

Appendix VII:

Project Report:

*Using Observers to Monitor Status
of Atlantic Herring Spawning Stocks
and Groundfish Bycatch
in the Gulf of Maine*

(Maine Department of Marine Resources,
February 17, 1999)

U.S. DEPARTMENT OF COMMERCE

**National Oceanic and Atmospheric Administration
National Marine Fisheries Service
Fisheries Development and Utilization Program**

"Using Observers to Monitor Status of Atlantic Herring Spawning Stocks and Groundfish By-Catch in the Gulf of Maine"

**State of Maine
Project #96-NER-136
Award #NA76FD0101
Completion Report**

May 1 1997 - July 31 1998

**David K. Stevenson
Barb Scully**

**Maine Department of Marine Resources
Bureau of Resource Management
W. Boothbay Harbor, ME 04575**

February 17 1999

Introduction

Funds totaling \$71,220 were awarded to the Maine Department of Marine Resources in May 1997 from the U.S. Department of Commerce, National Oceanic and Atmospheric Administration, Fisheries Development and Utilization Research and Development Grants Program, to support a project entitled "Using observers to monitor status of Atlantic herring spawning stocks and groundfish by-catch in the Gulf of Maine." Funds were used to pay for sea sampling and for three months salary for a DMR Marine Resource Specialist to analyze data. The Maine DMR contributed one month's time for the Principal Investigator. Sea sampling services were provided by the Manomet Center for Conservation Sciences through a contract with the Maine DMR following the evaluation of two proposals, one from Manomet and another from a second firm with more limited sea sampling experience. The grant was originally awarded for a twelve month period, May 1 1997 to April 30 1998. A three month no-cost extension was requested in March 1998 which extended the termination date to July 31 1998.

Project Goals and Objectives

1. Provide the information necessary to determine if there is a by-catch problem in the Gulf of Maine mobile gear fishery.
2. Evaluate the feasibility of collecting information from commercial herring fishermen that could be used to assess the status of individual spawning stocks.

Objectives under the first goal were to collect by-catch data and determine what percentage of the catch made by purse seiners and mid-water trawlers was composed of groundfish and other species, and to analyze the data for spatial and temporal patterns. For the second one, the information collected by observers was to be evaluated in terms of its usefulness for resource assessment and management purposes. Also, the observers were expected to show fishermen how to collect detailed catch and effort and other information at sea that could be used for the same purposes.

Sea Sampling Operations and Data Collection Methods

Sea sampling services provided by Manomet included making all the arrangements needed to place trained observers aboard commercial herring fishing vessels, providing all the necessary data collection forms and equipment needed at sea, making sure that data collected at sea were complete and accurate, and for processing all sea sampling data into a computerized database that was transmitted to the Maine DMR for analysis. Manomet observers were also responsible for collecting samples at sea, freezing them on shore, and transporting them to the DMR Laboratory for processing. The Manomet project manager coordinated all sea sampling activities with the principal investigator who determined which boats to place observers on and when to do so. A primary objective of the data collection effort was to place an observer aboard the same vessel for up to five consecutive trips in a week's time (or as many trips as the vessel made in a week) so as to minimize the possibility that fishing practices would be changed when the observer was aboard. This has been a problem (or at least perceived as a problem) in other sea sampling projects when

For trawlers, a vessel trawl gear characteristics log describing the type, size and weight of the trawl doors, size of the net opening (while being towed), length of bridles, mesh size in the cod end, etc. For seiners, this information included the length of the floatline, leadline and purse line, and the length and depth of the seine.

A daily sighting log on which the observer noted when the sonar was turned on and off and any observations of marine mammals made during the trip (species, number of animals, animal behavior).

A purse seine and trawl haul log for each haul or set with important details concerning weather and sea state conditions, depth range, tow speed and length of wire out (for trawls), time and position of the vessel when the gear was set and hauled back, depth range of herring in the water column, the captain's estimate of the amount of herring brought aboard and discarded, the reason why it was discarded, and the observer's estimates of by-catch by species (based on the weight composition of a sub-sample of the catch) and the quantity of each species that was kept or discarded.

A length frequency log on which length measurements for samples of herring and any other species caught in significant numbers in a single set or tow were recorded.

All the information recorded on these forms was entered into several different databases by Manomet data entry specialists, sometimes in coded format. In addition, observers made hand written notes in a small notebook which described additional details about fishing practices and fish behavior observed during each trip. Photocopies of these notes were appended to copies of the forms for each trip and given to Maine DMR project personnel.

The amount of herring caught in each set or haul (including herring that were either discarded intentionally or escaped due to a gear malfunction) were based on the captain's estimate of what was removed from the net and put into the fish hold, or what was released or escaped from the net into the water. Herring fishermen are expert at estimating catches, a fact that was confirmed by comparing, on several occasions, the captain's "hail weight" for the trip with the quantity that was pumped out of the boat at the dock. Hail weights were consistently within 5% of the actual catch weight. The amount of each incidentally caught species in each haul or set was estimated by the observer who weighed all the fish of a given species in a single sub-sample of known weight that was removed at random from the catch and then applied the percentage of the total weight for that species to the total estimated catch weight.

Fishing effort for the mid-water trawlers was measured in terms of tow time (in hours and minutes). No attempt was made to estimate fishing power. Fishing time, even when "corrected" for net size, is a meaningless index of fishing effort for purse seiners since the amount of herring caught is strictly a function of the size of the school that is found. An attempt was made to define fishing effort for the purse seiners in terms of search time, but it proved impossible to distinguish search time from other activities such as steaming time to and from the fishing grounds when the boat's sonar and sounder were turned on soon after the boat left port. CPUE was estimated for individual purse seine vessels in terms of catch per set before and after adjusting for the volume of

One escaped unhurt from the seine and the other was discarded dead. Harbor and grey seals were frequently observed inside and outside seines, feeding on herring. In all cases, they were released unharmed. On at least one occasion, herring that were being chased by seals inside a seine were observed escaping out of the bottom of the net.

Results of the by-catch monitoring indicate that the herring fishery is a clean one. The only two species that showed up in the catches in significant quantities were dogfish and mackerel. In the 50 purse seine sets and 54 trawl tows that were monitored in this study, groundfish accounted for 0.05% of the total trawl catch and 0.0001% of the purse seine catch, and those percentages reflect small amounts of whiting, the only gadoid species present in any appreciable quantity in the catches (trawls only). It should be understood, however, that mid-water trawlers make about 800 trips a year, so that a sample of 27 trips only represents about 3.5% of all trips. Occasional catches of groundfish could occur in this fishery when a net gets too close to the bottom or when groundfish (particularly juveniles) rise up into mid-water. It would be a mistake to conclude from this study that there is no groundfish by-catch in mid-water gear (or purse seines). It is clear that whatever by-catch does occur in the herring fishery, it is the exception rather than the rule.

"Discards"

Although this was not one of the initial objectives of this project, observations of herring discards at sea were made and incorporated into the results of this study. The estimated quantity of any herring that were discarded or escaped and the reasons why were recorded in the trawl haul and purse seine set logs. Herring were caught, but not brought aboard, during 14 purse seine trips (16 sets) and 7 mid-water trawl trips (8 tows), or during 32% of all seine sets and 15% of all trawl tows (Tables 1-3). The total quantity of herring discarded by seiners was considerable, reaching 13% of the total catch (including by-catch). Herring escaped due to some problem with the gear on three occasions, accounting for another 5% of the total seine catch. Discards only accounted for 1% of the trawl catch. Most of the herring discarded by seiners occurred during August and September near Mt. Desert Rock (area 512), with additional amounts in area 513 in September and area 515 (Cashes Ledge) in April.

The most common reason why herring were discarded by purse seiners was that the vessel was too full to take any more fish (Table 6). Most of the herring discarded by seiners were released for this reason. This is fairly common, even though purse seiners often work together in the same area and transfer fish from one boat to another (to another seiner or to a "carrier" boat) when one boat has caught more than it can take aboard. Herring are discarded only when there is nowhere to put them. On one occasion, 50,000 lbs of juvenile herring (<20 cm in length) caught in a seine were released because they had no market value. Lack of market demand was never cited as a reason for releasing fish that were of marketable size. On another occasion, 105,000 lbs escaped from a seine when the "zipper line" on the bottom of the seine opened up and another time 100,000 lbs escaped when the floatline dropped underwater as the seine was being "dried up." Another time when dogfish were mixed with herring, the pumps clogged and 20,000 lbs of herring were released along with 50,000 lbs of dogfish.

size range of herring than trawls, with reduced variation between time/area groupings. Modes were commonly at 23-24 cm. Herring caught in trawls varied in size over a wider range and included more larger fish. Modal lengths tended to be higher (28-29 cm) in the summer, prior to spawning, and lower in the fall, winter, and spring. These results illustrate the importance of sampling catches from both gear types if length (or age) frequency data from sea sampling trips are to be used to characterize the size distribution of the population.

Usefulness of Sea Sampling Data for Stock Assessment Purposes

This project successfully demonstrated that observers can be used to collect useful information on by-catch and discards which is useful for management purposes. Catch per unit effort and size frequency information can be used to assess trends in resource abundance and for certain stock assessment models, but the results of this study clearly show that fishing effort must be estimated on a tow by tow or set by set basis and must include factors such as fishing power (for trawlers) and search time (for seiners), parameters that were not obtained in this study. The data collected in this fairly limited sampling of herring fishing trips were not sufficient to support a statistical analysis (multiple regression) of all the factors affecting catch rates. The best solution, given the variation from boat to boat shown in this study, is to track the performance of individual boats (and captains) from year to year, integrating over all fishing trips to all fishing grounds in broad areas such as the Gulf of Maine, Georges Bank, and southern New England, and differentiating between the summer-fall and winter-spring fisheries. If a few fishermen would volunteer to collect detailed catch and effort and size information, a great deal could be learned without sending observers to sea. Using fishermen to document by-catch would not be so easy since there would be questions asked about the reliability of the information.

Training Fishermen to Collect Sea Sampling Data

One of the objectives of this project was to use the observers to train the fishermen to collect catch and effort information and record other observations on the distribution, size and spawning condition of herring harvested at sea. A form was designed for this purpose and given to a number of fishermen, but nobody was interested in filling it out. There were several good reasons why this happened. First of all, much of the information requested was duplicative of information that fishermen are required to include in their vessel trip reports, so they couldn't understand why they should have to fill out two forms. Secondly, since this was a voluntary program, it was impossible to sustain the fishermen's interest once the observer was off the boat. DMR staff attempted to encourage fishermen to keep filling out the forms, but these efforts were abandoned after a couple of months in favor of a voluntary phone-in system which the fishermen are now using to report daily catches and fishing locations (but not haul by haul or set by set information). Compliance with this phone-in system was much better than with the catch and effort forms. Fishermen generally prefer making a phone call (especially to a toll free number) to writing information down on paper. Perhaps in the future a phone in system could be used to obtain more detailed catch and effort information from selected fishermen.

TABLE 2. PER HAUL HERRING CATCH AND BYCATCH BY MID-WATER TRAWLERS

TRIPID	VESSEL	DATESAIL	AREA	LOCATION	HAULNUM	HAULTIME	HERRKEPT	HERRDISC	BYCATCH
A05701	Boat2	8/13/97	513	Platts Bank	1	2.17	9,000	-	45
A05701	Boat2	8/13/97	513	Platts Bank	2	3.91	71,000	-	124
A05702	Boat2	8/14/97	513	Kettle Bottom	1	5.75	32,000	-	187
A05702	Boat2	8/14/97	513	Kettle Bottom	2	1.62	10,000	-	48
A98701	Boat2	8/23/97	515	Cashes Ledge	1	6.67	45,000	-	251
A98702	Boat2	8/24/97	513	Jeffreys Ledge	1	1.25	-	20	310
A98702	Boat2	8/24/97	513	Jeffreys Ledge	2	5.33	30,000	-	65
A98703	Boat2	8/25/97	513	Kettle Bottom	1	4.09	35,000	-	97
A98703	Boat2	8/25/97	513	Kettle Bottom	2	4.84	75,000	-	133
D03701	Boat2	1/15/98	539	Block Island Sound	1	2.43	60,000	-	30
D03702	Boat2	1/18/98	539	SW Block Island	1	2.79	30,000	-	381
D03702	Boat2	1/18/98	539	SW Block Island	2	3.22	35,000	-	160
D03703	Boat2	1/19/98	539	E Side Block Island	1	2.15	20,000	-	15,022
D03703	Boat2	1/19/98	539	E Side Block Island	2	3.33	60,000	-	50
D03703	Boat2	1/19/98	539	E Side Block Island	3	2.25	40,000	-	482
D03704	Boat2	1/27/98	539	S of Block Island	1	4.53	145,000	-	5,145
D03704	Boat2	1/27/98	539	S of Block Island	2	1.05	5,500	-	665
D03705	Boat2	1/30/98	539	S of Block Island	1	2.60	24,000	-	1,216
D03705	Boat2	1/30/98	539	S of Block Island	2	5.00	40,000	-	762
A53705	Boat6	8/19/97	513	Jeffreys Ledge	1	1.87	180,000	-	-
A53705	Boat6	8/19/97	513	Jeffreys Ledge	2	3.25	50,000	-	-
A53706	Boat6	8/20/97	513	Jeffreys Ledge	1	2.08	20,000	-	25
A53706	Boat6	8/20/97	513	Jeffreys Ledge	2	3.25	40,000	-	25
A53707	Boat6	8/22/97	513	Jeffreys Ledge	1	3.80	140,000	100	200
A53708	Boat6	8/23/97	514	Jeffreys Ledge	1	2.60	130,000	-	75
A53708	Boat6	8/23/97	514	Jeffreys Ledge	2	2.25	30,000	-	50
A53709	Boat6	8/24/97	513	Jeffreys Ledge	1	0.67	-	4,000	-
A53709	Boat6	8/24/97	513	Jeffreys Ledge	2	2.58	-	-	-
A53713	Boat6	10/10/97	521	BB Buoy	1	2.35	-	7,000	450
A53713	Boat6	10/10/97	521	BB Buoy	2	4.20	75,000	-	653
A53713	Boat6	10/10/97	521	BB Buoy	3	1.71	-	6,000	2,400
A53713	Boat6	10/10/97	521	BB Buoy	4	1.70	-	-	-
A53713	Boat6	10/10/97	521	BB Buoy	5	2.30	-	6,000	50
A53714	Boat6	10/13/97	561	Georges Bank	1	3.91	45,000	-	-
A53714	Boat6	10/13/97	561	Georges Bank	2	7.89	160,000	-	50
A53714	Boat6	10/13/97	561	Georges Bank	3	5.20	195,000	-	-
D07701	Boat6	5/30/98	513	Jeffreys Ledge	1	5.67	20,000	4,000	2,600
D07701	Boat6	5/30/98	513	Jeffreys Ledge	2	2.58	55,000	-	805
D07701	Boat6	5/30/98	513	Jeffreys Ledge	3	3.92	25,000	-	1,400
D07702	Boat6	5/31/98	522	Cultivator Shoal	1	2.58	201,450	-	13,615
D07702	Boat6	5/31/98	522	Cultivator Shoal	2	3.42	232,320	19,360	8,557
D0703	Boat6	6/23/98	522	Cultivator Shoal	1	5.17	130,059	-	4,928
D0703	Boat6	6/23/98	522	Cultivator Shoal	2	0.58	-	-	-
D0703	Boat6	6/23/98	522	Cultivator Shoal	3	3.42	96,738	-	18,262
D07704	Boat6	6/30/98	522	Cultivator Shoal	1	8.92	136,281	-	13,939
D07704	Boat6	6/30/98	522	Cultivator Shoal	2	4.67	96,570	-	13,679
A53710	Boat3	10/1/97	513	Portland Head	1	6.29	180,000	-	60
A53711	Boat3	10/2/97	513	Portland Head	1	2.55	200,000	-	414
A53712	Boat3	10/3/97	513	Portland Head	1	2.10	10,000	-	10,000
A53715	Boat3	10/16/97	514	Thatchers Island	1	3.87	475,000	-	-
A53716	Boat3	10/18/97	514	Thatchers Island	1	3.54	205,000	-	-
A53716	Boat3	10/18/97	514	Thatchers Island	2	3.18	325,000	-	-
D03706	Boat3	2/3/98	613	SW Montauk, NY	1	3.97	220,000	-	500
D03706	Boat3	2/3/98	539	SW Montauk, NY	2	0.22	-	3,500	-

Table 4: Total Bycatch (lbs.) by Species and Gear			
Species Name	Purse seine	Trawl	Combined
ATLANTIC MACKEREL	1,052	98,171	99,223
SPINY DOGFISH	75,050	3,837	78,887
BLUEBACK HERRING		7,319	7,319
BLUEFIN TUNA	700	2,770	3,470
WHITING (SILVER HAKE)		2,224	2,224
STRIPED BASS		850	850
SQUID	289	497	786
BLUEFISH	250	312	562
BUTTERFISH		427	427
BLUE SHARK		310	310
HARBOR SEAL		300	300
THRESHER SHARK		250	250
MAKO SHARK	25	199	224
POLLOCK		168	168
PORBEAGLE SHARK		70	70
ATLANTIC MENHADEN		50	50
TORPEDO RAY		40	40
MONKFISH		37	37
LUMPFISH	10	17	27
ATLANTIC COD		19	19
OCEAN POUT		16	16
WHITE HAKE		11	11
SCULPIN	2	8	10
SEA RAVEN		4	4
SEA ROBIN		3	3
SKATE	2	1	3
SCUP		1	1
WINTER FLOUNDER		1	1
BYCATCH Total	77,380	117,910	195,290

		STATISTICAL AREA										TABLE 5 (CONT.)	
MID-WATER TRAWLS		511	512	513	514	515	521	522	539	561	613	TOTAL	
DATE	BYCATCH SPECIES												
Aug-97	ATLANTIC MACKEREL											4	
	SPINY DOGFISH			340	25	4						365	
	SQUID			74	100	5						179	
	BLUEFISH			12								12	
	SILVER HAKE			440		60						500	
	BLUE SHARK					310						310	
	POLLOCK					168						168	
	TORPEDO RAY			40								40	
	MONKFISH			22								22	
	LUMPFISH			17								17	
	ATLANTIC COD					8						8	
	WHITE HAKE			4		6						10	
	Aug-97 TOTAL	-	-	949	125	561	-	-	-	-	-	1,635	
Oct-97	ATLANTIC MACKEREL												
	SPINY DOGFISH			10,000						30		10,030	
	BLUEFIN TUNA			40								40	
	STRIPED BASS						2,400					2,400	
	SQUID						850					850	
	BLUEFISH			10						5		15	
	HARBOR SEAL						300					300	
	MAKO SHARK			300								300	
	ATLANTIC MENHADEN			74								74	
	MONKFISH			50								50	
	SEA ROBIN								15			15	
	Oct-97 TOTAL	-	-	10,474	-	-	3,553	-	-	50	-	14,077	
Jan-98	ATLANTIC MACKEREL												
	SPINY DOGFISH							17,790				17,790	
	BLUEBACK HERRING							132				132	
	WHITING (SILVER HAKE)							5,916				5,916	
	SQUID							4				4	
	BUTTERFISH							1				1	
								29				29	

TABLE 6. REASONS WHY HERRING ESCAPED CAPTURE OR WERE DISCARDED

Gear	TRIPID	DISCARD REASON						Grand Total
		42	43	44	48	49	50	
Seine	A05703				10000			10000
	A05704				5000			5000
	A05705					1000		1000
	A05707			50000				50000
	A53701				20000			20000
	A53702				10000			10000
	A53703						20000	20000
	A53718				20000			20000
	A72701		100000		100000			200000
	A72703				1000			1000
	M03701			2000	40000			42000
	M03702	105000						105000
	M03703				150000			150000
	M03704				100000			100000
Seine Total		105000	102000	50000	456000	1000	20000	734000
Trawl	A53707	100						100
	A53709					4000		4000
	A53713					19000		19000
	A98702					20		20
	D03706					3500		3500
	D07701						4000	4000
	D07702				19360			19360
trawl Total		100			19360	26250	4000	49980
		105100	102000	50000	475360	27520	24000	783980

	Percent total						
Seine	0.14	0.14	0.07	0.62	0.00	0.03	
Trawl	0.00	0.00	0.00	0.39	0.53	0.08	
Both gears	0.13	0.13	0.06	0.61	0.04	0.03	

Code

- 42 Gear damage prevented capture, fish escaped
- 43 Gear malfunction, fish escaped
- 44 No market value, fish discarded
- 48 Vessel capacity filled
- 49 Insufficient amount to pump aboard vessel
- 50 Pump clogged or otherwise malfunctioned

Table 8A. Catch per unit effort for five purse seine vessels participating in 1997-98 sea sampling study.

VESSEL	CATCH (LBS)	NO. SETS	LBS/SET	NET VOL	LBS/FM3
Boat 5	814,000	12	67,833	599.4	1,357
Boat 4	1,452,000	9	161,333	336.5	4,315
Boat 8	311,400	10	31,140	137.6	2,263
Boat 7	511,000	10	51,100	232.3	2,200
Boat 1	915,000	9	101,667	507.1	1,800

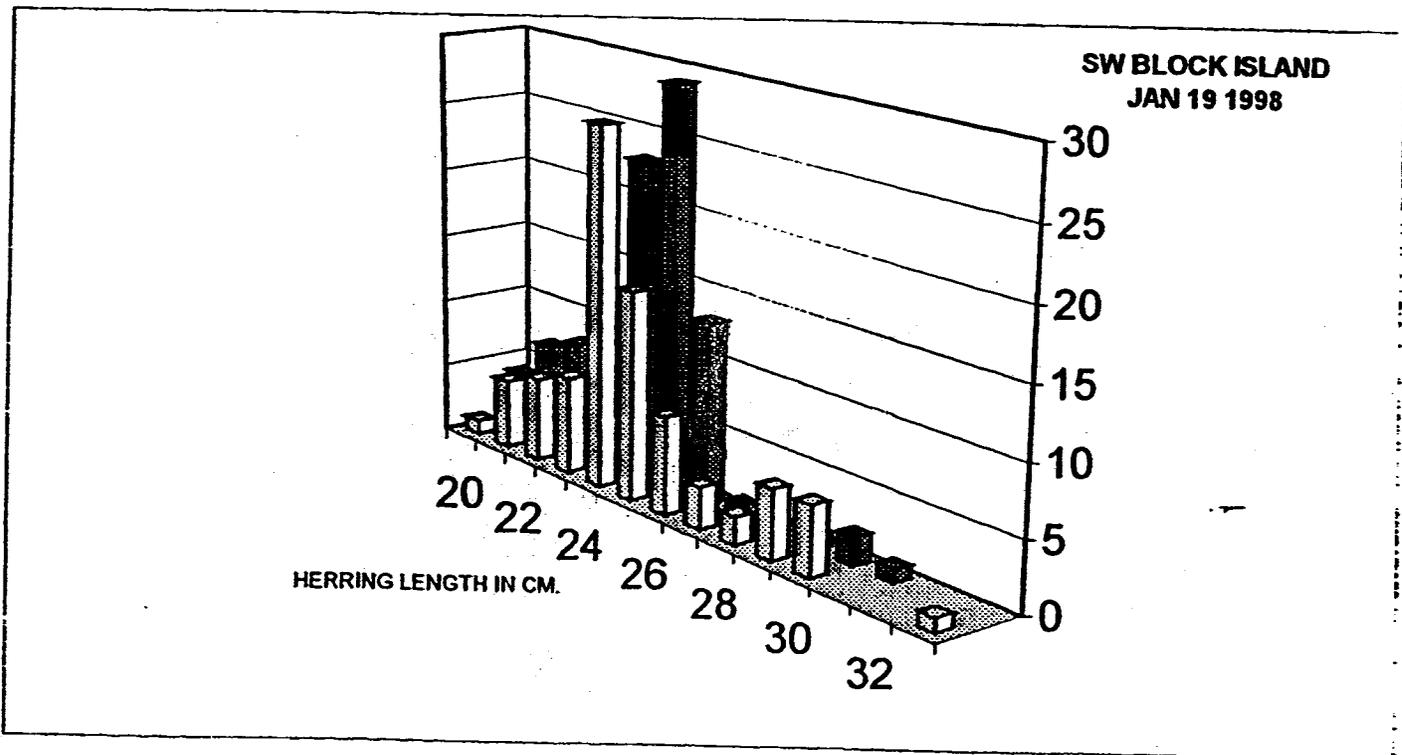
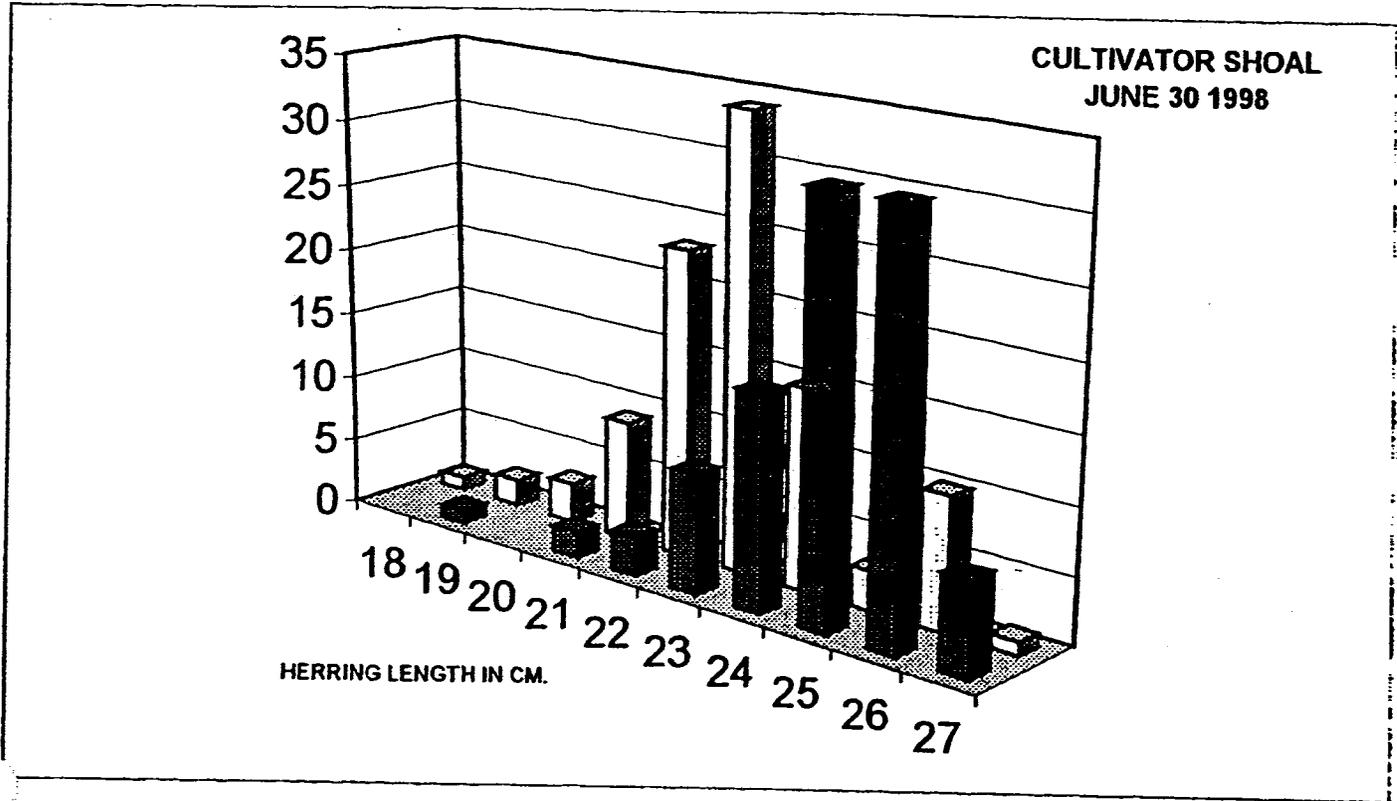
Table 8B. Catch per unit effort for two single boat mid-water trawlers participating in 1997-98 sea sampling study.

VESSEL	CATCH (LBS)	NO. TOWS	NO. TOW-HRS	LBS/TOW	LBS/TOW-HR
Boat 6	1,510,800	18	70.3	83,933	21,491
Boat 2	766,500	19	65.0	40,342	11,792

Table 8C. Catch per unit effort for two pair trawlers participating in 1997-98 sea sampling study.

VESSEL	CATCH (LBS)	NO. TOWS	NO. TOW-HRS	LBS/TOW	LBS/TOW-HR
Boat 3	1,618,500	8	25.7	202,312	62,976
Boat 6	594,100	9	22.3	66,011	26,641

FIGURE 2. LENGTHS OF HERRING CAUGHT IN CONSECUTIVE MID-WATER TRAWL TOWS



**FIGURE 4. LENGTH FREQUENCY ANALYSIS BY
MID-WATER TRAWL TRIP CLUSTERS**

