24	-	15	9
Catakill	-	-	-	-	21	48	-	15	9
Albany	-	-	-	-	30	60	-	15	15
Total	24	20	76	51	210	279	51	39	231
			196			579			597

Region	3-Week Period from 19 MAY to 6 JUN			4-Week Period from 9 JUN to 4 JUL			13-Week Period from 14 JUL to 10 OCT		
	Shoal Sled	Channel Trawl	Bottom Sled	Shoal Sled	Channel Trawl	Bottom Sled	Shoal Sled	Channel Trawl	Bottom Sled
Battery	-	12	24	-	16	24	-	42	42
Yonkers	6	3	18	8	28	24	14	30	42
Tappan Zee	12	6	12	8	28	20	21	28	28
Croton-Haverstraw	12	6	12	12	32	24	21	28	28
Indian Point	6	6	18	12	8	20	21	28	28
West Point	-	60	21	8	80	32	-	28	28
Cornwall	9	6	24	8	116	48	14	21	21
Poughkeepsie	-	67	36	-	60	28	-	21	21
Hyde Park	-	37	21	-	72	28	-	-	-
Kingston	-	19	12	-	44	16	-	-	-
Saugerties	-	9	15	-	24	16	-	-	-
Catakill	-	9	9	-	8	16	-	-	-
Albany	-	9	9	-	12	12	-	-	-
Total	45	27	231	48	532	296	91	226	238
			633			916			646

NOTE: Dashes (-) indicate no sampling scheduled.

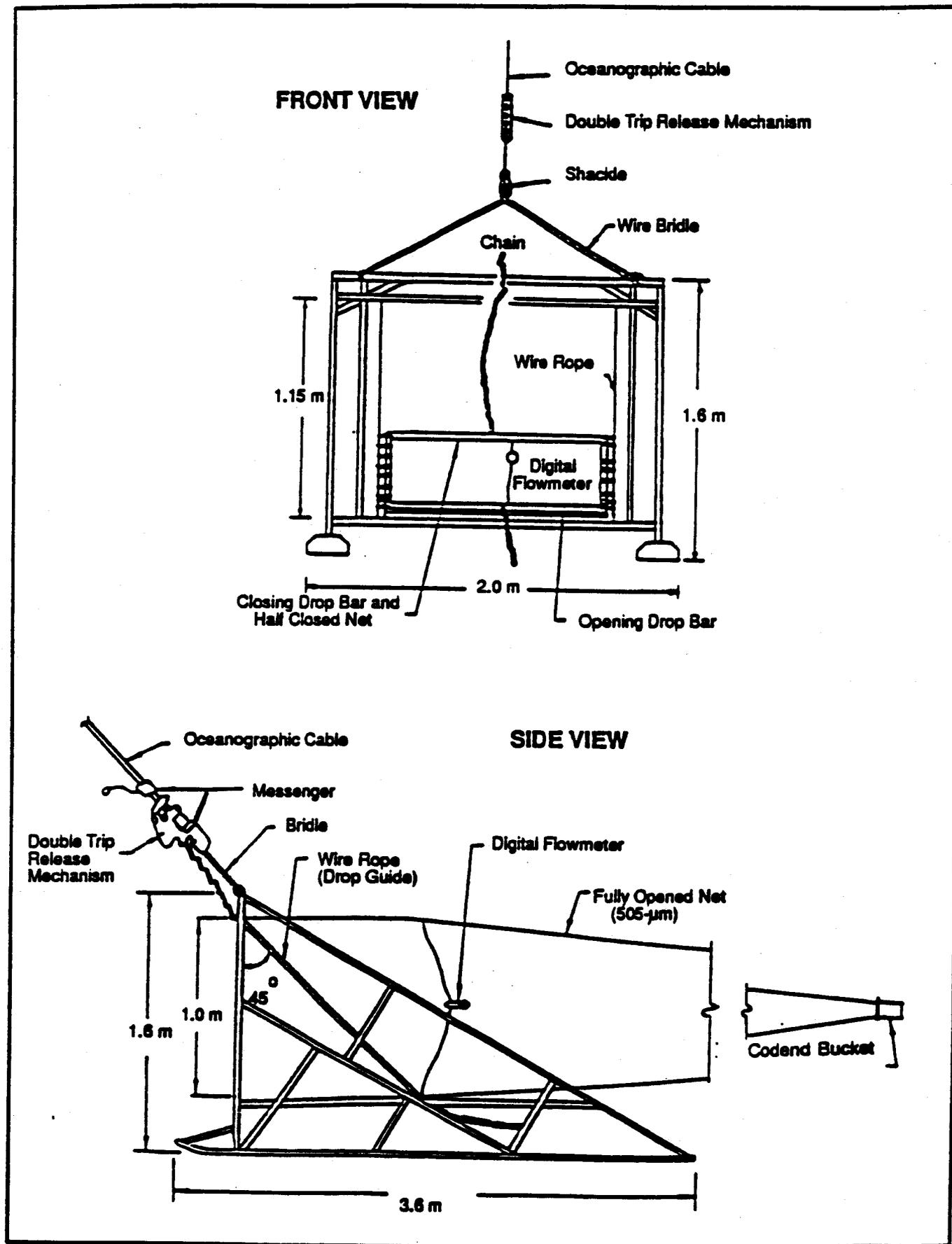


Figure 2-5. Design and dimensions of 1.0-m<sup>2</sup> Tucker trawl mounted on an epibenthic sled.

**TABLE 2-4 SPECIFICATIONS OF SAMPLING GEAR USED DURING THE 1997  
LONGITUDINAL RIVER ICHTHYOPLANKTON SURVEY**

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**1.0-m<sup>2</sup> Tucker Trawl**

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<b>Length</b>	<b>8.0 m</b>
<b>Mouth (width)</b>	<b>1.0 m</b>
<b>Mouth (height)</b>	<b>1.4 m</b>
<b>Mesh size</b>	<b>500 <math>\mu</math>m</b>
<b>Net material</b>	<b>Nytex (monofilament nylon)</b>
<b>Collection cup</b>	
<b>Length</b>	<b>30 cm</b>
<b>Length with net-retaining ring</b>	<b>37 cm</b>
<b>Mesh size</b>	<b>500 <math>\mu</math>m</b>
<b>Net material</b>	<b>Nytex (monofilament nylon)</b>

**1.0-m<sup>2</sup> Net Mounted on Epibenthic Sled**

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<b>Length</b>	<b>8.0 m</b>
<b>Mouth (width)</b>	<b>1.0 m</b>
<b>Mouth (height)</b>	<b>1.4 m</b>
<b>Mesh size</b>	<b>500 <math>\mu</math>m</b>
<b>Net material</b>	<b>Nytex (monofilament nylon)</b>
<b>Collection cup</b>	
<b>Length</b>	<b>30 cm</b>
<b>Length with net-retaining ring</b>	<b>37 cm</b>
<b>Mesh size</b>	<b>500 <math>\mu</math>m</b>
<b>Net material</b>	<b>Nytex (monofilament nylon)</b>

**TABLE 2-5 WATER QUALITY SAMPLING LOCATIONS DURING THE 1997 LONGITUDINAL RIVER ICHTHYOPLANKTON AND FALL SHOALS SURVEYS**

River Region	Scheduled Sampling Locations (RM)		Number of Water Quality Samples Scheduled Per Region Per River Run			
	Shoals <sup>a</sup>	Channel	LRS River Runs 1-3	LRS River Runs 4-16	LRS River Runs 17-23	FSS River Runs 1-8
Battery	--	1, 3, 6, 9	12	12	12	12
Yonkers	19	12, 14, 17, 19, 22	19	19	19	19
Tappan Zee	29	25, 27, 29, 32	16	16	16	16
Croton-Haverstraw	36	35, 36, 37, 38	16	16	16	16
Indian Point	43	40, 42, 43, 46	16	16	16	16
West Point	--	49, 51, 53, 55	12	12	12	12
Cornwall	59	56, 57, 59, 61	16	16	16	16
Poughkeepsie	--	63, 67, 71, 75	--	12	12	12
Hyde Park	--	78, 80, 82, 84	--	12	--	12
Kingston	--	87, 89, 91, 93	--	12	--	12
Saugerties	--	96, 99, 102, 105	--	12	--	12
Catskill	--	109, 114, 118, 122	--	12	--	12
Albany	--	126, 131, 135, 138, 142	--	15	--	15
<b>Total per River Run</b>			<b>107</b>	<b>182</b>	<b>119</b>	<b>182</b>

NOTE: Dashes (--) indicate no sampling scheduled.

a. Sample collected from east and west shoals at designated river mile.

3. If there were more than 12 samples in the group, then 20 percent of the samples were randomly selected for analysis.

The allocation of samples for laboratory analysis among regions, strata, and gear types based on these criteria is listed in Table 2-6. The total number of analyzed samples was 2,365, comprising 69 percent of the collected samples (excluding those collected for otolith analysis).

In 1997, as in previous years, splitting (or subsampling) was permitted. A trained technician first determined, by visual inspection, if the sample needed splitting. Any sample containing large numbers of eggs may have been split so that eggs were only sorted from one or more splits containing a total of at least 250 eggs (all species combined).

There were two different sets of criteria for subsampling larvae, depending on the river run. Beginning with the river run in which striped bass PYSL first appeared, and for the next 8 river runs (a total of 9 consecutive river runs), a minimum of 500 *Morone* larvae (i.e., the combined total of YSL, PYSL, and YOY of striped bass, white perch, and unidentified *Morone*) was sorted from the entire sample and a minimum of 50 non-*Morone* larvae was also sorted. Because some of the more difficult distinctions between species (e.g., striped bass versus white perch) or between life stages could not be made reliably during sorting, samples from these 9 river runs were usually sorted in their entirety for larvae (i.e., YSL, PYSL, and YOY combined) of all species combined. An exception to this may have been made, at the discretion of the laboratory supervisor, under the following circumstances: when extremely large numbers of non-*Morone* larvae occurred in the sample and a qualified identifier had verified that sufficient numbers of both *Morone* larvae and non-*Morone* larvae were sorted to meet their respective subsampling quotas. The purpose of this exception was to allow splitting before sorting of taxa such as clupeids which could readily be distinguished from *Morone* by sorters.

The second set of criteria for subsampling larvae applied to the 14 other river runs not covered in the previous paragraph (before and after the period of striped bass abundance). Any sample from these river runs may have been subsampled so that larvae were sorted from one or more splits containing at least 100 larvae (i.e., YSL, PYSL, and YOY combined) of all species combined.

To eliminate any chance of bias, some steps in the splitting procedure were performed by an assistant so that the sorter had no prior knowledge of which splits were to be used for the analysis. This procedure is explained in Figure 2-6. Randomness of the splitting procedure was monitored and controlled by testing selected samples to determine whether splits from the same sample differed by more than random variation. Samples were selected to test for randomness by a continuous sampling plan, shown in Figure 2-7 (CSP-V from MIL-STD-1235B, AQL = 10 percent).

For each split sample evaluated, three fractions of the same size were sorted and compared by the chi-square test according to the following procedure. The counts of the three splits (including any quality control [QC] finds) were averaged to obtain the expected value for the sample. Chi-square was calculated as:

$$\text{chi square} = \frac{(O_1 - E)^2}{E} + \frac{(O_2 - E)^2}{E} + \frac{(O_3 - E)^2}{E}$$

where

- $O_1, O_2,$  and  $O_3$  = Observed counts for splits 1, 2, and 3.
- $E$  = Expected value for the sample (average of  $O_1, O_2,$  and  $O_3$ ).

TABLE 2-6 SUMMARY OF 1997 SAMPLE ANALYSIS INFORMATION BY RIVER REGION AND STRATUM FOR THE LONGITUDINAL RIVER ICHTHYOPLANKTON SURVEY

Region	4-Week Period from 10 MAR to 4 APR			3-Week Period from 7 APR to 23 APR			3-Week Period from 28 APR to 16 MAY		
	Shoal	Channel	Bottom	Shoal	Channel	Bottom	Shoal	Channel	Bottom
	Sled	Trawl	Total	Sled	Trawl	Total	Sled	Trawl	Total
Battery	--	10	20	--	9	12	--	9	18
Yonkers	4	6	20	6	15	12	6	15	12
Tappan Zee	6	6	22	9	12	12	9	12	13
Croton-Haverstraw	6	6	22	12	9	12	12	9	12
Indian Point	4	6	20	6	6	12	6	15	9
West Point	--	10	20	--	15	15	--	9	9
Cornwall	4	8	24	9	6	9	5	15	11
Poughkeepsie	--	--	--	--	9	9	--	15	15
Hyde Park	--	--	--	--	12	9	--	18	15
Kingston	--	--	--	--	9	12	--	12	15
Saugerties	--	--	--	--	9	12	--	15	9
Catskill	--	--	--	--	12	9	--	15	9
Albany	--	--	--	--	15	12	--	15	15
Total	24	52	148	42	39	147	39	177	405

Region	3-Week Period from 19 MAY to 6 JUN			4-Week Period from 9 JUN to 4 JUL			13-Week Period from 14 JUL to 10 OCT		
	Shoal	Channel	Bottom	Shoal	Channel	Bottom	Shoal	Channel	Bottom
	Sled	Trawl	Total	Sled	Trawl	Total	Sled	Trawl	Total
Battery	--	12	24	--	16	12	--	21	42
Yonkers	6	12	30	8	16	12	14	28	21
Tappan Zee	12	12	42	8	20	20	14	28	21
Croton-Haverstraw	12	12	42	12	12	12	21	28	28
Indian Point	6	18	39	12	8	20	14	28	28
West Point	--	9	21	--	20	16	--	28	27
Cornwall	9	15	42	8	24	24	13	21	21
Poughkeepsie	--	12	30	--	12	16	--	21	21
Hyde Park	--	15	27	--	20	20	--	21	21
Kingston	--	9	21	--	13	15	--	--	--
Saugerties	--	9	24	--	8	16	--	--	--
Catskill	--	9	18	--	12	11	--	--	--
Albany	--	9	18	--	12	12	--	--	--
Total	45	153	378	48	197	206	76	203	195

NOTE: Dashes (--) indicate no sampling scheduled.

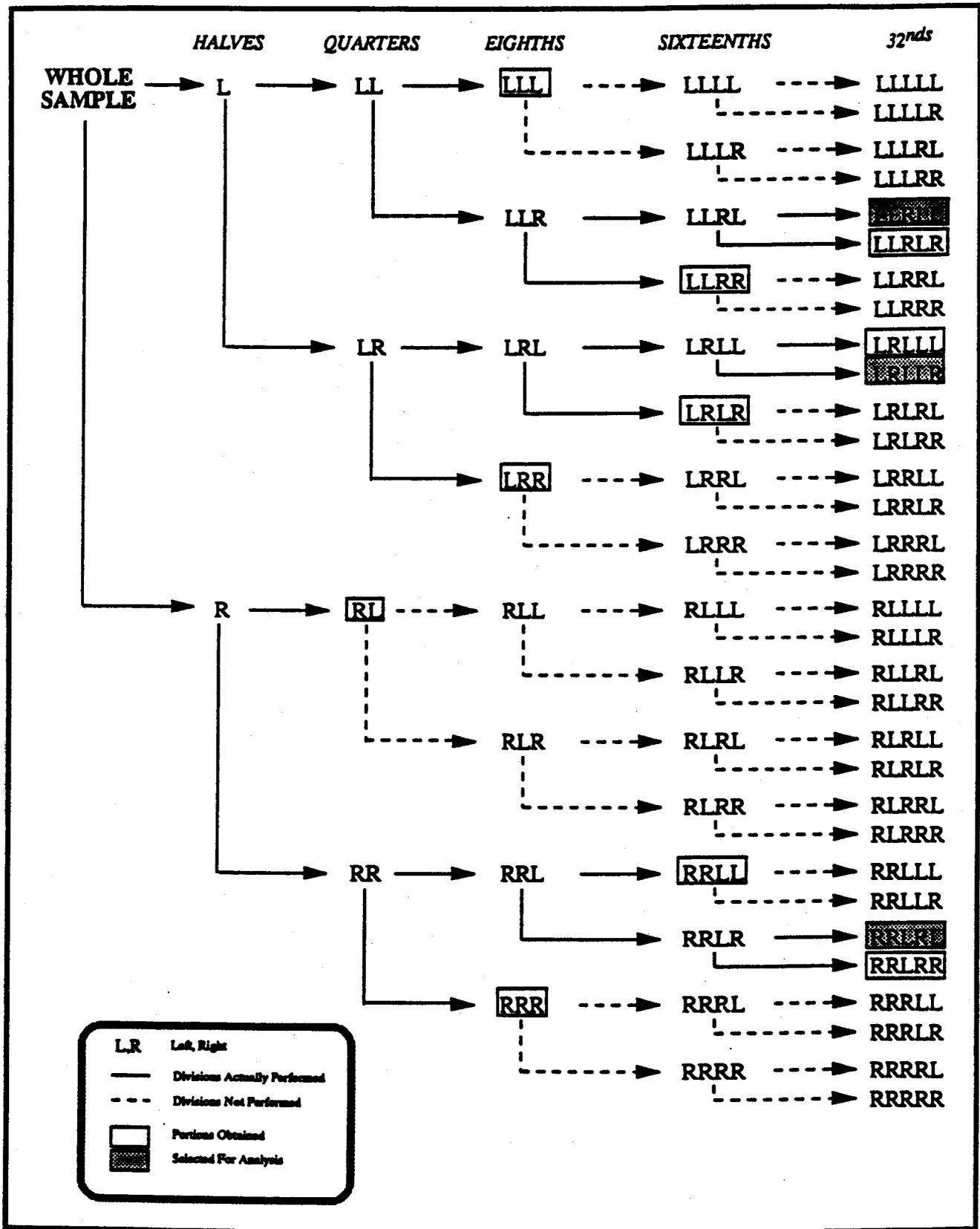


Figure 2-6. Conceptual diagram of the splitting process.

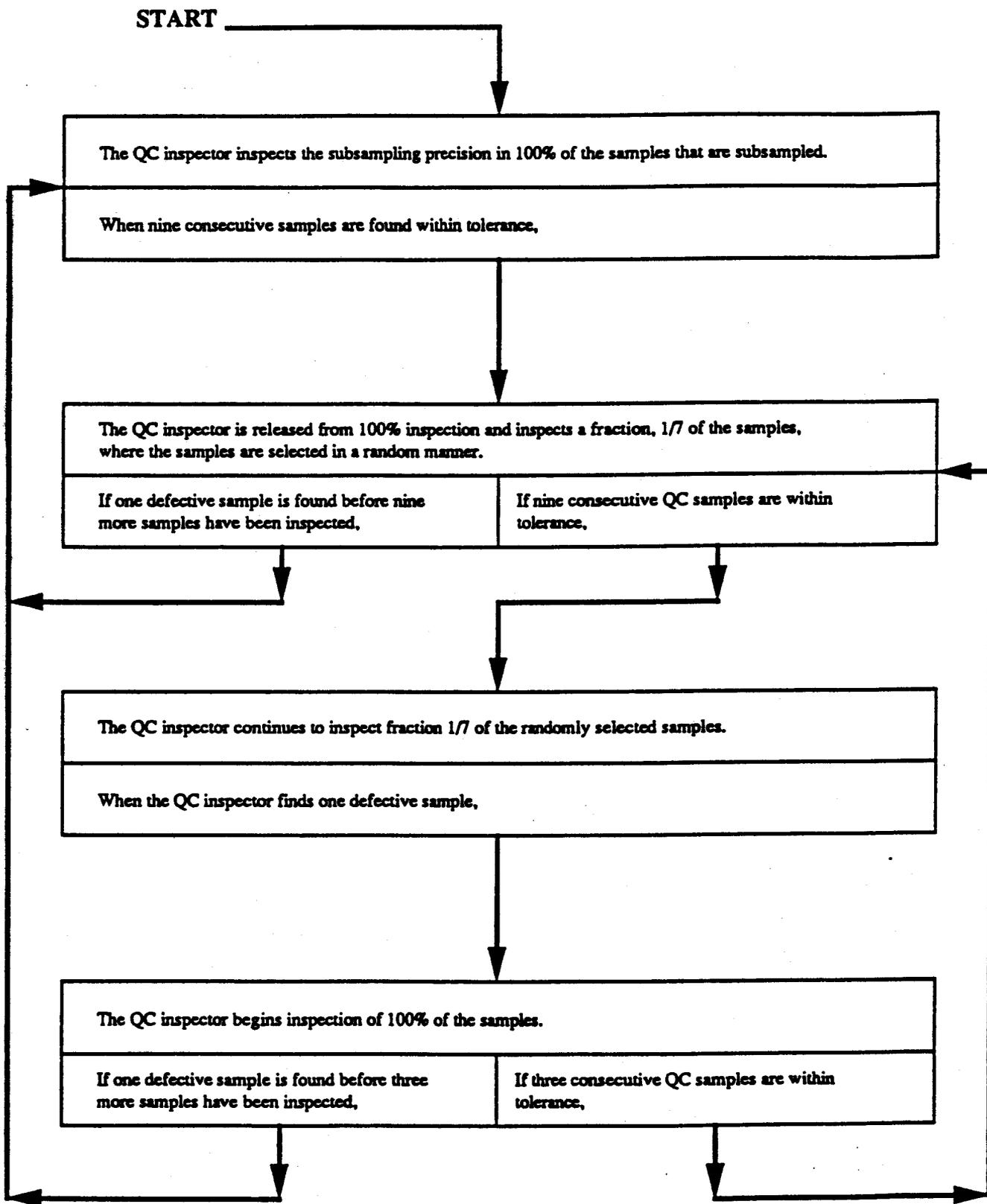


Figure 2-7. Inspection plan for evaluation of splitting precision.

If the calculated value for chi-square was less than 5.99, then the splits of that sample were considered random, and the sample passed the split QC (5.99 was the critical value of chi-square with two degrees of freedom at an alpha level of 0.05). If a sample was split for both eggs and larvae, then both stages were tested separately. The sample passed the split QC only if chi-square was below the critical value for both life stages.

Eggs and larvae were separated from detrital material, sorted by major taxonomic group and life stage, counted, and placed in vials containing 5 percent formalin or in alcohol. Sorted samples were evaluated by a trained technician under magnification and all organisms were identified and enumerated. The following life stage designations were used in identification:

<u>Life Stage</u>	<u>Description</u>
Egg	Embryonic stage from spawning to hatching
YSL	From hatching to development of a complete and functional digestive system
PYSL	From development of a complete digestive system to transformation to juvenile form
YOY	From completed transformation to Age 1.

Whenever possible, a maximum of 30 striped bass, 30 white perch, 30 American shad, 30 Atlantic tomcod, and 30 bay anchovy per sample were measured. Organisms were chosen at random from each taxon regardless of life stage until the required number were obtained; life stages to be included were YSL, PYSL, and YOY. The total length of YSL and PYSL was measured to the nearest 0.1 mm and to the nearest 1 mm for YOY. Measurements were recorded on the laboratory data sheet. Selection of specimens for measuring was randomized by spreading them uniformly in a gridded container, selecting a starting point in the grid by means of a random number table, and then measuring the first 30 measurable specimens encountered in a predetermined pattern commencing at the starting point. Every grid space had an equal probability of being selected as the starting point, so every specimen had an equal probability of being included in the subsample.

Continuous sampling inspection was employed during the sort and identification procedures to ensure an average outgoing quality limit of 10 percent or better. Two sampling modes were required in the continuous sampling plan (CSP-1):

**Mode 1**—The first eight samples sorted or analyzed for larval identification by an individual are subject to 100 percent QC reanalysis. If all eight pass the reanalysis, i.e., if  $\leq 10$  percent of the ichthyoplankton are missed or misidentified per sample, the individual is placed in CSP Mode 2. If any sample fails during Mode 1, then Mode 1 is continued until eight consecutive samples pass. For example, if a sample with QC No. 7 fails, then samples with QC Nos. 8 through 15 are subject to QC resorting.

**Mode 2**—Lots of seven consecutive samples per individual are assigned for identification QC and per laboratory facility for sort QC. One sample from each lot is randomly chosen for QC analysis. If a sample fails ( $>10$  percent of organisms missed or misidentified) during Mode 2, the individual is placed back into Mode 1. For example, if a sample with QC No. 6 fails in a lot of seven samples,

then samples with QC Nos. 7 through 14 are subject to QC reanalysis. If samples 7 through 14 pass, the individual is again placed in Mode 2.

Results of the 1997 CSP-1 Quality Control Program are contained in Appendix A.

## 2.3 FALL SHOALS SURVEY

### 2.3.1 Field Methods

The 1997 FSS biweekly sampling program extended from RM 1 to 152 and covered 21 weeks from 7 July to 28 November (Figure 2-3). Samples were collected at night for the first 8 river runs from 7 July through 17 October and during the day for last 3 river runs from 27 October through 28 November. These last river runs, which were conducted with a modified sampling design, were intended to examine Atlantic tomcod distribution. Table 2-7 presents the distribution of the FSS sampling effort among the 13 river regions by stratum. During the final collection week, sampling was terminated after 30 samples were collected due to boat engine failure. Of the 2,130 samples scheduled for collection; 2,015 samples, or 94.60 percent of the scheduled number, were actually collected.

A 1.0-m<sup>2</sup> Tucker trawl and a 3.0-m beam trawl were used to collect YOY fish in the 1997 FSS. The Tucker trawl with 3.0-mm mesh was used to collect samples in the channel stratum, while the beam trawl (Figure 2-8) was used to sample the shoal and bottom strata. The latter gear was first used in this capacity in the 1985 FSS; prior to 1985, an epibenthic sled-mounted Tucker trawl was used. With the modified sampling design of the last 3 river runs from 27 October through 28 November, no channel samples or Tucker trawl samples were scheduled for collection. Only beam trawl samples in the shoal and bottom strata were taken during these river runs. Design specifications for both trawl types currently in use are listed in Table 2-8.

Both gear types were towed against the prevailing current for approximately 5 minutes. For the Tucker trawl, vessel speed was adjusted as necessary to achieve and maintain a 45° wire angle; the resultant tow speed was recorded. The beam trawl was towed at a speed of approximately 1.5 m/second.

Tow speed was established and maintained by use of an electronic flowmeter mounted along the side of the research vessel and equipped with an on-deck readout display. Tucker trawl samples taken in over 20 ft of river depth were remotely opened and closed at sampling depth. A calibrated digital flowmeter mounted in the center of the net mouth was used to calculate the volume of water filtered for each sample.

Calibrated meters were used to measure water temperature (°C), dissolved oxygen (mg/L), and specific conductance (microsiemen/cm at 25°C) at fixed river mile and strata stations in conjunction with field sampling. Sampling locations were the same as those used for the 1997 LRS sampling program (Table 2-5). Measurements of physical/chemical parameters were recorded during the first 8 biweekly FSS sampling periods from surface, mid-, and bottom water depths at channel stations and from surface and bottom water depths at shoal stations. During the first 8 river runs of the 1997 FSS, 1,456 samples were scheduled for collection and 1,455 samples, or 99.93 percent of the number scheduled, were actually collected. No water quality samples were scheduled for the last 3 river runs of the FSS.

Because of the difficulty in differentiating some species, especially YOY *Morone* (striped bass, white perch) and *Alosa* (alewife, blueback herring), samples collected during the first three sampling periods (River Runs 1 through 3) for the 1997 FSS program were preserved with 10 percent formalin at the time of collection and returned to the laboratory for analysis. Before preservation, samples were examined for fish

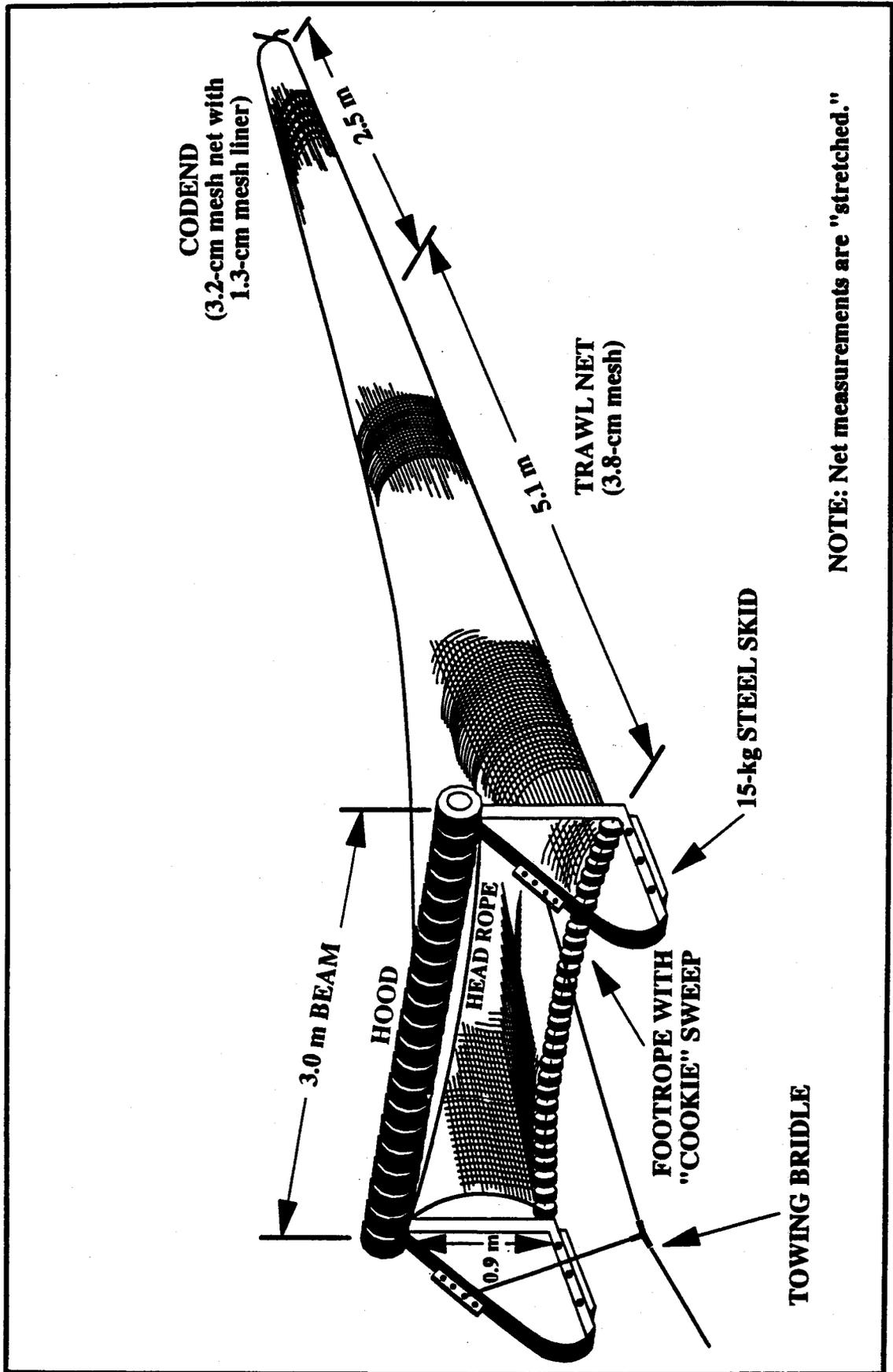


Figure 2-8. Design and dimensions of the 3.0-m beam trawl.

TABLE 2-7 SUMMARY OF 1997 SAMPLE COLLECTION BY RIVER REGION AND STRATUM FOR THE FALL SHOALS SURVEY

Region	15-Week Period from 7 JUL to 17 OCT						5-Week Period from 27 OCT to 28 NOV					
	Shoal		Channel		Bottom		Shoal		Channel		Bottom	
	Beam	Tucker	Tucker	Tucker	Beam	Total	Beam	Tucker	Tucker	Tucker	Beam	Total
Battery	--	--	49	64	113	--	--	--	--	24	24	
Yonkers	16	16	48	64	144	11	--	--	--	23	34	
Tappan Zee	48	48	48	48	192	11	--	--	--	20	31	
Croton-Haverstraw	40	40	48	48	176	15	--	--	--	18	33	
Indian Point	32	32	56	56	176	15	--	--	--	30	45	
West Point	--	--	96	80	176	--	--	--	--	24	24	
Cornwall	40	40	48	48	176	10	--	--	--	20	30	
Poughkeepsie	--	--	88	87	175	--	--	--	--	20	20	
Hyde Park	--	--	48	65	113	--	--	--	--	20	20	
Kingston	--	--	48	32	80	--	--	--	--	16	16	
Saugerties	--	--	16	32	48	--	--	--	--	20	20	
Catskill	--	--	25	24	49	--	--	--	--	20	20	
Albany	--	--	32	32	64	--	--	--	--	16	16	
<b>Total</b>	<b>176</b>	<b>176</b>	<b>650</b>	<b>680</b>	<b>1682</b>	<b>62</b>	<b>--</b>	<b>--</b>	<b>--</b>	<b>271</b>	<b>333</b>	

NOTE: Dashes (--) indicate no sampling scheduled.

**TABLE 2-8 SPECIFICATIONS OF SAMPLING GEAR USED DURING THE 1997 FALL SHOALS SURVEY**

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**1.0-m<sup>2</sup> Tucker Trawl**

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<b>Length</b>	<b>8.0 m</b>
<b>Mouth (width)</b>	<b>1.0 m</b>
<b>Mesh size</b>	<b>3.0 mm</b>

**Collection cage (codend)**

<b>Length</b>	<b>81 cm</b>
<b>Diameter</b>	<b>41 cm</b>
<b>Mesh size</b>	<b>3.0 mm</b>

**3.0-m Beam Trawl**

---

<b>Length</b>	<b>7.6 m</b>
<b>Beam width</b>	<b>3.0 m</b>
<b>Net body</b>	<b>3.8-cm mesh (stretch)</b>
<b>Codend</b>	<b>3.2-cm mesh (stretch) net with 1.3-cm mesh (stretch) liner</b>
<b>Hood</b>	<b>3.8-cm mesh (stretch)</b>
<b>Footrope</b>	<b>Equipped with 5.1-cm rollers</b>
<b>Headrope</b>	<b>Equipped with three floats</b>
<b>Mouth area</b>	<b>2.7 m<sup>2</sup></b>

determined to be yearling or older, based on length categorization; live fish were returned to the river after count data were determined.

Samples collected following the third biweekly sampling period were evaluated in the field; only fish required to fill length measurement and food habit quotas were returned to the laboratory. The quota was to be 20 specimens of a selected species from each river region per river run; because of the necessity of returning fish to the river alive, the first 20 specimens of a selected species were brought to the laboratory for length measurements. The Hyde Park through Albany regions were considered one region for the purpose of filling length measurement quotas during the entire FSS and during River Runs 4 through 10 of the BSS. Also for the BSS during River Runs 1 through 3, the Yonkers through West Point regions were considered as one region for the same purpose. In river regions where fewer than 10 samples were collected per survey, no more than 10 specimens of each selected species from an individual sample were used to fill the length measurement quota. This criterion was used in the following surveys by river region:

<u>Sampling Program</u>	<u>Region</u>
BSS	YK, IP, WP, CW, PK
FSS	WP, PK

In all other regions, when the sample schedule resulted in 10 or more samples per survey, no more than 5 specimens per species in a sample were used to fill the length measurement quotas. If more specimens of a species were collected than needed, the individuals used to fill the quotas were randomly selected.

All fish not returned to the laboratory were identified and enumerated into length classes as described in the following section. All Atlantic sturgeon, shortnose sturgeon, and striped bass were examined for external and internal magnetic tags. All sturgeon were measured to the nearest millimeter, weighed to the nearest gram, and, if alive, returned to the river or, if dead, frozen and saved for the NYSDEC. All striped bass with external streamer tags were measured and a scale sample was taken.

### 2.3.2 Laboratory Methods

Fish from the FSS in both the field and laboratory were identified and enumerated into the following length classes:

**Length Class 1**—Less than or equal to the YOY length limit ("Division 1"), which was obtained from the field contractor on a weekly basis for each species.

**Length Class 2**—Greater than Division 1 and less than or equal to the yearling length limit ("Division 2"); set at 150 mm for most species, also obtained weekly from the field contractor. From 1 January through 31 May, Division 2 represents the upper length limit for yearling fish for all species. From 1 June through 31 December, Division 2 is assigned a static value of 150 mm total length for all species except alewife, American shad, blueback herring, striped bass, Atlantic tomcod, and white perch. For these species, Division 2 is maintained as a dynamic upper length limit for yearling fish throughout the year.

**Length Class 3**—Greater than Division 2 and less than or equal to 250 mm.

**Length Class 4**—Greater than 250 mm.

Twenty specimens of the following selected species collected in each river region per river run were measured for total length (nearest millimeter) in the laboratory (except for sturgeon species which were measured in the field):

- Alewife
- American shad
- Atlantic sturgeon
- Atlantic tomcod
- Bay anchovy
- Blueback herring
- Shortnose sturgeon
- Spottail shiner
- Striped bass
- Weakfish
- White catfish
- White perch

## **2.4 BEACH SEINE SURVEY**

### **2.4.1 Field Methods**

The BSS utilized a 30.5-m bag beach seine to collect YOY fish in the shorezone of each region, except the Battery region. Table 2-9 presents specifications for the beach seine. One end of the net was held on shore and the other end was towed perpendicularly away from the shore by boat. The seine was then hauled, clockwise if possible, in a semicircular path toward shore. The complete tow swept an area of approximately 450 m<sup>2</sup> (TI 1981). All BSS samples were collected on a diurnal schedule during alternate weeks of the FSS.

The 1997 BSS biweekly sampling program was conducted from 16 June through 23 October (Figure 2-3). Ten of the 19 weeks in this time period were collection weeks with 100 beach seine samples per river run scheduled for collection. Allocation of the total number of samples by river region collected for the 1997 BSS are presented in Table 2-10. All of the scheduled 1,000 samples projected for collection in 1997 were collected.

Measurements of water temperature (°C), dissolved oxygen (mg/L), and specific conductance (microsieman/cm at 25°C) were taken with each beach seine sample. Physical/chemical measurements were taken 1 ft below the water surface and approximately 50 ft from the shoreline. During the 10 collection weeks of the 1996 BSS, 1,000 water quality samples were scheduled and 1,000 samples were actually collected.

YOY fishes collected during the first 4 beach seine river runs in 1997 were processed in the laboratory because of the difficulty in distinguishing species at the YOY life stage, adults were processed in the field. All samples collected following River Run 4 were field processed; 20 specimens of the selected species from each region per run were collected (as described in Section 2.3.1) for length determination in the laboratory. Samples maintained for laboratory analysis were preserved using 10 percent formalin. Fish from the BSS in both the field and laboratory were identified and enumerated into length classes as described in Section 2.3.2. All sturgeon collected during the BSS in 1997 were measured to the nearest 1 mm and weighed to the nearest 1 g. Fish that remained alive were returned to the Hudson River estuary; dead fish were frozen and held for NYSDEC. All sturgeon and striped bass were examined for external and internal magnetic tags. Striped bass with external tags were measured and a scale sample was taken.

### **2.4.2 Laboratory Methods**

All fish returned to the laboratory were measured for total length to the nearest 1.0 mm. Laboratory analysis was conducted in the same manner as described for samples collected during the FSS.