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GOVERNOR

STATE OF MAINE  
DEPARTMENT OF  
MARINE RESOURCES  
MARINE RESOURCES LABORATORY  
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11/18/99 FI 0022

GEORGE D. LAPOINTE  
COMMISSIONER

November 15, 1999

Harold C. Mears, Director  
State, Federal and Constituent Programs Office  
National Marine Fisheries Service  
One Blackburn Drive  
Gloucester, MA 01930

*Handwritten signatures:*  
Rick  
Bob  
Pete

Dear Harry,

Thank you for your kind comments on our most recent (01/01/98-12/31/98) Completion Report for Interjurisdictional Fisheries Resource Monitoring and Assessment, Project No. 3-IJ-143. Please allow me to respond to the comments and questions you had regarding some of the work on lobsters referenced in the report.

We have reported our observations on sexual maturity of V-notched females in several earlier reports (see attached report excerpts). Our sea sampling since 1986 has indicated that <20% of V-notched females are actually ovigerous in any given year. This is consistent from year to year. There is good agreement on proportion of V-notched females carrying eggs between our sea sampling and the results of the Maine Lobstermen's Association V-notch survey as reported by Daniel et al. (1989). The latter survey reported that only 18.1% of 7,860 V-notched females observed by fishers during 1982-84 were egg-bearing.

Our sea sampling has also indicated that the largest numbers of non-berried V-notched lobsters are within the first molt above legal size, where the majority of Gulf of Maine females have not reached sexual maturity. To further investigate this, since 1987 we have been using the ratio of abdominal width to carapace length to approximate maturity of V-notched females that are not ovigerous. As the enclosed information from previous annual reports has indicated, 25-34% of the nearly 5,000 non-berried V-notched observed were immature. The fact that a significant portion of the V-notched population is apparently not sexually mature merits consideration in assessment of the reproductive contribution of V-notched females.



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The ecosystem modeler under contract to the State of Maine is Dr. Daniel Campbell of the U.S. Environmental Protection Agency, Narragansett, RI. He is currently developing a model to evaluate the effects of management practices such as maximum legal size and V-notching on the lobster resource of coastal Maine.

Hopefully I have provided some insight relative to the areas referred to in the completion report. Please let us know if any further information is needed.

Sincerely,



Kevin H. Kelly  
Marine Resources Scientist

Reference cited:

Daniel, P.C., R.C. Bayer, and C. Waltz. 1989. Egg production of V-notched American lobsters (*Homarus americanus*) along coastal Maine. *Journal of Crustacean Biology*, 9(1): 77-82.



**MAINE DEPARTMENT OF MARINE RESOURCES**  
**LOBSTER STOCK ASSESSMENT PROJECT 3-IJ-102-1**

**COMPLETION REPORT**

**February 1, 1995 THROUGH February 29, 1996**

**by Jay S. Krouse**  
**and**  
**Norris C. Bowie,**  
**Kevin H. Kelly,**  
**Glenn E. Nutting,**  
**David B. Parkhurst, Jr.,**  
**Gary A. Robinson, Barbara C. Scully,**  
**Stuart W. Sherburne**



1.76 lbs./TH and 0.32 lb./THSOD. In 1995, CPUE values (lbs./TH, lbs./THSOD) by area were: Cape Porpoise (1.38, 0.21), Boothbay Harbor (1.09, 0.19), and Spruce Head (1.42, 0.34) (Figures 2-3). CPUE values declined in all locations between 1994 and 1995, with the exception of Spruce Head, where the lb./THSOD value of 0.34 was the highest of the 11-year sampling period.

A total of 205 berried females were observed during sea-sampling in 1995, of which 62.9% had a V-notch. The highest number of egg-bearing females for 1995 was at Spruce Head (n=86), followed by Cape Porpoise (n=64) and Boothbay Harbor (n=55). Highest catch rate of berried females was at Cape Porpoise (0.057 lobsters/TH), followed by Spruce Head (0.054 lobsters/TH) and Boothbay Harbor (0.030 lobsters/TH).

Of 512 V-notched lobsters observed in 1995, 25.2% were ovigerous. Boothbay Harbor had the largest number of V-notched females observed in 1995 (n=202). Cape Porpoise and Spruce Head had 179 and 131 V-notched lobsters, respectively. Catch rates of V-notched females were: Boothbay Harbor (0.111 lobsters/TH), Cape Porpoise (0.160 lobsters/TH) and Spruce Head (0.082 lobsters/TH). Condition of V-notch (whether notch was made before or after recent molt, and whether manmade or naturally-occurring) and width of second abdominal segment were recorded for all V-notched lobsters.

Shell condition data from our sea-sampling and research trap programs dating back to 1987 reveal almost all lobsters to be in a hardshell condition at the time of egg extrusion. Of nearly 2000 berried lobsters examined, only two were new shells, indicating

these lobsters had molted, mated, and extruded in the same season. Considering that most Maine female lobsters molt and mate about one yr. prior to spawning, the reproductive cycle occurs over a two yr. period.

With a two yrs. spawning schedule, sexually mature lobsters would bear eggs every other year. Thus, if all V-notched lobsters are mature, as most proponents of Maine's V-notch law believe, one would expect about half of the V-notched lobsters to be ovigerous. When in reality, only 25% of the V-notched lobsters caught in 1995 were berried and from 1985-1994 only 18% of 5,603 V-notched lobsters were carrying external eggs. This in itself shows that many notched lobsters are not yet capable of reproducing.

In addition to monitoring the incidence of expressed female maturity, we have continued to assess maturity of V-notched and/or ovigerous lobsters by relating abdominal width to carapace length. When a female matures, the tail disproportionately widens in order to accommodate the egg clutch. This morphological change has allowed us to render a cursory assessment of the reproductive potential of V-notched lobsters.

While sea-sampling in 1995 we observed 378 V-notched and 201 berried lobsters. Since 1987, when we first began to record second abdominal widths, a total of 1,628 ovigerous (Cape Porpoise, 540; Tenants Harbor/Spruce Head, 663; and Boothbay Harbor 425) and 4,953 non-berried V-notch lobsters (Cape Porpoise, 1,625; Tenants Harbor/Spruce Head, 1,377; and Boothbay Harbor, 1,951) have been measured.



A comparison of the scattergrams plotted for the abdominal width/ carapace length ratios (AW/CL) against CL of ovigerous and non-ovigerous V-notched lobsters for each sea-sampling location reveals marked differences (Figures 4 and 5). For example, only 2.3-5.0% of the berried females had  $AW/CL \leq 0.59$  while 27.8-36.7% of the non-berried V-notched females were  $\leq 0.59$ . Because, as indicated above, some mature females will have  $CW/CL \geq 0.59$ , we adjusted the percentages of non-berried  $< 0.60$  by subtracting the percentage of berried  $< 0.60$  for each location. The corrected values show that about 25.2, 27.3, and 34.4% of the V-notched females are immature at Cape Porpoise, Boothbay Harbor, and Tenants Harbor/Spruce Head, respectively. As discussed in previous reports, these spatial variations in maturity rates are largely related to coastwide differences in maturity schedules in conjunction with how lobsters become V-notched (whether a man-made or natural mark).

Although the incidence of immature V-notched lobsters still appears to be declining ever so slightly (refer to 1994 Annual Report), our data indicates as many as 1/4 to 1/3 of V-notched lobsters are immature. If the estimated rates of maturity are considered along with other factors influencing the conservation merit of the V-notch practice, the true benefit of this largely, industry embraced management measure becomes more in doubt. Some of those questions pertinent to a complete V-notch evaluation include:

- 1) What fraction of the berried V-notched lobsters spawn while protected by the V-notch law?
- 2) Considering the higher cull rate of V-notched lobsters, how does this affect reproductive capacity?
- 3) Understanding the aggressive nature of large female lobsters, does their protection via the V-notch significantly impact natural mortality?
- 4) What yield is lost through V-notch protection of nonspawners?
- 5) To what extent do industry members actively V-notch? Plans are presently underway to contract a population modeller for purposes of assessing the V-notch programs contribution to reproductive potential.

#### Bottom Temperature Monitoring (Kevin Kelly)

Sea bottom temperature was monitored at two sites off Boothbay Harbor, Maine, in 1995. Depths at the two locations were approximately 14 m (Spruce Point) and 27 m (Ram Island). Temperature monitoring began at these locations in 1989. A third station was located off the Department's laboratory dock, and has been monitored since 1991.

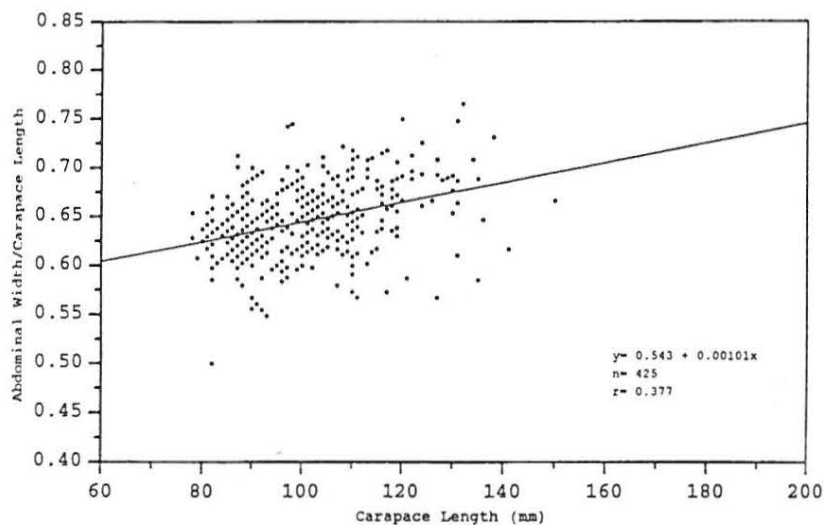
Temperatures were recorded at 2 hour intervals. Temperature sensors which had been put in place at each site in September 1994 were retrieved and replaced with newly-programmed units in October 1995. Data were transferred from the thermographs to a desktop PC for processing and analysis.

Ocean bottom temperatures in 1995 were generally higher than the combined average of the previous five years (Figure 6).

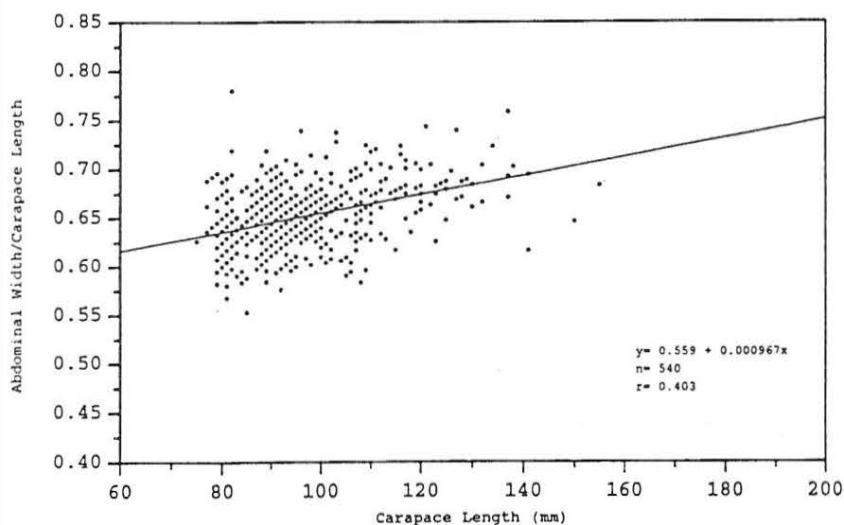


53  
Figure 4. Relationship between width of second abdominal segment and carapace length for ovigerous lobsters caught while sea-sampling at three different areas along the Maine coast, 1987-95.

Boothbay Harbor  
Berried Females  
1987 - 1995



Cape Porpoise  
Berried Females  
1987 - 1995



Tenants Harbor/Spruce Head  
Berried Females  
1987 - 1995

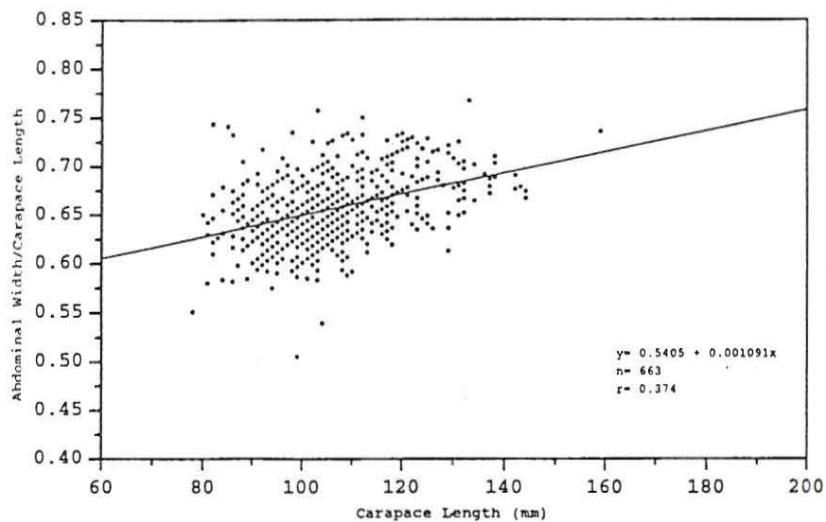
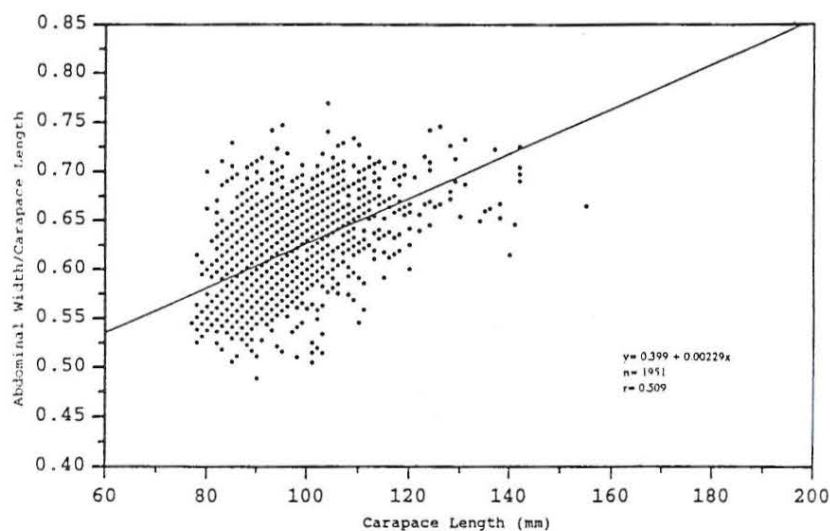
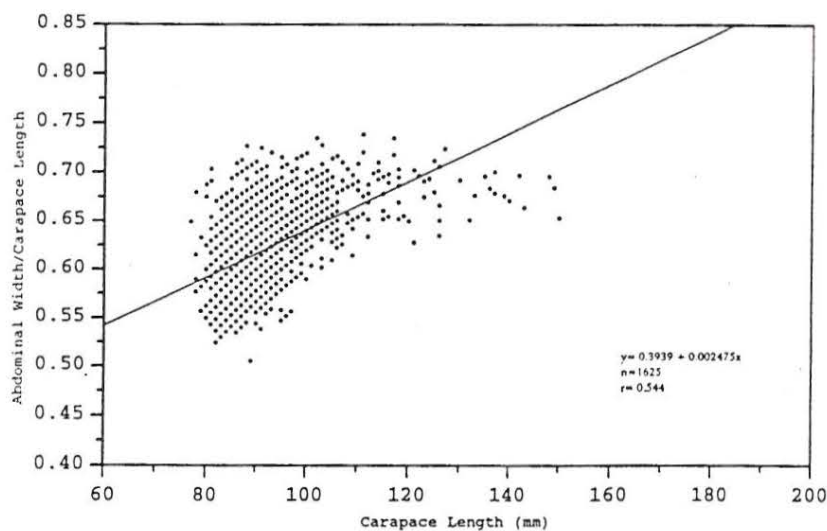


Figure 5. Relationship between width of second abdominal segment and carapace length for non-ovigerous V-notched female lobsters caught while sea-sampling at three different areas along the Maine coast, 1987-95.

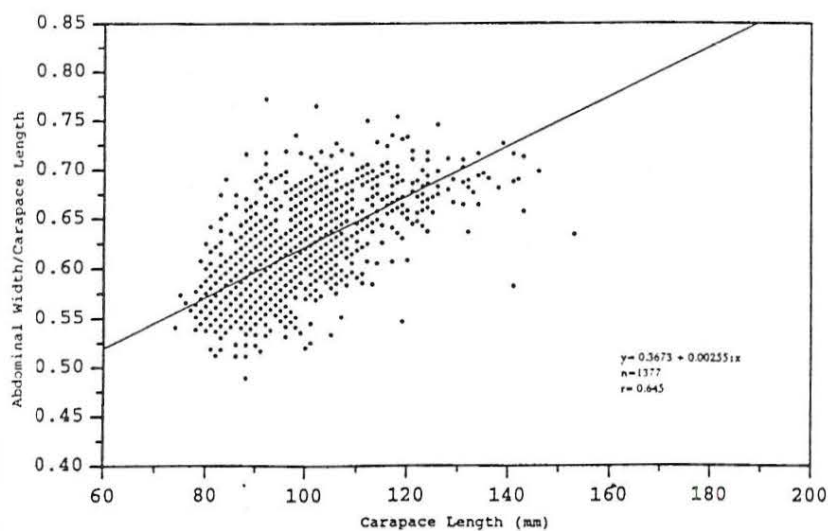
Boothbay Harbor  
V-Notched Females  
1987 - 1995



Cape Porpoise  
V-Notched Females  
1987 - 1995



Tenants Harbor/Spruce Head  
V-Notched Females  
1987 - 1995





MAINE DEPARTMENT OF MARINE RESOURCES  
LOBSTER STOCK ASSESSMENT PROJECT 3-IJ-61-3

COMPLETION REPORT  
APRIL 1, 1992 THROUGH JANUARY 31, 1995

by Jay S. Krouse  
and  
Norris C. Bowie,  
Kevin H. Kelly,  
Glenn E. Nutting,  
David B. Parkhurst, Jr.,  
Gary A. Robinson, Barbara C. Scully

years were high, the elevated 1994 CPUE's reflected that year's very high lobster catch.

There were 394 V-notched females encountered in 1994, and of these 22.3% were egg-bearing (Table 17). The highest number of V-notched females was seen at Tenants Harbor/Spruce Head ( $n = 165$ ). Cape Porpoise and Boothbay Harbor had 147 and 82 V-notched females, respectively. Catch rates of V-notched females were: Cape Porpoise (0.161 lobsters/TH), Boothbay Harbor (0.102/TH) and Tenants Harbor/Spruce Head (0.101/TH).

Of all ovigerous females seen in 1994 ( $n = 169$ ), 52.1% were V-notched. The largest number of berried females for the year was recorded at Tenants Harbor/Spruce Head ( $n = 108$ ), followed by Cape Porpoise ( $n = 52$ ) and Boothbay Harbor ( $n = 9$ ). Highest catch rate of berried females was at Tenants Harbor/Spruce Head (0.066 lobsters/TH). This was followed by Cape Porpoise (0.057/TH) and Boothbay Harbor (0.011/TH). The very low number from Boothbay Harbor likely reflected the absence and/or short duration of sea-sampling trips from this area during times when many eggers are usually seen i.e., July, October and November.

If all V-notched lobsters were sexually mature as many advocates of Maine's V-notch law contend, one would expect, assuming a two year reproductive cycle, about 50% of the notched females to be ovigerous. When in fact, from 1992 through 1994, only 22.8 to 25.4% of the notched females were egg-bearing. To further assess the V-notch practice's contribution to reproductive potential, we have examined the width of female lobsters second



abdominal segment. Since Templeman (1935) first observed that the relative width of a female's abdomen increased with the onset of maturity, several investigators have developed maturity indices on the basis of this morphometric change.

Accordingly, for purposes of approximating the incidence of maturity amongst V-notched females, we compared the abdominal width/ carapace length (AW/CL) ratios of ovigerous and V-notched females observed during sea-sampling trips from 1987 through 1994. During this eight year period we have measured a total of 1,440 ovigerous (Cape Porpoise, 478; Boothbay Harbor, 376; and Spruce Head/ Tenants Harbor 586) and 4,598 V-notched lobsters (Cape Porpoise, 1,485; Boothbay Harbor, 1,822; and Spruce Head/ Tenants Harbor, 1,291).

If we first examine the AW/CL ratios plotted against CL for ovigerous lobster, we will notice few mature females (1.7-4.8%) with ratios less than 0.60 (Fig. 4). Whereas, plots of the same ratios for non-berried V-notched lobster reveal considerably more females (27.2-37.1%) with ratios under 0.60 (Fig. 5). These values were then adjusted by subtracting the percentage of berried females with AW/CL <0.60 for each of the three sampling areas. The results indicated that about 26, 27, and 35% of the V-notched females at Cape Porpoise, Boothbay Harbor, and Tenants Harbor/ Spruce Head, respectively, would be immature. As noted in previous reports, the areal differences in the incidence of immature V-notched lobster, which increased from west to east, is related to geographical variations in size at maturity in association with how a lobster

acquires a V-notched or mutilated tail flipper (refer to 1991 Annual Report for more detailed account).

Apart from these spatial disparities which remained rather consistent from 1987 through 1994, there has been a downward trend in the relative abundance of immature V-notched females since 1991, particularly at Boothbay Harbor and Cape Porpoise (Fig. 6). Average percentages of occurrence declined during 1987-90 from 32.6-36.9% to 23.7-19.7% in 1991-94 at Cape Porpoise and Boothbay Harbor, respectively (Table 18). While at Tenants Harbor/Spruce Head, the most eastern sampling area, immature indices, which were generally high, dropped from 48.0 to 34.0% over the same time periods.

A change in the DMR Bureau of Marine Patrol's V-notch policy in 1992, may be partly responsible for the decline in immature V-notched lobsters. The V-notch definition was revised for purposes of reducing the measure's subjectivity, subsequently unless the notch is a straight-sided triangular cut at least 1/8 in. deep or a mutilation a minimum depth of 1/4 in., the lobster can be harvested. This revision has voided legal protection for many of those lobsters with questionable notches/mutilations, thereby reducing the number of immature lobster once protected by the V-notch law.

Another factor possibly contributing to the apparent reduction in immature V-notched lobsters could be the minimum size increases of 1988-89. Understanding that fishers are not likely to notch undersized lobsters and the recent gauge increase has enhanced the

broodstock; intuitively, we can conclude that there are now fewer legal-size immature females eligible for V-notching.

In spite of these recent declines in immature females, which may be on the increase as indicated by the higher 1994 values (Fig. 6), clearly as many as one third of all V-notched females found in Maine waters are not sexually mature. This information contradicts a commonly held belief that all V-notched lobsters are "proven breeders". If we also consider that many mature females only become V-notched subsequent to egg extrusion, the true benefit of the V-notch program as a conservation measure is in question.

Apart from any contribution V-notching makes toward broodstock enhancement, one must consider any costs associated with the notching program. For instance, recognizing that many V-notched females are not mature and therefore not likely to ever spawn while protected by the V-notch statute, clearly the removal of these females from the harvestable component of the resource negatively impacts yield. Moreover, competition for food and shelter by these immature females will also come at a price to the resource (higher cull and natural mortality rates). Another factor to consider is the extent of the potentially damaging behavior of large V-notched females. Large sexually mature females are well-known for their aggressiveness toward smaller conspecifics, particularly during the molting season. While hauling our research traps and riding aboard commercial lobster boats, we have often found solitary large V-notched females in traps with maimed lobsters or only their remains.



Although V-notching dates back to 1948 in Maine, the pros and cons of this practice as a conservation measure have yet to be completely evaluated. Until the cost of V-notching can be weighed against any gain in egg production, we would urge fishery managers to consider adoption of alternative measures. For example, even though some industry members and a few academic scientists have opposed any minimum size increase, if the minimum size were increased so as to afford adequate broodstock protection, there would be no need for the questionable V-notch program.

#### Bottom Temperature Monitoring (Kevin Kelly)

The nearshore sea bottom temperature monitoring program, which began in 1989, continued through the current year. Among the objectives in collecting this information is to evaluate physical characteristics of lobster habitat in the nearshore zone, including study of the relation between temperature and molting.

Bottom temperatures were continuously monitored at two sites off Boothbay Harbor during 1994. Thermographs at these two sites were located at depths of approximately 45 ft. (Spruce Point) and 90 ft. (Ram Island). In addition, bottom temperatures were recorded at the DMR laboratory dock in Boothbay Harbor. The recorders were programmed to read temperature at 2 hour intervals. In September 1994, SCUBA divers retrieved the thermographs at the two deep sites and replaced them with newly-programmed units.

Ocean bottom temperatures in 1994 were markedly higher than in 1993, except for January and February (Figs. 7-8). January and February bottom temperatures were similar between the two years.

Table 18. Annual occurrence (%) of immature V-notched female lobsters observed while sea-sampling, 1987-94. Total number of V-notched lobsters are in parentheses.

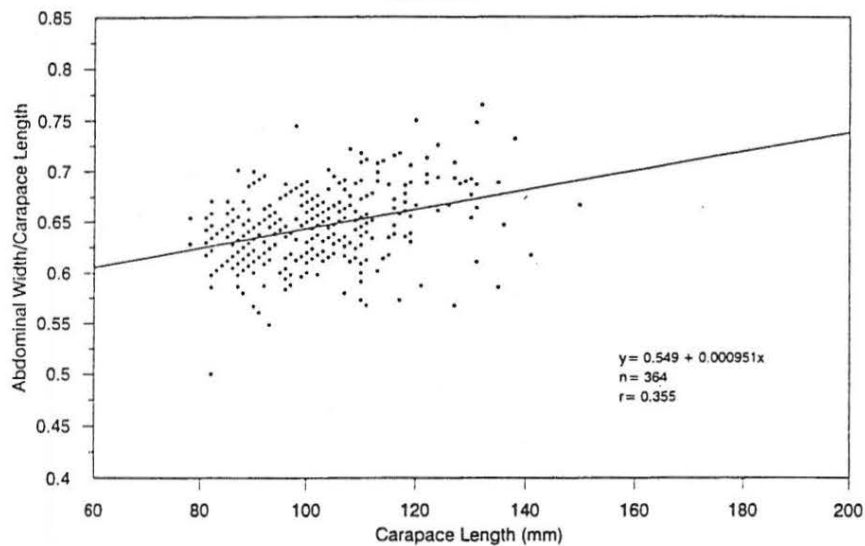
| Area                        | Year          |               |               |               |               |               |               |               |
|-----------------------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|
|                             | 1987          | 1988          | 1989          | 1990          | 1991          | 1992          | 1993          | 1994          |
| Cape Porpoise               | 26.4<br>(218) | 36.2<br>(152) | 32.1<br>(283) | 35.8<br>(283) | 26.9<br>(226) | 17.7<br>(131) | 18.1<br>(73)  | 32.1<br>(119) |
| Boothbay Harbor             | 42.3<br>(319) | 30.6<br>(342) | 37.6<br>(296) | 37.1<br>(203) | 26.4<br>(194) | 29.2<br>(220) | 14.2<br>(171) | 9.0<br>(77)   |
| Tenants Hbr/<br>Spruce Head | 43.4<br>(96)  | 43.5<br>(79)  | 62.1<br>(155) | 43.1<br>(279) | 39.3<br>(196) | 30.1<br>(182) | 29.8<br>(196) | 36.7<br>(108) |

Figure 4. Relationship between width of second abdominal segment and carapace length for ovigerous lobsters caught while sea-sampling at three different areas along the Maine coast, 1987-94.

Boothbay Harbor

Berried Females

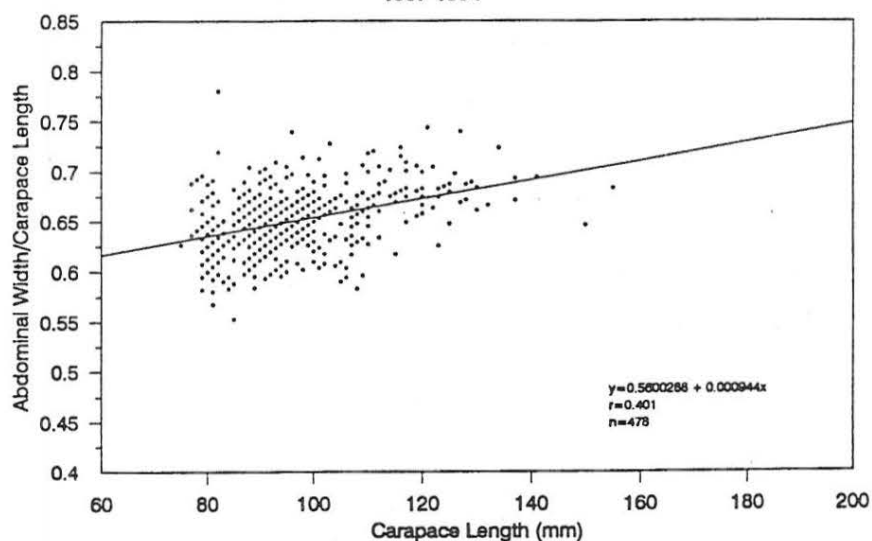
1987-1994



Cape Porpoise

Berried Females

1987-1994



Tenants Harbor/Sprucehead

Berried Females

1987-1994

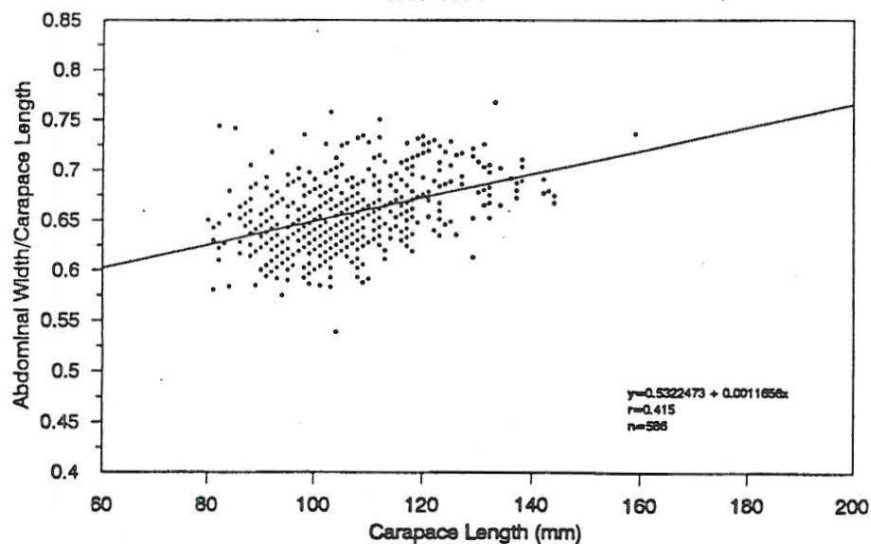
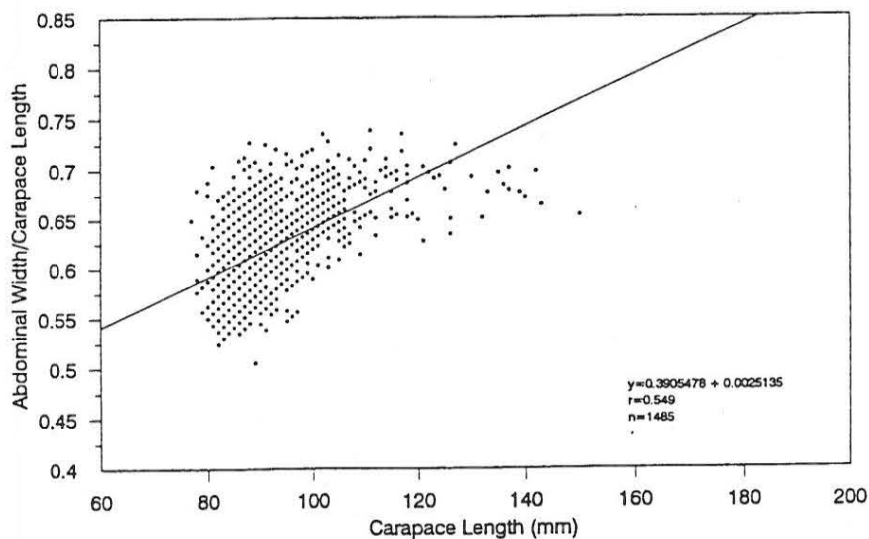


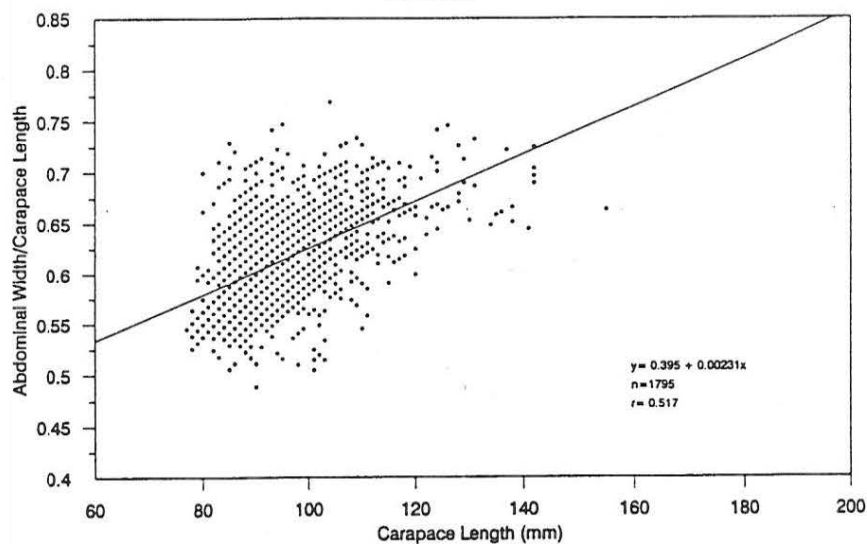


Figure 5. Relationship between width of second abdominal segment and carapace length for non-ovigerous V-notched female lobsters caught while sea-sampling at three different areas along the Maine coast, 1987-94.

**Cape Porpoise**  
**V-Notched Females**  
1987-1994



**Boothbay Harbor**  
**V-Notched Females**  
1987-1994



**Tenants Harbor/Sprucehead**  
**V-Notched Females**  
1987-1994

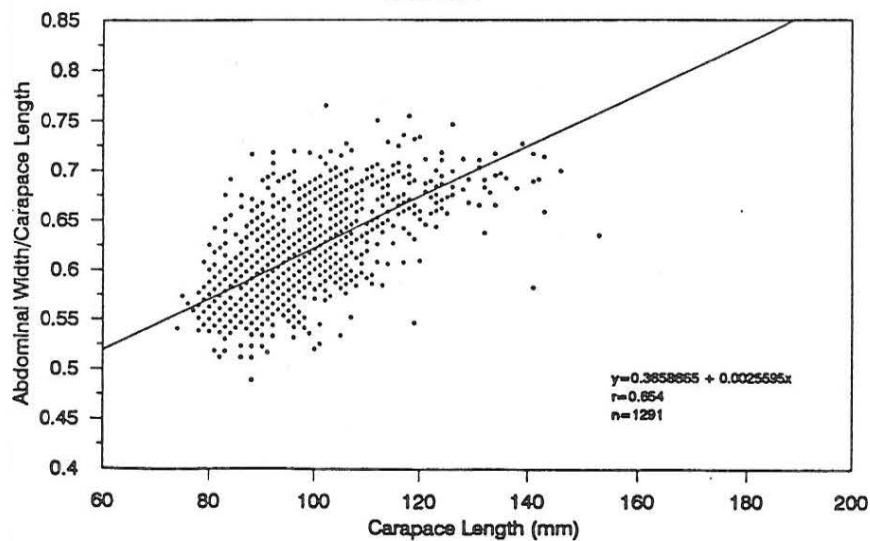
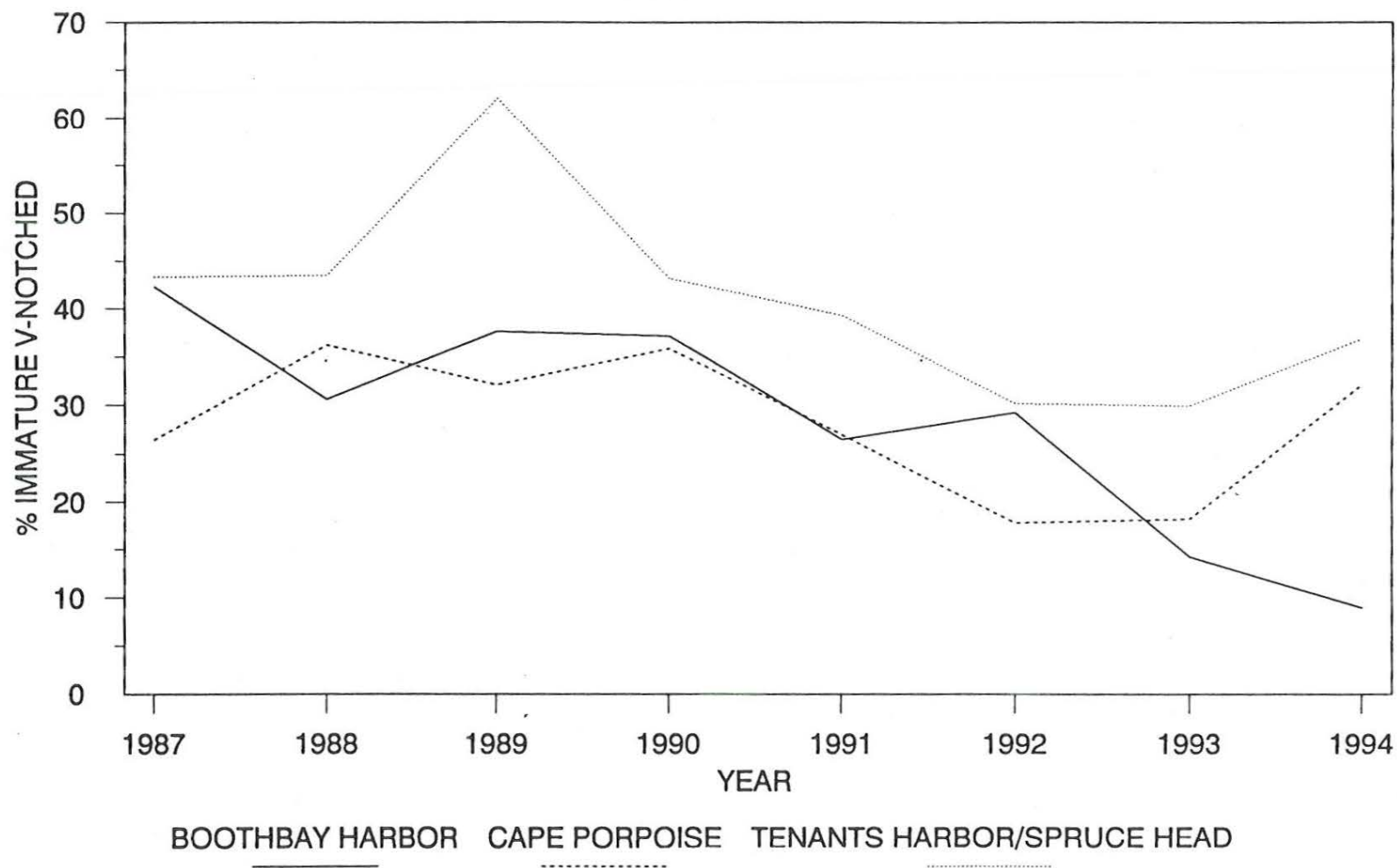


Figure 6. Annual occurrence of immature V-notched female lobsters observed while sea-sampling, 1987-94.

## IMMATURE V-NOTCHED LOBSTERS 1987-1994



UNITED STATES  
DEPARTMENT OF COMMERCE  
National Oceanic and Atmospheric Administration  
National Marine Fisheries Service  
Northeast Region  
State, Federal & Constituent Programs Office



**COMPLETION REPORT**

Grantee: MAINE DEPARTMENT OF MARINE RESOURCES

Project No: 3-IJ-143

Grant No: NA86FI0022

Project Title: INTERJURISDICTIONAL FISHERIES RESOURCE MONITORING  
AND ASSESSMENT

Period Covered: 01/01/98 - 12/31/98

Prepared by: \_\_\_\_\_

Approved by: JEAN CHENOWETH

Date: APRIL 26, 1999

Statutory Funding Authority: Anadromous Fish Conservation Act  
(P.L. 89-304)

- ☐ Chesapeake Bay Studies
- ☐ Endangered Species Act
- ☒ Interjurisdictional Fisheries Act  
(Title III of P.L. 99-659)
- ☐ Magnuson Act
- ☐ Oyster Disease Research
- ☐ Saltonstall-Kennedy
- ☐ Unallied Industry Projects
- ☐ Unallied Science Projects
- ☐ ACFCMA
- ☐ Unallied Management Projects



**UNITED STATES  
DEPARTMENT OF COMMERCE**

**National Oceanic and Atmospheric Administration  
National Marine Fisheries Service  
State, Federal and Constituent Program Division**

**Completion Report  
Interjurisdictional Fisheries Resource Monitoring and Assessment**

**State: Maine  
Project No. 3-IJ-143  
Grant No. NA86FI0022**

**January 1, 1998 - December 31, 1998**

**Maine Department of Marine Resources  
21 State House Station  
Augusta, ME 04333**

**April 22, 1999**

HERRING

## HERRING

### **Resource Monitoring**

#### Sample processing and ageing

A total of 9,136 herring were processed in 1998, 40% from fishing trips made in 1997 and 60% from 1998 trips (Table 1). Otoliths were removed from 2,548 fish for ageing purposes. Processing and ageing of the 1997 samples was completed in May. Fewer fish and otoliths were processed in 1998 than in 1997 when extra samples were collected by observers assigned to a by-catch study (Stevenson and Scully 1999). The number of herring processed in 1998 increased by 37% compared to 1996 and the number of otoliths that were aged increased by 29%. Length, weight, and age data generated from the 1997 samples were used to estimate the numbers of herring caught at age by month, gear type, and fishing area for stock assessment purposes (see Resource Assessment); the 1998 data will be used for the same purpose once all the 1998 samples and otoliths are processed.

#### Spawning closures

Examination of adult herring caught in the central Maine coastal area during the 1997 spawning closures revealed that 45% of the adults in the samples were in spawning condition, a proportion that exceeded the allowable tolerance of 25% in the state's spawning closure regulations. In previous years, samples taken from purse seiners operating in the same area at the same time of year showed that the catch was almost exclusively made up of juveniles. Based on this information, the Maine Department of Marine Resources revised its herring spawning closure regulations in 1998 to make enforcement more effective by eliminating individual closed areas and closure dates and extending the prohibition on the landing of spawn herring (subject to a 20% tolerance) caught anywhere in ASMFC management area 1 over a three month period (August-October) instead of the pre-existing five week time periods. At the same time, a spawn herring was re-defined to include only males or females in maturity stages IV, V and VI (stage III fish, which are in a very early developmental stage, were eliminated). These changes to the state's regulations eliminated the need to monitor changes in the gonadosomatic index (GSI) of adult herring for the purpose of closing individual areas on a date when a certain percentage of the females reached a pre-determined mean GSI. Project personnel worked closely with the Bureau of Marine Patrol in developing the new regulations and a protocol that was used to collect and examine samples taken from fishing vessels that continued to fish (for juveniles and spent adults) during the restricted period. Marine Patrol officers were trained in sample collection and processing procedures, especially in how to distinguish spawning herring from non-spawning herring.

#### Voluntary catch reporting

Another new project activity in 1998 was the implementation of a voluntary automated call-in system (FishFone) that was used by the fishermen to report catches and fishing



locations on a daily basis. Reports were received from nine different vessels between April and December that were operating in eight different statistical areas in the Gulf of Maine, east of Cape Cod, and on Georges Bank (Table 2, Figure 1). The total reported catch was 27,464 metric tons and was almost equally divided between purse seiners and mid-water trawlers. The total reported catch for management area 1A (statistical areas 511-514) was 19,867 mt and represented about 50% of the total catch from that area in 1998. Most of the unreported portion of the catch was landed in Gloucester. A mandatory call-in system is included in the New England Fishery Management Council's Herring Fishery Management Plan which is expected to be approved in 1999. Once a mandatory call-in system is in place for the entire fishery, FishFone will be terminated.

#### Landings data

Landings reports received from Maine canneries and bait dealers during 1998 were processed as they arrived at the DMR laboratory and the data entered into Dbase files. This information was combined with vessel trip report data from the NMFS and a master database of 1997 catch data was created that eliminated any missing or incorrect data in either primary database. Total 1997 Maine landings data were summarized by month, fishing area, and gear type in an annual report (Appendix A) that was completed in March 1998. This report was made available at the 1998 Fisherman's Forum and mailed to herring industry members and other interested parties throughout New England. Landings and catch data were also made available to the ASMFC and NEFMC Atlantic Herring Plan Development Team to be included in the Fishery Management Plans that were developed by both organizations during 1998.

#### Historical data analysis

Herring sample data were gathered from various sources for the years 1960 through 1997. Up until 1987 the data were entered and stored on tape at the NMFS Science Center in Woods Hole. Since 1988 sample data have been entered and stored at the DMR laboratory. The data tapes at the Science Center were not upgraded when tape and computer systems were changed and subsequently the data could not be readily accessed from those tapes. Fortunately a copy of the complete data was found on tape at the University of Maine in Orono. The data that were downloaded from tape was in columnar text form and the format had been changed throughout the time period. While checking for errors in the data it became apparent that after the data was first entered into its electronic form it had not been checked for transcribing errors. Typical errors included multiple duplicate sample and record entries, sample and record omissions, incorrect sample numbers, dates, locations, and errors in all of the biological variables. There was also only one column allotted for the age field resulting in an incorrect entry for ages greater than nine. A search of agencies and personnel yielded no correct electronic version of these data. On checking of subsequent analysis (e.g. weight at age used in the assessments) it is presumed that from 1960 these data have been treated as the original data. In order to correct this problem a number of programs were written and applied to the data to help identify and correct these problems. The original sample data sheets were

requested from the Maine State Archives and all the problem electronic records were corrected. The present sample database comprises a period of 38 years or 10,441 catch samples consisting of over 650,000 fish.

## **Resource Assessment and Management**

### 1997 catch at age

1997 catch at age estimates were derived from sample data and catch statistics for different fishing areas in the Gulf of Maine, southern New England and the mid-Atlantic area, and Georges Bank using age-length keys and mean weight data from the sample database. The results (Figure 2) show that young adults (age 3) belonging to the 1994 year class dominated the catch in all areas. Older adults (particularly six and seven year olds) were caught primarily in southern New England and the mid-Atlantic region and on Jeffreys Ledge. Overall, the 1994 year class accounted for 48% of the total catch compared to only 12% in 1996 and 1995 (Table 3).

### Virtual population analysis (VPA)

Catch at age, mean weight at age, and percent maturity at age estimates for 1995, 1996 and 1997 were incorporated into an up-dated virtual population analysis of the Atlantic coastal stock complex of herring that was presented to the Stock Assessment Review Committee of the 27th Stock Assessment Workshop in June 1998 (NEFSC 1998). Catch at age estimates for ASMFC management area 1 (the Gulf of Maine) were also used in an exploratory VPA for the portion of the resource that is harvested in that area (NEFSC 1998 and Stevenson 1998). Information on herring catches, population size and fishing mortality estimates, and other related subjects was provided to the Atlantic Herring Plan Development Team and incorporated into the ASMFC and NEFMC Atlantic Herring Management Plans that were completed in the fall of 1998 (ASMFC 1998, NEFSC 1999).

Results of these analyses indicate that the coastal stock complex, which includes the Georges Bank/Nantucket Shoals and Gulf of Maine spawning stocks, is large and underutilized. Stock biomass is poorly estimated, however. Total stock biomass at the beginning of 1997 was estimated to be 2.9 million mt (NEFSC 1998), but a retrospective analysis showed that biomass estimates in the most recent portion of the time series are considerably over-estimated. An estimate of 1.9 million mt based on a surplus production model is probably much more accurate. If so, the current biomass is approximately twice the biomass at maximum sustainable yield ( $B_{MSY}$ ) of about 1 million mt established by the NEFMC Overfishing Definition Review Panel in 1998 and the 1997 catch of 120,000 mt is about one-third of the MSY of 317,000 mt that has been established for the stock complex (Applegate et al. 1998).

The exploratory Gulf of Maine VPA indicates that this portion of the stock complex increased in size between 1984 and 1986, reaching 300,000-350,000 mt, and then



increased again slightly after 1995, reaching 400,000-450,000 mt at the beginning of 1997. The increase in stock size that occurred in the mid-1980s pre-dated the re-appearance of adult herring on Georges Bank and was a direct result of reduced juvenile fishing mortality rates in the inshore Gulf of Maine fixed gear fishery after 1982, which allowed the large 1983 year class to recruit in large numbers to the adult portion of the stock. Juvenile and adult fishing mortality rates have remained between 0.2 and 0.6 over the past 15 years, indicating that this stock component is smaller than the Georges Bank/Nantucket Shoals stock component (about 25% of the total stock complex) and in some years has been exploited above the  $F_{MSY}$  of 0.30 that has been established for the entire stock complex (Applegate et al. 1998).

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Table 1. Number of Atlantic Herring Processed and Aged, January-June 1998

| Month         | Fishing Year |      | No. fish processed | No. fish aged |
|---------------|--------------|------|--------------------|---------------|
|               |              |      |                    |               |
| January       | 1997         |      | 750                | 230           |
| February      | 1997         |      | 695                | 335           |
| March         | 1997         |      | 848                | 325           |
| April         | 1997         |      | 800                | 212           |
| May           | 1997         |      | 622                | 182           |
| May           |              | 1998 | 366                | 135           |
| June          |              | 1998 | 998                | 334           |
| July          |              | 1998 | 600                | 187           |
| August        |              | 1998 | 1361               | 318           |
| September     |              | 1998 | 300                | 89            |
| October       |              | 1998 | 546                | 121           |
| November      |              | 1998 | 500                | 0             |
| December      |              | 1998 | 750                | 80            |
|               |              |      |                    |               |
| Total by year | 1997         |      | 3715               | 1284          |
|               |              | 1998 | 5421               | 1264          |
|               |              |      |                    |               |
| Total         |              |      | 9136               | 2548          |
| Jan-Dec 1997  |              |      | 11590              | 3452          |
| Jan-Dec 1996  |              |      | 5741               | 1800          |

Table 2. Reported 1998 Fishfone Herring Catches by Area, Month and Gear Type

| Sum of MT   |       | STAREA |      |      |      |     |      |      |      | Grand Total |
|-------------|-------|--------|------|------|------|-----|------|------|------|-------------|
| GEAR        | MONTH | 511    | 512  | 513  | 514  | 515 | 521  | 522  | 561  |             |
| MW          | 04    |        | 77   | 926  |      | 127 |      |      |      | 1130        |
|             | 05    |        | 122  | 1005 |      |     |      |      |      | 1127        |
|             | 06    |        |      | 93   |      |     |      | 2323 |      | 2416        |
|             | 07    |        |      |      |      | 132 |      | 1091 | 354  | 1576        |
|             | 08    |        |      | 98   |      | 59  |      | 379  | 1043 | 1578        |
|             | 09    |        |      | 98   |      |     |      | 236  |      | 333         |
|             | 10    |        |      |      | 1052 |     | 18   | 181  |      | 1252        |
|             | 11    |        |      | 318  | 464  |     | 941  |      |      | 1723        |
|             | 12    |        |      | 1086 | 118  |     | 354  |      |      | 1558        |
| MW Total    |       |        | 200  | 3623 | 1634 | 318 | 1313 | 4210 | 1397 | 12694       |
| PS          | 04    |        | 24   | 848  |      | 304 |      |      |      | 1176        |
|             | 05    | 389    | 967  | 150  |      |     |      |      |      | 1506        |
|             | 06    | 175    | 812  |      |      |     |      |      |      | 986         |
|             | 07    | 2445   | 1220 | 718  |      | 18  |      |      |      | 4401        |
|             | 08    | 606    | 1769 | 390  |      | 20  |      |      |      | 2785        |
|             | 09    | 59     | 634  | 1061 |      | 18  |      |      |      | 1771        |
|             | 10    |        | 1064 | 307  |      |     |      |      |      | 1371        |
|             | 11    |        |      | 273  | 355  |     |      |      |      | 628         |
|             | 12    |        |      | 146  |      |     |      |      |      | 146         |
| PS Total    |       | 3674   | 6490 | 3892 | 355  | 360 |      |      |      | 14770       |
| Grand Total |       | 3674   | 6689 | 7515 | 1989 | 678 | 1313 | 4210 | 1397 | 27464       |

Table 3. 1995-97 CATCH AT AGE (MT)

| AGE | 1997   | 1996    | 1995   |
|-----|--------|---------|--------|
| 1   | 22     |         |        |
| 2   | 5,343  | 18,108  | 11,558 |
| 3   | 46,177 | 12,141  | 9,036  |
| 4   | 9,376  | 7,602   | 4,756  |
| 5   | 6,455  | 11,079  | 5,064  |
| 6   | 10,638 | 28,453  | 12,560 |
| 7   | 13,153 | 18,461  | 15,268 |
| 8   | 3,582  | 5,700   | 10,790 |
| 9   | 637    | 1,465   | 3,876  |
| 10  | 8      | 545     | 869    |
| 11+ | 32     | 48      | 239    |
|     | 95,424 | 103,602 | 74,016 |

Figure 1. NMFS Statistical Areas

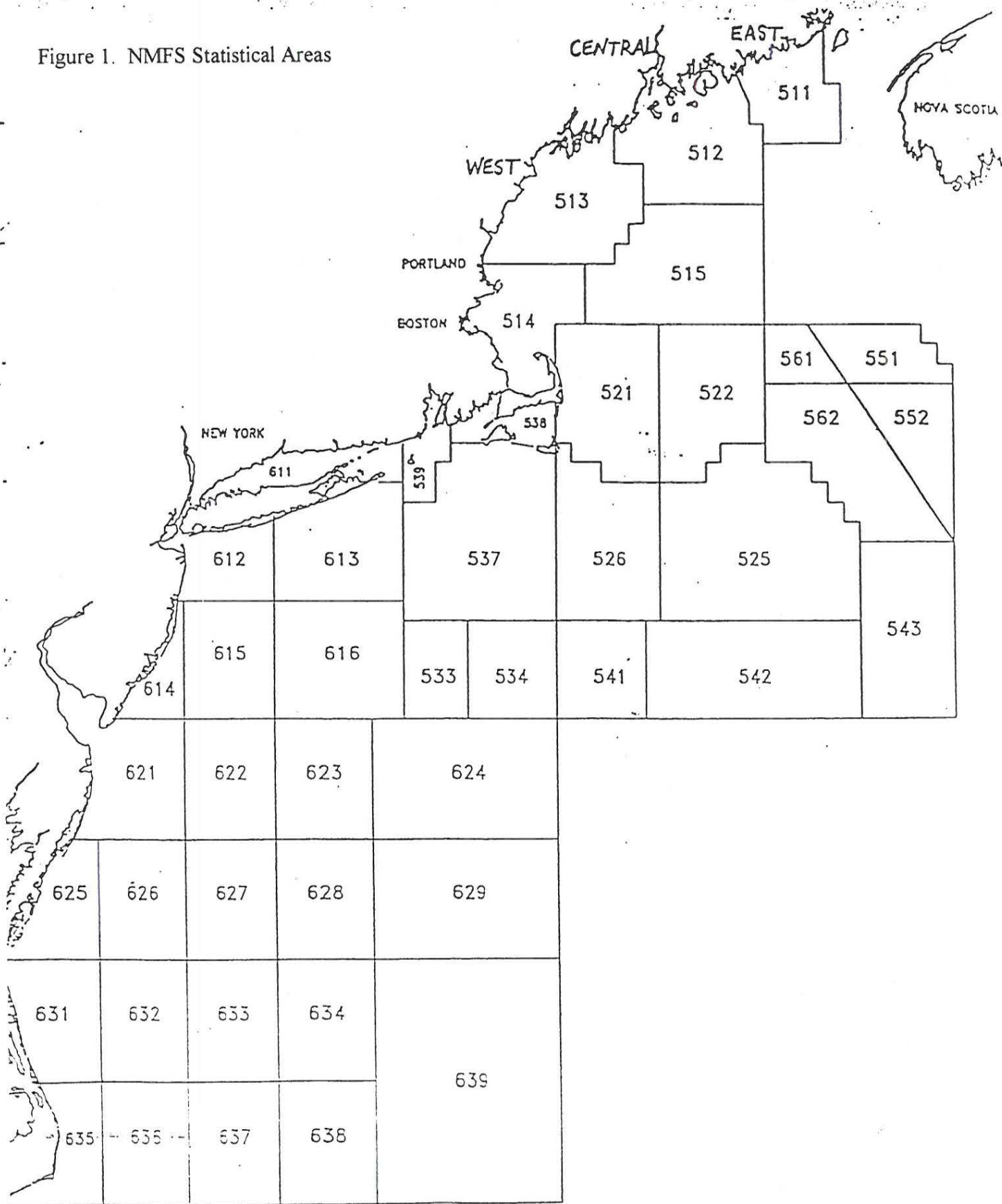
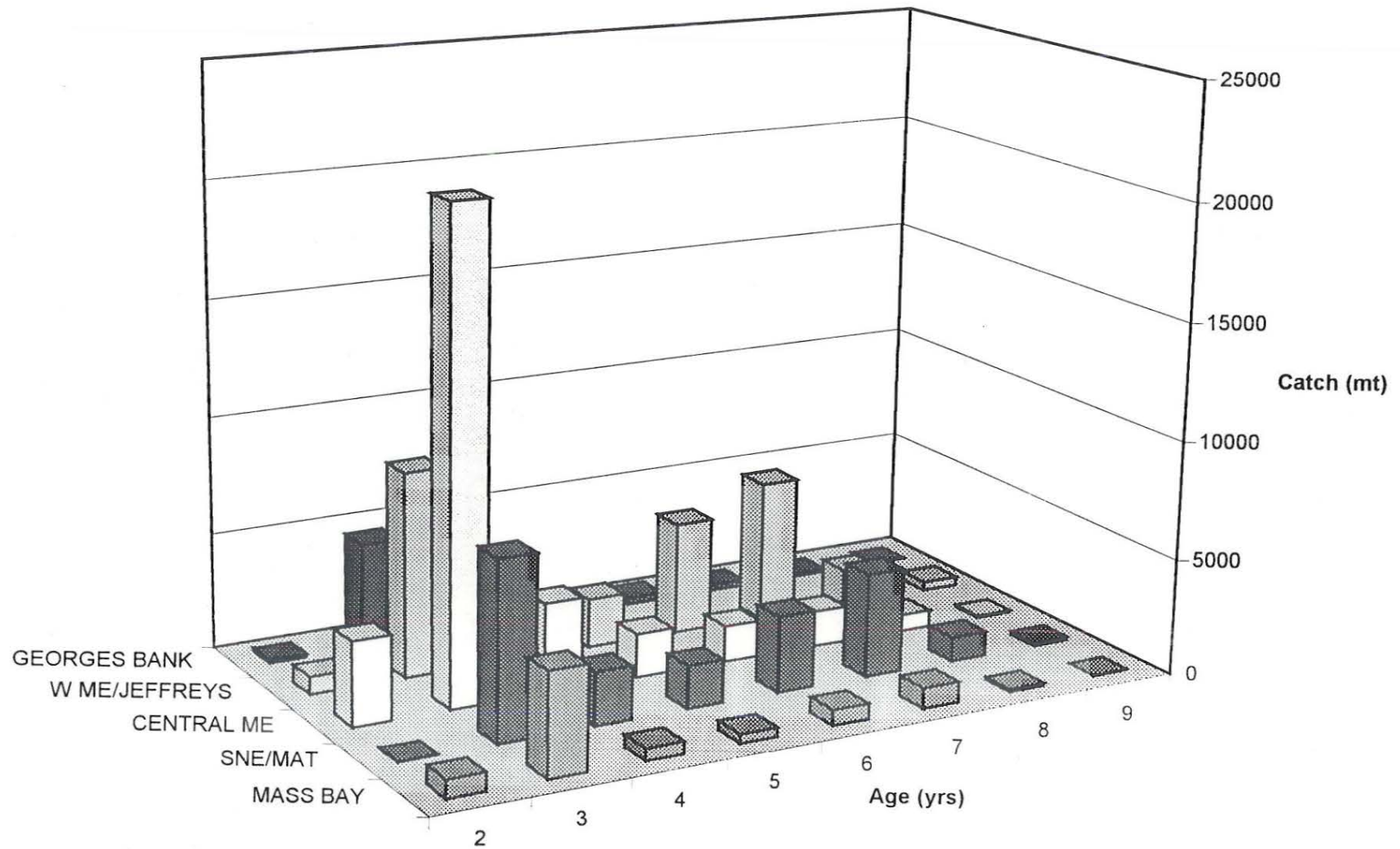




Figure 2. 1997 Catch At Age



# 1997 MAINE HERRING FISHERY STATISTICS

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## Maine Herring Fishery Statistics

Collection and tabulation of Maine herring landings and catch data were performed by the Maine Department of Marine Resources (MDMR) from 1947 until 1985. After that time, the duties were assumed by the U.S. National Marine Fisheries Service (NMFS) until they were once again taken over by the MDMR in 1990. The primary data that are recorded include landing date, quantity landed, gear type, name of the vessel and fishing location. In some cases this information is provided by fishermen who sell bait directly to other fishermen or by bait dealers who purchase herring from fishermen. The canneries provide detailed information for herring that arrives at the plants which includes point of origin (port of landing), method of transport (truck or boat), name of vessel, gear type, date of catch, quantity landed, quantity transferred to other plants for processing and/or quantity discarded (because of poor quality) and method of processing (bait or canned). Data from dealers is forwarded directly to the Maine DMR. Data from the canneries are either sent directly to the MDMR or first to the Maine Sardine Council which sends them on to the MDMR. Additional landings data are provided by NMFS port agents in Portland and Rockland. Information on Internal Waters Processing operations are provided by the trading companies. Records of herring transfers at sea are provided by the Canadian company that purchases and processes the fish. Landings data compiled by the MDMR are made available at the end of the year to the NMFS for entry into the NMFS commercial fishery dealer data base.

This report includes detailed information on catches by area, month and gear type for three different sectors of the fishery: domestic or shoreside landings, Internal Waters Processing (IWP) operations, and at-sea transfers of herring caught in U.S. waters to Canadian carriers which land in Canadian ports. IWP operations refer to herring caught by U.S. fishermen which are processed aboard foreign-owned processing ships anchored in Maine state internal waters. Throughout the report, a distinction is made between landings and catches. Landings refer to fish landed in Maine ports, regardless of where they are caught. Detailed information showing the month of capture, gear used, and fishing location describes when, how, and where the herring landed in Maine ports during 1997 was captured. Some of the information (e.g., total domestic landings, IWP landings, at-sea transfers, domestic landings by gear type, and domestic plus IWP landings by catch location) is presented historically, with records going back to 1947 or to the 1880's and 1890's. There is also some additional historical information in the last two tables which summarizes cannery production and product utilization. Gear types are categorized as "fixed" and "mobile" where fixed refers to weirs (pound nets) and stop seines and mobile refers primarily to purse seines and mid-water trawls. Stop seines are used to "stop off" a school of herring that enters a bay or cove.

Landings data are recorded and analyzed for the fishing locations shown on the map on the last page. These data are subsequently combined into seven major areas for presentation in this report: western, central, and eastern coastal Maine (plus New Brunswick), Jeffreys Ledge and Massachusetts Bay, and western, central and eastern Maine offshore areas (41, 42 and 43). Fishing grounds included in the offshore areas are Platts Bank and Cashes Ledge (area 41) and Skate Bank, Newfound Ground and Outer Falls (area 42). Increased fishing activity in these offshore areas has prompted the designation of a new area category for data analysis in 1997, labeled 'Offshore Gulf of Maine', which includes Georges Bank and other offshore fishing



grounds in areas 515, 521 and 522. The pre-existing 'Offshore Maine' category includes those portions of areas 511, 512 and 513 (excluding Jeffreys Ledge) which are more than 3 miles offshore.

Catch at age estimates in numbers and metric tons are derived for the entire U.S. herring fishery every year from information on the age composition of samples taken from commercial catches throughout the year in the Gulf of Maine, southern New England and Georges Bank. All commercial catch samples (over 200 samples of 50 fish each) were collected in 1997 and processed at the Maine Department of Marine Resources laboratory in Boothbay Harbor.

## SUMMARY OF 1997 MAINE LANDINGS AND CATCH STATISTICS

Shoreside landings of Atlantic herring to domestic markets in 1997 totalled 52,041 metric tons (mt), exceeding what was landed in 1981, the last year of a strong fixed gear fishery in the state. Maine herring landings in 1997 represented 54% of total U.S. landings for the year (96,120 mt), with 24% in Massachusetts and 21% in Rhode Island. As in past years, the primary markets for herring landed in Maine ports were for canned products and lobster bait.

Herring caught in Maine waters, transferred at sea and landed in Canada (trans-shipments) totaled 1280 mt for 1997. This represented a decrease of 2410 mt from 1996, a 65% reduction. There were no Maine Internal Waters Processing (IWP) landings in 1997, despite the fact that 6,000 mt were allocated for this purpose.

The total reported catch of herring, including Maine domestic landings, and at-sea trans-shipments to Canada, was 53,321 mt in 1997 compared to 55,974 in 1996. Although the total catch was 2,653 mt less than last year, domestic landings increased by 3,524 mt (7.3%) over 1996. The decrease in the total catch for 1997 was caused by a decrease in Canadian trans-shipments and the absence of any IWP landings. The fishery has been almost strictly a mobile gear fishery since 1982 when fixed gear accounted for 45% of total landings. Since 1982, fixed gear has not accounted for more than 5,000 mt, and during the last four years, less than 500 mt have been caught and landed from fixed gear. Herring caught in fixed gear in New Brunswick, however, are still processed in Maine canneries.

Trawls accounted for 10,538 mt, or 20% of the total Maine catch in 1997. Purse seines continue to account for most of the catch, increasing to 41,332 mt (80%) of domestic landings plus 1,237 mt (97%) of Canadian trans-shipments in 1997. This figure represents the highest percentage of Maine domestic landings by seiners since mid-water trawlers made a significant presence in the mobile gear fishery in 1995 and 1996, when trawlers accounted for up to 25% of the catch. Domestic landings by purse seiners were lower in previous years, averaging 32,724 mt during 1993-1996 and only 16,060 mt during 1990-1992.

There was a sharp decline in herring caught in western coastal waters in 1997 (down 38% from 1996), while catches in central and eastern coastal waters showed slight increases (up 8% combined). Catch for all inshore Maine waters combined (28,447 mt), accounted for only 53% of the total catch, reflecting the increasing use of offshore fishing grounds in the past several years. Herring caught on offshore fishing grounds (19,997 mt), accounted for 38% of the total Maine herring catch for 1997, an increase of 70 % over 1996. Total catch from offshore fishing grounds averaged only 4 % from 1992-1994, and 20 % from 1995-1996. The reported catch from Jeffreys Ledge and other areas in Massachusetts Bay declined significantly in 1997 to less than 5,000 mt, a 67% decrease from the 1993-1996 period when the catch averaged 12,639 mt. Most of the herring caught in area 514 and on Jeffreys Ledge (in area 513) in 1997 were landed in Gloucester, Massachusetts.

Peak months for the domestic fishery in 1997 were July, August and September when 60% of the annual catch was taken. Significant shoreside landings were also made in June and October with smaller amounts in April, May, November, and December. The highest catches from western coastal Maine were made in September and October, and from central coastal Maine from July-October. Offshore



catches peaked during July at over 5,000 mt, exceeded 3,000 mt for June, August and September, and remained over 1,000 mt a month during May and October. Jeffreys Ledge catches were highest in April at just over 1,000 mt and remained unremarkable for the remainder of the year. The newly designated offshore Gulf of Maine area yielded under 650 mt for the month of August, and even lower catch values for all other months. At-sea transfers to Canadian carriers were most active during September and October, but played a less significant role overall in 1997 than in past years.

In eastern Maine, purse seiners fishing on offshore grounds had the highest catch during October, with smaller catches in July, August, September and November. In central Maine, purse seiners fished in coastal areas primarily during July-October and from June-September on offshore grounds. In western Maine, where purse seiners and mid-water trawlers were both active, catches were highest during May-October with 4,500 mt caught in September. The highest offshore catches in western Maine were made by purse seiners in August and September, and by trawlers from May-August. Catches from Jeffreys Ledge and Massachusetts Bay (39% seine and 61% trawl) were highest for seiners in April and May, and for trawlers during September-November.

Three year old herring belonging to the 1994 year class dominated the coastal U.S. catch in 1997, accounting for 48% of the total tonnage caught. Age 3 herring only accounted for 12% of the total catch in 1995 and 1996. As in previous years, most of the three year olds in 1995-1997 were caught in central Maine (45% of all three year olds caught in 1997 came from this area). Juveniles (age 2) only made up 5.5% of the total U.S. catch in 1997 compared to 17.4% in 1996 and 15.6% in 1995. Older fish accounted for 46% of the catch in 1997 (41% ages 4-7 and 5% age 8 and older). The proportion of older adults (age 4+) declined sharply in 1997, to 46% of the total catch, compared to 71-72% in 1995-1996. Six and seven year old fish made up a large proportion of the catches from southern New England (in the winter) and from western Maine and Jeffreys Ledge in 1997.



Table 1  
MAINE DOMESTIC HERRING LANDINGS<sup>1</sup>  
(metric tons)

| Year | Total<br>Maine<br>Landings | Year | Total<br>Maine<br>Landings | Year | Total<br>Maine<br>Landings |
|------|----------------------------|------|----------------------------|------|----------------------------|
| 1880 | 15,738                     | 1940 | 17,244                     | 1986 | 16,264                     |
| -    | -                          | 1941 | 32,931                     | 1987 | 20,376                     |
| 1887 | 15,277                     | 1942 | 42,637                     | 1988 | 16,575                     |
| 1888 | 18,508                     | 1943 | 25,941                     | 1989 | 15,630                     |
| 1889 | 14,586                     | 1944 | 37,244                     | 1990 | 22,398                     |
| -    | -                          | 1945 | 41,999                     | 1991 | 24,572                     |
| 1892 | 18,446                     | 1946 | 36,337                     | 1992 | 27,848                     |
| -    | -                          | 1947 | 65,486                     | 1993 | 34,741                     |
| 1897 | 51,079                     | 1948 | 76,437                     | 1994 | 35,124                     |
| 1898 | 82,673                     | 1949 | 74,029                     | 1995 | 39,503                     |
| 1899 | 56,086                     | 1950 | 90,557                     | 1996 | 48,517                     |
| 1900 | 44,068                     | 1951 | 34,411                     | 1997 | 52,041                     |
| 1901 | 67,390                     | 1952 | 79,139                     |      |                            |
| 1902 | 55,967                     | 1953 | 58,337                     |      |                            |
| 1903 | 55,549                     | 1954 | 64,067                     |      |                            |
| 1904 | 73,642                     | 1955 | 43,506                     |      |                            |
| 1905 | 78,694                     | 1956 | 66,494                     |      |                            |
| 1906 | 71,615                     | 1957 | 68,623                     |      |                            |
| 1907 | 27,649                     | 1958 | 80,759                     |      |                            |
| 1908 | 30,940                     | 1959 | 53,037                     |      |                            |
| 1909 | 49,716                     | 1960 | 59,348                     |      |                            |
| 1910 | 52,399                     | 1961 | 24,131                     |      |                            |
| 1911 | 79,466                     | 1962 | 69,376                     |      |                            |
| 1912 | 62,138                     | 1963 | 66,895                     |      |                            |
| 1913 | 17,772                     | 1964 | 26,295                     |      |                            |
| 1914 | 59,743                     | 1965 | 32,088                     |      |                            |
| 1915 | -                          | 1966 | 26,177                     |      |                            |
| 1916 | 93,935                     | 1967 | 28,576                     |      |                            |
| 1917 | -                          | 1968 | 31,072                     |      |                            |
| 1918 | -                          | 1969 | 23,852                     |      |                            |
| 1919 | 39,453                     | 1970 | 15,617                     |      |                            |
| -    | -                          | 1971 | 12,960                     |      |                            |
| 1924 | 21,741                     | 1972 | 20,271                     |      |                            |
| -    | -                          | 1973 | 16,886                     |      |                            |
| 1928 | 29,341                     | 1974 | 21,499                     |      |                            |
| 1929 | 41,668                     | 1975 | 17,348                     |      |                            |
| 1930 | 33,541                     | 1976 | 31,858                     |      |                            |
| 1931 | 25,301                     | 1977 | 33,135                     |      |                            |
| 1932 | 14,510                     | 1978 | 30,341                     |      |                            |
| 1933 | 19,856                     | 1979 | 40,540                     |      |                            |
| 1934 | -                          | 1980 | 48,912                     |      |                            |
| 1935 | 23,107                     | 1981 | 51,976                     |      |                            |
| 1936 | -                          | 1982 | 24,453                     |      |                            |
| 1937 | 22,658                     | 1983 | 19,824                     |      |                            |
| 1938 | 7,283                      | 1984 | 21,720                     |      |                            |
| 1939 | 31,572                     | 1985 | 14,657                     |      |                            |

<sup>1</sup> Maine landings include all herring caught in Maine territorial waters, plus any herring caught in other state or federal waters and brought to Maine by boat. "Domestic" landings exclude herring processed aboard foreign-owned ships operating in Maine's internal waters and herring transferred at sea to Canadian carriers.

Table 2  
MAINE IWP HERRING LANDINGS  
(metric tons)

| Year | Total |
|------|-------|
| 1987 | 300   |
| 1988 | 0     |
| 1989 | 3491  |
| 1990 | 0     |
| 1991 | 2918  |
| 1992 | 3339  |
| 1993 | 6647  |
| 1994 | 2849  |
| 1995 | 8776  |
| 1996 | 3767  |
| 1997 | 0     |

Table 3  
U.S. GULF OF MAINE HERRING CATCHES TRANSFERRED  
AT SEA AND LANDED IN CANADA\* (TRANS-SHIPMENTS)  
(metric tons)

| Year | Total |
|------|-------|
| 1987 | 791   |
| 1988 | 186   |
| 1989 | 118   |
| 1990 | 42    |
| 1991 | 723   |
| 1992 | 1537  |
| 1993 | 977   |
| 1994 | 1547  |
| 1995 | 2086  |
| 1996 | 3690  |
| 1997 | 1280  |

\* = Data provided by Connors Bros. February 1997

Table 4  
MAINE HERRING CATCH BY GEAR<sup>1</sup>  
(metric tons)

| Year | Stop Seines/<br>Haul Seines | Weirs               | Purse<br>Seines     | Floating<br>Traps | Trawl | Gill<br>Nets | Dip<br>Nets | Unknown | Total  |
|------|-----------------------------|---------------------|---------------------|-------------------|-------|--------------|-------------|---------|--------|
| 1887 |                             | 10,626 <sup>2</sup> | 10                  |                   |       | 2,832        |             | 1,759   | 15,227 |
| 1888 |                             | 13,179 <sup>3</sup> | 4                   |                   |       | 3,206        |             | 2,119   | 18,508 |
| 1919 |                             | 33,586 <sup>2</sup> | 5,740 <sup>4</sup>  |                   |       | 4            | 48          | 75      | 39,454 |
| 1924 | 6,551                       | 13,217              | 1,931 <sup>4</sup>  |                   |       | 1            |             | 42      | 21,741 |
| 1928 | 9,820                       | 13,914              | 5,213 <sup>4</sup>  | 395               |       |              |             |         | 29,341 |
| 1929 | 10,233                      | 21,864              | 9,339 <sup>4</sup>  | 232               |       |              |             |         | 41,668 |
| 1930 | 1,162                       | 14,013              | 17,683 <sup>4</sup> | 669               |       | 3            | 3           | 8       | 33,541 |
| 1931 | 117                         | 14,003              | 11,069 <sup>4</sup> | 106               |       | 6            |             |         | 25,301 |
| 1932 |                             | 7,194               | 7,190 <sup>4</sup>  | 91                |       | 35           |             |         | 14,510 |
| 1933 |                             | 8,761               | 10,995 <sup>4</sup> | 93                |       | 8            |             |         | 19,856 |
| 1935 |                             | 9,310               | 13,619 <sup>4</sup> | 179               |       | <1           |             |         | 23,108 |
| 1937 | 12,822                      | 9,336               | 327 <sup>4</sup>    | 174               |       |              |             |         | 22,659 |
| 1938 | 4,722                       | 2,111               | 363 <sup>4</sup>    | 86                | <1    |              |             |         | 7,282  |
| 1939 | 17,504                      | 12,566              | 173 <sup>4</sup>    | 1,274             |       |              | 51          | 4       | 31,572 |
| 1940 | 7,183                       | 9,492               | 491 <sup>4</sup>    | 59                |       |              | 18          |         | 17,244 |
| 1941 |                             |                     |                     |                   |       |              |             | 32,931  | 32,931 |
| 1942 | 25,178                      | 16,886              | 573 <sup>4</sup>    |                   |       |              |             |         | 42,637 |
| 1943 | 15,438                      | 7,246               | 3,256 <sup>4</sup>  | 1                 |       |              |             |         | 25,941 |
| 1944 | 13,026                      | 19,289              | 4,643               |                   |       |              |             | 286     | 37,244 |
| 1945 |                             |                     |                     |                   |       |              |             | 41,999  | 41,999 |
| 1946 |                             |                     |                     |                   |       |              |             | 36,336  | 36,336 |
| 1947 | 33,345                      | 15,629              | 2,621               |                   |       |              |             | 283     | 51,878 |
| 1948 | 46,030                      | 17,665              | 1,045               |                   |       |              |             | 316     | 65,057 |
| 1949 | 36,703                      | 26,326              | 74                  |                   |       |              |             | 38      | 63,142 |
| 1950 | 53,873                      | 26,793              | 379                 |                   |       |              |             | 372     | 81,417 |
| 1951 | 22,010                      | 8,727               | 456                 |                   |       |              |             | 157     | 31,349 |
| 1952 | 57,336                      | 16,789              | 1,814               |                   |       |              |             | 33      | 75,971 |
| 1953 | 40,982                      | 9,611               | 1,158               |                   |       |              |             | 493     | 52,243 |
| 1954 | 46,375                      | 11,070              | 493                 |                   |       |              |             | 76      | 58,014 |
| 1955 | 33,813                      | 6,775               | 31                  |                   |       |              |             | 76      | 40,694 |
| 1956 | 52,504                      | 7,386               | 404                 |                   |       |              |             | 2       | 60,296 |
| 1957 | 51,666                      | 10,222              | 671                 | 1                 |       |              |             | 30      | 62,590 |
| 1958 | 64,942                      | 8,522               | 156                 | 10                |       |              |             | 230     | 73,860 |
| 1959 | 45,027                      | 3,551               | 15                  |                   |       |              |             |         | 48,592 |
| 1960 | 43,899                      | 6,011               | 284                 | 2                 | 1     |              |             |         | 50,198 |
| 1961 | 15,670                      | 1,297               | 5,141               | 23                | 17    |              |             |         | 22,147 |
| 1962 | 50,918                      | 5,407               | 2,683               |                   | 41    |              |             | 89      | 59,138 |
| 1963 | 41,989                      | 3,655               | 1,104               | 5                 | 2     |              |             | 2,906   | 49,661 |
| 1964 | 20,047                      | 1,961               | 2,843               | 8                 | 112   |              |             | 159     | 25,129 |
| 1965 | 18,731                      | 6,148               | 5,026               |                   | 44    |              |             | 280     | 30,230 |
| 1966 | 9,156                       | 6,236               | 7,523               | 18                |       |              |             | 29      | 22,962 |
| 1967 | 8,287                       | 3,552               | 14,814              | 5                 |       |              |             | 23      | 26,681 |
| 1968 | 14,128                      | 5,039               | 8,681               | 3                 |       |              |             |         | 27,852 |
| 1969 | 3,980                       | 3,486               | 15,178              | 1                 |       |              |             | 21      | 22,667 |
| 1970 | 2,259                       | 925                 | 12,311              |                   |       |              |             |         | 15,495 |
| 1971 | 2,950                       | 246                 | 9,190               |                   |       |              |             | 572     | 12,957 |
| 1972 | 15,495                      | 1,731               | 3,031               |                   |       |              |             |         | 20,257 |

<sup>1</sup> Catches reported in Maine waters

<sup>2</sup> Includes floating traps & pound nets

<sup>3</sup> Includes floating traps

<sup>4</sup> Incidental to mackerel purse seine catches



Table 5  
MAINE DOMESTIC HERRING LANDINGS BY GEAR  
(metric tons)

| Year | Stop<br>Seines | Weirs  | Purse<br>Seines | Floating Traps/<br>Pound Nets | Trawl <sup>1</sup> | Gill<br>Nets | Dip<br>Nets | Unknown | Total  |
|------|----------------|--------|-----------------|-------------------------------|--------------------|--------------|-------------|---------|--------|
| 1973 | 5,468          | 808    | 10,546          | 3                             | 38                 |              |             | 23      | 16,887 |
| 1974 | 2,644          | 2,726  | 16,130          |                               |                    |              |             |         | 21,500 |
| 1975 | 6,866          | 2,407  | 8,075           |                               |                    |              |             |         | 17,349 |
| 1976 | 25,226         | 1,848  | 4,782           | 1                             |                    |              |             |         | 31,857 |
| 1977 | 19,139         | 1,320  | 12,336          | <1                            | 340                |              |             |         | 33,135 |
| 1978 | 8,429          | 6,071  | 15,242          |                               | 599                |              |             |         | 30,341 |
| 1979 | 31,477         | 6,113  | 2,470           | 1                             | 479                |              |             |         | 40,540 |
| 1980 | 32,623         | 3,284  | 12,764          |                               | 240                |              |             |         | 48,911 |
| 1981 | 31,280         | 13,632 | 7,063           |                               | <1                 |              |             |         | 51,976 |
| 1982 | 6,680          | 4,278  | 13,495          |                               |                    |              |             |         | 24,453 |
| 1983 | 1,957          | 586    | 17,281          |                               |                    |              |             |         | 19,824 |
| 1984 | 149            | 231    | 21,279          |                               | 61                 |              |             |         | 21,720 |
| 1985 | 3,749          | 942    | 9,954           |                               | 12                 |              |             |         | 14,657 |
| 1986 | 1,284          | 383    | 14,587          |                               | 10                 |              |             |         | 16,264 |
| 1987 | 1,361          | 140    | 18,875          |                               |                    |              |             |         | 20,376 |
| 1988 | 732            | 1,240  | 14,219          | 1                             | 382                | 2            |             |         | 16,575 |
| 1989 | 733            | 700    | 14,197          |                               |                    |              |             |         | 15,630 |
| 1990 | 216            | 422    | 21,760          |                               |                    |              |             |         | 22,398 |
| 1991 | 918            | 215    | 23,409          |                               |                    |              |             | 30      | 24,572 |
| 1992 | 3,440          | 397    | 24,011          |                               |                    |              |             |         | 27,848 |
| 1993 | 2,290          | 56     | 32,334          |                               | 61                 |              |             |         | 34,741 |
| 1994 | 292            | 168    | 32,418          |                               | 2,054              | 19           |             | 173     | 35,124 |
| 1995 | 0              | 0      | 30,128          |                               | 9,258              |              |             | 117     | 39,503 |
| 1996 | 438            | 18     | 36,015          |                               | 12,046             |              |             |         | 48,517 |
| 1997 | 0              | 171    | 41,332          |                               | 10,538             |              |             |         | 52,041 |

<sup>1</sup> Mid-water, pair and bottom trawls have been combined under the heading "Trawl"

Table 6  
MAINE IWP HERRING LANDINGS BY GEAR  
(metric tons)

| Year | Purse Seines | Trawls | Total |
|------|--------------|--------|-------|
| 1987 | 300          | 0      | 300   |
| 1988 | 0            | 0      | 0     |
| 1989 | 3491         | 0      | 3491  |
| 1990 | 0            | 0      | 0     |
| 1991 | 2918         | 0      | 2918  |
| 1992 | 3339         | 0      | 3339  |
| 1993 | 2650         | 3997   | 6647  |
| 1994 | 331          | 2518   | 2849  |
| 1995 | 133          | 8643   | 8776  |
| 1996 | 0            | 3767   | 3767  |
| 1997 | 0            | 0      | 0     |

Table 7  
CANADA TRANS-SHIPMENTS BY GEAR\*  
(metric tons)

| Year | Fixed Gear | Mobile Gear | Total |
|------|------------|-------------|-------|
| 1987 | 274        | 517         | 791   |
| 1988 | 186        |             | 186   |
| 1989 | 118        |             | 118   |
| 1990 | 42         |             | 42    |
| 1991 | 115        | 608         | 723   |
| 1992 | 1537       |             | 1537  |
| 1993 | 977        |             | 977   |
| 1994 | 809        | 738         | 1547  |
| 1995 |            | 2086        | 2086  |
| 1996 | 104        | 3586        | 3690  |
| 1997 | 43         | 1237        | 1280  |

\* = Data provided by Connors Bros. February 1997

Table 8  
MAINE HERRING CATCH BY AREA\*  
(metric tons)

| Year | Western<br>Coastal<br>Maine | Central<br>Coastal<br>Maine | Eastern<br>Coastal<br>Maine | Jeffreys<br>NH &<br>Mass.Bay | Unknown<br>Areas | Total  |
|------|-----------------------------|-----------------------------|-----------------------------|------------------------------|------------------|--------|
| 1947 | 25,251                      | 21,587                      | 20,106                      |                              |                  | 66,944 |
| 1948 | 24,547                      | 37,189                      | 14,378                      |                              | 17               | 76,131 |
| 1949 | 20,873                      | 21,638                      | 33,182                      |                              |                  | 75,693 |
| 1950 | 23,895                      | 34,300                      | 33,128                      |                              |                  | 91,323 |
| 1951 | 6,672                       | 17,273                      | 10,442                      |                              |                  | 34,387 |
| 1952 | 15,529                      | 38,872                      | 23,526                      |                              | 18               | 77,945 |
| 1953 | 19,415                      | 27,830                      | 10,983                      |                              | 15               | 58,243 |
| 1954 | 24,046                      | 24,592                      | 15,397                      |                              | 43               | 64,078 |
| 1955 | 16,504                      | 16,675                      | 7,530                       |                              | 36               | 40,745 |
| 1956 | 24,556                      | 32,710                      | 9,355                       |                              |                  | 66,621 |
| 1957 | 22,584                      | 30,378                      | 15,638                      |                              |                  | 68,600 |
| 1958 | 33,306                      | 33,074                      | 14,897                      |                              |                  | 81,277 |
| 1959 | 25,560                      | 19,721                      | 7,425                       |                              |                  | 52,706 |
| 1960 | 20,650                      | 30,843                      | 7,852                       |                              |                  | 59,345 |
| 1961 | 12,322                      | 10,106                      | 1,665                       |                              |                  | 24,093 |
| 1962 | 29,374                      | 30,316                      | 8,906                       |                              | 89               | 68,685 |
| 1963 | 21,804                      | 33,388                      | 8,011                       |                              | 2,830            | 66,033 |
| 1964 | 13,109                      | 9,762                       | 3,402                       |                              | 177              | 26,450 |
| 1965 | 9,368                       | 12,848                      | 9,581                       |                              | 1,037            | 32,834 |
| 1966 | 8,313                       | 9,262                       | 8,576                       |                              |                  | 26,151 |
| 1967 | 6,413                       | 17,148                      | 4,837                       | 12                           |                  | 28,410 |
| 1968 | 7,238                       | 12,984                      | 10,068                      | 41                           | 5                | 30,336 |
| 1969 | 5,653                       | 13,816                      | 4,685                       |                              |                  | 24,154 |
| 1970 | 5,657                       | 9,432                       | 945                         | 36                           |                  | 16,070 |
| 1971 | 3,944                       | 7,577                       | 575                         | 664                          | 370              | 13,130 |
| 1972 | 5,798                       | 11,567                      | 2,168                       | 897                          |                  | 20,430 |

\* Catches reported in Maine waters



Table 9  
TOTAL MAINE HERRING CATCH BY AREA<sup>1</sup>  
(metric tons)

| Year | InshoreCoastal Maine |         |         | Offshore <sup>2</sup><br>Maine | Jeffreys       | Offshore <sup>3</sup><br>Gulf of<br>Maine | Canada | Unknown<br>Areas | Total  |
|------|----------------------|---------|---------|--------------------------------|----------------|-------------------------------------------|--------|------------------|--------|
|      | Western              | Central | Eastern |                                | NH<br>Mass.Bay |                                           |        |                  |        |
| 1973 | 2,852                | 12,184  | 1,339   |                                | 488            |                                           |        | 23               | 16,886 |
| 1974 | 1,663                | 13,279  | 4,199   |                                | 2,358          |                                           |        |                  | 21,499 |
| 1975 | 1,170                | 9,456   | 4,556   |                                | 2,166          |                                           |        |                  | 17,348 |
| 1976 | 5,671                | 17,824  | 6,694   |                                | 1,668          |                                           |        |                  | 31,857 |
| 1977 | 9,404                | 16,530  | 6,423   |                                | 776            |                                           |        |                  | 33,133 |
| 1978 | 10,503               | 6,548   | 12,804  |                                | 486            |                                           |        |                  | 30,341 |
| 1979 | 8,008                | 17,582  | 14,629  |                                | 322            |                                           |        |                  | 40,541 |
| 1980 | 4,701                | 20,301  | 21,200  |                                | 2,710          |                                           |        |                  | 48,912 |
| 1981 | 4,924                | 18,527  | 24,795  |                                | 3,730          |                                           |        |                  | 51,976 |
| 1982 | 5,175                | 11,614  | 7,218   |                                | 446            |                                           |        |                  | 24,453 |
| 1983 | 2,695                | 14,833  | 659     |                                | 1,637          |                                           |        |                  | 19,824 |
| 1984 | 3,252                | 10,582  | 5,678   |                                | 2,208          |                                           |        |                  | 21,720 |
| 1985 | 1,650                | 8,528   | 3,691   |                                | 788            |                                           |        |                  | 14,657 |
| 1986 | 2,112                | 11,036  | 2,384   |                                | 732            |                                           |        |                  | 16,264 |
| 1987 | 5,810                | 11,350  | 3,642   |                                | 665            |                                           |        |                  | 21,467 |
| 1988 | 4,060                | 8,120   | 2,106   |                                | 1,875          |                                           |        | 600              | 16,761 |
| 1989 | 4,010                | 13,228  | 930     |                                | 1,070          |                                           |        |                  | 19,238 |
| 1990 | 6,731                | 13,462  | 570     |                                | 1,205          |                                           |        | 472              | 22,440 |
| 1991 | 2,646                | 21,584  | 594     |                                | 2,510          |                                           |        | 877              | 28,212 |
| 1992 | 7,951                | 17,640  | 2,231   | 1,231                          | 3,671          |                                           |        |                  | 32,724 |
| 1993 | 16,953               | 14,135  | 225     | 1,213                          | 9,394          |                                           | 352    | 93               | 42,366 |
| 1994 | 9,520                | 12,387  | 1,674   | 2,241                          | 13,131         |                                           | 20     | 546              | 39,519 |
| 1995 | 9,832                | 12,246  | 322     | 9,828                          | 16,464         |                                           |        | 1,674            | 50,365 |
| 1996 | 14,411               | 18,089  | 102     | 11,739                         | 11,567         |                                           | 65     |                  | 55,974 |
| 1997 | 8,873                | 19,125  | 449     | 18,939                         | 4,874          | 1,058                                     |        |                  | 53,321 |

<sup>1</sup> Includes Internal Waters Processing landings and Canadian trans-shipments

<sup>2</sup> Fishing grounds >3 miles offshore in NMFS statistical areas 511, 512 and 513 (excluding Jeffreys Ledge)

<sup>3</sup> Offshore fishing grounds in NMFS statistical areas 515, 521 and 522 and Georges Bank

Table 10  
1997 TOTAL MAINE HERRING CATCH BY MONTH AND GEAR (metric tons)

| Month | DOMESTIC LANDINGS |      |             |          |       | IWP         |          |       | CANADIAN TRANS-SHIPMENTS |      |       |          |       | Grand<br>Total |
|-------|-------------------|------|-------------|----------|-------|-------------|----------|-------|--------------------------|------|-------|----------|-------|----------------|
|       | Stop Seine        | Weir | Purse Seine | Midwater | Total | Purse Seine | Midwater | Total | Stop Seine               | Weir | Purse | Midwater | Total |                |
| Jan   |                   |      |             |          |       |             |          |       |                          |      |       |          |       |                |
| Feb   |                   |      |             | 6        | 6     |             |          |       |                          |      |       |          |       | 6              |
| Mar   |                   |      |             |          |       |             |          |       |                          |      |       |          |       |                |
| Apr   |                   |      | 894         | 303      | 1197  |             |          |       |                          |      |       |          |       | 1197           |
| May   |                   |      | 2219        | 639      | 2859  |             |          |       |                          |      |       |          |       | 2859           |
| Jun   |                   |      | 4543        | 1132     | 5675  |             |          |       |                          |      | 150   |          | 150   | 5825           |
| Jul   |                   | 92   | 8504        | 1521     | 10117 |             |          |       |                          | 17   | 62    |          | 79    | 10197          |
| Aug   |                   | 70   | 8413        | 1560     | 10043 |             |          |       |                          | 26   | 61    |          | 87    | 10130          |
| Sep   |                   | 9    | 8096        | 3183     | 11288 |             |          |       |                          |      | 381   |          | 381   | 11669          |
| Oct   |                   |      | 6996        | 1397     | 8393  |             |          |       |                          |      | 582   |          | 582   | 8975           |
| Nov   |                   |      | 1651        | 770      | 2422  |             |          |       |                          |      |       |          |       | 2422           |
| Dec   |                   |      | 16          | 27       | 43    |             |          |       |                          |      |       |          |       | 43             |
| Total |                   | 171  | 41332       | 10538    | 52041 |             |          |       |                          | 43   | 1237  |          | 1280  | 53321          |

Table 11  
1997 TOTAL MAINE HERRING CATCH BY MONTH AND AREA  
(metric tons)

| <u>Month</u> | <u>Western<br/>Coastal<br/>Maine</u> | <u>Central<br/>Coastal<br/>Maine</u> | <u>Eastern<br/>Coastal<br/>Maine</u> | <u>Offshore<br/>Maine</u> | <u>Jeffreys<br/>NH and<br/>Mass. Bay</u> | <u>Offshore<br/>Gulf of<br/>Maine</u> | <u>Total</u> |
|--------------|--------------------------------------|--------------------------------------|--------------------------------------|---------------------------|------------------------------------------|---------------------------------------|--------------|
| Jan          |                                      |                                      |                                      |                           |                                          |                                       |              |
| Feb          | 5                                    |                                      |                                      |                           |                                          |                                       | 5            |
| Mar          |                                      |                                      |                                      |                           |                                          |                                       |              |
| Apr          |                                      | 11                                   |                                      | 162                       | 1,023                                    |                                       | 1,196        |
| May          | 316                                  | 186                                  |                                      | 1,521                     | 802                                      | 32                                    | 2,858        |
| Jun          | 706                                  | 1,223                                |                                      | 3,479                     | 332                                      | 83                                    | 5,824        |
| Jul          | 713                                  | 3,626                                | 109                                  | 5,220                     | 262                                      | 265                                   | 10,196       |
| Aug          | 555                                  | 5,159                                | 95                                   | 3,396                     | 290                                      | 631                                   | 10,129       |
| Sep          | 4,151                                | 3,089                                | 131                                  | 3,540                     | 753                                      | 2                                     | 11,669       |
| Oct          | 2,338                                | 4,980                                |                                      | 1,144                     | 466                                      | 45                                    | 8,975        |
| Nov          | 86                                   | 848                                  | 113                                  | 458                       | 915                                      |                                       | 2,421        |
| Dec          |                                      |                                      |                                      | 15                        | 27                                       |                                       | 43           |
| Total        | 8,873                                | 19,125                               | 449                                  | 18,939                    | 4,874                                    | 1,058                                 | 53,320       |



Table 12  
1997 DOMESTIC LANDINGS FOR HERRING CAUGHT IN  
EASTERN MAINE BY GEAR AND MONTH  
(metric tons)

| Month | Coastal    |      |             |          | Offshore    |          |                | Grand Total |
|-------|------------|------|-------------|----------|-------------|----------|----------------|-------------|
|       | Stop Seine | Weir | Purse Seine | Midwater | Purse Seine | Midwater | Offshore Total |             |
| Jan   |            |      |             |          |             |          |                |             |
| Feb   |            |      |             |          |             |          |                |             |
| Mar   |            |      |             |          |             |          |                |             |
| Apr   |            |      |             |          |             |          |                |             |
| May   |            |      |             |          |             |          |                |             |
| Jun   |            |      |             |          |             |          |                |             |
| Jul   |            | 92   |             |          | 216         |          | 216            | 309         |
| Aug   |            | 69   |             |          | 267         |          | 267            | 337         |
| Sep   |            | 8    | 122         |          |             |          |                | 131         |
| Oct   |            |      |             |          | 601         | 110      | 711            | 711         |
| Nov   |            |      | 113         |          | 335         |          | 335            | 449         |
| Dec   |            |      |             |          | 15          |          | 15             | 15          |
| Total |            | 170  | 235         |          | 1437        | 110      | 1548           | 1954        |

Table 13  
1997 DOMESTIC LANDINGS FOR HERRING CAUGHT IN  
CENTRAL MAINE BY GEAR AND MONTH  
(metric tons)

| <u>Month</u> | <u>Coastal</u>    |             |                    |                 | <u>Offshore</u>      |                    |                 | <u>Grand Total</u>    |
|--------------|-------------------|-------------|--------------------|-----------------|----------------------|--------------------|-----------------|-----------------------|
|              | <u>Stop Seine</u> | <u>Weir</u> | <u>Purse Seine</u> | <u>Midwater</u> | <u>Coastal Total</u> | <u>Purse Seine</u> | <u>Midwater</u> | <u>Offshore Total</u> |
| Jan          |                   |             |                    |                 |                      |                    |                 |                       |
| Feb          |                   |             |                    |                 |                      |                    |                 |                       |
| Mar          |                   |             |                    |                 |                      |                    |                 |                       |
| Apr          |                   |             | 11                 |                 | 11                   |                    |                 | 11                    |
| May          |                   |             | 186                |                 | 186                  | 912                |                 | 1098                  |
| Jun          |                   |             | 1224               |                 | 1224                 | 2937               | 6               | 4166                  |
| Jul          |                   |             | 3332               | 128             | 3460                 | 4619               | 44              | 8123                  |
| Aug          |                   |             | 5099               |                 | 5099                 | 2383               |                 | 7482                  |
| Sep          |                   |             | 2771               |                 | 2771                 | 3110               |                 | 5882                  |
| Oct          |                   |             | 4505               |                 | 4505                 | 371                |                 | 4877                  |
| Nov          |                   |             | 849                |                 | 849                  | 122                |                 | 971                   |
| Dec          |                   |             |                    |                 |                      |                    |                 |                       |
| Total        |                   |             | 17977              | 128             | 18105                | 14455              | 50              | 32610                 |

Table 14  
1997 DOMESTIC HERRING LANDINGS FOR HERRING CAUGHT IN  
WESTERN MAINE BY GEAR AND MONTH  
(metric tons)

| <u>Month</u> | <u>Coastal</u>     |                 |                      | <u>Offshore</u>    |                 |                       | <u>Grand Total</u> |
|--------------|--------------------|-----------------|----------------------|--------------------|-----------------|-----------------------|--------------------|
|              | <u>Purse Seine</u> | <u>Midwater</u> | <u>Coastal Total</u> | <u>Purse Seine</u> | <u>Midwater</u> | <u>Offshore Total</u> |                    |
| Jan          |                    |                 |                      |                    |                 |                       |                    |
| Feb          |                    | 6               | 6                    |                    |                 |                       | 6                  |
| Mar          |                    |                 |                      |                    |                 |                       |                    |
| Apr          |                    |                 |                      | 107                | 56              | 162                   | 162                |
| May          | 289                | 27              | 316                  |                    | 610             | 610                   | 926                |
| Jun          | 268                | 438             | 707                  | 37                 | 392             | 429                   | 1136               |
| Jul          | 112                | 601             | 713                  | 89                 | 220             | 309                   | 1022               |
| Aug          | 278                | 278             | 556                  | 218                | 528             | 746                   | 1302               |
| Sep          | 1748               | 2404            | 4152                 | 345                | 23              | 367                   | 4519               |
| Oct          | 1518               | 820             | 2338                 |                    |                 |                       | 2338               |
| Nov          | 86                 |                 | 86                   |                    |                 |                       | 86                 |
| Dec          |                    |                 |                      |                    |                 |                       |                    |
| Total        | 4299               | 4575            | 8874                 | 795                | 1828            | 2624                  | 11497              |



Table 15  
 1997 DOMESTIC LANDINGS FOR JEFFREYS LEDGE AND  
 MASSACHUSETTS BAY VICINITY BY GEAR AND MONTH  
 (metric tons)

| <u>MONTH</u> | <u>Purse Seine</u> | <u>Midwater</u> | <u>Total</u> |
|--------------|--------------------|-----------------|--------------|
| Jan          |                    |                 |              |
| Feb          |                    |                 |              |
| Mar          |                    |                 |              |
| Apr          | 776                | 247             | 1023         |
| May          | 800                | 3               | 803          |
| Jun          |                    | 290             | 290          |
| Jul          |                    | 263             | 263          |
| Aug          | 168                | 123             | 291          |
| Sep          |                    | 754             | 754          |
| Oct          |                    | 466             | 466          |
| Nov          | 145                | 770             | 915          |
| Dec          |                    | 27              | 27           |
| Total        | 1889               | 2943            | 4832         |

Table 16  
 1997 DOMESTIC HERRING LANDINGS FOR HERRING CAUGHT IN  
 OFFSHORE GOM (statistical area 515) GEAR AND MONTH  
 (metric tons)

| <u>Month</u> | <u>Offshore GOM</u> |                 | <u>Coastal Total</u> |
|--------------|---------------------|-----------------|----------------------|
|              | <u>Purse Seine</u>  | <u>Midwater</u> |                      |
| Jan          |                     |                 |                      |
| Feb          |                     |                 |                      |
| Mar          |                     |                 |                      |
| Apr          |                     |                 |                      |
| May          | 31                  |                 | 31                   |
| Jun          | 77                  | 5               | 82                   |
| Jul          | 134                 | 265             | 399                  |
| Aug          |                     | 631             | 631                  |
| Sep          |                     | 2               | 2                    |
| Oct          |                     |                 |                      |
| Nov          |                     |                 |                      |
| Dec          |                     |                 |                      |
| Total        | 243                 | 904             | 1147                 |

Table 17  
 1997 MAINE HERRING LANDINGS FROM OVER THE SIDE TRANSFERS  
 BY AREA CAUGHT, GEAR AND MONTH  
 (metric tons)

| Month | WESTERN MAINE |          | CENTRAL MAINE |            |      | EASTERN MAINE |            |      | GOM.OFFSHORE |          | Total |
|-------|---------------|----------|---------------|------------|------|---------------|------------|------|--------------|----------|-------|
|       | Purse seine   | Midwater | Purse seine   | Stop seine | Weir | Purse seine   | Stop seine | Weir | Purse seine  | Midwater |       |
| Jan   |               |          |               |            |      |               |            |      |              |          |       |
| Feb   |               |          |               |            |      |               |            |      |              |          |       |
| Mar   |               |          |               |            |      |               |            |      |              |          |       |
| Apr   |               |          |               |            |      |               |            |      |              |          |       |
| May   |               |          |               |            |      |               |            |      |              |          |       |
| Jun   | 43            |          | 107           |            |      |               |            |      |              |          | 150   |
| Jul   |               |          | 62            |            |      |               |            | 17   |              |          | 79    |
| Aug   |               |          | 61            |            |      |               |            | 26   |              |          | 87    |
| Scp   |               |          | 381           |            |      |               |            |      |              |          | 381   |
| Oct   |               |          | 537           |            |      |               |            |      | 45           |          | 582   |
| Nov   |               |          |               |            |      |               |            |      |              |          |       |
| Dec   |               |          |               |            |      |               |            |      |              |          |       |
| Total | 43            |          | 1149          |            |      |               |            | 43   | 45           |          | 1280  |



Table 18

## Catch at Age Analysis

*Metric tons of herring caught by age and region*  
1995-1997

| Age            | Region                     | 1995   | 1996    | 1997   | 1995-1997<br>Combined |
|----------------|----------------------------|--------|---------|--------|-----------------------|
| 1              | Massachusetts Bay          |        |         |        |                       |
|                | S.New England/Mid-Atlantic |        |         |        |                       |
|                | Central Maine              |        |         |        |                       |
|                | W.Maine/Jeffreys Ledge     |        |         | 22     | 22                    |
|                | Georges Bank*              |        |         |        |                       |
| 2              | Massachusetts Bay          | 407    | 1,635   | 786    | 2,827                 |
|                | S.New England/Mid-Atlantic | 36     | 1,942   | 29     | 2,007                 |
|                | Central Maine              | 9,633  | 9,128   | 3,640  | 22,400                |
|                | W.Maine/Jeffreys Ledge     | 1,483  | 5,403   | 750    | 7,636                 |
|                | Georges Bank*              |        |         | 139    | 139                   |
|                | Subtotals:                 | 11,558 | 18,108  | 5,343  | 35,009                |
| 3              | Massachusetts Bay          | 735    | 594     | 4,447  | 5,775                 |
|                | S.New England/Mid-Atlantic | 413    | 1,718   | 7,650  | 9,781                 |
|                | Central Maine              | 5,395  | 4,648   | 20,749 | 30,792                |
|                | W.Maine/Jeffreys Ledge     | 2,494  | 5,181   | 8,762  | 16,436                |
|                | Georges Bank*              |        |         | 4,570  | 4,570                 |
|                | Subtotals:                 | 9,036  | 12,141  | 46,177 | 67,354                |
| 4              | Massachusetts Bay          | 423    | 363     | 545    | 1,331                 |
|                | S.New England/Mid-Atlantic | 789    | 1,792   | 2,308  | 4,889                 |
|                | Central Maine              | 1,809  | 1,642   | 3,902  | 7,352                 |
|                | W.Maine/Jeffreys Ledge     | 1,736  | 3,805   | 1,948  | 7,489                 |
|                | Georges Bank*              |        |         | 673    | 673                   |
|                | Subtotals:                 | 4,756  | 7,602   | 9,376  | 21,735                |
| 5              | Massachusetts Bay          | 1,064  | 329     | 374    | 1,767                 |
|                | S.New England/Mid-Atlantic | 977    | 2,613   | 1,862  | 5,452                 |
|                | Central Maine              | 586    | 1,343   | 1,901  | 3,830                 |
|                | W.Maine/Jeffreys Ledge     | 2,438  | 6,794   | 2,131  | 11,363                |
|                | Georges Bank*              |        |         | 186    | 186                   |
|                | Subtotals:                 | 5,064  | 11,079  | 6,455  | 22,598                |
| 6              | Massachusetts Bay          | 1,550  | 430     | 651    | 2,631                 |
|                | S.New England/Mid-Atlantic | 2,726  | 8,716   | 3,314  | 14,756                |
|                | Central Maine              | 1,191  | 1,768   | 1,573  | 4,532                 |
|                | W.Maine/Jeffreys Ledge     | 7,092  | 17,539  | 4,810  | 29,441                |
|                | Georges Bank*              |        |         | 292    | 292                   |
|                | Subtotals:                 | 12,560 | 28,453  | 10,638 | 51,651                |
| 7              | Massachusetts Bay          | 1,068  | 334     | 889    | 2,292                 |
|                | S.New England/Mid-Atlantic | 3,691  | 5,033   | 4,474  | 13,198                |
|                | Central Maine              | 1,742  | 1,603   | 1,560  | 4,905                 |
|                | W.Maine/Jeffreys Ledge     | 8,767  | 11,491  | 5,991  | 26,249                |
|                | Georges Bank*              |        |         | 239    | 239                   |
|                | Subtotals:                 | 15,268 | 18,461  | 13,153 | 46,882                |
| 8              | Massachusetts Bay          | 693    | 52      | 120    | 864                   |
|                | S.New England/Mid-Atlantic | 2,062  | 1,273   | 1,071  | 4,406                 |
|                | Central Maine              | 1,145  | 752     | 732    | 2,629                 |
|                | W.Maine/Jeffreys Ledge     | 6,891  | 3,623   | 1,527  | 12,041                |
|                | Georges Bank*              |        |         | 133    | 133                   |
|                | Subtotals:                 | 10,790 | 5,700   | 3,582  | 20,073                |
| 9              | Massachusetts Bay          | 173    | 13      | 21     | 207                   |
|                | S.New England/Mid-Atlantic | 812    | 256     | 145    | 1,213                 |
|                | Central Maine              | 567    | 73      | 66     | 706                   |
|                | W.Maine/Jeffreys Ledge     | 2,324  | 1,123   | 374    | 3,822                 |
|                | Georges Bank*              |        |         | 31     | 31                    |
|                | Subtotals:                 | 3,876  | 1,465   | 637    | 5,978                 |
| 10             | Massachusetts Bay          | 49     |         |        | 49                    |
|                | S.New England/Mid-Atlantic |        | 44      |        | 44                    |
|                | Central Maine              | 29     | 3       |        | 60                    |
|                | W.Maine/Jeffreys Ledge     | 792    | 470     | 8      | 1,270                 |
|                | Georges Bank*              |        |         |        |                       |
|                | Subtotals:                 | 869    | 517     | 8      | 1,423                 |
| 11             | Massachusetts Bay          | 26     |         | 32     | 58                    |
|                | S.New England/Mid-Atlantic |        |         |        |                       |
|                | Central Maine              | 41     |         |        | 41                    |
|                | W.Maine/Jeffreys Ledge     | 172    | 46      |        | 220                   |
|                | Georges Bank*              |        |         |        |                       |
|                | Subtotals:                 | 239    | 46      | 32     | 319                   |
| Yearly Totals: |                            | 74,016 | 103,602 | 95,424 | 273,042               |

\* Georges Bank data for 1997 only

Table 19

## Catch at Age Analysis

*Metric tons of herring caught by age and region*  
1995-1997

| Year | Region                      | AGE 1 | AGE 2 | AGE 3  | AGE 4 | AGE 5 | AGE 6  | AGE 7  | AGE 8 | AGE 9 | AGE 10 | AGE 11+ | Total  |
|------|-----------------------------|-------|-------|--------|-------|-------|--------|--------|-------|-------|--------|---------|--------|
| 1995 | Massachusetts Bay           |       | 407   | 735    | 423   | 1,064 | 1,550  | 1,068  | 693   | 173   | 49     | 26      | 6,187  |
|      | S. New England/Mid-Atlantic |       | 36    | 413    | 789   | 977   | 2,726  | 3,691  | 2,062 | 812   |        |         | 11,505 |
|      | Central Maine               |       | 9,633 | 5,395  | 1,809 | 586   | 1,191  | 1,742  | 1,145 | 567   | 29     | 41      | 22,136 |
|      | W. Maine/Jeffreys Ledge     |       | 1,483 | 2,494  | 1,736 | 2,438 | 7,092  | 8,767  | 6,891 | 2,324 | 792    | 172     | 34,188 |
| 1996 | Massachusetts Bay           |       | 1,635 | 594    | 363   | 329   | 430    | 334    | 52    | 13    |        |         | 3,750  |
|      | S. New England/Mid-Atlantic |       | 1,942 | 1,718  | 1,792 | 2,613 | 8,716  | 5,033  | 1,273 | 256   | 44     |         | 23,387 |
|      | Central Maine               |       | 9,128 | 4,648  | 1,642 | 1,343 | 1,768  | 1,603  | 752   | 73    | 31     |         | 20,988 |
|      | W. Maine/Jeffreys Ledge     |       | 5,403 | 5,181  | 3,805 | 6,794 | 17,539 | 11,491 | 3,623 | 1,123 | 470    | 48      | 55,477 |
| 1997 | Massachusetts Bay           |       | 786   | 4,447  | 545   | 374   | 651    | 889    | 120   | 21    |        | 32      | 7,864  |
|      | S. New England/Mid-Atlantic |       | 29    | 7,650  | 2,308 | 1,862 | 3,314  | 4,474  | 1,071 | 145   |        |         | 20,854 |
|      | Central Maine               |       | 3,640 | 20,749 | 3,902 | 1,901 | 1,573  | 1,560  | 732   | 66    |        |         | 34,122 |
|      | W. Maine/Jeffreys Ledge     | 22    | 750   | 8,762  | 1,948 | 2,131 | 4,810  | 5,991  | 1,527 | 374   | 8      |         | 26,323 |
|      | Georges Bank                |       | 139   | 4,570  | 673   | 186   | 292    | 239    | 133   | 31    |        |         | 6,263  |

Chart 1  
 1997 Catch at Age by Region  
 (metric tons)

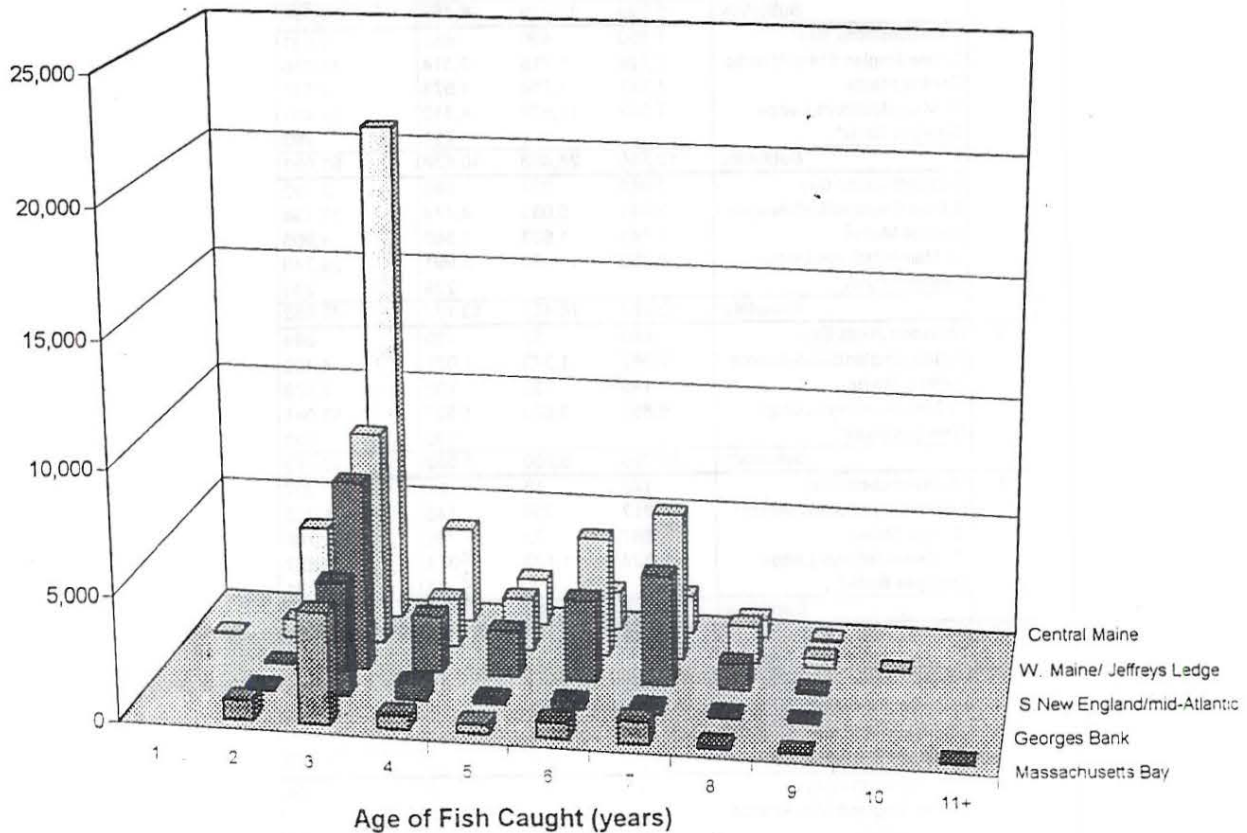


Table 20  
NUMBER AND VALUE OF STANDARD CASES<sup>1</sup> OF MAINE CANNED  
HERRING PRODUCTS AND NUMBER OF MAINE HERRING PACKING PLANTS<sup>2</sup>

| Year | Standard Cases       | Wholesale Value (\$) | No. of Maine Packing Plants |
|------|----------------------|----------------------|-----------------------------|
| 1950 | 3,844,164            | 21,209,033           | 46                          |
| 1951 | 1,676,764            | 14,635,352           | 44                          |
| 1952 | 3,530,876            | 21,507,970           | 48                          |
| 1953 | 2,782,495            | 16,954,119           | 44                          |
| 1954 | 2,934,933            | 18,152,815           | 43                          |
| 1955 | 1,268,843            | 9,333,350            | 35                          |
| 1956 | 2,231,441            | 16,692,008           | 39                          |
| 1957 | 2,217,688            | 14,733,259           | 37                          |
| 1958 | 2,099,959            | 15,873,963           | 33                          |
| 1959 | 1,753,145            | 14,902,142           | 31                          |
| 1960 | 1,997,618            | 16,699,987           | 31                          |
| 1961 | 753,647              | 7,559,619            | 31                          |
| 1962 | 2,144,372            | 19,931,333           | 31                          |
| 1963 | 1,637,348            | 13,547,306           | 27                          |
| 1964 | 865,751              | 7,583,821            | 23                          |
| 1965 | 1,226,903            | 10,868,060           | 23                          |
| 1966 | 1,332,544            | 12,261,590           | 23                          |
| 1967 | 1,250,411            | 13,862,330           | 23                          |
| 1968 | 1,730,306            | 19,296,678           | 22                          |
| 1969 | 1,042,806            | 11,531,342           | 21                          |
| 1970 | 806,501              | 11,226,817           | 21                          |
| 1971 | 950,821              | 11,796,509           | 20                          |
| 1972 | 1,561,535            | 23,877,119           | 18                          |
| 1973 | 995,056              | 15,688,156           | 17                          |
| 1974 | 1,143,801            | 23,954,640           | 16                          |
| 1975 | 1,248,929            | 27,998,614           | 15                          |
| 1976 | 1,209,074            | 29,591,481           | 15                          |
| 1977 | 1,269,955            | 34,407,778           | 15                          |
| 1978 | 1,301,965            | 41,167,963           | 15                          |
| 1979 | 1,429,646            | 49,370,005           | 14                          |
| 1980 | 1,109,883            | 41,370,210           | 14                          |
| 1981 | 1,468,809            | 49,433,137           | 14                          |
| 1982 | 1,014,336            | 40,573,440           | 13                          |
| 1983 | 724,103              | 26,450,000           | 12                          |
| 1984 | 870,179              | 34,213,000           | 12                          |
| 1985 | 983,651              | 37,800,000           | 11                          |
| 1986 | 953,194              | 43,680,696           | 10                          |
| 1987 | 882,178              | 40,414,536           | 10                          |
| 1988 | 980,826 <sup>3</sup> | 44,137,170           | 9                           |
| 1989 | 770,224              | 34,660,080           | 8                           |
| 1990 | 815,758              | 37,340,886           | 8                           |
| 1991 | 847,319              | 42,317,602           | 7                           |
| 1992 | 948,792              | 47,439,600           | 6                           |
| 1993 | 924,298              | 46,214,900           | 6                           |
| 1994 | 934,686              | 46,734,300           | 6                           |
| 1995 | 872,924              | 43,646,200           | 6                           |
| 1996 | 1,022,621            | 51,131,050           | 6                           |
| 1997 | 891,000              | 44,550,000           | 5                           |

<sup>1</sup>Data reported as standard cases of 100 cans beginning in 1990 when cans larger than 3 1/4 oz. were eliminated and value of \$50. per case beginning in 1991.

<sup>2</sup>Data prior to 1950 (1919-1949) are available from the Maine Department of Marine Resources.

<sup>3</sup>Maine & Massachusetts --- Mass. with 1 plant.







# LOBSTER

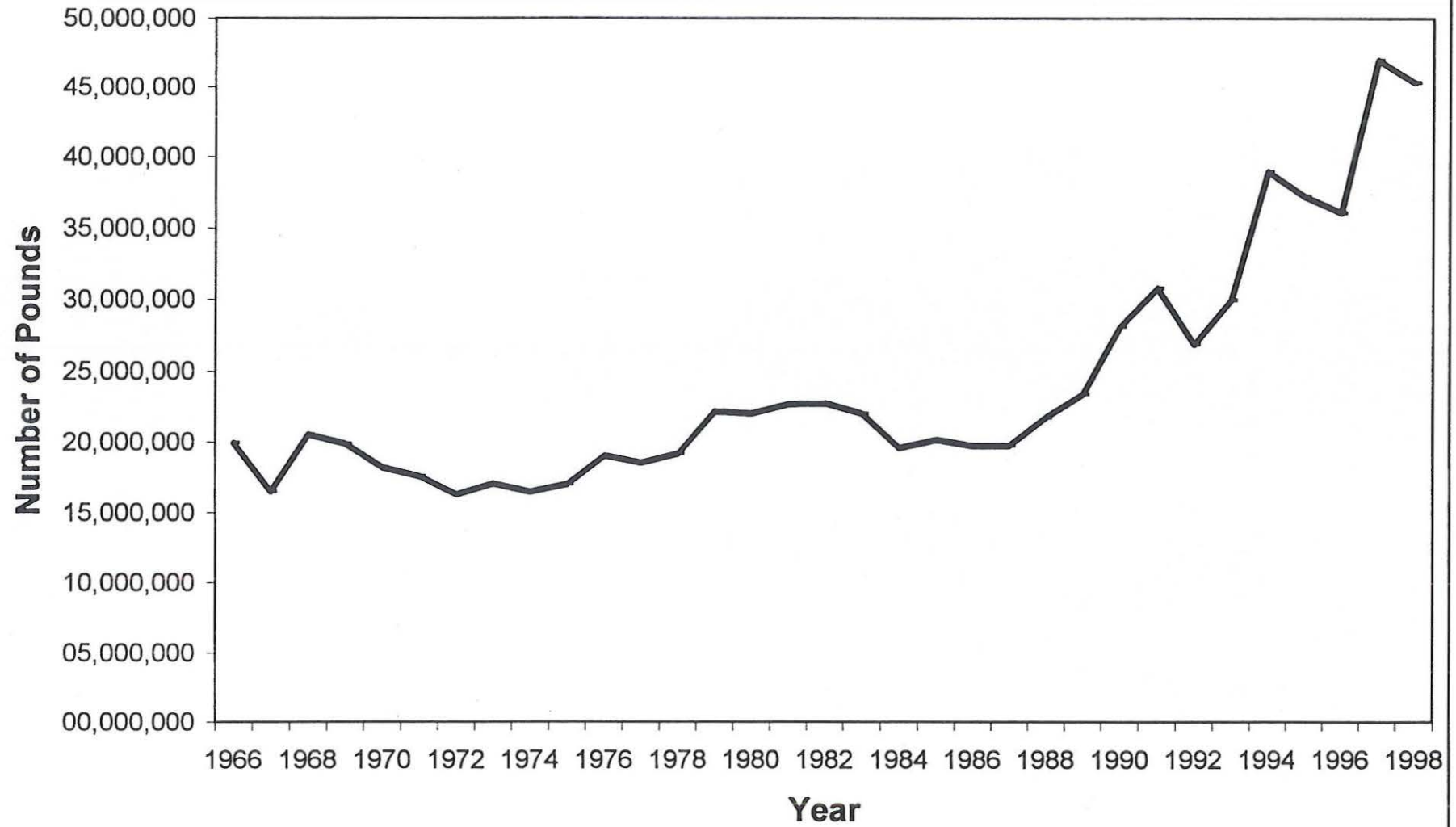
## Introduction

In 1998, Maine lobster fishers harvested 45,324,956 pounds of lobster valued at \$131,762,825. Although this represents a slight decline in landings when compared with 1997, overall the 1998 landings maintain the trend of high landings reported for the past decade (Figure 1). The decline in landings can be attributed to the York and Knox Counties (Figure 2). Lincoln and Sagadahoc County landings remained at 1997 levels, while Cumberland, Hancock and Washington Counties showed increases in landings.

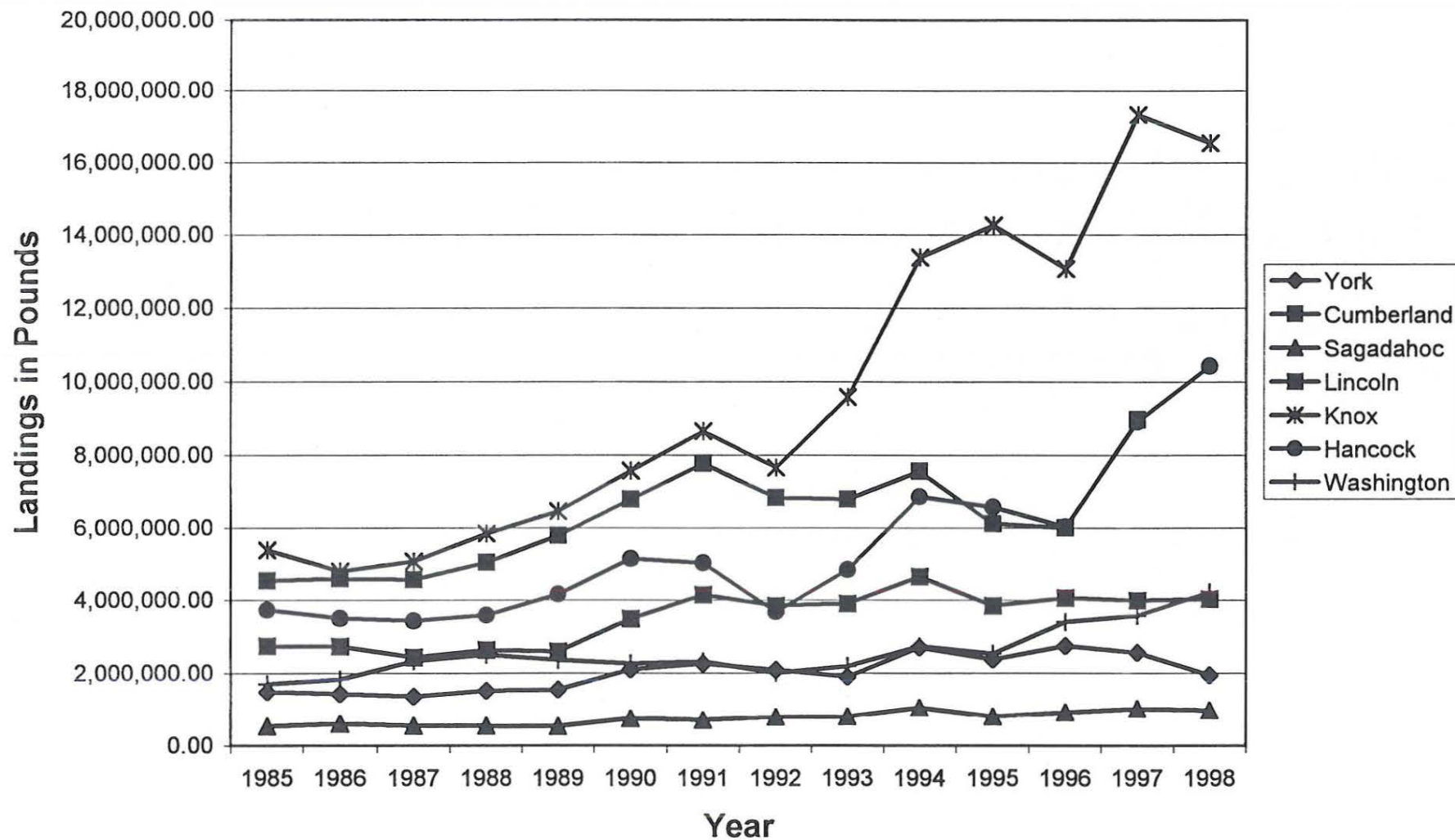
During 1998, we continued our ongoing port (begun in 1966) and sea (begun in 1985) sampling programs. The port samplers collected catch and effort data from 449 lobster boats that landed catches at randomly selected dealerships along Maine's coastline. In addition to collecting catch and effort data, sea samplers collected detailed information of individual lobsters. The sea sampling program allows us to make observations on lobsters that are protected from harvest including undersized lobsters, v-notched and egg-bearing females. In addition to maintaining both of these long-term time series, we made three important advances in the sea-sampling program by: (1) expanding area sampled to increase coastal coverage, (2) sampling a higher percentage of planned trips (Figure 3), and (3) creating a database to prepare our time series for analysis and interpretation.

An inventory of sampling data – including compilation of both tag and recapture and gear selectivity studies – was done to determine data input and analysis needs and potentials. Our most recent size-at-maturity and fecundity data were analyzed and compared with other studies done in the Gulf of Maine. A special study was also set up in an attempt to determine the impact of aerial spraying of pesticides on lobsters.

## Maine Lobster Landings



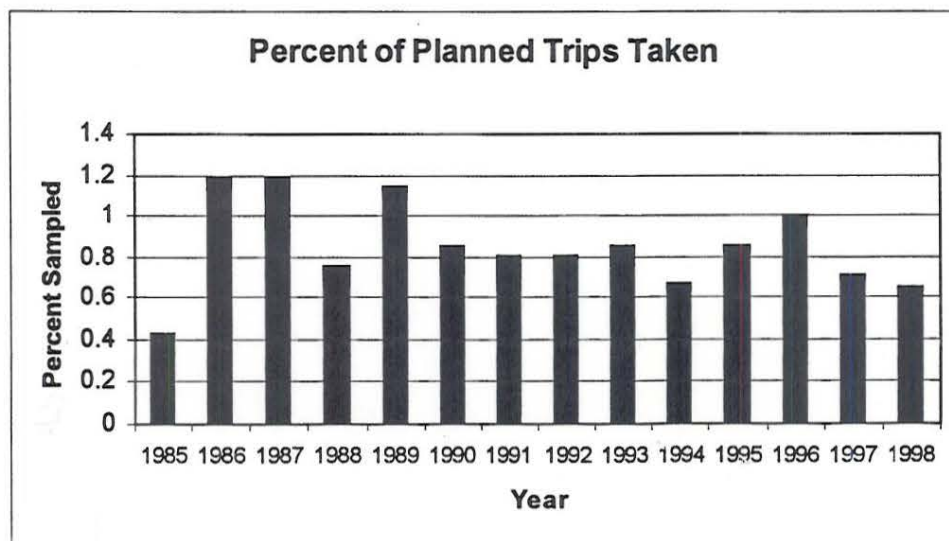
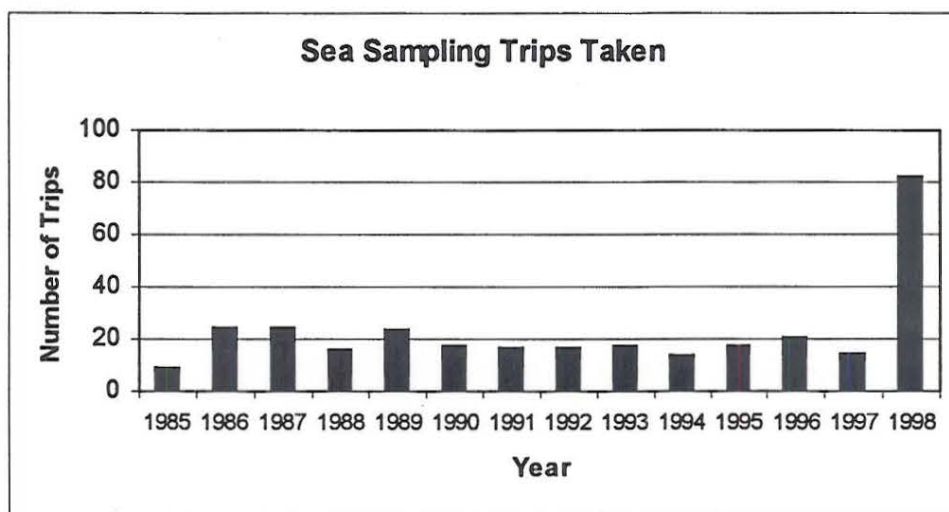
## Maine Lobster Landings by County





Inventory of Sea Sampling Trips from 1985-1998.

| Year | Number of Trips Taken | Number of Trips Planned | Percent of Planned Trips Taken |
|------|-----------------------|-------------------------|--------------------------------|
| 1985 | 9                     | 21                      | 43                             |
| 1986 | 25                    | 21                      | 119                            |
| 1987 | 25                    | 21                      | 119                            |
| 1988 | 16                    | 21                      | 76                             |
| 1989 | 24                    | 21                      | 114                            |
| 1990 | 18                    | 21                      | 86                             |
| 1991 | 17                    | 21                      | 81                             |
| 1992 | 17                    | 21                      | 81                             |
| 1993 | 18                    | 21                      | 86                             |
| 1994 | 14                    | 21                      | 67                             |
| 1995 | 18                    | 21                      | 86                             |
| 1996 | 21                    | 21                      | 100                            |
| 1997 | 15                    | 21                      | 71                             |
| 1998 | 82                    | 126                     | 65                             |



**MAINE DEPARTMENT OF MARINE RESOURCES  
INTERJURISDICTIONAL FISHERIES RESOURCE MONITORING AND  
ASSESSMENT**

**LOBSTER PORT SAMPLING SURVEY  
PROJECT NO. 3-IJ-143  
GRANT NO. NA86FI0022**

**COMPLETION REPORT  
JANUARY 1 THROUGH DECEMBER 31, 1998**

**BY GARY ROBINSON**

## Commercial Port Sampling Survey

### 1. Survey Summary

During 1998 we have: (1) collected catch and effort data along with pertinent biological information from lobster fishers who landed their catches at ten randomly selected lobster dealers each month, except January through March when the lobster fishery was the least active; (2) compiled the survey data by sample day, then summarized these results by month and year (Table 1); (3) completed daily, monthly, and annual estimates of mean lengths and weights along with percentage of females, culls, and shedders from the cluster samples (Table 2); and (4) completed the expanded estimates by sample month and year for all dealer-days in the survey (Table 3).

Length-frequencies for the cluster samples of 10 lobsters from each boat were grouped by 1 mm increments for males, females, and sexes combined by month and year for 1998 (Table 4). With the size frequency data for sexes combined we determined the percentage of lobsters within 14% carapace length (molt) groupings of 83-94, 95-108, 109-124, and 125-127 mm (maximum legal size). These values were then applied to the number of lobsters caught in 1998 (obtained by dividing total pounds harvested, according to the Maine Landings, by the mean weight of commercially caught lobsters) to estimate the number of lobsters harvested by size category the number of lobsters harvested in 1998 (Table 5).

From April through December 1998, the port-sampling crew collected catch and effort data from 449 lobster boats which landed catches at randomly selected dealers who purchase lobsters from at least five boats, located from Kittery to Eastport. A total of 90 dealer buying locations (10 locations per month) were randomly selected in 1998. Of these, we recorded statistical information at 58 locations. Out of the remaining 32 dealers we were able to call ahead 19 times during inclement weather to determine if fishers were actually fishing that day. If the dealer had no boats out the survey trip was canceled, thereby saving travel time and expense (Table 6). Calling ahead is not always possible due to the logistics of the Maine Coast and dealer location.

The total catch sampled weighed approximately 52 tons and consisted of 83,508 lobsters in count, valued at \$265,178.00 (ex-vessel price). The cluster sample (measurements recorded) for this landed catch was 2.79 tons of lobsters. To accomplish this task the port sampling crew traveled 16,259 miles during this nine month period, in addition to distances traveled to off shore islands.

Starting in the midsummer of 1997 we conducted a re-survey program to identify lobster dealers buying from five or more boats. Because of time restraints we were only able to



interview about half of the dealers licensed to purchase lobsters directly from lobster fishers. The survey showed that there has been a significant increase in lobster dealers, possibly due to the exceptional landings in recent years. As a result the number of dealers (by county) eligible to be sampled, number of dealers selected and the number of dealer locations that we collected statistical information in 1998 were as follows:

|            | No.<br>Dealers | No.<br>Drawn | No. of Days we<br>obtained samples |
|------------|----------------|--------------|------------------------------------|
| York       | 14             | 5            | 2                                  |
| Cumberland | 27             | 18           | 10                                 |
| Sagadahoc  | 6              | 4            | 2                                  |
| Lincoln    | 17             | 12           | 8                                  |
| Knox       | 29             | 18           | 12                                 |
| Hancock    | 29             | 21           | 18                                 |
| Washington | <u>21</u>      | <u>12</u>    | <u>6</u>                           |
| Total      | 143            | 90           | 58                                 |

This increased in the number of dealers from 116 in 1997 to a high of 143 dealers in 1998 is spread over all counties (Figure 1) and may reflect an increase in our expanded estimates, even though all our catch-per-unit -of-effort values show the total catch for 1998 may decrease slightly from 1997 (Figure 2).

Compared to the coast wide distribution of lobsters dealers, the number of boats sampled by county was proportional to the number of dealers (Figure 3). In the instances of Knox and Hancock counties having the same number of dealers, Knox county was drawn 18 times, but had 6 days canceled (4 were due to poor weather conditions which result in boats staying in port on the selected sample days, 1 dealer unexpectedly went out of business and one delayed opening his business in the spring due to poor fishing) or 33% of the time; whereas Hancock was drawn 21 times but only had 3 days canceled or 14% of the time (Table 6). In spite of this situation the survey data is still considered to be representative of the coastal lobster fishery.

Some selected findings from the 1998 survey show: 1) the 1998 catch-per-unit-effort values of 1.12 lbs. / trap-haul and 224.3 lbs. / boat-day, down from 1997 (1.24 and 253.0 respectively), but is the second highest recorded since the inception of the program in 1966. 2) landed lobsters had an average CL of 89.3 mm and weight of 564.6 g (1.25 lbs.) a slight decrease from 1997, 3) 1998 prices per lb. averaged \$3.90 for hardshells, \$2.67 for softshells, and \$4.11 for selects, only one dealer in the survey was recorded to be paying a cull price (\$3.00 per lb.).



Table 1. Survey catch and effort values summarized by catagory for each sample month, 1998.

|                                   | APRIL     | MAY      | JUNE      | JULY      | AUGUST    | SEPTEMBER | OCTOBER   | NOVEMBER  | DECEMBER | TOTAL   |
|-----------------------------------|-----------|----------|-----------|-----------|-----------|-----------|-----------|-----------|----------|---------|
| 1. TOTAL CATCH IN POUNDS (LBS.)   | 2,951     | 2,308    | 3,128     | 11,502    | 23,761    | 32,292    | 19,313    | 5,641     | 2,746    | 103,642 |
| 2. TOTAL CATCH IN NUMBERS (NO.)   | 2,310     | 1,797    | 2,406     | 9,010     | 19,193    | 26,049    | 15,798    | 4,754     | 2,191    | 83,508  |
| 3. TOTAL VALUE OF CATCH (\$)      | 12,899.70 | 7,449.00 | 10,708.40 | 30,813.20 | 59,674.90 | 82,848.65 | 56,243.13 | 16,178.80 | 8,362.20 | 285,178 |
| 4. TOTAL NO. OF FEMALES IN SAMPLE | 147       | 76       | 144       | 173       | 355       | 542       | 469       | 135       | 71       | 2,112   |
| 5. TOTAL NO. OF MALES IN SAMPLE   | 151       | 66       | 206       | 377       | 505       | 568       | 341       | 115       | 39       | 2,368   |
| 6. TOTAL NO. OF TRAP-HAULS        | 6,351     | 2,967    | 6,723     | 12,053    | 17,459    | 24,380    | 16,542    | 3,927     | 2,360    | 92,762  |
| 7. TOTAL NO. OF TRAPS SET OUT     | 15,396    | 8,489    | 17,983    | 29,123    | 59,420    | 77,853    | 48,922    | 14,741    | 4,714    | 276,641 |
| 8. TOTAL NO. OF MAN-DAYS          | 60        | 27       | 55        | 95        | 143       | 205       | 132       | 42        | 20       | 779     |
| 9. TOTAL NO. OF MAN-HOURS         | 483.75    | 220.43   | 406.56    | 790.16    | 1,230.18  | 1,664.36  | 971.17    | 343.83    | 151.50   | 6,262   |
| 10. TOTAL NO. OF BOAT-DAYS        | 30        | 15       | 35        | 57        | 86        | 117       | 84        | 25        | 13       | 462     |
| 11. TOTAL NO. OF BOAT-HOURS       | 241.29    | 117.48   | 253.82    | 473.18    | 733.32    | 951.35    | 596.46    | 207.16    | 96.87    | 3,671   |
| 12. MEAN WEIGHT LOBSTERS (LBS.)   | 1.28      | 1.28     | 1.30      | 1.28      | 1.24      | 1.24      | 1.22      | 1.19      | 1.25     | 1.24    |
| 13. CATCH IN LBS. / TRAP-HAUL     | 0.46      | 0.78     | 0.47      | 0.95      | 1.36      | 1.32      | 1.17      | 1.44      | 1.16     | 1.12    |
| 14. CATCH IN NO. / TRAP-HAUL      | 0.36      | 0.61     | 0.36      | 0.75      | 1.10      | 1.07      | 0.96      | 1.21      | 0.93     | 0.90    |
| 15. CATCH IN LBS. / MAN-DAY       | 49.18     | 85.48    | 56.87     | 121.07    | 166.16    | 157.52    | 146.31    | 134.31    | 137.30   | 133.04  |
| 16. CATCH IN NO. / MAN-DAY        | 38.50     | 66.56    | 43.75     | 94.84     | 134.22    | 127.07    | 119.68    | 113.19    | 109.55   | 107.20  |
| 17. CATCH IN LBS. / MAN-HOUR      | 6.10      | 10.47    | 7.69      | 14.56     | 19.32     | 19.40     | 19.89     | 16.41     | 18.13    | 16.55   |
| 18. CATCH IN NO. / MAN-HOUR       | 4.78      | 8.15     | 5.92      | 11.40     | 15.60     | 15.65     | 16.27     | 13.83     | 14.46    | 13.34   |
| 19. CATCH IN LBS. / BOAT-DAY      | 98.37     | 153.87   | 89.37     | 201.79    | 276.29    | 276.00    | 229.92    | 225.64    | 211.23   | 224.33  |
| 20. CATCH IN NO. / BOAT-DAY       | 77.00     | 119.80   | 68.74     | 158.07    | 223.17    | 222.64    | 188.07    | 190.16    | 168.54   | 180.75  |
| 21. VALUE / TRAP-HAUL             | \$ 2.03   | 2.51     | 1.59      | 2.56      | 3.42      | 3.40      | 3.40      | 4.12      | 3.54     | 3.07    |
| 22. VALUE/MAN-DAY                 | \$ 215.00 | 275.89   | 194.70    | 324.35    | 417.31    | 404.14    | 426.08    | 385.21    | 418.11   | 366.08  |
| 23. VALUE/MAN-HOUR                | \$ 26.67  | 33.79    | 26.34     | 39.00     | 48.51     | 49.78     | 57.91     | 47.05     | 55.20    | 45.54   |
| 24. VALUE/BOAT-DAY                | \$ 429.99 | 496.60   | 305.95    | 540.58    | 693.89    | 708.11    | 669.56    | 647.15    | 643.25   | 617.27  |
| 25. VALUE/BOAT-HOUR               | \$ 53.46  | 63.41    | 42.19     | 65.12     | 81.38     | 87.09     | 94.29     | 78.10     | 86.32    | 77.69   |

Table 2. Mean carapace length (mm) and weight (g) with percentages of female (F), softshells (S), and culls (C, missing and/or regenerative claws [S]) of lobsters in cluster samples by dealer code and sampled months, 1998

1998

| APRIL |      |       |      |     |      | MAY  |      |       |      |     |      | JUNE |      |       |      |      |      | JULY |      |       |      |       |      | AUGUST |      |       |      |       |      |
|-------|------|-------|------|-----|------|------|------|-------|------|-----|------|------|------|-------|------|------|------|------|------|-------|------|-------|------|--------|------|-------|------|-------|------|
| CODE  | LTH  | WGT   | F    | S   | C    | CODE | LTH  | WGT   | F    | S   | C    | CODE | LTH  | WGT   | F    | S    | C    | CODE | LTH  | WGT   | F    | S     | C    | CODE   | LTH  | WGT   | F    | S     | C    |
| W-10  | 88.6 | 556.5 | 40.8 | 0.0 | 0.0  | W-10 | 92.5 | 661.0 | 40.0 | 0.0 | 0.0  | K-4  | 90.4 | 600.0 | 51.7 | 0.0  | 5.1  | W-4  | 92.6 | 651.1 | 70.0 | 0.0   | 20.0 | Y-9    | 87.8 | 527.9 | 34.5 | 72.4  | 17.7 |
| L-11  | 89.2 | 574.1 | 51.8 | 0.0 | 9.3  | K-14 | 90.9 | 579.6 | 31.2 | 0.0 | 22.5 | L-2  | 89.8 | 585.7 | 48.6 | 0.0  | 11.4 | L-4  | 88.9 | 570.3 | 23.4 | 94.8  | 8.1  | S-7    | 89.5 | 558.5 | 39.0 | 98.5  | 7.9  |
| H-24  | 88.4 | 552.0 | 55.8 | 0.0 | 2.7  | H-20 | 88.1 | 552.3 | 60.2 | 0.0 | 6.2  | H-15 | 95.6 | 745.6 | 78.9 | 0.0  | 18.9 | C-19 | 88.2 | 541.5 | 21.0 | 97.6  | 8.3  | H-16   | 90.0 | 607.0 | 40.0 | 100.0 | 10.0 |
| H-11  | 89.0 | 550.6 | 26.0 | 0.0 | 10.6 |      |      |       |      |     |      | H-35 | 89.7 | 575.3 | 57.1 | 0.0  | 17.1 | W-12 | 91.8 | 613.4 | 57.4 | 53.2  | 3.8  | K-33   | 89.1 | 548.4 | 53.2 | 100.0 | 11.3 |
| H-29  | 87.8 | 545.4 | 55.6 | 0.0 | 3.5  |      |      |       |      |     |      | C-31 | 89.0 | 573.7 | 22.3 | 90.4 | 14.8 | L-12 | 90.5 | 618.7 | 7.5  | 84.1  | 1.4  | K-3    | 89.1 | 577.8 | 37.0 | 99.3  | 10.8 |
| K-40  | 89.6 | 586.3 | 51.7 | 0.0 | 8.8  |      |      |       |      |     |      | C-19 | 88.0 | 529.0 | 19.8 | 94.1 | 12.0 | H-7  | 90.6 | 584.9 | 38.6 | 100.0 | 7.9  | H-30   | 90.2 | 585.0 | 37.3 | 100.0 | 6.9  |
| H-2   | 90.3 | 586.6 | 55.9 | 0.0 | 34.6 |      |      |       |      |     |      |      |      |       |      |      |      | S-5  | 89.2 | 562.2 | 34.8 | 91.9  | 15.3 | C-18   | 88.9 | 534.8 | 55.6 | 100.0 | 18.1 |
|       |      |       |      |     |      |      |      |       |      |     |      |      |      |       |      |      |      |      |      |       |      |       |      | K-42   | 88.7 | 535.9 | 43.4 | 100.0 | 7.1  |
|       |      |       |      |     |      |      |      |       |      |     |      |      |      |       |      |      |      |      |      |       |      |       |      | H-13   | 90.0 | 585.2 | 45.0 | 100.0 | 5.6  |
| X     | 89.0 | 564.5 | 48.2 | 0.0 | 9.9  | X    | 90.5 | 597.6 | 43.8 | 0.0 | 9.6  | X    | 90.4 | 601.6 | 46.4 | 30.8 | 13.2 | X    | 90.3 | 591.7 | 36.1 | 74.5  | 9.4  | X      | 89.4 | 562.3 | 42.8 | 96.7  | 10.6 |
| SE    | 0.3  | 6.6   | 4.2  | 0.0 | 4.4  | SE   | 1.3  | 32.6  | 8.6  | 0.0 | 6.7  | SE   | 1.1  | 30.4  | 9.1  | 19.5 | 2.0  | SE   | 6.1  | 14.3  | 8.2  | 13.8  | 2.4  | SE     | 0.3  | 9.2   | 2.5  | 3.0   | 1.5  |

| SEPTEMBER |      |       |      |       |      | OCTOBER |      |       |      |       |      | NOVEMBER |      |       |      |       |      | DECEMBER |      |       |      |       |     | TOTAL |      |       |      |      |      |
|-----------|------|-------|------|-------|------|---------|------|-------|------|-------|------|----------|------|-------|------|-------|------|----------|------|-------|------|-------|-----|-------|------|-------|------|------|------|
| CODE      | LTH  | WGT   | F    | S     | C    | CODE    | LTH  | WGT   | F    | S     | C    | CODE     | LTH  | WGT   | F    | S     | C    | CODE     | LTH  | WGT   | F    | S     | C   | CODE  | LTH  | WGT   | F    | S    | C    |
| K-10      | 88.4 | 532.9 | 40.8 | 100.0 | 8.7  | W-16    | 89.6 | 562.8 | 54.4 | 100.0 | 8.8  | L-4      | 88.9 | 550.5 | 57.1 | 100.0 | 4.5  | H-26     | 90.5 | 595.2 | 62.4 | 100.0 | 6.4 |       |      |       |      |      |      |
| C-15      | 89.3 | 562.8 | 50.1 | 100.0 | 6.8  | C-3     | 87.2 | 499.6 | 60.0 | 100.0 | 18.5 | L-10     | 89.5 | 554.1 | 54.1 | 100.0 | 14.1 | H-11     | 90.1 | 571.5 | 62.7 | 100.0 | 9.7 |       |      |       |      |      |      |
| H-34      | 90.3 | 590.6 | 53.3 | 100.0 | 7.8  | K-7     | 89.2 | 555.3 | 52.7 | 100.0 | 18.2 | L-8      | 89.3 | 555.6 | 61.8 | 100.0 | 16.3 | L-4      | 90.7 | 605.0 | 80.0 | 100.0 | 0.0 |       |      |       |      |      |      |
| H-15      | 91.0 | 613.9 | 51.2 | 100.0 | 4.6  | C-19    | 88.8 | 546.0 | 69.8 | 100.0 | 12.2 | K-5      | 88.8 | 536.1 | 65.7 | 100.0 | 21.7 |          |      |       |      |       |     |       |      |       |      |      |      |
| C-18      | 87.3 | 503.6 | 51.2 | 100.0 | 21.2 | W-7     | 90.3 | 582.2 | 47.8 | 100.0 | 12.6 | K-6      | 89.2 | 567.1 | 44.4 | 100.0 | 5.7  |          |      |       |      |       |     |       |      |       |      |      |      |
| H-4       | 89.8 | 566.3 | 55.3 | 100.0 | 13.9 | H-18    | 89.2 | 557.1 | 54.2 | 100.0 | 12.1 |          |      |       |      |       |      |          |      |       |      |       |     |       |      |       |      |      |      |
| H-20      | 89.8 | 577.4 | 50.3 | 100.0 | 9.0  | K-41    | 90.7 | 587.9 | 28.0 | 100.0 | 6.7  |          |      |       |      |       |      |          |      |       |      |       |     |       |      |       |      |      |      |
| C-27      | 88.2 | 539.5 | 66.6 | 100.0 | 6.0  | Y-23    | 87.5 | 512.0 | 72.0 | 100.0 | 8.7  |          |      |       |      |       |      |          |      |       |      |       |     |       |      |       |      |      |      |
| C-12      | 88.4 | 539.5 | 48.9 | 100.0 | 7.6  |         |      |       |      |       |      |          |      |       |      |       |      |          |      |       |      |       |     |       |      |       |      |      |      |
| K-2       | 89.5 | 572.1 | 43.9 | 100.0 | 11.4 |         |      |       |      |       |      |          |      |       |      |       |      |          |      |       |      |       |     |       |      |       |      |      |      |
| X         | 89.2 | 559.9 | 51.2 | 100.0 | 9.7  | X       | 89.1 | 550.4 | 54.9 | 100.0 | 12.2 | X        | 89.1 | 552.7 | 56.6 | 100.0 | 12.4 | X        | 90.5 | 590.6 | 68.4 | 100.0 | 5.3 | X     | 89.6 | 570.6 | 48.7 | 72.0 | 10.5 |
| SE        | 0.4  | 10.1  | 2.2  | 0.0   | 1.5  | SE      | 0.4  | 10.9  | 4.9  | 0.0   | 1.5  | SE       | 0.1  | 5.0   | 3.7  | 0.0   | 3.3  | SE       | 0.2  | 9.9   | 5.8  | 0.0   | 2.8 | SE    | 0.2  | 5.1   | 2.0  | 5.7  | 0.9  |

Table 3. Some expanded estimates of catch and effort with standard errors calculated for all dealer-days in the survey, April through December, 1998.

EXPANDED ESTIMATES - 1998

| MONTHS | Catch in<br>Pounds | Catch in<br>Numbers | Value in<br>Dollars | Number of<br>Traps | Number of<br>Trap-Hauls | Number of<br>T.H.S.O.D. | Number of<br>Man-Days | Number of<br>Boat-Days | Pounds per<br>Trap-Haul | Numbers per<br>Trap-Haul | Numbers per<br>T.H.S.O.D. | Pounds per<br>Boat-Day | Pounds per<br>Man-Day |
|--------|--------------------|---------------------|---------------------|--------------------|-------------------------|-------------------------|-----------------------|------------------------|-------------------------|--------------------------|---------------------------|------------------------|-----------------------|
| APRIL  | 1,000,389          | 783,090             | 4,372,998           | 248,535            | 2,152,989               | 9,560,817               | 20,340                | 10,170                 | 0.48465                 | 0.36372                  | 0.08191                   | 98.38687               | 49.18333              |
|        | +/- 329,800        | +/- 254,679         | +/- 1,390,588       | +/- 75,856         | +/- 637,228             | +/- 3,227,539           | +/- 5,468             | +/- 2,674              | +/- 0.06044             | +/- 0.04347              | +/- 0.00812               | +/- 14.64555           | +/- 5.90349           |
| MAY    | 908,680            | 707,479             | 2,932,671           | 359,368            | 1,168,108               | 6,948,018               | 10,630                | 5,906                  | 0.77789                 | 0.60586                  | 0.10182                   | 153.88687              | 85.48181              |
|        | +/- 641,939        | +/- 503,361         | +/- 2,086,594       | +/- 300,198        | +/- 891,041             | +/- 5,173,921           | +/- 7,448             | +/- 4,668              | +/- 0.13254             | +/- 0.09698              | +/- 0.01415               | +/- 32.11233           | +/- 11.19110          |
| JUNE   | 1,138,244          | 875,517             | 3,896,888           | 392,629            | 2,446,425               | 11,283,831              | 20,014                | 12,736                 | 0.46527                 | 0.35788                  | 0.07759                   | 89.37143               | 56.87273              |
|        | +/- 401,807        | +/- 301,873         | +/- 1,318,919       | +/- 126,337        | +/- 769,861             | +/- 3,863,871           | +/- 6,065             | +/- 3,720              | +/- 0.08647             | +/- 0.04554              | +/- 0.01209               | +/- 11.94735           | +/- 9.75578           |
| JULY   | 4,254,590          | 3,332,799           | 11,397,803          | 569,979            | 4,458,405               | 14,386,521              | 35,141                | 21,084                 | 0.95429                 | 0.74753                  | 0.23186                   | 201.79235              | 121.07368             |
|        | +/- 1,941,088      | +/- 1,517,691       | +/- 5,189,914       | +/- 205,313        | +/- 1,730,806           | +/- 5,160,469           | +/- 11,726            | +/- 7,063              | +/- 0.10310             | +/- 0.07867              | +/- 0.04974               | +/- 31.42345           | +/- 20.37146          |
| AUG    | 8,896,118          | 7,185,859           | 22,342,283          | 950,720            | 6,536,650               | 25,316,928              | 53,539                | 32,198                 | 1.38096                 | 1.09932                  | 0.26384                   | 278.29070              | 166.16084             |
|        | +/- 2,610,090      | +/- 2,126,157       | +/- 6,687,157       | +/- 275,661        | +/- 1,684,050           | +/- 6,381,633           | +/- 13,751            | +/- 8,596              | +/- 0.08461             | +/- 0.06727              | +/- 0.02585               | +/- 25.46786           | +/- 13.01705          |
| SEPT   | 13,950,144         | 11,253,168          | 35,790,617          | 1,121,083          | 10,532,160              | 40,148,784              | 88,560                | 50,544                 | 1.32453                 | 1.08846                  | 0.28029                   | 276.00000              | 157.52195             |
|        | +/- 2,509,632      | +/- 1,936,980       | +/- 6,823,682       | +/- 234,154        | +/- 1,841,225           | +/- 7,564,313           | +/- 16,547            | +/- 8,520              | +/- 0.10769             | +/- 0.08500              | +/- 0.028029              | +/- 14.64741           | +/- 10.24389          |
| OCT    | 8,561,453          | 7,003,253           | 24,932,580          | 874,481            | 7,333,089               | 37,357,778              | 58,516                | 37,237                 | 1.16751                 | 0.95502                  | 0.18746                   | 229.91667              | 140.31061             |
|        | +/- 2,996,890      | +/- 2,492,409       | +/- 8,571,765       | +/- 240,198        | +/- 2,300,615           | +/- 12,831,158          | +/- 15,733            | +/- 9,233              | +/- 0.08316             | +/- 0.07025              | +/- 0.00749               | +/- 30.32200           | +/- 18.57958          |
| NOV    | 2,381,129          | 2,006,716           | 6,829,251           | 386,214            | 1,657,630               | 9,138,706               | 17,729                | 10,553                 | 1.43647                 | 1.21059                  | 0.21958                   | 225.63527              | 134.30701             |
|        | +/- 883,524        | +/- 742,603         | +/- 2,533,222       | +/- 158,840        | +/- 636,078             | +/- 3,704,177           | +/- 6,701             | +/- 4,189              | +/- 0.10139             | +/- 0.07931              | +/- 0.02154               | +/- 34.33129           | +/- 18.86383          |
| DEC    | 995,974            | 794,678             | 3,032,970           | 183,848            | 855,972                 | 5,589,207               | 7,254                 | 4,715                  | 1.16356                 | 0.92839                  | 0.14218                   | 211.23077              | 137.30000             |
|        | +/- 510,607        | +/- 406,419         | +/- 1,562,025       | +/- 123,093        | +/- 502,480             | +/- 3,369,012           | +/- 4,325             | +/- 2,914              | +/- 0.34506             | +/- 0.27807              | +/- 0.04467               | +/- 77.03461           | +/- 39.72653          |
| TOTALS | 42,086,701         | 33,942,557          | 115,527,841         | 5,086,855          | 37,141,408              | 159,730,590             | 311,723               | 185,143                | 1.11729                 | 0.90024                  | 0.21001                   | 224.33333              | 133.04493             |
|        | +/- 5,252,012      | +/- 4,233,399       | +/- 14,441,058      | +/- 0              | +/- 4,118,790           | +/- 19,141,584          | +/- 32,151            | +/- 18,720             | +/- 0.04002             | +/- 0.03174              | +/- 0.00906               | +/- 9.40478            | +/- 5.55505           |



Table 4. Carapace length frequencies from survey of commercial landings by sex and month for 1998.

| carapace<br>length<br>(mm) | APRIL |         |       | MAY   |         |       | JUNE  |         |       | JULY  |         |       | AUGUST |         |       | SEPTEMBER |         |       | OCTOBER |         |       | NOVEMBER |         |       | DECEMBER |         |       | TOTALS |         |       |
|----------------------------|-------|---------|-------|-------|---------|-------|-------|---------|-------|-------|---------|-------|--------|---------|-------|-----------|---------|-------|---------|---------|-------|----------|---------|-------|----------|---------|-------|--------|---------|-------|
|                            | Males | Females | Total | Males | Females | Total | Males | Females | Total | Males | Females | Total | Males  | Females | Total | Males     | Females | Total | Males   | Females | Total | Males    | Females | Total | Males    | Females | Total | Males  | Females | Total |
| 82                         |       |         | 0     |       |         | 0     |       |         | 0     |       |         | 0     |        |         | 0     |           |         | 0     |         |         | 0     |          |         | 0     |          |         | 0     | 0      | 0       | 0     |
| 83                         | 29    | 18      | 47    | 5     | 6       | 11    | 18    | 12      | 30    | 20    | 9       | 29    | 31     | 28      | 59    | 36        | 53      | 89    | 30      | 42      | 72    | 13       | 12      | 25    | 1        | 2       | 3     | 183    | 182     | 365   |
| 84                         | 19    | 11      | 30    | 9     | 11      | 20    | 22    | 11      | 33    | 20    | 18      | 38    | 40     | 37      | 77    | 34        | 40      | 74    | 19      | 47      | 66    | 8        | 9       | 17    | 4        | 6       | 10    | 175    | 190     | 365   |
| 85                         | 15    | 10      | 25    | 5     | 8       | 13    | 14    | 17      | 31    | 17    | 20      | 37    | 50     | 31      | 81    | 36        | 50      | 86    | 27      | 42      | 69    | 5        | 12      | 17    | 2        | 3       | 5     | 171    | 193     | 364   |
| 86                         | 10    | 12      | 22    | 8     | 6       | 14    | 10    | 14      | 24    | 29    | 14      | 43    | 41     | 44      | 85    | 43        | 42      | 85    | 34      | 50      | 84    | 6        | 12      | 18    | 1        | 3       | 4     | 182    | 197     | 379   |
| 87                         | 5     | 3       | 8     | 7     | 5       | 12    | 15    | 10      | 25    | 26    | 14      | 40    | 30     | 31      | 61    | 45        | 46      | 91    | 15      | 38      | 53    | 12       | 11      | 23    | 5        | 2       | 7     | 160    | 160     | 320   |
| 88                         | 8     | 9       | 17    | 5     | 5       | 10    | 13    | 12      | 25    | 28    | 11      | 39    | 43     | 38      | 81    | 36        | 48      | 84    | 23      | 35      | 58    | 8        | 14      | 22    | 2        | 6       | 8     | 166    | 178     | 344   |
| 89                         | 11    | 14      | 25    | 2     | 6       | 8     | 16    | 10      | 26    | 21    | 10      | 31    | 23     | 23      | 46    | 35        | 34      | 69    | 24      | 36      | 60    | 7        | 12      | 19    | 1        | 5       | 6     | 140    | 150     | 290   |
| 90                         | 14    | 8       | 22    | 4     | 3       | 7     | 9     | 11      | 20    | 37    | 13      | 50    | 39     | 31      | 70    | 47        | 53      | 100   | 29      | 45      | 74    | 12       | 14      | 26    | 3        | 6       | 9     | 194    | 184     | 378   |
| 91                         | 12    | 13      | 25    | 1     | 6       | 7     | 13    | 9       | 22    | 29    | 13      | 42    | 31     | 17      | 48    | 38        | 36      | 74    | 16      | 36      | 52    | 8        | 12      | 20    | 1        | 9       | 10    | 149    | 151     | 300   |
| 92                         | 7     | 14      | 21    | 2     | 1       | 3     | 18    | 4       | 22    | 32    | 8       | 40    | 29     | 19      | 48    | 39        | 38      | 77    | 18      | 32      | 50    | 5        | 10      | 15    | 3        | 9       | 12    | 153    | 135     | 288   |
| 93                         | 6     | 12      | 18    | 3     | 4       | 7     | 9     | 10      | 19    | 28    | 10      | 38    | 28     | 18      | 46    | 46        | 31      | 77    | 27      | 21      | 48    | 10       | 10      | 20    | 3        | 7       | 10    | 160    | 123     | 283   |
| 94                         | 2     | 7       | 9     | 1     | 4       | 5     | 9     | 7       | 16    | 21    | 9       | 30    | 40     | 12      | 52    | 38        | 21      | 59    | 16      | 11      | 27    | 7        | 4       | 11    | 5        | 3       | 8     | 139    | 78      | 217   |
| 95                         | 3     | 5       | 8     | 3     | 2       | 5     | 13    | 7       | 20    | 22    | 4       | 26    | 27     | 11      | 38    | 28        | 21      | 49    | 20      | 13      | 33    | 8        | 1       | 9     | 1        | 6       | 7     | 125    | 70      | 195   |
| 96                         | 4     | 6       | 10    | 5     | 5       | 10    | 9     | 4       | 13    | 18    | 7       | 25    | 24     | 4       | 28    | 25        | 12      | 37    | 16      | 9       | 25    | 3        | 1       | 4     | 2        | 3       | 5     | 106    | 51      | 157   |
| 97                         | 2     | 1       | 3     | 3     | 1       | 4     | 5     | 2       | 7     | 15    | 2       | 17    | 14     | 3       | 17    | 20        | 5       | 25    | 10      | 4       | 14    |          |         |       | 4        | 1       | 5     | 73     | 20      | 93    |
| 98                         | 1     | 1       | 2     | 1     | 1       | 2     | 4     |         | 4     | 6     | 3       | 9     | 5      | 1       | 6     | 11        | 5       | 16    | 8       | 4       | 12    |          |         |       |          |         | 0     | 36     | 15      | 51    |
| 99                         |       | 2       | 2     |       |         | 0     | 1     | 2       | 3     | 4     | 1       | 5     | 3      | 2       | 5     | 4         | 4       | 8     | 2       | 1       | 3     |          |         |       |          |         | 0     | 14     | 12      | 26    |
| 100                        |       |         | 0     |       |         | 0     | 1     | 1       | 2     | 1     | 1       | 2     | 2      |         | 2     | 2         |         | 2     | 1       | 1       | 2     |          |         |       |          |         | 0     | 7      | 3       | 10    |
| 101                        |       | 1       | 1     |       |         | 0     | 1     | 1       | 2     | 1     |         | 1     | 2      |         | 2     |           |         | 0     |         |         | 0     |          |         |       |          |         | 0     | 4      | 2       | 6     |
| 102                        |       |         | 0     |       |         | 0     |       |         | 0     |       | 2       | 2     |        |         | 0     |           |         | 0     |         |         | 0     |          |         |       |          |         | 0     | 0      | 2       | 2     |
| 103                        |       |         | 0     |       | 1       | 1     | 1     |         | 1     | 1     |         | 1     | 1      |         | 1     | 1         |         | 1     | 2       | 1       | 3     | 1        |         | 1     |          |         | 0     | 6      | 3       | 9     |
| 104                        |       |         | 0     |       |         | 0     | 1     |         | 1     |       |         | 0     |        | 1       | 1     |           |         | 0     | 1       |         | 1     | 1        |         | 1     |          |         | 0     | 3      | 1       | 4     |
| 105                        |       |         | 0     |       |         | 0     |       |         | 0     |       |         | 0     |        |         | 0     |           |         | 0     |         |         | 0     |          |         |       |          |         | 0     | 0      | 0       | 0     |
| 106                        |       |         | 0     |       |         | 0     | 1     |         | 1     |       | 1       | 1     |        |         | 0     |           | 1       | 1     | 1       | 1       | 2     | 1        |         | 1     |          |         | 0     | 3      | 3       | 6     |
| 107                        |       |         | 0     |       |         | 0     |       |         | 0     |       | 1       | 1     |        |         | 0     |           |         | 0     |         |         | 0     |          |         |       |          |         | 0     | 0      | 1       | 1     |
| 108                        |       |         | 0     |       |         | 0     |       |         | 0     |       |         | 0     |        | 4       | 4     |           | 1       | 1     |         |         | 0     |          |         |       |          |         | 0     | 0      | 5       | 5     |
| 109                        |       |         | 0     | 1     |         | 1     |       |         | 0     |       | 1       | 1     | 1      |         | 1     |           |         | 0     | 1       |         | 1     |          |         |       |          |         | 0     | 3      | 1       | 4     |
| 110                        |       |         | 0     |       |         | 0     |       |         | 0     |       |         | 0     |        |         | 0     |           |         | 0     |         |         | 0     |          |         |       |          |         | 0     | 0      | 0       | 0     |
| 111                        | 1     |         | 1     |       |         | 0     |       |         | 0     |       |         | 0     |        |         | 0     | 1         |         | 1     | 1       |         | 1     |          |         |       |          |         | 0     | 3      | 0       | 3     |
| 112                        |       |         | 0     |       |         | 0     |       | 2       | 2     | 1     |         | 1     | 1      |         | 1     |           | 1       | 1     |         |         | 0     |          |         |       |          |         | 0     | 4      | 0       | 4     |
| 113                        |       |         | 0     |       | 1       | 1     |       |         | 0     |       |         | 0     |        |         | 0     | 1         |         | 1     |         |         | 0     |          | 1       |       |          |         | 0     | 2      | 1       | 3     |
| 114                        |       |         | 0     |       |         | 0     | 1     |         | 1     |       |         | 0     |        |         | 0     |           |         | 0     |         |         | 0     |          |         |       |          |         | 0     | 1      | 0       | 1     |
| 115                        |       |         | 0     |       |         | 0     | 1     |         | 1     |       |         | 0     |        |         | 0     |           |         | 0     |         |         | 0     |          |         |       |          |         | 0     | 1      | 0       | 1     |
| 116                        |       |         | 0     |       |         | 0     |       |         | 0     |       |         | 0     |        |         | 0     |           |         | 0     |         |         | 0     |          |         |       |          |         | 0     | 0      | 0       | 0     |
| 117                        | 1     |         | 1     |       |         | 0     |       |         | 0     |       |         | 0     |        |         | 0     |           | 1       | 1     |         |         | 0     |          |         |       |          |         | 0     | 1      | 1       | 2     |
| 118                        |       |         | 0     |       |         | 0     |       |         | 0     |       |         | 0     |        |         | 0     | 1         |         | 1     |         |         | 0     |          |         |       |          |         | 0     | 1      | 0       | 1     |
| 119                        |       |         | 0     |       |         | 0     |       |         | 0     |       |         | 0     |        |         | 0     |           |         | 0     |         |         | 0     |          |         |       |          |         | 0     | 0      | 0       | 0     |
| 120                        |       |         | 0     |       |         | 0     |       |         | 0     |       |         | 0     |        |         | 0     |           |         | 0     |         |         | 0     |          |         |       |          |         | 0     | 0      | 0       | 0     |
| 121                        |       |         | 0     |       |         | 0     |       |         | 0     |       |         | 0     |        |         | 0     |           |         | 0     |         |         | 0     |          |         |       |          |         | 0     | 0      | 0       | 0     |
| 122                        |       |         | 0     | 1     |         | 1     | 1     |         | 1     |       |         | 0     |        |         | 0     |           |         | 0     |         |         | 0     |          |         |       |          |         | 0     | 2      | 0       | 2     |
| 123                        |       |         | 0     |       |         | 0     |       |         | 0     |       |         | 0     |        |         | 0     |           |         | 0     |         |         | 0     |          |         |       |          |         | 0     | 0      | 0       | 0     |
| 124                        |       |         | 0     |       |         | 0     |       |         | 0     |       |         | 0     |        |         | 0     |           |         | 0     |         |         | 0     |          |         |       |          |         | 0     | 0      | 0       | 0     |
| 125                        |       |         | 0     |       |         | 0     |       |         | 0     |       |         | 0     |        |         | 0     |           |         | 0     |         |         | 0     |          |         |       |          |         | 0     | 0      | 0       | 0     |
| 126                        |       |         | 0     |       |         | 0     |       |         | 0     |       |         | 0     |        |         | 0     |           |         | 0     |         |         | 0     |          |         |       |          |         | 0     | 0      | 0       | 0     |
| 127                        | 1     |         | 1     |       |         | 0     |       |         | 0     |       |         | 0     |        |         | 0     |           |         | 0     |         |         | 0     |          |         |       |          |         | 0     | 1      | 0       | 1     |
|                            | 151   | 147     | 298   | 66    | 76      | 142   | 206   | 144     | 350   | 377   | 173     | 550   | 505    | 355     | 860   | 568       | 542     | 1110  | 341     | 469     | 810   | 115      | 135     | 250   | 39       | 71      | 110   | 2,368  | 2,112   | 4,480 |



**Table 5. Size Composition by Number and 14 Percent Groupings of Total Maine Lobster Landings, 1967 Through Present.**

| Year | Total Commercial<br>Catch in Numbers | (0.93-1.32 lbs.)<br>81-92 mm.                          | (1.36-1.98 lbs.)<br>93-108 mm.                         | (2.03-2.98 lbs.)<br>107-122 mm.                      | (3.02-3.31 lbs.)<br>123-127 mm. (legal max.)                   |
|------|--------------------------------------|--------------------------------------------------------|--------------------------------------------------------|------------------------------------------------------|----------------------------------------------------------------|
| 1967 | 14,175,747                           | 11,462,509<br>(80.86)                                  | 2,435,393<br>(17.18)                                   | 249,493<br>(1.75)                                    | 28,352<br>(.20)                                                |
| 1968 | 17,550,287                           | 14,338,584<br>(81.70)                                  | 2,930,898<br>(16.70)                                   | 281,499<br>(1.49)                                    | 19,305<br>(.11)                                                |
| 1969 | 16,952,803                           | 13,423,229<br>(79.18)                                  | 3,254,938<br>(19.20)                                   | 252,597<br>(1.49)                                    | 22,039<br>(.13)                                                |
| 1970 | 15,400,228                           | 11,442,369<br>(74.30)                                  | 3,678,034<br>(23.87)                                   | 264,884<br>(1.72)                                    | 16,940<br>(.11)                                                |
| 1971 | 15,007,138                           | 11,567,502<br>(77.08)                                  | 3,270,055<br>(21.79)                                   | 165,078<br>(1.10)                                    | 4,502<br>(.03)                                                 |
| 1972 | 13,894,416                           | 10,184,607<br>(73.30)                                  | 3,458,320<br>(24.89)                                   | 220,921<br>(1.59)                                    | 30,568<br>(.22)                                                |
| 1973 | 14,322,852                           | 10,034,590<br>(70.06)                                  | 3,968,862<br>(27.71)                                   | 309,374<br>(2.16)                                    | 10,026<br>(.07)                                                |
| 1974 | 13,829,971                           | 10,041,942<br>(72.61)                                  | 3,532,175<br>(25.54)                                   | 233,726<br>(1.69)                                    | 22,128<br>(.16)                                                |
| 1975 | 14,421,535                           | 10,842,110<br>(75.18)                                  | 3,252,056<br>(22.55)                                   | 310,063<br>(2.15)                                    | 17,306<br>(.12)                                                |
| 1976 | 16,102,587                           | 12,010,920<br>(74.59)                                  | 3,774,446<br>(23.44)                                   | 275,354<br>(1.71)                                    | 41,867<br>(.26)                                                |
| 1977 | 15,535,410                           | 11,789,823<br>(75.89)                                  | 3,441,093<br>(22.15)                                   | 270,316<br>(1.74)                                    | 34,178<br>(.22)                                                |
| 1978 | 16,212,253                           | 12,893,605<br>(79.53)                                  | 3,062,495<br>(18.89)                                   | 238,320<br>(1.47)                                    | 17,833<br>(.11)                                                |
| 1979 | 18,444,362                           | 15,061,666<br>(81.66)                                  | 3,181,652<br>(17.25)                                   | 178,910<br>(.97)                                     | 22,133<br>(.12)                                                |
| 1980 | 18,165,880                           | 14,089,441<br>(77.56)                                  | 3,745,800<br>(20.62)                                   | 330,819<br>(1.82)                                    | 0<br>(0)                                                       |
| 1981 | 18,859,682                           | 15,153,754<br>(80.35)                                  | 3,381,541<br>(17.93)                                   | 303,641<br>(1.61)                                    | 20,746<br>(.11)                                                |
| 1982 | 19,077,739                           | 14,209,100<br>(74.48)                                  | 4,586,288<br>(24.04)                                   | 257,549<br>(1.35)                                    | 24,801<br>(.13)                                                |
| 1983 | 18,466,341                           | 14,507,157<br>(78.56)                                  | 3,792,986<br>(20.54)                                   | 158,810<br>(.86)                                     | 7,386<br>(.04)                                                 |
| 1984 | 16,419,066                           | 13,399,600<br>(81.61)                                  | 2,738,700<br>(16.68)                                   | 262,705<br>(1.60)                                    | 16,419<br>(.10)                                                |
| 1985 | 15,662,026                           | 13,101,285<br>(83.65)                                  | 2,216,177<br>(14.15)                                   | 302,277<br>(1.93)                                    | 42,287<br>(.27)                                                |
| 1986 | 16,284,560                           | 13,346,825<br>(81.96)                                  | 2,703,237<br>(16.60)                                   | 226,355<br>(1.39)                                    | 8,142<br>(.05)                                                 |
| 1987 | 16,443,400                           | 13,851,920<br>(84.24)                                  | 2,385,937<br>(14.51)                                   | 198,965<br>(1.21)                                    | 6,577<br>(.04)                                                 |
| 1988 | 17,612,735                           | (0.96-1.37 lbs.)<br>82-93 mm.<br>15,481,594<br>(87.90) | (1.41-2.04 lbs.)<br>94-107 mm.<br>1,937,400<br>(11.00) | (2.09-3.02 lbs.)<br>108-123 mm.<br>186,456<br>(1.07) | (3.09-3.31 lbs.)<br>24-127 mm. (legal max.)<br>7,045<br>(.04)  |
| 1989 | 19,041,146                           | (0.99-1.41 lbs.)<br>83-94 mm.<br>17,266,511<br>(90.68) | (1.46-2.09 lbs.)<br>95-108 mm.<br>1,620,402<br>(8.51)  | (2.16-3.09 lbs.)<br>109-124 mm.<br>140,904<br>(.74)  | (3.16-3.31 lbs.)<br>25-127 mm. (legal max.)<br>11,425<br>(.06) |
| 1990 | 22,642,627                           | 19,893,812<br>(87.86)                                  | 2,499,746<br>(11.04)                                   | 242,276<br>(1.07)                                    | 9,057<br>(.04)                                                 |
| 1991 | 24,875,717                           | 22,201,577<br>(89.25)                                  | 2,509,960<br>(10.09)                                   | 156,717<br>(.63)                                     | 7,463<br>(.03)                                                 |
| 1992 | 21,509,906                           | 18,814,715<br>(87.47)                                  | 2,374,694<br>(11.04)                                   | 286,082<br>(1.33)                                    | 32,265<br>(.15)                                                |
| 1993 | 23,982,134                           | 20,552,689<br>(85.70)                                  | 3,093,695<br>(12.90)                                   | 294,980<br>(1.23)                                    | 38,371<br>(.16)                                                |
| 1994 | 30,656,826                           | 26,622,388<br>(86.84)                                  | 3,933,271<br>(12.83)                                   | 101,168<br>(0.33)                                    | 0<br>(0)                                                       |
| 1995 | 28,301,132                           | 23,693,708<br>(83.72)                                  | 4,332,903<br>(15.31)                                   | 263,200<br>(.93)                                     | 8,490<br>(.03)                                                 |
| 1996 | 28,978,102                           | 25,161,686<br>(86.83)                                  | 3,523,737<br>(12.16)                                   | 283,985<br>(0.98)                                    | 8,693<br>(0.03)                                                |
| 1997 | 36,486,936                           | 31,721,742<br>(86.94)                                  | 4,473,298<br>(12.26)                                   | 259,057<br>(0.71)                                    | 32,838<br>(0.09)                                               |
| 1998 | 36,688,030                           | 31,889,236<br>(86.92)                                  | 4,619,023<br>(12.59)                                   | 172,434<br>(0.47)                                    | 7,338<br>(0.02)                                                |

Table 6. Listing of lobster dealers sampled in 1998 with daily catch and effort values. Reasons are given for "no boat" days as well as other comments. Code refers to dealers in York (Y) , Cumberland (C), Sagadahoc (S), Lincoln (L), Knox (K), Hancock (H), and Washington (W) counties.

### Commercial Port Sampling Trips - 1998

| Code  | Date      | Total Lbs | Lbs/TH | Lbs/THSOD | No. Boats | Comments                                              |
|-------|-----------|-----------|--------|-----------|-----------|-------------------------------------------------------|
| Y -23 | 05/28/98  | 0         | 0      | 0         | 0         | Called ahead, no boats selling yet.                   |
| Y - 9 | 06/08/98  | 0         | 0      | 0         | 0         | Catch ahead of last year for May.                     |
| Y - 9 | 08/03/98  | 796       | 0.75   | 0.1117    | 8         | Not as good as last year, but good.                   |
| Y -23 | 10/27/98  | 1426      | 1.06   | 0.1825    | 4         | Seeing an unusual amount of dead lob.                 |
| Y - 4 | 11/11/98  | 0         | 0      | 0         | 0         | Called ahead, wind and rain, no boats                 |
|       | Subtotals | 2222      |        |           | 12        |                                                       |
| C -18 | 04/10/98  | 0         | 0      | 0         | 0         | Called ahead, no boats, Gale 20-30                    |
| C -24 | 04/13/98  | 0         | 0      | 0         | 0         | Sunny day, no boats selling yet                       |
| C -31 | 06/26/98  | 660       | 0.37   | 0.1655    | 8         | Don't like government interference.                   |
| C -19 | 06/27/98  | 450       | 0.48   | 0.1516    | 5         | Leave us alone and it will be fine.                   |
| C -19 | 07/08/98  | 700       | 0.67   | 0.2233    | 6         | Trap day here, price drop.                            |
| C -30 | 08/19/98  | 0         | 0      | 0         | 0         | 1 boat in early with engine trouble.                  |
| C -18 | 08/22/98  | 1572      | 0.86   | 0.264     | 7         | Think U of M sea sampling is dumb.                    |
| C -15 | 09/05/98  | 4474      | 0.93   | 0.3264    | 16        | Fishing about the same as last year.                  |
| C -18 | 09/13/98  | 805       | 1.09   | 0.3276    | 3         | Finding dead lobster in traps (6 lob).                |
| C -27 | 09/18/98  | 1045      | 0.9    | 0.2525    | 4         | Longer SOD more dead lobsters.                        |
| C -12 | 09/22/98  | 1256      | 0.94   | 0.2422    | 6         | Rain, cold and thick fog, 6 boats out                 |
| C - 3 | 10/03/98  | 1816      | 1.06   | 0.2347    | 10        | Fishing less than last year.                          |
| C -19 | 10/13/98  | 7472      | 1.36   | 0.2371    | 22        | Good catches, busy day.                               |
| C - 3 | 11/17/98  | 0         | 0      | 0         | 0         | Called ahead, snow + rain, no boats                   |
| C -19 | 11/27/98  | 0         | 0      | 0         | 0         | Called ahead, small craft, no boats                   |
| C -11 | 12/01/98  | 0         | 0      | 0         | 0         | Called ahead, one boat out, in early.                 |
| C -15 | 12/23/98  | 0         | 0      | 0         | 0         | Called ahead, small Craft, no boats.                  |
| C -28 | 12/24/98  | 0         | 0      | 0         | 0         | Called ahead, no boats out.                           |
|       | Subtotals | 20250     |        |           | 87        |                                                       |
| S - 5 | 05/09/98  | 0         | 0      | 0         | 0         | Waited 1 hr. dealer didn't show.                      |
| S - 5 | 07/27/98  | 1206      | 0.97   | 0.2867    | 9         | Was Georgetown Fishermen's Co-op                      |
| S - 7 | 08/05/98  | 1263      | 1.25   | 0.2838    | 5         | Very hard place to find.                              |
| S - 2 | 12/20/98  | 0         | 0      | 0         | 0         | Called ahead, burned down, buying at Seaside location |
|       | Subtotals | 2469      |        | 0.5705    | 14        |                                                       |
| L -11 | 04/09/98  | 368       | 0.87   | 0.1331    | 3         | Fisherman very upset over ASMFC regulations           |
| L - 5 | 05/24/98  | 0         | 0      | 0         | 0         | Called ahead, very windy, no boats.                   |
| L - 2 | 06/10/98  | 367       | 0.29   | 0.0493    | 6         | Fishermen unhappy with government regulations.        |
| L -14 | 07/01/98  | 0         | 0      | 0         | 0         | 4 boats out, all in before 12:00                      |
| L - 4 | 07/07/98  | 2994      | 0.89   | 0.2226    | 13        | Things are picking up here.                           |
| L -12 | 07/16/98  | 991       | 1.18   | 0.2582    | 5         | Dealer - Never seen such large shedders               |
| L -10 | 10/19/98  | 0         | 0      | 0         | 0         | Whale came into harbor last night.                    |
| L - 4 | 11/03/98  | 1731      | 1.43   | 0.2221    | 6         | Getting good catches.                                 |
| L -10 | 11/09/98  | 1483      | 1.33   | 0.3059    | 8         | Need a better price.                                  |
| L - 8 | 11/10/98  | 395       | 1.22   | 0.3048    | 2         | Dealer sick, only bought from 2 boats                 |
| L - 4 | 12/09/98  | 828       | 3.07   | 0.6133    | 1         | Very very cold.                                       |
| L -14 | 12/13/98  | 0         | 0      | 0         | 0         | Called ahead, gale, no boats, fishing slow.           |
|       | Subtotals | 9157      |        |           | 44        |                                                       |

Table 6. Continued

Code refers to dealers in York (Y) , Cumberland (C), Sagadahoc (S), Lincoln (L), Knox (K), Hancock (H), and Washington (W) counties.

## Commercial Port Sampling Trips - 1998

| Code      | Date     | Total Lbs | Lbs/TH | Lbs/THSOD | No. Boats | Comments                                  |
|-----------|----------|-----------|--------|-----------|-----------|-------------------------------------------|
| K -10     | 04/06/98 | 0         | 0      | 0         | 0         | Called ahead,small craft advisory         |
| K -40     | 04/25/98 | 879       | 0.68   | 0.1394    | 5         | Very cold, sunny day, New location        |
| K -41     | 05/02/98 | 0         | 0      | 0         | 0         | Called ahead, not buying for 2 wks.       |
| K -14     | 05/17/98 | 626       | 1.36   | 0.2115    | 2         | Good catches compared to other places     |
| K - 4     | 06/02/98 | 1096      | 0.7    | 0.1091    | 8         | Beautiful day, fishing good so far.       |
| K - 5     | 06/16/98 | 0         | 0      | 0         | 0         | Called ahead, no boats, rain, wind.       |
| K -31     | 07/14/98 | 0         | 0      | 0         | 0         | Went out of business.                     |
| K -33     | 08/10/98 | 1265      | 1.58   | 0.3161    | 4         | Very windy and rough seas.                |
| K - 3     | 08/14/98 | 5905      | 1.43   | 0.3268    | 23        | Great catches, windy day.                 |
| K -42     | 08/25/98 | 2986      | 1.48   | 0.3617    | 7         | Dealer less than cooperative.             |
| K -10     | 09/03/98 | 4989      | 1.95   | 0.4303    | 12        | Fishing very good here as usual.          |
| K - 2     | 09/24/98 | 4296      | 1.41   | 0.2467    | 16        | New name - Fishermans Heritage.           |
| K - 7     | 10/12/98 | 2057      | 1.17   | 0.1931    | 11        | Only a few dead lobsters in traps.        |
| K -41     | 10/26/98 | 896       | 2.63   | 0.2497    | 4         | Windy "catch is always poor here"         |
| K -21     | 11/01/98 | 0         | 0      | 0         | 0         | Called ahead, wind and rain,no boats.     |
| K - 5     | 11/12/98 | 1099      | 1.28   | 0.2031    | 7         | U of M sea sampling doesn't do it.        |
| K - 6     | 11/14/98 | 933       | 2.25   | 0.406     | 2         | Leave us alone, we'll handle it.          |
| K -15     | 12/26/98 | 0         | 0      | 0         | 0         | Called ahead,3 out,in early, high sea     |
| Subtotals |          | 27027     |        |           | 101       |                                           |
| H -24     | 04/11/98 | 701       | 0.41   | 0.0771    | 7         | United we stand divided we fall           |
| H -11     | 04/16/98 | 43        | 0.11   | 0.0555    | 2         | Lobs. are a bycatch of Crab fishing       |
| H -29     | 04/23/98 | 346       | 0.32   | 0.0859    | 5         | Lobstering is slow, poor catches.         |
| H - 2     | 04/29/98 | 388       | 0.49   | 0.1236    | 5         | New name - Green Head Lobs. Co.           |
| H -33     | 05/03/98 | 0         | 0      | 0         | 0         | Called ahead, gale,no boats out today.    |
| H -20     | 05/19/98 | 1589      | 0.69   | 0.1199    | 12        | Fishing is OK here.                       |
| H -20     | 06/03/98 | 0         | 0      | 0         | 0         | Island - trip cancelled by Marine Patrol. |
| H -15     | 06/12/98 | 131       | 0.44   | 0.0734    | 2         | Beautiful day only two boats out.         |
| H -35     | 06/25/98 | 424       | 0.5    | 0.0887    | 6         | Catch so so for this time of year.        |
| H - 7     | 07/23/98 | 5088      | 1.2    | 0.5546    | 16        | Pouring rain, Lobstermen in poor mood     |
| H -16     | 08/08/98 | 132       | 1.89   | 1.8857    | 1         | Nice day, lobstering is good.             |
| H -30     | 08/17/98 | 5833      | 1.72   | 0.4918    | 15        | Also runs smack to Swans Island.          |
| H -13     | 08/27/98 | 4009      | 1.27   | 0.5118    | 16        | Heavy fog all day.                        |
| H -34     | 09/09/98 | 5977      | 1.69   | 0.491     | 16        | Buys from float.                          |
| H -15     | 09/11/98 | 2768      | 1.49   | 0.4763    | 9         | Beautiful day, weather good.              |
| H - 4     | 09/16/98 | 2278      | 1.55   | 0.5436    | 10        | Dealer was already aware of low D.O.      |
| H -20     | 09/17/98 | 4404      | 1.14   | 0.2708    | 19        | No more dead lobsters than usual          |
| H -18     | 10/17/98 | 1858      | 1.15   | 0.3244    | 9         | Nice day, lobstermen in good mood.        |
| H -26     | 12/03/98 | 879       | 0.76   | 0.1368    | 5         | Very cold and windy, catch down.          |
| H -11     | 12/05/98 | 1039      | 1.12   | 0.1361    | 5         | Lobstermen bringing in traps.             |
| H -29     | 12/14/98 | 0         | 0      | 0         | 0         | One boat out, in early.                   |
| Subtotals |          | 37887     |        |           | 160       |                                           |
| W -10     | 04/04/98 | 226       | 0.37   | 0.1076    | 3         | Not catching much, poor spring            |
| W -21     | 05/01/98 | 0         | 0      | 0         | 0         | Road blocked off, can't buy today.        |
| W -10     | 05/07/98 | 93        | 0.42   | 0.065     | 1         | Miserable day rain, fog & wind.           |
| W -26     | 05/20/98 | 0         | 0      | 0         | 0         | No one selling here yet, fishing poor     |
| W -10     | 06/04/98 | 0         | 0      | 0         | 0         | Very Windy, one boat out, in early.       |
| W -24     | 07/02/98 | 40        | 0.68   | 0.0502    | 1         | Nice day only one boat out.               |
| W -12     | 07/10/98 | 483       | 0.39   | 0.1126    | 5         | Heavy fog.                                |
| W -26     | 07/11/98 | 0         | 0      | 0         | 0         | Called ahead, no boats out high winds.    |
| W -16     | 10/02/98 | 997       | 0.83   | 0.249     | 7         | Things are slow.                          |
| W - 7     | 10/14/98 | 2791      | 0.91   | 0.2108    | 14        | Not many dead lobster in traps.           |
| W - 8     | 10/15/98 | 0         | 0      | 0         | 0         | Checked water for dealer.                 |
| W -24     | 11/28/98 | 0         | 0      | 0         | 0         | Called ahead, gale, no boats, no go.      |
| Subtotals |          | 4630      |        |           | 31        |                                           |
| Totals    |          | 103642    |        |           | 449       |                                           |



Figure 1. Increase in port sampling dealers from 1997 - 1998

DEALERS BUYING FROM 5 OR MORE BOATS

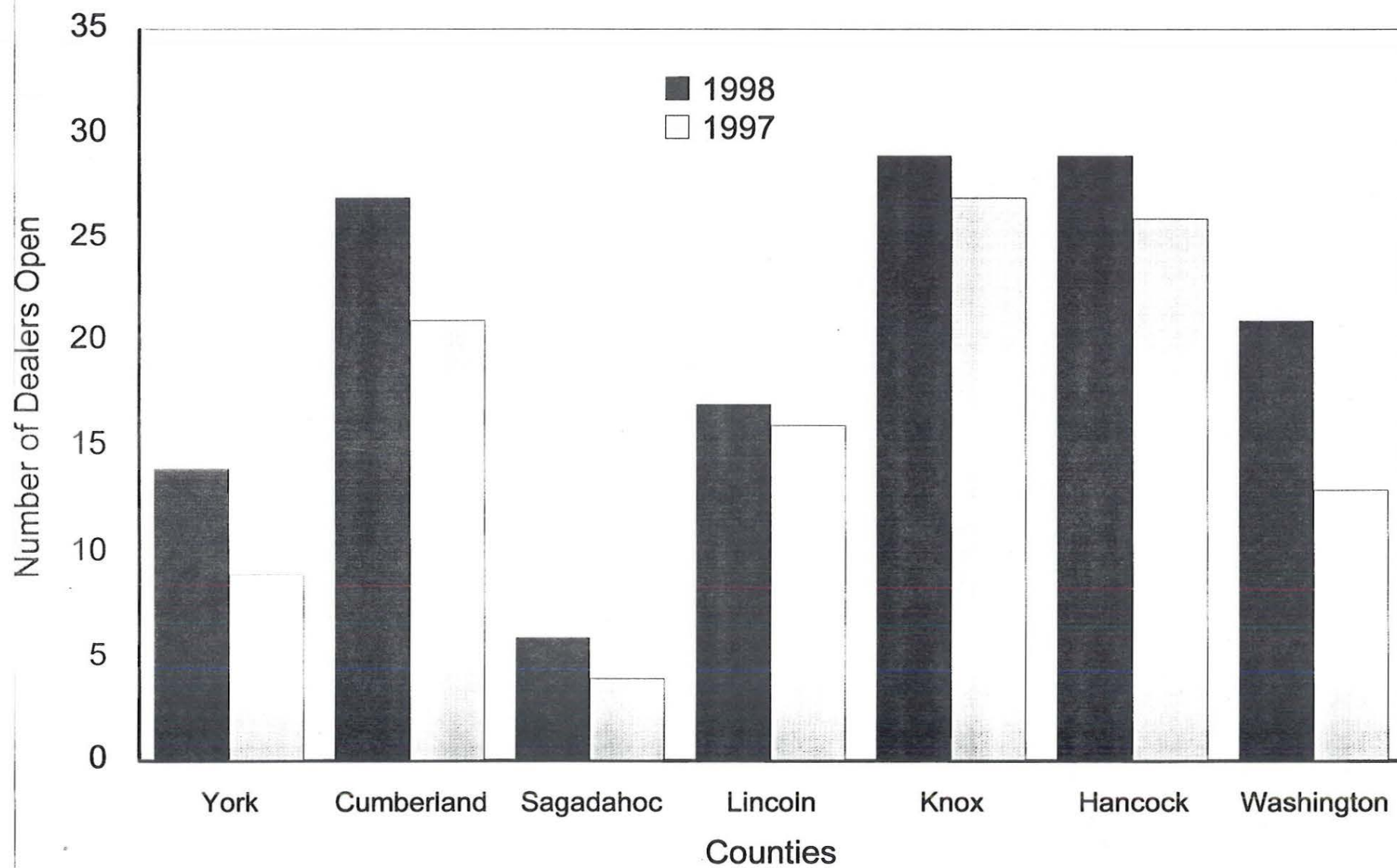




Figure 2. Comparison of catch-per-unit-effort values, 1968-1998

## CATCH EFFORT COMPARISONS 1968 - 1998

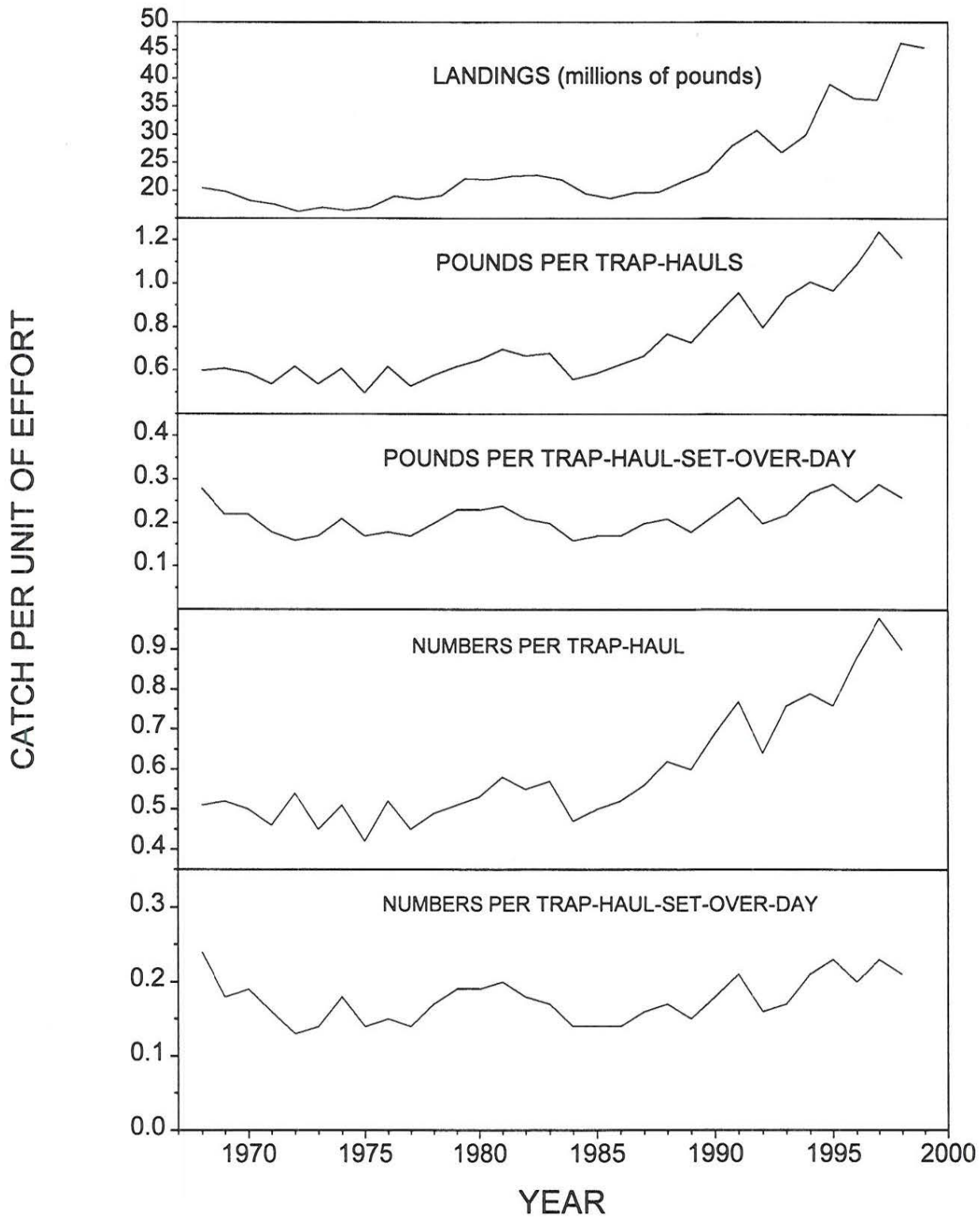
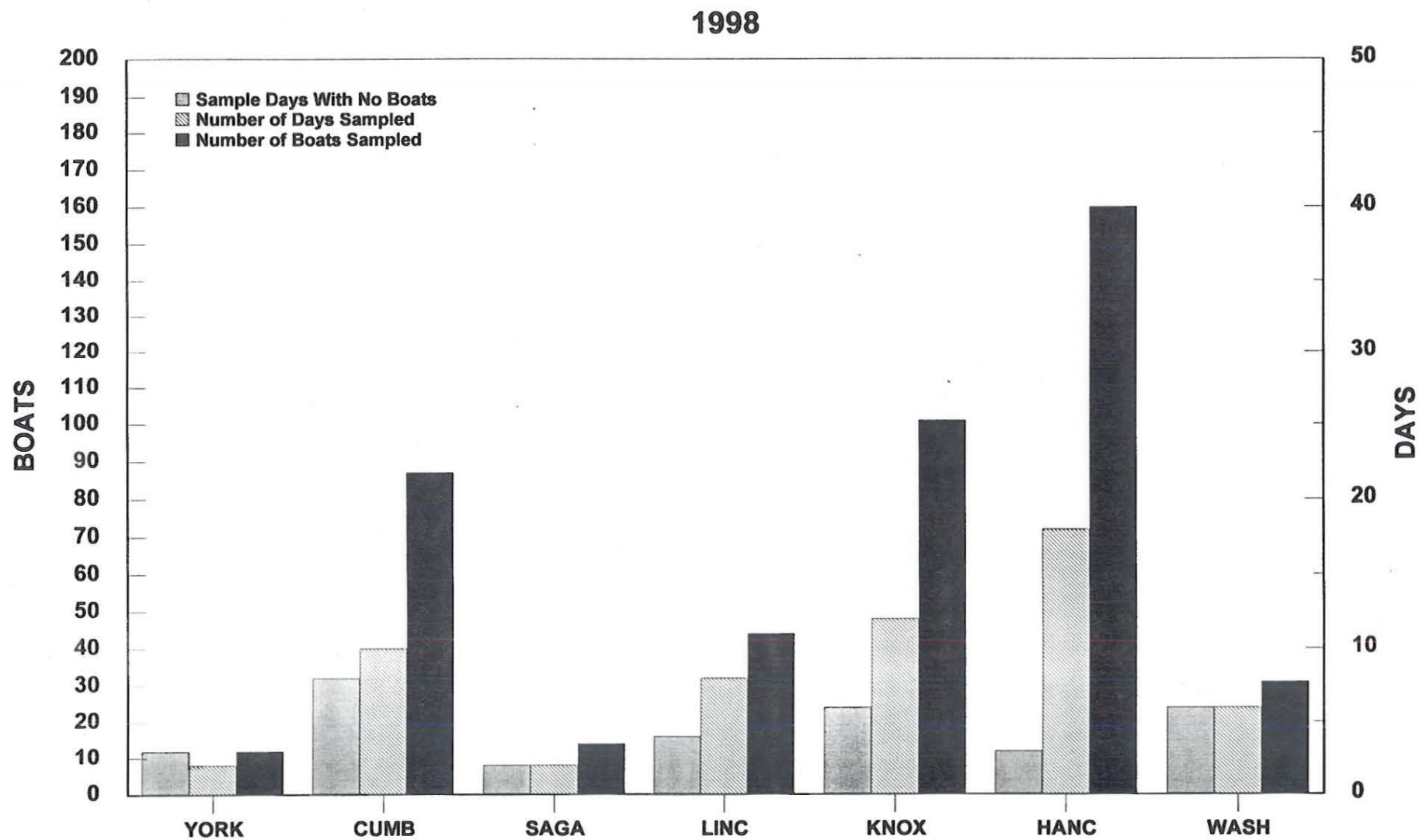


Figure 3. Coastwide distribution of commercial port-sampling trips and boats surveyed by county during 1998.



**EXPANDED ESTIMATES**  
**YEAR 1998**

**NUMBER OF FISHING DAYS**

N => 260

**NUMBER OF DAYS SAMPLED**

n => 58

Catch in Pounds      Std Error  
42086701            5252012

Catch in Numbers      Std Error  
33942557            4233399

Value of Catch      Std Error  
.115E+9            14441058

T.H.S.O.D.      Std Error  
159730590        19141584

Trap Sets Fished      Std Error  
111376350        12589344

Total Traps      Std Error  
5086855            0

Trap Hauls      Std Error  
37141408           4118790

Man Days      Std Error  
311723            32151

Man Hours      Std Error  
2501183            269242

Boat Days      Std Error  
185143            18720

Boat Hours      Std Error  
1467969            156707

Pounds/Trap Haul      Std Error  
1.117289            0.040018

Numbers/Trap Haul      Std Error  
0.900239            0.031741

Pounds/T.H.S.O.D.      Std Error  
0.260641            0.011755

Numbers/T.H.S.O.D.      Std Error  
0.210008            0.009058

Pounds/Man Day      Std Error  
133.04493           5.555045

Numbers/Man Day      Std Error  
107.19897           4.446690

Pounds/Man Hour      Std Error  
16.551101           0.568014

Numbers/Man Hour      Std Error  
13.335803           0.459219

Pounds/Boat Day      Std Error  
224.33333           9.404778

Numbers/Boat Day      Std Error  
180.75325           7.578343

Pounds/Boat Hour      Std Error  
28.233173           1.050044

Numbers/Boat Hour      Std Error  
22.748459           0.854950

# YEARLY SUMMARIES 1998

|        |                        |                     |                      |                    |                        |
|--------|------------------------|---------------------|----------------------|--------------------|------------------------|
| Pounds | <u>TOTAL</u><br>103642 | <u>HARD</u><br>8866 | <u>SOFT</u><br>92273 | <u>CULLS</u><br>70 | <u>SELECTS</u><br>2433 |
| Value  | \$285178.0             | \$33618.05          | \$242763.0           | \$ 210.00          | \$ 8586.96             |

Total Number ---> 83508

Total Number of Females in Sample- 2112

Total Number of Males in Sample- 2368

Total Number of Trap Hauls- 92762

Total Number of Traps Set Out- 276641

Total Number of Man-Days- 779

Total Number of Man-Hours- 6261.94

Total Number of Boat-Days- 462

Total Number of Boat-Hours- 3670.93

Mean Weight of Lobsters in Catch- 1.24

Catch in Pounds/Trap-Haul- 1.12

Catch in Numbers/Trap-Haul- 0.90

Catch in Pounds/Man-Day- 133.04

Catch in Numbers/Man-Day- 107.20

Catch in Pounds/Man-Hour- 16.55

Catch in Numbers/Man-Hour- 13.34

Catch in Pounds/Boat-Day- 224.33

Catch in Numbers/Boat-Day- 180.75

Catch in Pounds/Boat-Hours- 28.23

Catch in Numbers/Boat-Hours- 22.75

Value/Trap-Haul- \$ 3.07

Value/Man-Day- \$366.08

Value/Man-Hour- \$ 45.54

Value/Boat-Day- \$617.27

Value/Boat-Hour- \$ 77.69

T.H.S.O.D.

397642



# 1998 COMMERCIAL LOBSTER CATCH

## LOBSTERS SOLD TO DEALERS

| <u>POUNDS of LOBSTERS</u> | <u>VALUE</u> | <u>NUMBER in SAMPLE</u> | <u>NUMBER of LOBSTERS SOLD</u> |
|---------------------------|--------------|-------------------------|--------------------------------|
| HARD ----> 8866           | \$33618.05   | FEMALES 2112            | 83508                          |
| SOFT ----> 92273          | \$242763.0   | MALES 2368              |                                |
| CULL ----> 70             | \$ 210.00    | TOTAL 4480              |                                |
| SELECT --> 2433           | \$ 8586.96   |                         |                                |
| TOTALS --> 103642         | \$285178.0   |                         |                                |

| <u>TRAP</u> | <u>TOTAL</u> | <u>BOAT</u> | <u>TOTAL</u> | <u>MAN</u> | <u>TOTAL</u> |
|-------------|--------------|-------------|--------------|------------|--------------|
| HAULS       | 92762        | NUMBER      | 449          | DAYS       | 779          |
| SETS        | 276641       | DAYS        | 462          | HOURS      | 6261.9       |
| THSOD       | 397642       | HOURS       | 3670.9       |            |              |
| S-O-D       | 2013.0       |             |              |            |              |

MEAN WEIGHT of LOBSTERS = 1.24 Pounds

|           | <u>POUNDS/</u> | <u>NUMBERS/</u> | <u>VALUE/</u> |
|-----------|----------------|-----------------|---------------|
| TRAP-HAUL | 1.12           | 0.90            | \$ 3.07       |
| MAN-DAY   | 133.04         | 107.20          | \$ 366.08     |
| MAN-HOUR  | 16.55          | 13.34           | \$ 45.54      |
| BOAT-DAY  | 224.33         | 180.75          | \$ 617.27     |
| BOAT-HOUR | 28.23          | 22.75           | \$ 77.69      |
| THSOD     | 0.2606         | 0.2100          | \$ .71717     |

## CLUSTER SAMPLE PERCENTS

| <u>SAMPLED</u>   | <u>ESTIMATES</u> | <u>STD ERROR</u> | <u>CULLS</u> | <u>%</u> | <u>STD ERROR</u> |
|------------------|------------------|------------------|--------------|----------|------------------|
| MEAN LENGTH (mm) | 89.5579          | 0.1854           | (A - F)      | 0.1054   | 0.0085           |
| MEAN WEIGHT (gm) | 570.5642         | 5.12272          | (ABCE)       | 0.0482   | 0.0041           |
| FEMALES (%)      | 0.4869           | 0.0195           | (D + F)      | 0.0570   | 0.0072           |
| SHEDDERS (%)     | 0.7200           | 0.0571           | (C)          | 0.0034   | 0.0011           |
|                  |                  |                  | (E)          | .00335   | 0.0015           |
|                  |                  |                  | (F)          | .00201   | .00082           |

## ESTIMATED PERCENTS

|                 | <u>%</u> | <u>STD ERROR</u> |
|-----------------|----------|------------------|
| WIRE TRAPS      | 0.9773   | 0.0111           |
| PUNTS           | 0.0473   | 0.0126           |
| BOATS CARRING   | 0.0049   | 0.0037           |
| LOBSTERS CARRED | 0.0027   | 0.0019           |
| LOBSTERS KEPT   | 0.0204   | 0.0047           |

## 1998 COMMERCIAL LOBSTER CATCH --&gt; ALL LOBSTERS

| MM  | MALES | %TOTAL | FEMALES | %TOTAL | M+F | %TOTAL | CULLS | 14%                       |
|-----|-------|--------|---------|--------|-----|--------|-------|---------------------------|
| 92  | 0     | 0.00   | 0       | 0.00   | 0   | 0.00   | 0     |                           |
| 33  | 183   | 7.73   | 182     | 8.62   | 365 | 8.15   | 46    |                           |
| 84  | 176   | 7.43   | 190     | 9.00   | 366 | 8.17   | 49    |                           |
| 85  | 170   | 7.18   | 193     | 9.14   | 363 | 8.10   | 39    | Males 1973 %Total 83.32   |
| 36  | 182   | 7.69   | 197     | 9.33   | 379 | 8.46   | 44    | Females 1921 %Total 90.96 |
| 37  | 160   | 6.76   | 160     | 7.58   | 320 | 7.14   | 46    | Subtotal 3894 86.92       |
| 88  | 166   | 7.01   | 178     | 8.43   | 344 | 7.68   | 47    |                           |
| 39  | 140   | 5.91   | 150     | 7.10   | 290 | 6.47   | 40    |                           |
| 90  | 194   | 8.19   | 184     | 8.71   | 378 | 8.44   | 35    |                           |
| 91  | 149   | 6.29   | 151     | 7.15   | 300 | 6.70   | 28    |                           |
| 92  | 153   | 6.46   | 135     | 6.39   | 288 | 6.43   | 27    |                           |
| 93  | 160   | 6.76   | 123     | 5.82   | 283 | 6.32   | 29    |                           |
| 94  | 140   | 5.91   | 78      | 3.69   | 218 | 4.87   | 10    |                           |
| 95  | 125   | 5.28   | 70      | 3.31   | 195 | 4.35   | 8     |                           |
| 96  | 105   | 4.43   | 51      | 2.41   | 156 | 3.48   | 10    |                           |
| 97  | 73    | 3.08   | 20      | 0.95   | 93  | 2.08   | 2     |                           |
| 98  | 36    | 1.52   | 15      | 0.71   | 51  | 1.14   | 0     | Males 376 %Total 15.88    |
| 99  | 14    | 0.59   | 12      | 0.57   | 26  | 0.58   | 1     | Females 188 %Total 8.90   |
| 00  | 7     | 0.30   | 3       | 0.14   | 10  | 0.22   | 1     | Subtotal 564 12.59        |
| 101 | 4     | 0.17   | 2       | 0.09   | 6   | 0.13   | 2     |                           |
| 102 | 0     | 0.00   | 2       | 0.09   | 2   | 0.04   | 0     |                           |
| 03  | 6     | 0.25   | 3       | 0.14   | 9   | 0.20   | 1     |                           |
| 04  | 3     | 0.13   | 1       | 0.05   | 4   | 0.09   | 0     |                           |
| 105 | 0     | 0.00   | 0       | 0.00   | 0   | 0.00   | 0     |                           |
| 06  | 3     | 0.13   | 3       | 0.14   | 6   | 0.13   | 1     |                           |
| 07  | 0     | 0.00   | 1       | 0.05   | 1   | 0.02   | 0     |                           |
| 108 | 0     | 0.00   | 5       | 0.24   | 5   | 0.11   | 0     |                           |
| 109 | 3     | 0.13   | 1       | 0.05   | 4   | 0.09   | 0     |                           |
| 10  | 0     | 0.00   | 0       | 0.00   | 0   | 0.00   | 0     |                           |
| 111 | 3     | 0.13   | 0       | 0.00   | 3   | 0.07   | 1     |                           |
| 112 | 4     | 0.17   | 0       | 0.00   | 4   | 0.09   | 0     | Males 18 %Total 0.76      |
| 13  | 2     | 0.08   | 1       | 0.05   | 3   | 0.07   | 0     | Females 3 %Total 0.14     |
| 14  | 1     | 0.04   | 0       | 0.00   | 1   | 0.02   | 1     | Subtotal 21 0.47          |
| 115 | 1     | 0.04   | 0       | 0.00   | 1   | 0.02   | 0     |                           |
| 116 | 0     | 0.00   | 0       | 0.00   | 0   | 0.00   | 0     |                           |
| 17  | 1     | 0.04   | 1       | 0.05   | 2   | 0.04   | 0     |                           |
| 118 | 1     | 0.04   | 0       | 0.00   | 1   | 0.02   | 1     |                           |
| 119 | 0     | 0.00   | 0       | 0.00   | 0   | 0.00   | 0     |                           |
| 20  | 0     | 0.00   | 0       | 0.00   | 0   | 0.00   | 0     |                           |
| 121 | 0     | 0.00   | 0       | 0.00   | 0   | 0.00   | 0     |                           |
| 122 | 2     | 0.08   | 0       | 0.00   | 2   | 0.04   | 1     |                           |
| 23  | 0     | 0.00   | 0       | 0.00   | 0   | 0.00   | 0     |                           |
| 24  | 0     | 0.00   | 0       | 0.00   | 0   | 0.00   | 0     |                           |
| 125 | 0     | 0.00   | 0       | 0.00   | 0   | 0.00   | 0     | Males 1 %Total 0.04       |
| 126 | 0     | 0.00   | 0       | 0.00   | 0   | 0.00   | 0     | Females 0 %Total 0.00     |
| 27  | 1     | 0.04   | 0       | 0.00   | 1   | 0.02   | 1     | Subtotal 1 0.02           |
| 128 | 0     | 0.00   | 0       | 0.00   | 0   | 0.00   | 0     |                           |

TOTALS 2368

2112

4480

471

# 1998 COMMERCIAL LOBSTER CATCH --> ALL LOBSTERS

| Count | MALES | FEMALES | M+F | %TOTALS | CULLS | GM   | MALES | FEMALES | M+F | %TOTALS | CULLS |
|-------|-------|---------|-----|---------|-------|------|-------|---------|-----|---------|-------|
| 280   | 1     | 0       | 1   | 0.02    | 1     |      |       |         |     |         |       |
| 300   | 1     | 0       | 1   | 0.02    | 1     |      |       |         |     |         |       |
| 310   | 0     | 0       | 0   | 0.00    | 0     | 780  | 13    | 3       | 16  | 0.36    | 0     |
| 320   | 1     | 0       | 1   | 0.02    | 1     | 790  | 9     | 2       | 11  | 0.25    | 0     |
| 330   | 1     | 0       | 1   | 0.02    | 1     | 800  | 7     | 2       | 9   | 0.20    | 0     |
| 340   | 1     | 1       | 2   | 0.04    | 2     | 810  | 4     | 3       | 7   | 0.16    | 0     |
| 350   | 4     | 2       | 6   | 0.13    | 5     | 820  | 3     | 1       | 4   | 0.09    | 0     |
| 360   | 0     | 2       | 2   | 0.04    | 2     | 830  | 4     | 3       | 7   | 0.16    | 0     |
| 370   | 7     | 3       | 10  | 0.22    | 10    | 840  | 1     | 1       | 2   | 0.04    | 0     |
| 380   | 7     | 9       | 16  | 0.36    | 16    | 850  | 1     | 0       | 1   | 0.02    | 0     |
| 390   | 14    | 5       | 19  | 0.42    | 19    | 860  | 4     | 3       | 7   | 0.16    | 1     |
| 400   | 20    | 8       | 28  | 0.63    | 27    | 870  | 1     | 2       | 3   | 0.07    | 0     |
| 410   | 13    | 6       | 19  | 0.42    | 15    | 880  | 0     | 1       | 1   | 0.02    | 0     |
| 420   | 19    | 19      | 38  | 0.85    | 25    | 890  | 2     | 1       | 3   | 0.07    | 0     |
| 430   | 29    | 22      | 51  | 1.14    | 30    | 900  | 2     | 0       | 2   | 0.04    | 0     |
| 440   | 38    | 32      | 70  | 1.56    | 29    | 910  | 0     | 0       | 0   | 0.00    | 0     |
| 450   | 54    | 36      | 90  | 2.01    | 21    | 920  | 0     | 2       | 2   | 0.04    | 0     |
| 460   | 61    | 57      | 118 | 2.63    | 25    | 930  | 0     | 0       | 0   | 0.00    | 0     |
| 470   | 91    | 81      | 172 | 3.84    | 28    | 940  | 1     | 1       | 2   | 0.04    | 1     |
| 480   | 101   | 94      | 195 | 4.35    | 18    | 950  | 1     | 1       | 2   | 0.04    | 0     |
| 490   | 106   | 125     | 231 | 5.16    | 29    | 960  | 1     | 1       | 2   | 0.04    | 1     |
| 500   | 85    | 116     | 201 | 4.49    | 19    | 970  | 0     | 1       | 1   | 0.02    | 0     |
| 510   | 82    | 104     | 186 | 4.15    | 18    | 980  | 0     | 3       | 3   | 0.07    | 0     |
| 520   | 86    | 92      | 178 | 3.97    | 17    | 990  | 0     | 0       | 0   | 0.00    | 0     |
| 530   | 89    | 99      | 188 | 4.20    | 17    | 1000 | 1     | 0       | 1   | 0.02    | 0     |
| 540   | 77    | 91      | 168 | 3.75    | 17    | 1010 | 3     | 0       | 3   | 0.07    | 1     |
| 550   | 85    | 77      | 162 | 3.62    | 4     | 1020 | 2     | 2       | 4   | 0.09    | 0     |
| 560   | 79    | 90      | 169 | 3.77    | 6     | 1030 | 0     | 0       | 0   | 0.00    | 0     |
| 570   | 64    | 95      | 159 | 3.55    | 7     | 1040 | 0     | 0       | 0   | 0.00    | 0     |
| 580   | 88    | 83      | 171 | 3.82    | 12    | 1050 | 0     | 1       | 1   | 0.02    | 0     |
| 590   | 59    | 73      | 132 | 2.95    | 9     | 1060 | 2     | 0       | 2   | 0.04    | 0     |
| 600   | 75    | 64      | 139 | 3.10    | 12    | 1070 | 2     | 0       | 2   | 0.04    | 0     |
| 610   | 80    | 84      | 164 | 3.66    | 4     | 1080 | 0     | 0       | 0   | 0.00    | 0     |
| 620   | 75    | 57      | 132 | 2.95    | 2     | 1090 | 0     | 2       | 2   | 0.04    | 0     |
| 630   | 76    | 44      | 120 | 2.68    | 2     | 1100 | 1     | 0       | 1   | 0.02    | 0     |
| 640   | 66    | 55      | 121 | 2.70    | 6     | 1110 | 0     | 0       | 0   | 0.00    | 0     |
| 650   | 61    | 55      | 116 | 2.59    | 0     | 1120 | 1     | 0       | 1   | 0.02    | 1     |
| 660   | 67    | 58      | 125 | 2.79    | 2     | 1130 | 2     | 1       | 3   | 0.07    | 0     |
| 670   | 63    | 34      | 97  | 2.17    | 2     | 1140 | 0     | 0       | 0   | 0.00    | 0     |
| 680   | 50    | 34      | 84  | 1.88    | 1     | 1150 | 0     | 0       | 0   | 0.00    | 0     |
| 690   | 55    | 36      | 91  | 2.03    | 1     | 1160 | 0     | 0       | 0   | 0.00    | 0     |
| 700   | 41    | 26      | 67  | 1.50    | 0     | 1170 | 0     | 0       | 0   | 0.00    | 0     |
| 710   | 43    | 28      | 71  | 1.58    | 0     | 1180 | 0     | 0       | 0   | 0.00    | 0     |
| 720   | 39    | 19      | 58  | 1.29    | 0     | 1190 | 0     | 0       | 0   | 0.00    | 0     |
| 730   | 41    | 13      | 54  | 1.21    | 0     | 1200 | 0     | 0       | 0   | 0.00    | 0     |
| 740   | 25    | 10      | 35  | 0.78    | 0     | 1210 | 0     | 1       | 1   | 0.02    | 0     |
| 750   | 24    | 12      | 36  | 0.80    | 0     | 1220 | 1     | 0       | 1   | 0.02    | 0     |
| 760   | 19    | 10      | 29  | 0.65    | 0     | 1230 | 1     | 0       | 1   | 0.02    | 0     |
| 770   | 22    | 4       | 26  | 0.58    | 1     | 1240 | 0     | 0       | 0   | 0.00    | 0     |
| 780   | 7     | 9       | 16  | 0.36    | 1     | 1250 | 0     | 0       | 0   | 0.00    | 0     |
|       |       |         |     |         |       | 1280 | 1     | 0       | 1   | 0.02    | 0     |
|       |       |         |     |         |       | 1350 | 1     | 0       | 1   | 0.02    | 0     |
|       |       |         |     |         |       | 1440 | 1     | 0       | 1   | 0.02    | 0     |
|       |       |         |     |         |       | 1450 | 1     | 0       | 1   | 0.02    | 0     |
|       |       |         |     |         |       | 1460 | 1     | 0       | 1   | 0.02    | 1     |
|       |       |         |     |         |       | 1470 | 1     | 0       | 1   | 0.02    | 0     |

TOTALS: 2368

2112

4480

471



1998 COMMERCIAL LOBSTER CATCH --> SOFTSHELL ONLY

| MM  | MALES | %TOTAL | FEMALES | %TOTAL | M+F | %TOTAL | CULLS | 14%                       |
|-----|-------|--------|---------|--------|-----|--------|-------|---------------------------|
| 92  | 0     | 0.00   | 0       | 0.00   | 0   | 0.00   | 0     |                           |
| 33  | 131   | 6.53   | 149     | 8.61   | 280 | 7.49   | 41    |                           |
| 84  | 137   | 6.83   | 162     | 9.36   | 299 | 8.00   | 42    |                           |
| 85  | 138   | 6.88   | 160     | 9.25   | 298 | 7.98   | 34    | Males 1665 %Total 83.00   |
| 36  | 156   | 7.78   | 167     | 9.65   | 323 | 8.65   | 39    | Females 1600 %Total 92.49 |
| 37  | 138   | 6.88   | 146     | 8.44   | 284 | 7.60   | 41    | Subtotal 3265 87.39       |
| 88  | 144   | 7.18   | 149     | 8.61   | 293 | 7.84   | 43    |                           |
| 39  | 121   | 6.03   | 118     | 6.82   | 239 | 6.40   | 30    |                           |
| 90  | 168   | 8.37   | 160     | 9.25   | 328 | 8.78   | 29    |                           |
| 91  | 126   | 6.28   | 122     | 7.05   | 248 | 6.64   | 22    |                           |
| 92  | 132   | 6.58   | 113     | 6.53   | 245 | 6.56   | 23    |                           |
| 93  | 143   | 7.13   | 96      | 5.55   | 239 | 6.40   | 26    |                           |
| 94  | 131   | 6.53   | 58      | 3.35   | 189 | 5.06   | 9     |                           |
| 95  | 113   | 5.63   | 53      | 3.06   | 166 | 4.44   | 5     |                           |
| 96  | 91    | 4.54   | 33      | 1.91   | 124 | 3.32   | 8     |                           |
| 97  | 67    | 3.34   | 14      | 0.81   | 81  | 2.17   | 2     |                           |
| 98  | 30    | 1.50   | 12      | 0.69   | 42  | 1.12   | 0     | Males 330 %Total 16.45    |
| 99  | 13    | 0.65   | 7       | 0.40   | 20  | 0.54   | 1     | Females 129 %Total 7.46   |
| 00  | 5     | 0.25   | 1       | 0.06   | 6   | 0.16   | 1     | Subtotal 459 12.29        |
| 101 | 3     | 0.15   | 0       | 0.00   | 3   | 0.08   | 2     |                           |
| 102 | 0     | 0.00   | 1       | 0.06   | 1   | 0.03   | 0     |                           |
| 03  | 4     | 0.20   | 1       | 0.06   | 5   | 0.13   | 1     |                           |
| 04  | 2     | 0.10   | 1       | 0.06   | 3   | 0.08   | 0     |                           |
| 105 | 0     | 0.00   | 0       | 0.00   | 0   | 0.00   | 0     |                           |
| 06  | 2     | 0.10   | 3       | 0.17   | 5   | 0.13   | 1     |                           |
| 07  | 0     | 0.00   | 0       | 0.00   | 0   | 0.00   | 0     |                           |
| 108 | 0     | 0.00   | 3       | 0.17   | 3   | 0.08   | 0     |                           |
| 109 | 2     | 0.10   | 0       | 0.00   | 2   | 0.05   | 0     |                           |
| 110 | 0     | 0.00   | 0       | 0.00   | 0   | 0.00   | 0     |                           |
| 111 | 2     | 0.10   | 0       | 0.00   | 2   | 0.05   | 1     |                           |
| 112 | 4     | 0.20   | 0       | 0.00   | 4   | 0.11   | 0     | Males 11 %Total 0.55      |
| 113 | 2     | 0.10   | 0       | 0.00   | 2   | 0.05   | 0     | Females 1 %Total 0.06     |
| 114 | 0     | 0.00   | 0       | 0.00   | 0   | 0.00   | 0     | Subtotal 12 0.32          |
| 115 | 0     | 0.00   | 0       | 0.00   | 0   | 0.00   | 0     |                           |
| 116 | 0     | 0.00   | 0       | 0.00   | 0   | 0.00   | 0     |                           |
| 117 | 0     | 0.00   | 1       | 0.06   | 1   | 0.03   | 0     |                           |
| 118 | 1     | 0.05   | 0       | 0.00   | 1   | 0.03   | 1     |                           |
| 119 | 0     | 0.00   | 0       | 0.00   | 0   | 0.00   | 0     |                           |
| 120 | 0     | 0.00   | 0       | 0.00   | 0   | 0.00   | 0     |                           |
| 121 | 0     | 0.00   | 0       | 0.00   | 0   | 0.00   | 0     |                           |
| 122 | 0     | 0.00   | 0       | 0.00   | 0   | 0.00   | 0     |                           |
| 123 | 0     | 0.00   | 0       | 0.00   | 0   | 0.00   | 0     |                           |
| 124 | 0     | 0.00   | 0       | 0.00   | 0   | 0.00   | 0     |                           |
| 125 | 0     | 0.00   | 0       | 0.00   | 0   | 0.00   | 0     | Males 0 %Total 0.00       |
| 126 | 0     | 0.00   | 0       | 0.00   | 0   | 0.00   | 0     | Females 0 %Total 0.00     |
| 127 | 0     | 0.00   | 0       | 0.00   | 0   | 0.00   | 0     | Subtotal 0 0.00           |
| 128 | 0     | 0.00   | 0       | 0.00   | 0   | 0.00   | 0     |                           |

TOTALS 2006

1730

3736

402



## 1998 COMMERCIAL LOBSTER CATCH --&gt; SOFTSHELL ONLY

| C   | MALES | FEMALES | M+F | %TOTALS | CULLS | GM   | MALES | FEMALES | M+F | %TOTALS | CULLS |
|-----|-------|---------|-----|---------|-------|------|-------|---------|-----|---------|-------|
| 280 | 1     | 0       | 1   | 0.03    | 1     |      |       |         |     |         |       |
| 290 | 1     | 0       | 1   | 0.03    | 1     |      |       |         |     |         |       |
| 300 | 0     | 0       | 0   | 0.00    | 0     | 780  | 13    | 2       | 15  | 0.40    | 0     |
| 310 | 1     | 0       | 1   | 0.03    | 1     | 790  | 6     | 1       | 7   | 0.19    | 0     |
| 320 | 1     | 0       | 1   | 0.03    | 1     | 800  | 6     | 2       | 8   | 0.21    | 0     |
| 330 | 1     | 1       | 2   | 0.05    | 2     | 810  | 4     | 2       | 6   | 0.16    | 0     |
| 340 | 3     | 2       | 5   | 0.13    | 4     | 820  | 3     | 0       | 3   | 0.08    | 0     |
| 350 | 0     | 2       | 2   | 0.05    | 2     | 830  | 3     | 1       | 4   | 0.11    | 0     |
| 360 | 6     | 3       | 9   | 0.24    | 9     | 840  | 1     | 0       | 1   | 0.03    | 0     |
| 370 | 7     | 7       | 14  | 0.37    | 14    | 850  | 1     | 0       | 1   | 0.03    | 0     |
| 380 | 14    | 5       | 19  | 0.51    | 19    | 860  | 4     | 1       | 5   | 0.13    | 1     |
| 390 | 16    | 8       | 24  | 0.64    | 23    | 870  | 0     | 2       | 2   | 0.05    | 0     |
| 400 | 12    | 5       | 17  | 0.46    | 14    | 880  | 0     | 1       | 1   | 0.03    | 0     |
| 410 | 18    | 18      | 36  | 0.96    | 25    | 890  | 1     | 1       | 2   | 0.05    | 0     |
| 420 | 20    | 20      | 40  | 1.07    | 25    | 900  | 0     | 0       | 0   | 0.00    | 0     |
| 430 | 34    | 27      | 61  | 1.63    | 28    | 910  | 0     | 0       | 0   | 0.00    | 0     |
| 440 | 43    | 32      | 75  | 2.01    | 16    | 920  | 0     | 2       | 2   | 0.05    | 0     |
| 450 | 40    | 52      | 92  | 2.46    | 20    | 930  | 0     | 0       | 0   | 0.00    | 0     |
| 460 | 74    | 70      | 144 | 3.85    | 25    | 940  | 0     | 0       | 0   | 0.00    | 0     |
| 470 | 80    | 81      | 161 | 4.31    | 15    | 950  | 1     | 0       | 1   | 0.03    | 0     |
| 480 | 84    | 109     | 193 | 5.17    | 27    | 960  | 0     | 1       | 1   | 0.03    | 0     |
| 490 | 74    | 98      | 172 | 4.60    | 15    | 970  | 0     | 1       | 1   | 0.03    | 0     |
| 500 | 68    | 85      | 153 | 4.10    | 16    | 980  | 0     | 3       | 3   | 0.08    | 0     |
| 510 | 69    | 76      | 145 | 3.88    | 13    | 990  | 0     | 0       | 0   | 0.00    | 0     |
| 520 | 71    | 87      | 158 | 4.23    | 16    | 1000 | 0     | 0       | 0   | 0.00    | 0     |
| 530 | 60    | 78      | 138 | 3.69    | 12    | 1010 | 3     | 0       | 3   | 0.08    | 1     |
| 540 | 74    | 58      | 132 | 3.53    | 2     | 1020 | 2     | 0       | 2   | 0.05    | 0     |
| 550 | 73    | 76      | 149 | 3.99    | 5     | 1030 | 0     | 0       | 0   | 0.00    | 0     |
| 560 | 56    | 87      | 143 | 3.83    | 4     | 1040 | 0     | 0       | 0   | 0.00    | 0     |
| 570 | 74    | 73      | 147 | 3.93    | 11    | 1050 | 0     | 1       | 1   | 0.03    | 0     |
| 580 | 51    | 56      | 107 | 2.86    | 6     | 1060 | 2     | 0       | 2   | 0.05    | 0     |
| 590 | 68    | 52      | 120 | 3.21    | 9     | 1070 | 1     | 0       | 1   | 0.03    | 0     |
| 600 | 63    | 73      | 136 | 3.64    | 3     | 1080 | 0     | 0       | 0   | 0.00    | 0     |
| 610 | 67    | 42      | 109 | 2.92    | 2     | 1090 | 0     | 0       | 0   | 0.00    | 0     |
| 620 | 72    | 35      | 107 | 2.86    | 2     | 1100 | 1     | 0       | 1   | 0.03    | 0     |
| 630 | 56    | 47      | 103 | 2.76    | 5     | 1110 | 0     | 0       | 0   | 0.00    | 0     |
| 640 | 57    | 43      | 100 | 2.68    | 0     | 1120 | 1     | 0       | 1   | 0.03    | 1     |
| 650 | 59    | 45      | 104 | 2.78    | 1     | 1130 | 2     | 0       | 2   | 0.05    | 0     |
| 660 | 55    | 24      | 79  | 2.11    | 2     | 1140 | 0     | 0       | 0   | 0.00    | 0     |
| 670 | 46    | 23      | 69  | 1.85    | 1     | 1150 | 0     | 0       | 0   | 0.00    | 0     |
| 680 | 51    | 27      | 78  | 2.09    | 0     | 1160 | 0     | 0       | 0   | 0.00    | 0     |
| 690 | 36    | 19      | 55  | 1.47    | 0     | 1170 | 0     | 0       | 0   | 0.00    | 0     |
| 700 | 37    | 19      | 56  | 1.50    | 0     | 1180 | 0     | 0       | 0   | 0.00    | 0     |
| 710 | 34    | 14      | 48  | 1.28    | 0     | 1190 | 0     | 0       | 0   | 0.00    | 0     |
| 720 | 36    | 7       | 43  | 1.15    | 0     | 1200 | 0     | 0       | 0   | 0.00    | 0     |
| 730 | 21    | 7       | 28  | 0.75    | 0     | 1210 | 0     | 1       | 1   | 0.03    | 0     |
| 740 | 20    | 2       | 22  | 0.59    | 0     | 1220 | 1     | 0       | 1   | 0.03    | 0     |
| 750 | 17    | 7       | 24  | 0.64    | 0     | 1230 | 1     | 0       | 1   | 0.03    | 0     |
| 760 | 20    | 2       | 22  | 0.59    | 1     | 1240 | 0     | 0       | 0   | 0.00    | 0     |
| 770 | 7     | 4       | 11  | 0.29    | 1     | 1250 | 0     | 0       | 0   | 0.00    | 0     |
|     |       |         |     |         |       | 1440 | 1     | 0       | 1   | 0.03    | 0     |

TOTALS: 2006 1730 3736 402

**LEGAL CATCH IN POUNDS OF LOBSTERS PER TRAP-HAUL**

|               | 1968 | 1969 | 1970 | 1971 | 1972 | 1973 | 1974 | 1975 | 1976 | 1977 | 1978 |
|---------------|------|------|------|------|------|------|------|------|------|------|------|
| January       | 0.48 | 0.82 |      |      |      |      |      |      |      |      |      |
| February      | 0.45 | 0.71 |      |      |      |      |      |      |      |      |      |
| March         | 0.43 | 0.92 |      |      |      |      |      |      |      |      |      |
| April         | 0.34 | 0.53 | 0.57 | 0.45 | 0.32 | 0.40 | 0.26 | 0.29 | 0.49 | 0.26 | 0.30 |
| May           | 0.62 | 0.53 | 0.51 | 0.54 | 0.21 | 0.42 | 0.45 | 0.37 | 0.46 | 0.58 | 0.46 |
| June          | 0.58 | 0.32 | 0.40 | 0.29 | 0.28 | 0.57 | 0.55 | 0.32 | 0.37 | 0.26 | 0.33 |
| July          | 0.39 | 0.41 | 0.54 | 0.31 | 0.36 | 0.43 | 0.45 | 0.40 | 0.54 | 0.44 | 0.47 |
| August        | 0.51 | 0.56 | 0.51 | 0.58 | 0.55 | 0.59 | 0.60 | 0.49 | 0.60 | 0.67 | 0.56 |
| September     | 0.71 | 0.78 | 0.48 | 0.55 | 0.81 | 0.52 | 0.66 | 0.56 | 0.69 | 0.59 | 0.60 |
| October       | 0.74 | 0.72 | 0.69 | 0.68 | 0.81 | 0.57 | 0.64 | 0.59 | 0.66 | 0.46 | 0.58 |
| November      | 0.85 | 1.05 | 1.10 | 0.67 | 0.74 | 0.60 | 0.89 | 0.82 | 1.29 | 0.85 | 0.89 |
| December      |      | 0.80 | 0.71 | 0.86 | 1.38 | 1.28 | 0.85 | 0.89 | 0.61 | 0.48 | 0.91 |
| Yearly Values | 0.60 | 0.61 | 0.59 | 0.54 | 0.62 | 0.54 | 0.61 | 0.50 | 0.62 | 0.53 | 0.58 |

|               | 1979 | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 |
|---------------|------|------|------|------|------|------|------|------|------|------|------|
| January       |      |      |      |      |      |      |      |      |      |      |      |
| February      |      |      |      |      |      |      |      |      |      |      |      |
| March         |      |      |      |      |      |      |      |      |      |      |      |
| April         | 0.28 |      | 0.27 | 0.51 | 0.34 |      | 0.21 | 0.25 | 0.30 | 0.28 | 0.36 |
| May           | 0.29 | 0.48 | 0.90 | 0.37 | 0.43 | 0.44 | 0.26 | 0.56 | 0.39 | 0.56 | 0.67 |
| June          | 0.44 | 0.38 | 0.66 | 0.48 | 0.62 | 0.41 | 0.38 | 0.45 | 0.44 | 0.36 | 0.40 |
| July          | 0.43 | 0.78 | 0.67 | 0.63 | 0.46 | 0.50 | 0.51 | 0.48 | 0.54 | 0.35 | 0.52 |
| August        | 0.64 | 0.69 | 0.74 | 0.77 | 0.80 | 0.74 | 0.66 | 0.78 | 0.58 | 0.77 | 0.64 |
| September     | 0.55 | 0.55 | 0.60 | 0.71 | 0.71 | 0.45 | 0.51 | 0.46 | 0.94 | 0.86 | 0.87 |
| October       | 0.66 | 0.71 | 0.70 | 0.76 | 0.49 | 0.62 | 0.72 | 0.62 | 0.87 | 1.06 | 0.91 |
| November      | 0.96 | 0.66 | 0.83 | 0.85 | 1.12 | 0.58 | 0.98 | 1.18 | 0.90 | 1.48 | 0.89 |
| December      | 0.68 | 0.68 | 0.96 | 0.34 | 0.75 | 0.65 |      | 0.72 | 0.50 | 1.34 | 1.60 |
| Yearly Values | 0.62 | 0.65 | 0.70 | 0.67 | 0.68 | 0.56 | 0.59 | 0.63 | 0.67 | 0.77 | 0.73 |

|               | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | Monthly Mean |
|---------------|------|------|------|------|------|------|------|------|------|--------------|
| January       |      |      |      |      |      |      |      |      |      |              |
| February      |      |      |      |      |      |      |      |      |      |              |
| March         |      |      |      |      |      |      |      |      |      |              |
| April         | 0.34 | 0.37 | 0.21 | 0.20 | 0.29 |      | 0.42 | 0.41 | 0.46 | 0.35         |
| May           | 0.66 | 0.33 | 0.25 | 0.57 | 0.52 | 0.44 | 0.63 | 0.86 | 0.78 | 0.50         |
| June          | 0.71 | 0.43 | 0.40 | 0.44 | 0.42 | 0.37 | 0.4  | 0.45 | 0.47 | 0.43         |
| July          | 0.68 | 1.17 | 0.49 | 0.69 | 0.93 | 0.66 | 0.76 | 0.84 | 0.95 | 0.57         |
| August        | 0.79 | 1.11 | 1.04 | 0.90 | 1.38 | 1.42 | 1.79 | 1.39 | 1.36 | 0.81         |
| September     | 1.05 | 0.98 | 1.24 | 0.89 | 0.86 | 0.97 | 1.14 | 1.71 | 1.32 | 0.78         |
| October       | 1.24 | 0.77 | 0.76 | 1.09 | 1.37 | 1.25 | 1.05 | 1.25 | 1.17 | 0.81         |
| November      | 1.33 | 0.96 | 0.58 | 1.42 | 1.13 | 1.27 | 0.89 | 1.64 | 1.44 | 0.99         |
| December      |      | 2.30 | 0.66 | 1.32 | 1.08 |      | 0.88 | 1.3  | 1.16 | 0.95         |
| Yearly Values | 0.85 | 0.96 | 0.80 | 0.94 | 1.01 | 0.97 | 1.09 | 1.24 | 1.12 |              |

**LEGAL CATCH IN POUNDS OF LOBSTERS PER TRAP-HAUL-SET-OVER-DAY**

|               | 1968 | 1969 | 1970 | 1971 | 1972 | 1973 | 1974 | 1975 | 1976 | 1977 | 1978 |
|---------------|------|------|------|------|------|------|------|------|------|------|------|
| January       | 0.10 | 0.15 |      |      |      |      |      |      |      |      |      |
| February      | 0.06 | 0.11 |      |      |      |      |      |      |      |      |      |
| March         | 0.15 | 0.92 |      |      |      |      |      |      |      |      |      |
| April         | 0.20 | 0.20 | 0.16 | 0.06 | 0.01 | 0.26 | 0.11 | 0.11 | 0.13 | 0.05 | 0.07 |
| May           | 0.26 | 0.12 | 0.22 | 0.15 | 0.07 | 0.22 | 0.17 | 0.18 | 0.12 | 0.20 | 0.10 |
| June          | 0.19 | 0.09 | 0.11 | 0.07 | 0.05 | 0.14 | 0.14 | 0.10 | 0.13 | 0.07 | 0.09 |
| July          | 0.17 | 0.14 | 0.27 | 0.09 | 0.14 | 0.12 | 0.16 | 0.13 | 0.21 | 0.15 | 0.16 |
| August        | 0.31 | 0.30 | 0.22 | 0.23 | 0.19 | 0.16 | 0.22 | 0.18 | 0.20 | 0.27 | 0.29 |
| September     | 0.41 | 0.37 | 0.23 | 0.27 | 0.26 | 0.18 | 0.29 | 0.20 | 0.22 | 0.22 | 0.27 |
| October       | 0.41 | 0.36 | 0.31 | 0.22 | 0.23 | 0.22 | 0.27 | 0.20 | 0.23 | 0.17 | 0.24 |
| November      | 0.38 | 0.37 | 0.27 | 0.22 | 0.17 | 0.14 | 0.26 | 0.21 | 0.20 | 0.23 | 0.22 |
| December      |      | 0.08 | 0.12 | 0.15 | 0.34 | 0.24 | 0.10 | 0.14 | 0.08 | 0.10 | 0.16 |
| Yearly Values | 0.28 | 0.22 | 0.22 | 0.18 | 0.16 | 0.17 | 0.21 | 0.17 | 0.18 | 0.17 | 0.20 |

|               | 1979 | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 |
|---------------|------|------|------|------|------|------|------|------|------|------|------|
| January       |      |      |      |      |      |      |      |      |      |      |      |
| February      |      |      |      |      |      |      |      |      |      |      |      |
| March         |      |      |      |      |      |      |      |      |      |      |      |
| April         | 0.08 |      | 0.14 | 0.09 | 0.08 |      | 0.02 | 0.06 | 0.06 | 0.08 | 0.13 |
| May           | 0.11 | 0.10 | 0.26 | 0.11 | 0.15 | 0.10 | 0.06 | 0.11 | 0.13 | 0.15 | 0.17 |
| June          | 0.12 | 0.11 | 0.17 | 0.14 | 0.18 | 0.09 | 0.07 | 0.16 | 0.09 | 0.08 | 0.13 |
| July          | 0.14 | 0.30 | 0.24 | 0.21 | 0.14 | 0.15 | 0.23 | 0.20 | 0.18 | 0.13 | 0.17 |
| August        | 0.26 | 0.26 | 0.32 | 0.28 | 0.31 | 0.23 | 0.28 | 0.26 | 0.24 | 0.22 | 0.15 |
| September     | 0.35 | 0.23 | 0.26 | 0.24 | 0.23 | 0.13 | 0.15 | 0.18 | 0.26 | 0.24 | 0.24 |
| October       | 0.33 | 0.27 | 0.23 | 0.24 | 0.14 | 0.26 | 0.23 | 0.15 | 0.20 | 0.22 | 0.24 |
| November      | 0.26 | 0.24 | 0.17 | 0.25 | 0.25 | 0.18 | 0.19 | 0.18 | 0.17 | 0.36 | 0.14 |
| December      | 0.11 | 0.08 | 0.23 | 0.06 | 0.12 | 0.11 |      | 0.12 | 0.09 | 0.19 | 0.20 |
| Yearly Values | 0.23 | 0.23 | 0.24 | 0.21 | 0.20 | 0.16 | 0.17 | 0.17 | 0.20 | 0.21 | 0.18 |

|               | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | Monthly Means |
|---------------|------|------|------|------|------|------|------|------|------|---------------|
| January       |      |      |      |      |      |      |      |      |      |               |
| February      |      |      |      |      |      |      |      |      |      |               |
| March         |      |      |      |      |      |      |      |      |      |               |
| April         | 0.10 | 0.08 | 0.05 | 0.03 | 0.08 |      | 0.07 | 0.08 | 0.11 | 0.10          |
| May           | 0.18 | 0.08 | 0.06 | 0.10 | 0.13 | 0.08 | 0.15 | 0.16 | 0.13 | 0.14          |
| June          | 0.16 | 0.09 | 0.08 | 0.10 | 0.09 | 0.10 | 0.08 | 0.09 | 0.10 | 0.11          |
| July          | 0.20 | 0.31 | 0.12 | 0.17 | 0.27 | 0.24 | 0.21 | 0.21 | 0.30 | 0.18          |
| August        | 0.24 | 0.33 | 0.37 | 0.24 | 0.42 | 0.47 | 0.46 | 0.42 | 0.35 | 0.27          |
| September     | 0.27 | 0.29 | 0.33 | 0.35 | 0.22 | 0.28 | 0.25 | 0.40 | 0.35 | 0.26          |
| October       | 0.32 | 0.28 | 0.16 | 0.27 | 0.35 | 0.33 | 0.20 | 0.27 | 0.23 | 0.24          |
| November      | 0.27 | 0.23 | 0.15 | 0.24 | 0.22 | 0.28 | 0.18 | 0.26 | 0.26 | 0.22          |
| December      |      | 0.37 | 0.06 | 0.24 | 0.21 |      | 0.13 | 0.21 | 0.18 | 0.15          |
| Yearly Values | 0.22 | 0.26 | 0.20 | 0.22 | 0.27 | 0.29 | 0.25 | 0.29 | 0.26 |               |



**LEGAL CATCH IN NUMBERS OF LOBSTERS PER TRAP-HAUL**

|               | 1968 | 1969 | 1970 | 1971 | 1972 | 1973 | 1974 | 1975 | 1976 | 1977 | 1978 |
|---------------|------|------|------|------|------|------|------|------|------|------|------|
| January       | 0.43 | 0.69 |      |      |      |      |      |      |      |      |      |
| February      | 0.36 | 0.59 |      |      |      |      |      |      |      |      |      |
| March         | 0.36 | 0.80 |      |      |      |      |      |      |      |      |      |
| April         | 0.31 | 0.48 | 0.48 | 0.40 | 0.25 | 0.42 | 0.23 | 0.25 | 0.42 | 0.23 | 0.25 |
| May           | 0.52 | 0.45 | 0.44 | 0.46 | 0.19 | 0.36 | 0.38 | 0.31 | 0.38 | 0.46 | 0.38 |
| June          | 0.47 | 0.27 | 0.33 | 0.24 | 0.23 | 0.45 | 0.45 | 0.27 | 0.31 | 0.21 | 0.27 |
| July          | 0.34 | 0.34 | 0.46 | 0.25 | 0.29 | 0.36 | 0.37 | 0.34 | 0.46 | 0.38 | 0.38 |
| August        | 0.46 | 0.48 | 0.43 | 0.50 | 0.46 | 0.50 | 0.52 | 0.41 | 0.52 | 0.56 | 0.47 |
| September     | 0.60 | 0.66 | 0.41 | 0.47 | 0.69 | 0.43 | 0.56 | 0.47 | 0.57 | 0.50 | 0.52 |
| October       | 0.63 | 0.62 | 0.58 | 0.58 | 0.72 | 0.51 | 0.53 | 0.50 | 0.56 | 0.40 | 0.50 |
| November      | 0.73 | 0.92 | 0.92 | 0.59 | 0.62 | 0.53 | 0.76 | 0.70 | 1.13 | 0.72 | 0.74 |
| December      |      | 0.67 | 0.63 | 0.75 | 1.16 | 1.12 | 0.70 | 0.75 | 0.53 | 0.47 | 0.78 |
| Yearly Values | 0.51 | 0.52 | 0.50 | 0.46 | 0.54 | 0.45 | 0.51 | 0.42 | 0.52 | 0.45 | 0.49 |

|               | 1979 | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 |
|---------------|------|------|------|------|------|------|------|------|------|------|------|
| January       |      |      |      |      |      |      |      |      |      |      |      |
| February      |      |      |      |      |      |      |      |      |      |      |      |
| March         |      |      |      |      |      |      |      |      |      |      |      |
| April         | 0.23 |      | 0.23 | 0.43 | 0.28 |      | 0.17 | 0.19 | 0.23 | 0.24 | 0.28 |
| May           | 0.24 | 0.41 | 0.75 | 0.31 | 0.35 | 0.37 | 0.22 | 0.45 | 0.32 | 0.45 | 0.53 |
| June          | 0.36 | 0.31 | 0.52 | 0.39 | 0.50 | 0.33 | 0.29 | 0.37 | 0.34 | 0.28 | 0.32 |
| July          | 0.35 | 0.66 | 0.56 | 0.52 | 0.37 | 0.43 | 0.42 | 0.39 | 0.45 | 0.29 | 0.43 |
| August        | 0.55 | 0.58 | 0.62 | 0.64 | 0.68 | 0.64 | 0.56 | 0.66 | 0.48 | 0.64 | 0.52 |
| September     | 0.46 | 0.42 | 0.50 | 0.59 | 0.60 | 0.38 | 0.44 | 0.38 | 0.80 | 0.71 | 0.72 |
| October       | 0.55 | 0.59 | 0.58 | 0.64 | 0.41 | 0.52 | 0.60 | 0.51 | 0.77 | 0.85 | 0.75 |
| November      | 0.78 | 0.47 | 0.71 | 0.72 | 0.95 | 0.46 | 0.84 | 1.01 | 0.76 | 1.17 | 0.71 |
| December      | 0.59 | 0.57 | 0.80 | 0.30 | 0.68 | 0.54 |      | 0.60 | 0.42 | 1.16 | 1.29 |
| Yearly Values | 0.51 | 0.53 | 0.58 | 0.55 | 0.57 | 0.47 | 0.50 | 0.52 | 0.56 | 0.62 | 0.60 |

|               | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | Monthly Mean |
|---------------|------|------|------|------|------|------|------|------|------|--------------|
| January       |      |      |      |      |      |      |      |      |      |              |
| February      |      |      |      |      |      |      |      |      |      |              |
| March         |      |      |      |      |      |      |      |      |      |              |
| April         | 0.27 | 0.29 | 0.17 | 0.16 | 0.24 |      | 0.33 | 0.32 | 0.36 | 0.29         |
| May           | 0.53 | 0.25 | 0.20 | 0.46 | 0.44 | 0.33 | 0.49 | 0.65 | 0.61 | 0.41         |
| June          | 0.57 | 0.34 | 0.30 | 0.32 | 0.33 | 0.29 | 0.27 | 0.35 | 0.36 | 0.34         |
| July          | 0.54 | 0.92 | 0.38 | 0.55 | 0.73 | 0.52 | 0.60 | 0.67 | 0.75 | 0.47         |
| August        | 0.63 | 0.92 | 0.83 | 0.71 | 1.08 | 1.11 | 1.45 | 1.11 | 1.10 | 0.67         |
| September     | 0.87 | 0.78 | 0.99 | 0.72 | 0.68 | 0.75 | 0.93 | 1.33 | 1.07 | 0.65         |
| October       | 1.00 | 0.63 | 0.60 | 0.89 | 1.08 | 0.97 | 0.85 | 1.00 | 0.96 | 0.67         |
| November      | 1.08 | 0.77 | 0.48 | 1.14 | 0.86 | 1.00 | 0.70 | 1.26 | 1.21 | 0.82         |
| December      |      | 1.87 | 0.51 | 1.07 | 0.89 |      | 0.60 | 1.01 | 0.93 | 0.79         |
| Yearly Values |      | 0.77 | 0.64 | 0.76 | 0.79 | 0.76 | 0.88 | 0.98 | 0.90 |              |



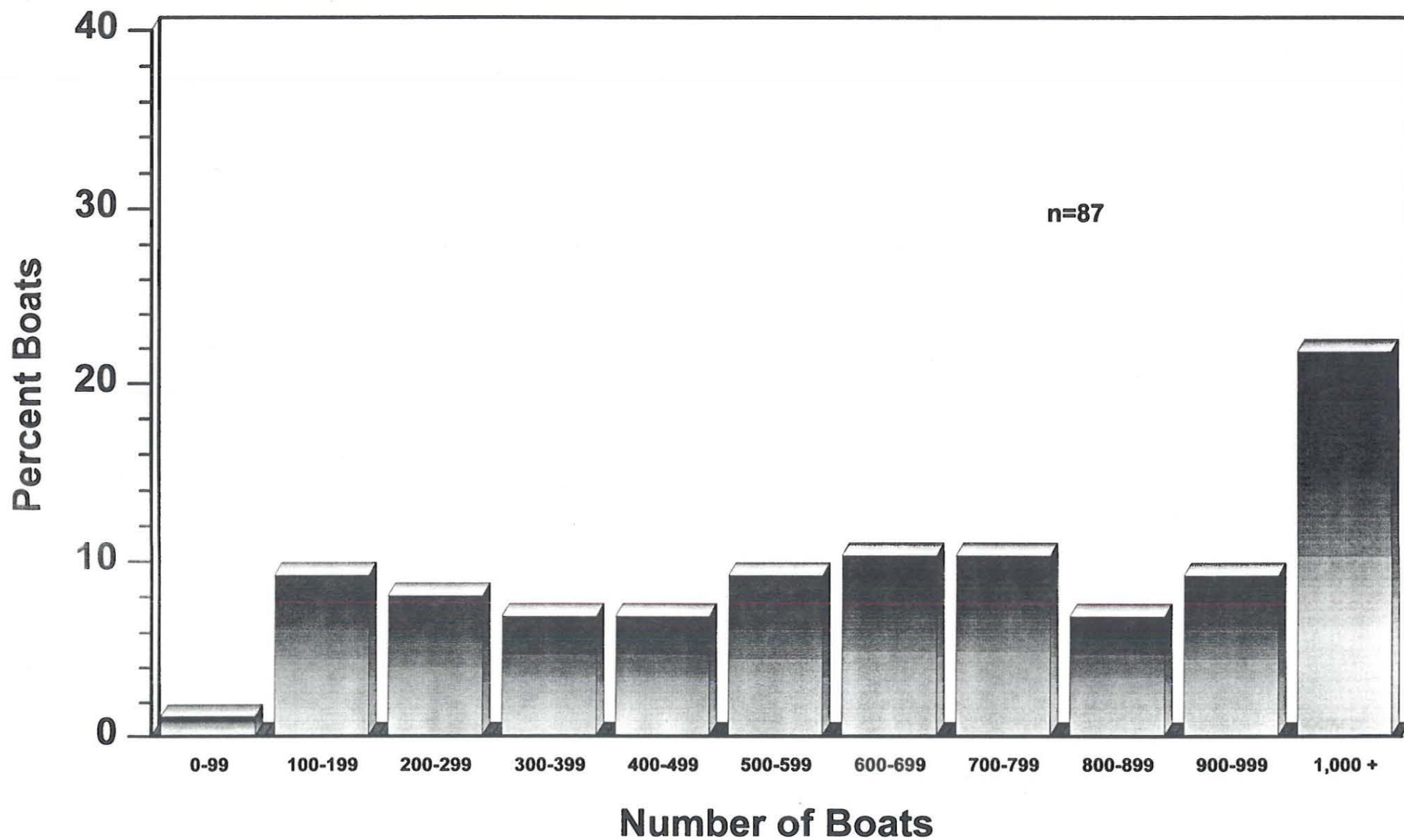
**LEGAL CATCH IN NUMBERS OF LOBSTERS PER TRAP-HAUL-SET-OVER-DAY**

|               | 1968 | 1969 | 1970 | 1971 | 1972 | 1973 | 1974 | 1975 | 1976 | 1977 | 1978 |
|---------------|------|------|------|------|------|------|------|------|------|------|------|
| January       | 0.09 | 0.13 |      |      |      |      |      |      |      |      |      |
| February      | 0.05 | 0.09 |      |      |      |      |      |      |      |      |      |
| March         | 0.13 |      |      |      |      |      |      |      |      |      |      |
| April         | 0.18 | 0.18 | 0.13 | 0.06 | 0.01 | 0.22 | 0.09 | 0.09 | 0.11 | 0.04 | 0.06 |
| May           | 0.22 | 0.10 | 0.19 | 0.13 | 0.06 | 0.19 | 0.14 | 0.15 | 0.10 | 0.16 | 0.08 |
| June          | 0.15 | 0.08 | 0.09 | 0.06 | 0.05 | 0.11 | 0.11 | 0.08 | 0.11 | 0.06 | 0.07 |
| July          | 0.15 | 0.12 | 0.24 | 0.08 | 0.11 | 0.10 | 0.13 | 0.11 | 0.17 | 0.12 | 0.13 |
| August        | 0.28 | 0.26 | 0.19 | 0.20 | 0.16 | 0.14 | 0.19 | 0.16 | 0.17 | 0.23 | 0.24 |
| September     | 0.35 | 0.32 | 0.20 | 0.23 | 0.23 | 0.15 | 0.25 | 0.17 | 0.18 | 0.18 | 0.23 |
| October       | 0.35 | 0.31 | 0.26 | 0.19 | 0.20 | 0.20 | 0.22 | 0.16 | 0.19 | 0.15 | 0.21 |
| November      | 0.32 | 0.32 | 0.22 | 0.19 | 0.14 | 0.12 | 0.23 | 0.18 | 0.18 | 0.19 | 0.18 |
| December      |      | 0.07 | 0.10 | 0.13 | 0.28 | 0.20 | 0.08 | 0.12 | 0.07 | 0.09 | 0.14 |
| Yearly Values | 0.24 | 0.18 | 0.19 | 0.16 | 0.13 | 0.14 | 0.18 | 0.14 | 0.15 | 0.14 | 0.17 |

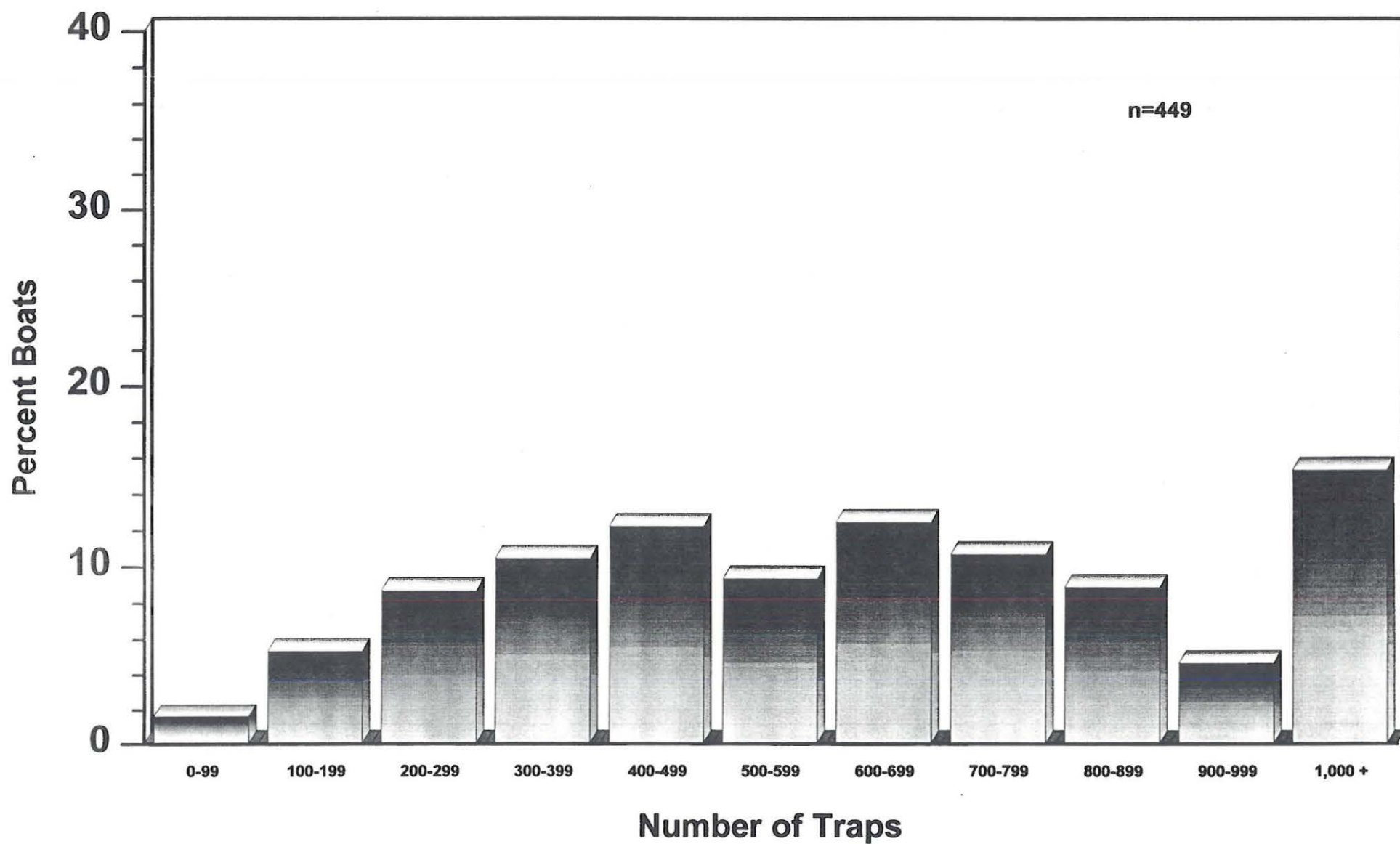
|               | 1979 | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 |
|---------------|------|------|------|------|------|------|------|------|------|------|------|
| January       |      |      |      |      |      |      |      |      |      |      |      |
| February      |      |      |      |      |      |      |      |      |      |      |      |
| March         |      |      |      |      |      |      |      |      |      |      |      |
| April         | 0.06 |      | 0.12 | 0.08 | 0.07 |      | 0.01 | 0.05 | 0.05 | 0.07 | 0.10 |
| May           | 0.09 | 0.09 | 0.22 | 0.10 | 0.12 | 0.08 | 0.05 | 0.09 | 0.10 | 0.12 | 0.14 |
| June          | 0.10 | 0.09 | 0.13 | 0.11 | 0.14 | 0.07 | 0.06 | 0.13 | 0.07 | 0.07 | 0.10 |
| July          | 0.11 | 0.26 | 0.20 | 0.18 | 0.11 | 0.13 | 0.19 | 0.16 | 0.15 | 0.11 | 0.14 |
| August        | 0.22 | 0.22 | 0.27 | 0.23 | 0.27 | 0.20 | 0.23 | 0.21 | 0.20 | 0.18 | 0.12 |
| September     | 0.29 | 0.18 | 0.22 | 0.20 | 0.19 | 0.11 | 0.13 | 0.15 | 0.22 | 0.20 | 0.20 |
| October       | 0.27 | 0.22 | 0.19 | 0.20 | 0.12 | 0.22 | 0.19 | 0.12 | 0.18 | 0.17 | 0.20 |
| November      | 0.21 | 0.17 | 0.14 | 0.21 | 0.21 | 0.14 | 0.16 | 0.15 | 0.14 | 0.29 | 0.11 |
| December      | 0.09 | 0.07 | 0.19 | 0.06 | 0.11 | 0.09 |      | 0.10 | 0.08 | 0.16 | 0.16 |
| Yearly Values | 0.19 | 0.19 | 0.20 | 0.18 | 0.17 | 0.14 | 0.14 | 0.14 | 0.16 | 0.17 | 0.15 |

|               | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | Monthly Means |
|---------------|------|------|------|------|------|------|------|------|------|---------------|
| January       |      |      |      |      |      |      |      |      |      |               |
| February      |      |      |      |      |      |      |      |      |      |               |
| March         |      |      |      |      |      |      |      |      |      |               |
| April         | 0.08 | 0.06 | 0.04 | 0.02 | 0.06 |      | 0.05 | 0.07 | 0.08 | 0.08          |
| May           | 0.15 | 0.06 | 0.05 | 0.08 | 0.10 | 0.06 | 0.11 | 0.12 | 0.10 | 0.12          |
| June          | 0.12 | 0.07 | 0.06 | 0.08 | 0.07 | 0.08 | 0.05 | 0.07 | 0.08 | 0.09          |
| July          | 0.16 | 0.24 | 0.10 | 0.14 | 0.21 | 0.20 | 0.17 | 0.17 | 0.23 | 0.15          |
| August        | 0.20 | 0.27 | 0.30 | 0.19 | 0.33 | 0.36 | 0.38 | 0.33 | 0.28 | 0.22          |
| September     | 0.22 | 0.23 | 0.26 | 0.28 | 0.18 | 0.22 | 0.21 | 0.31 | 0.28 | 0.21          |
| October       | 0.26 | 0.22 | 0.12 | 0.22 | 0.28 | 0.25 | 0.16 | 0.21 | 0.19 | 0.21          |
| November      | 0.22 | 0.18 | 0.13 | 0.19 | 0.16 | 0.23 | 0.14 | 0.20 | 0.22 | 0.19          |
| December      |      | 0.30 | 0.04 | 0.19 | 0.18 |      | 0.09 | 0.16 | 0.14 | 0.13          |
| Yearly Values | 0.18 | 0.21 | 0.16 | 0.17 | 0.21 | 0.23 | 0.20 | 0.23 | 0.21 |               |

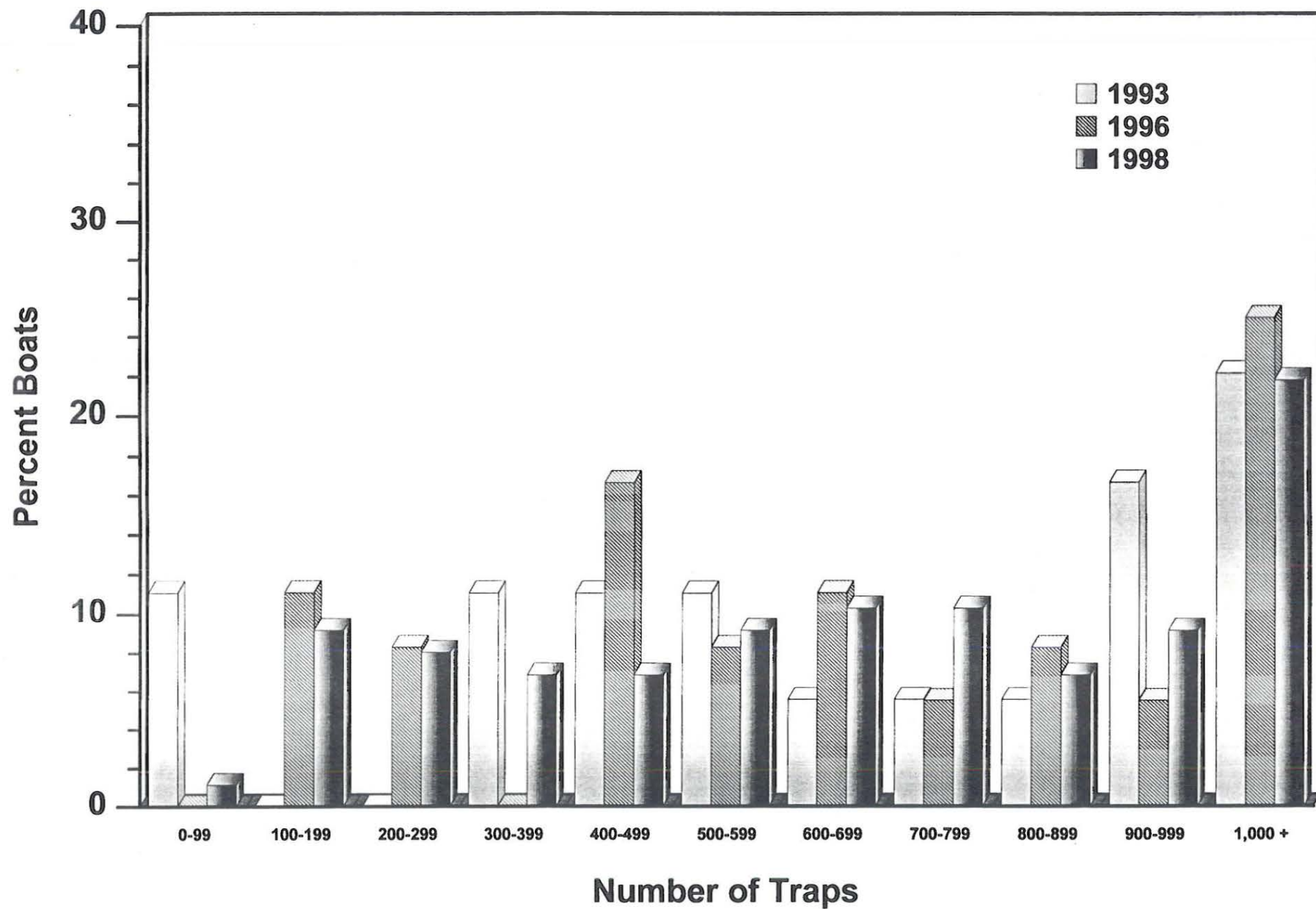
# Traps Per Boat Casco Bay 1998



## Traps Per Boat Coastwide 1998

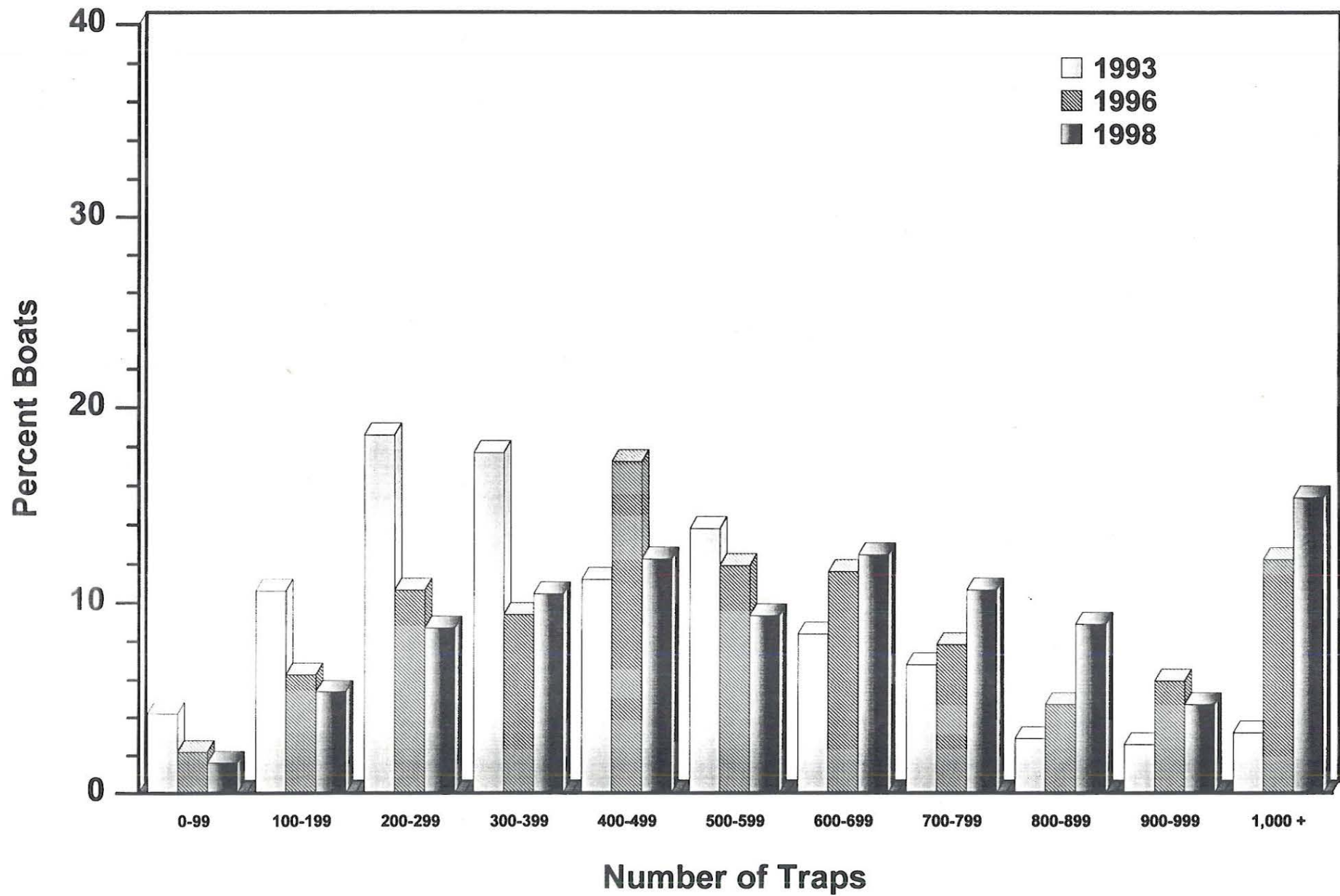


# Traps Per Boat Casco Bay

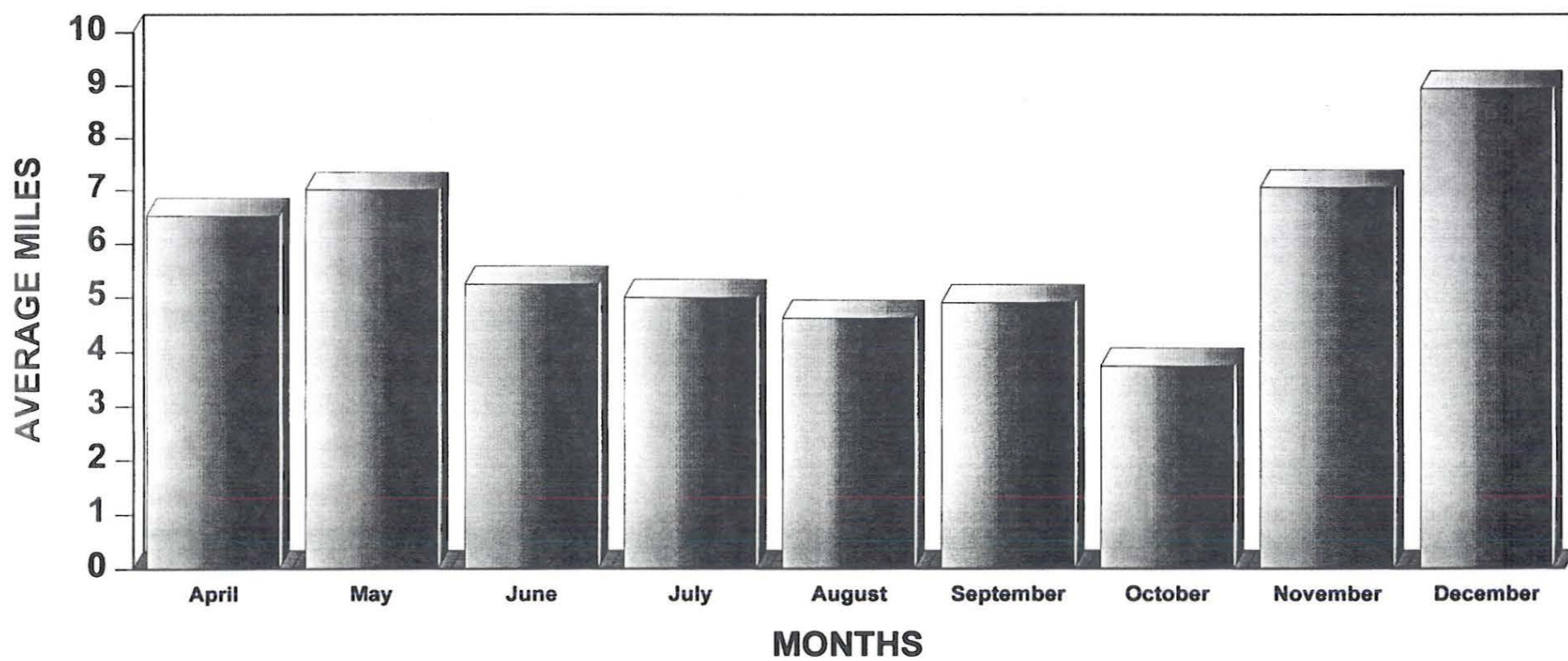




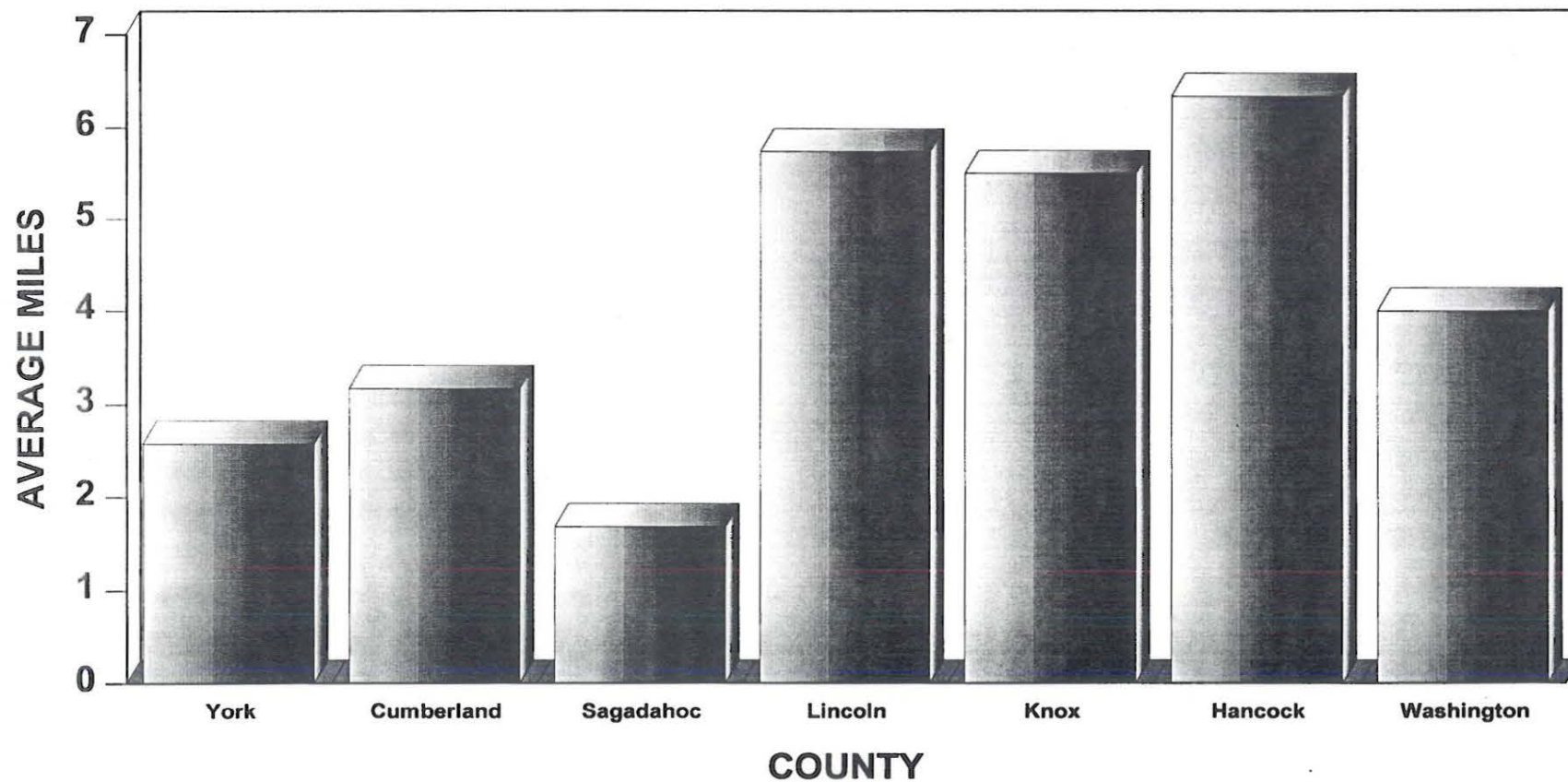
## Traps Per Boat Coastwide



**FISHING  
MILES FROM SHORE  
1998**

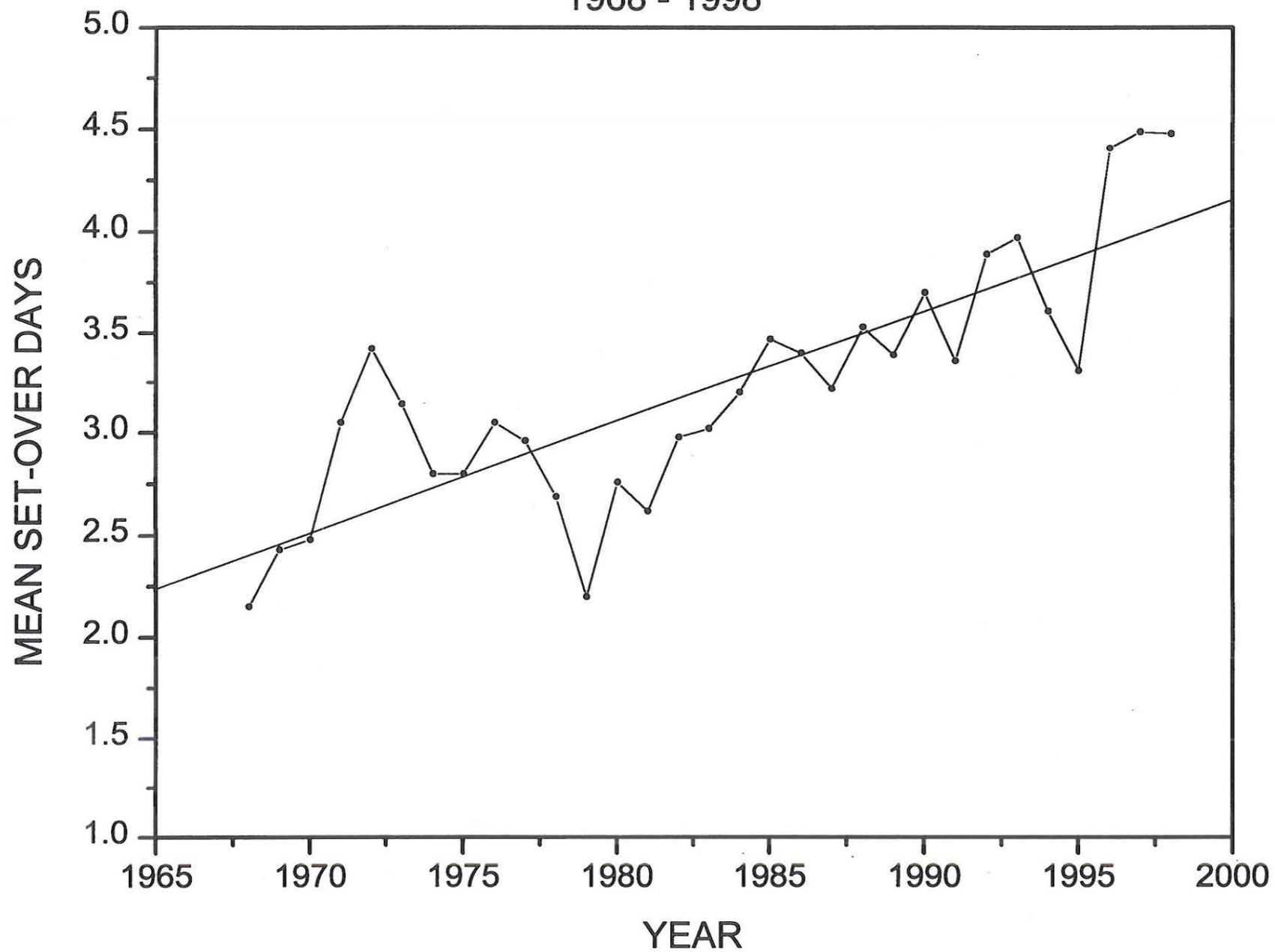


**FISHING  
MILES FROM SHORE  
1998**



# MAINE LOBSTER TRAP IMMERSION TIME

## 1968 - 1998





# PORT SAMPLING LOBSTER DEALERS 1998

## BY COUNTY

| YORK                   | CUMBERLAND             | SAGADAHOC               | LINCOLN                 |
|------------------------|------------------------|-------------------------|-------------------------|
| Seaview Lobster Co.    | Pine Point Co-op       | Seahorse Seafoods       | Robinson's Wharf        |
| Port Lobster Co.       | Pine Point Co-op       | Inland Seafood, Inc.    | Boothbay Region Co-op   |
| Port Lobster Co.       | Harseeket Lob. Co.     | Inland Seafood, Inc.    | Boothbay Region Co-op   |
| J. P. Shellfish        | Allen's Lobster Co.    | Georgetown Fishermans C | Boothbay Region Co-op   |
| J. P. Shellfish        | Interstate Lob. Co.    |                         | Bristol Lobster Co.     |
|                        | Interstate Lob. Co.    |                         | Eugley's Wharf          |
|                        | Cook's Lobster         |                         | Pemaquid Co-op          |
|                        | Cook's Lobster         |                         | Pemaquid Co-op          |
|                        | Cook's Lobster         |                         | New Harbor Co-op        |
|                        | Glen's Lobster Co.     |                         | Shaw's Fish & Lobster W |
|                        | Glen's Lobster Co.     |                         | Muscongus Bay Lob. Co.  |
|                        | Glen's Lobster Co.     |                         | Muscongus Bay Lob. Co.  |
|                        | Glen's Lobster Co.     |                         |                         |
|                        | Cundy's Harbor Wharf   |                         |                         |
|                        | Cundy's Harbor Wharf   |                         |                         |
|                        | Ken's Lobster          |                         |                         |
|                        | Tiny Bigman Seafood Co |                         |                         |
|                        | Toby's Lobster         |                         |                         |
| KNOX                   | HANCOCK                | WASHINGTON              |                         |
| U.S.I. Coproration     | The Lobster Co.        | No. Atlantic Fish Co.   |                         |
| Friendship Co-op       | Coastside Lobster      | Smith Lob. Co.          |                         |
| Simmons' Lobster Whf.  | Conary Cove Lob.       | Oscar Look              |                         |
| Kip's Seafood Co.      | Thurston Lobster Co.   | Oscar Look              |                         |
| Kip's Seafood Co.      | Thurston Lobster Co.   | Oscar Look              |                         |
| John Olson             | C.H. Rich              | Barney Cove Lob.        |                         |
| Bay Lobster Co.        | Swan's Island Co-op    | BBS lobsters            |                         |
| Art's Lobster Co.      | Swan's Island Co-op    | Hixey Head              |                         |
| Art's Lobster Co.      | Kent's Wharf           | Stillman Fitzhenry      |                         |
| Spruce Head Co-op      | Southwest Lob. Co.     | Stillman Fitzhenry      |                         |
| Wm. Atwood Lobster Co. | Cranberry Island Co-op | Cobscook Bay Seafood    |                         |
| Victor Ames            | Cranberry Island Co-op | Cobscook Bay Seafood    |                         |
| Eastern Horizon, Inc.  | Cranberry Island Co-op |                         |                         |
| Witham's Lobster Co.   | Winter Harbor Co-op    |                         |                         |
| Bickford Lobster Co    | Prospect Hbr. Trading  |                         |                         |
| Grindle Point Lobster  | D.B. Rice              |                         |                         |
| Grindle Point Lobster  | D. B. Rice             |                         |                         |
| Saint George Marine    | Sunshine Seafood       |                         |                         |
|                        | Parsons Lobster        |                         |                         |
|                        | Colwell Bros.          |                         |                         |
|                        | Fisherman's Landing    |                         |                         |

# SURVIVAL ESTIMATES 1998

| MONTH     | SEX     | R<br>VALUE | RZ<br>VALUE | H<br>VALUE | HZ<br>VALUE | Standard<br>ERROR | CHI-Square<br>TEST |
|-----------|---------|------------|-------------|------------|-------------|-------------------|--------------------|
| April     | Males   | 0.25000    | 1.38629     | 0.23077    | 1.46634     | 0.11180           | 0.12821            |
|           | Females | 0.09877    | 2.31501     | 0.10884    | 2.21784     | 0.02351           | 1.80039            |
|           | Sexes C | 0.10000    | 2.30259     | 0.09732    | 2.32980     | 0.01654           | 0.24534            |
| May       | Males   | 0.18750    | 1.67398     | 0.19697    | 1.62471     | 0.04391           | 0.21923            |
|           | Females | 0.13793    | 1.98100     | 0.14474    | 1.93284     | 0.03718           | 0.23146            |
|           | Sexes C | 0.16071    | 1.82813     | 0.16901    | 1.77777     | 0.02842           | 0.46580            |
| June      | Males   | 0.17339    | 1.75223     | 0.19417    | 1.63900     | 0.02409           | 3.65264            |
|           | Females | 0.10625    | 2.24196     | 0.11806    | 2.13660     | 0.02444           | 2.10023            |
|           | Sexes C | 0.05085    | 2.97893     | 0.05263    | 2.94444     | 0.02885           | 0.10902            |
| July      | Males   | 0.02857    | 3.55535     | 0.02899    | 3.54096     | 0.02006           | 0.02941            |
|           | Females | 0.12690    | 2.06433     | 0.13873    | 1.97524     | 0.02378           | 1.78295            |
|           | Sexes C | 0.03158    | 3.45527     | 0.03226    | 3.43399     | 0.01804           | 0.06592            |
| August    | Males   | 0.02469    | 3.70130     | 0.02500    | 3.68888     | 0.01735           | 0.02532            |
|           | Females | 0.06842    | 2.68208     | 0.07324    | 2.61402     | 0.01297           | 1.96029            |
|           | Sexes C | 0.01869    | 3.97968     | 0.01887    | 3.97029     | 0.01315           | 0.01905            |
| September | Males   | 0.04082    | 3.19867     | 0.04211    | 3.16758     | 0.02009           | 0.13035            |
|           | Females | 0.08615    | 2.45168     | 0.09225    | 2.38324     | 0.01154           | 3.03023            |
|           | Sexes C | 0.03356    | 3.39451     | 0.03448    | 3.36730     | 0.01480           | 0.14176            |
| October   | Males   | 0.03125    | 3.46574     | 0.03175    | 3.44999     | 0.02192           | 0.03226            |
|           | Females | 0.06773    | 2.69224     | 0.07249    | 2.62424     | 0.01123           | 2.56101            |
|           | Sexes C | 0.02041    | 3.89182     | 0.02062    | 3.88156     | 0.01436           | 0.02083            |
| November  | Males   | 0.10938    | 2.21297     | 0.12174    | 2.10588     | 0.02770           | 1.76308            |
|           | Females | 0.02190    | 3.82137     | 0.02222    | 3.80666     | 0.01255           | 0.04511            |
|           | Sexes C | 0.06391    | 2.75028     | 0.06800    | 2.68825     | 0.01503           | 1.15791            |
| December  | Males   | 0.19149    | 1.65292     | 0.20513    | 1.58412     | 0.05801           | 0.26944            |
|           | Females | 0.12500    | 2.07944     | 0.14085    | 1.96010     | 0.03721           | 1.43058            |
|           | Sexes C | 0.14844    | 1.90759     | 0.16364    | 1.81011     | 0.03155           | 1.41836            |
| 1998      | Males   | 0.04831    | 3.03013     | 0.04810    | 3.03445     | 0.01055           | 0.00807            |
|           | Females | 0.01554    | 4.16408     | 0.01571    | 4.15366     | 0.00893           | 0.03174            |
|           | Sexes C | 0.03783    | 3.27468     | 0.03754    | 3.28228     | 0.00774           | 0.03641            |

Instantaneous Survival Estimates -> (F)

| April | May  | June | July | August | September | October | November | December | Year |
|-------|------|------|------|--------|-----------|---------|----------|----------|------|
| 2.20  | 1.73 | 2.88 | 3.36 | 3.88   | 3.29      | 3.79    | 2.65     | 1.81     | 3.17 |

# Catch/Effort and SOD 1998

| Month     | 1         |     | 2         |      | 3         |      | 4         |       | 5         |       |
|-----------|-----------|-----|-----------|------|-----------|------|-----------|-------|-----------|-------|
|           | SOD       |     | SOD       |      | SOD       |      | SOD       |       | SOD       |       |
|           | TH        | #   | TH        | #    | TH        | #    | TH        | #     | TH        | #     |
| April     | 150       | 8   | 320       | 75   | 500       | 213  | 880       | 292   | 600       | 279   |
|           | (0.05333) |     | (0.23438) |      | (0.42600) |      | (0.33182) |       | (0.46500) |       |
|           | ±0.00000  |     | ±0.01758  |      | ±0.01520  |      | ±0.02983  |       | ±0.16866  |       |
| May       | 200       | 102 | 54        | 12   | 360       | 184  | 388       | 185   | 500       | 310   |
|           | (0.51000) |     | (0.22222) |      | (0.51111) |      | (0.47680) |       | (0.62000) |       |
|           | ±0.00000  |     | ±0.00000  |      | ±0.00000  |      | ±0.05880  |       | ±0.12400  |       |
| June      |           |     | 650       | 208  | 615       | 223  | 726       | 185   | 640       | 352   |
|           |           |     | (0.32000) |      | (0.36260) |      | (0.25482) |       | (0.55000) |       |
|           |           |     | ±0.01538  |      | ±0.07115  |      | ±0.07641  |       | ±0.05553  |       |
| July      | 500       | 370 | 2572      | 1899 | 2205      | 1913 | 2421      | 1558  | 150       | 73    |
|           | (0.74000) |     | (0.73834) |      | (0.86757) |      | (0.64354) |       | (0.48667) |       |
|           | ±0.01600  |     | ±0.09113  |      | ±0.10960  |      | ±0.06004  |       | ±0.00000  |       |
| August    | 320       | 226 | 800       | 807  | 2347      | 2371 | 3905      | 4659  | 2769      | 3588  |
|           | (0.70625) |     | (1.00880) |      | (1.01020) |      | (1.19310) |       | (1.29580) |       |
|           | ±0.32227  |     | ±0.24873  |      | ±0.09042  |      | ±0.10270  |       | ±0.13646  |       |
| September | 300       | 233 | 2168      | 2212 | 4046      | 3709 | 3322      | 4391  | 1930      | 2476  |
|           | (0.77667) |     | (1.02030) |      | (0.91671) |      | (1.32180) |       | (1.28290) |       |
|           | ±0.00000  |     | ±0.10215  |      | ±0.11822  |      | ±0.17560  |       | ±0.09342  |       |
| October   |           |     | 575       | 259  | 570       | 339  | 1783      | 1477  | 4121      | 4513  |
|           |           |     | (0.45043) |      | (0.59474) |      | (0.82838) |       | (1.09510) |       |
|           |           |     | ±0.05909  |      | ±0.07273  |      | ±0.06994  |       | ±0.11310  |       |
| November  |           |     |           |      |           |      | 1451      | 1848  | 320       | 424   |
|           |           |     |           |      |           |      | (1.27360) |       | (1.32500) |       |
|           |           |     |           |      |           |      | ±0.14686  |       | ±0.15313  |       |
| December  |           |     | 368       | 307  | 100       | 41   | 250       | 136   | 750       | 977   |
|           |           |     | (0.83424) |      | (0.41000) |      | (0.54400) |       | (1.30270) |       |
|           |           |     | ±0.31983  |      | ±0.00000  |      | ±0.00000  |       | ±0.64946  |       |
| TOTAL     | 1470      | 939 | 7507      | 5779 | 10743     | 8993 | 15126     | 14731 | 11780     | 12992 |
|           | (0.63878) |     | (0.76981) |      | (0.83710) |      | (0.97389) |       | (1.10290) |       |
|           | ±0.08414  |     | ±0.09430  |      | ±0.06204  |      | ±0.12637  |       | ±0.07532  |       |

# Concentration Indices

1998

May - June - July

|        | Numbers (c) | TRAPHAULS (f)   | c/f             |
|--------|-------------|-----------------|-----------------|
| May    | 1797        | 2967            | .605662         |
| June   | 2406        | 6723            | .357876         |
| July   | 9010        | 12053           | .747532         |
|        | -----       | -----           | -----           |
| Totals | 13213       | 21743           | 1.71107         |
| Ec2 =  | 90198145    | Ef2 = 199276627 | Ec/f2 = 1.05371 |

$$R = .607690$$

$$\text{Variance of } f = 20845305$$

$$\text{Variance of } c/f = 0.038890$$

$$IG = 1.06546$$

$$IR = .300510$$

September - October - November

|           |           |                 |                 |
|-----------|-----------|-----------------|-----------------|
| September | 26049     | 24380           | 1.06846         |
| October   | 15798     | 16542           | .955024         |
| November  | 4754      | 3927            | 1.21059         |
|           | -----     | -----           | -----           |
| Totals    | 46601     | 44849           | 3.23408         |
| Ec2 =     | 950727721 | Ef2 = 883443493 | Ec/f2 = 3.51921 |

$$R = 1.03906$$

$$\text{Variance of } f = 106482946$$

$$\text{Variance of } c/f = 0.016400$$

$$IG = 0.963860$$

$$IR = -0.440780$$



# Concentration Indices

1998

April - December

|           | Numbers (c) | TRAPHAULS (f) | c/f        |
|-----------|-------------|---------------|------------|
| April     | 2310        | 6351          | .363722    |
| May       | 1797        | 2967          | .605662    |
| June      | 2406        | 6723          | .357876    |
| July      | 9010        | 12053         | .747532    |
| August    | 19193       | 17459         | 1.09932    |
| September | 26049       | 24380         | 1.06846    |
| October   | 15798       | 16542         | .955024    |
| November  | 4754        | 3927          | 1.21059    |
| December  | 2191        | 2360          | .928390    |
|           | -----       | -----         | -----      |
| Totals    | 83508       | 92762         | 7.33658    |
|           |             |               |            |
| Ec2 =     | 1419433696  | Ef2 =         | 1433441602 |
|           |             | Ec/f2 =       | 6.77562    |

R = .900239

Variance of f = 59669247

Variance of c/f = 0.099380

IG = 1.104350

IR = 0.360040

# Concentration Indices

1998

May - June - July

|        | Numbers (c) | THSOD (f)        | c/f             |
|--------|-------------|------------------|-----------------|
| May    | 1797        | 17648            | .101825         |
| June   | 2406        | 31009            | .077590         |
| July   | 9010        | 38893            | .231661         |
|        | -----       | -----            | -----           |
| Totals | 13213       | 87550            | .411076         |
| Ec2 =  | 90198145    | Ef2 = 2785675434 | Ec/f2 = .070055 |

R = .150919

Variance of f = 115337300

Variance of c/f = 0.006860

IG = 1.10140

IR = .455720

September - October - November

|           |           |                 |                 |
|-----------|-----------|-----------------|-----------------|
| September | 26049     | 92937           | .280287         |
| October   | 15798     | 84272           | .187464         |
| November  | 4754      | 21650           | .219584         |
|           | -----     | -----           | -----           |
| Totals    | 46601     | 198859          | .687335         |
| Ec2 =     | 950727721 | Ef2 = .1620E+11 | Ec/f2 = .161921 |

R = .234342

Variance of f = .151E+10

Variance of c/f = 0.002220

IG = 1.022830

IR = 0.189070

# Concentration Indices

1998

April - December

|           | Numbers (c) | THSOD (f) | c/f         |
|-----------|-------------|-----------|-------------|
| April     | 2310        | 28203     | .081906     |
| May       | 1797        | 17648     | .101825     |
| June      | 2406        | 31009     | .077590     |
| July      | 9010        | 38893     | .231661     |
| August    | 19193       | 67620     | .283836     |
| September | 26049       | 92937     | .280287     |
| October   | 15798       | 84272     | .187464     |
| November  | 4754        | 21650     | .219584     |
| December  | 2191        | 15410     | .142180     |
|           | -----       | -----     | -----       |
| Totals    | 83508       | 397642    | 1.60633     |
|           |             |           |             |
| Ec2 =     | 1419433696  | Ef2 =     | 24598795596 |
|           |             | Ec/f2 =   | .339463     |

R = .210008

Variance of f = 878750003

Variance of c/f = 0.006600

IG = 1.176640

IR = 0.578600

# Mean Number of Traps Per Boat

1967 through 1998

| YEAR | TOTAL TRAPS | WIRE TRAPS<br>% and S.E. | TOTAL BOATS | MEAN NO.<br>TRAPS/BOAT | NO.<br>S.E. | RANGE IN NUMBER<br>OF TRAPS |       | % DOUBLE<br>PARLOR TRAPS |
|------|-------------|--------------------------|-------------|------------------------|-------------|-----------------------------|-------|--------------------------|
|      |             |                          |             |                        |             | LOW                         | HIGH  |                          |
| 1967 | 63,210      | -                        | 256         | 247                    | ± 16        | 25                          | 1,000 | -                        |
| 1968 | 63,928      | -                        | 292         | 219                    | ± 17        | 15                          | 1,200 | -                        |
| 1969 | 67,484      | -                        | 320         | 211                    | ± 13        | 8                           | 900   | -                        |
| 1970 | 96,639      | -                        | 383         | 252                    | ± 14        | 25                          | 1,400 | -                        |
| 1971 | 89,673      | -                        | 363         | 247                    | ± 16        | 7                           | 900   | -                        |
| 1972 | 74,634      | -                        | 243         | 307                    | ± 16        | 5                           | 1,050 | -                        |
| 1973 | 90,696      | -                        | 281         | 323                    | ± 23        | 5                           | 1,250 | -                        |
| 1974 | 95,804      | -                        | 330         | 290                    | ± 16        | 13                          | 1,200 | -                        |
| 1975 | 107,470     | -                        | 345         | 312                    | ± 14        | 24                          | 1,200 | -                        |
| 1976 | 115,948     | -                        | 358         | 324                    | ± 25        | 30                          | 1,700 | -                        |
| 1977 | 133,598     | -                        | 431         | 310                    | ± 23        | 30                          | 1,800 | -                        |
| 1978 | 114,502     | 14 ± 3                   | 360         | 318                    | ± 27        | 26                          | 1,500 | -                        |
| 1979 | 82,031      | 20 ± 4                   | 252         | 326                    | ± 15        | 22                          | 1,200 | -                        |
| 1980 | 86,812      | 23 ± 4                   | 233         | 372                    | ± 16        | 25                          | 1,300 | -                        |
| 1981 | 93,503      | 40 ± 6                   | 281         | 333                    | ± 16        | 20                          | 1,215 | -                        |
| 1982 | 114,639     | 35 ± 4                   | 315         | 364                    | ± 14        | 30                          | 1,400 | -                        |
| 1983 | 113,920     | 39 ± 5                   | 281         | 405                    | ± 33        | 24                          | 1,500 | -                        |
| 1984 | 118,049     | 39 ± 5                   | 289         | 408                    | ± 31        | 17                          | 1,600 | -                        |
| 1985 | 95,646      | 48 ± 5                   | 262         | 365                    | ± 16        | 25                          | 1,000 | -                        |
| 1986 | 75,881      | 47 ± 5                   | 212         | 358                    | ± 23        | 15                          | 1,200 | -                        |
| 1987 | 119,116     | 69 ± 5                   | 281         | 424                    | ± 23        | 13                          | 1,500 | -                        |
| 1988 | 122,031     | 72 ± 4                   | 284         | 430                    | ± 23        | 25                          | 1,230 | -                        |
| 1989 | 140,590     | 73 ± 4                   | 312         | 451                    | ± 35        | 53                          | 1,500 | 29.79                    |
| 1990 | 124,275     | 75 ± 4                   | 263         | 472                    | ± 35        | 33                          | 3,000 | 41.45                    |
| 1991 | 160,364     | 74 ± 4                   | 319         | 503                    | ± 40        | 17                          | 1,600 | 45.01                    |
| 1992 | 196,445     | 83 ± 3                   | 392         | 501                    | ± 38        | 7                           | 2,000 | 26.62                    |
| 1993 | 132,762     | 93 ± 2                   | 311         | 427                    | ± 24        | 30                          | 1,600 | 44.68                    |
| 1994 | 188,282     | 91 ± 2                   | 338         | 557                    | ± 37        | 38                          | 2,800 | 48.67                    |
| 1995 | 157,383     | 93 ± 2                   | 313         | 503                    | ± 34        | 8                           | 1,600 | 41.12                    |
| 1996 | 179,237     | 97 ± .9                  | 319         | 562                    | ± 32        | 42                          | 1,600 | 46.18                    |
| 1997 | 276,513     | 96 ± 1                   | 464         | 596                    | ± 30        | 2                           | 1,885 | 57.77                    |
| 1998 | 282,441     | 98 ± 1                   | 449         | 629                    | ± 26        | 35                          | 1,720 | 54.31                    |





**MAINE DEPARTMENT OF MARINE RESOURCES  
INTERJURISDICTIONAL FISHERIES RESOURCE MONITORING AND  
ASSESSMENT**

**LOBSTER SEA SAMPLING SURVEY  
PROJECT NO. 3-IJ-143  
GRANT NO. NA86FI0022**

**COMPLETION REPORT  
JANUARY 1 THROUGH DECEMBER 31, 1998**

**BY GLENN NUTTING**

### Sea Sampling Survey (Glenn Nutting)

DMRs lobster sea sampling program, which began collecting at-sea catch/ effort and biological data on the near shore Maine lobster resource from three boats in 1985, was expanded in May 1998. In order to accomplish more representative sampling and to assess the strength of the broodstock along Maine's coast, we added 15 boats from 11 harbors (Figure 1). Catch and effort data were collected monthly from May through November (Table 1). The 81 trips made during 1998 provided data on the total lobster catch including sublegal ( $\leq 82$  mm CL), legal (83-127 mm CL) and oversize ( $>127$  mm CL). Sea sampling data were collected as described in Appendix A (Maine's Commercial Lobster Sea Sampling Program) of the April 1992-1995 Completion Report, with the following exceptions: 1) sampling was conducted aboard 19 boats; 2) due to funding limitations, the DMR contracted one sampler to ride aboard 10 boats from Stonington to Cutler; and 3) on vessels where 6- or 12-trap trawls were fished we systematically sampled every 6th trap.

Total commercial lobster fishing effort for 1998 was 745 boat-hours and 19,697 trap-hauls. Carapace length, cull status, and sex were recorded for 5150 legal and 8200 sublegal lobsters. The total legal catch was 22,836 lobsters weighing 29,164 lbs. for a mean weight of 1.28 lbs. The ratio of sublegals to legal was 1.6. Overall cull percentages, combining legal and sublegal lobsters measured from the systematically selected traps, ranged from 3.1 (Stonington) to 49.5 (Biddeford Pool). During 1998 both legal and sublegal cull rates decreased from west to east.

A total of 1117 berried females were observed during sea sampling in 1998, of which 64.7% had a mutilated flipper. Figure 2 indicates that fishers from Hancock and Washington counties caught the majority of the berried females. Figure 3 shows they also caught the greatest percentage of eggies compared to legal catch during October and November. York and Cumberland counties had the greatest percentage of eggies during June and August.

Of 4281 V-notched lobsters captured in 1998, only 721 (16.8%) were ovigerous. Considering that most Maine female lobsters molt and mate one year prior to spawning, the reproductive cycle occurs over a two year period, with sexually mature females bearing eggs every other year. Thus if all the V-notched lobsters are mature, as most industry members believe, about half of the V-notched lobsters would be ovigerous. From 1985-1997 only 19.3%

of the V-notched lobsters were ovigerous. We are presently working with an ecosystem modeler to develop a mathematical model that will allow us to objectively evaluate the pros and cons of V-notching.

In this important era of co-management we appreciate the interest and cooperation of Maine's lobster industry, and we look forward to a continued collaborative relationship in our sea sampling program.



**Table 1. Sea sampling catch and effort values summarized by category by month, 1998.**

|                                                 | MAY   | JUNE  | JULY   | AUGUST | SEPTEMBER | OCTOBER | NOVEMBER | TOTAL  |
|-------------------------------------------------|-------|-------|--------|--------|-----------|---------|----------|--------|
| TOTAL CATCH IN POUNDS                           | 200   | 1,055 | 3,906  | 7,305  | 8,494     | 5,498   | 2,706    | 29,164 |
| TOTAL CATCH IN NUMBERS                          | 1,208 | 2,494 | 11,034 | 14,627 | 15,568    | 12,627  | 6,174    | 63,732 |
| TOTAL NUMBER OF SAMPLING TRIPS                  | 2     | 4     | 17     | 18     | 16        | 15      | 9        | 81     |
| TOTAL NUMBER OF BOAT HOURS                      | 17    | 38    | 158    | 178    | 148       | 134     | 73       | 745    |
| TOTAL NUMBER OF TRAP HAULS                      | 346   | 842   | 4,725  | 5,206  | 3,922     | 3,140   | 1,516    | 19,697 |
| TOTAL NUMBER OF LEGAL LOBSTERS                  | 161   | 705   | 3,116  | 5,893  | 6,679     | 4,401   | 1,881    | 22,836 |
| TOTAL NUMBER OF SUBLEGAL LOBSTERS               | 910   | 1,681 | 7,267  | 8,035  | 8,043     | 7,162   | 3,684    | 36,782 |
| TOTAL NUMBER OF OVERSIZE LOBSTERS               | 0     | 2     | 17     | 34     | 40        | 23      | 12       | 128    |
| MEAN WEIGHT IN POUNDS OF LEGAL LOBSTERS         | 1.24  | 1.50  | 1.25   | 1.24   | 1.27      | 1.25    | 1.44     | 1.28   |
| TOTAL NUMBER OF LEGALS PER TRAP HAUL            | 0.47  | 0.84  | 0.66   | 1.13   | 1.70      | 1.40    | 1.24     | 1.16   |
| TOTAL NUMBER OF POUNDS PER TRAP HAUL            | 0.58  | 1.25  | 0.83   | 1.40   | 2.17      | 1.75    | 1.78     | 1.48   |
| TOTAL NUMBER OF BERRIED LOBSTERS                | 47    | 34    | 164    | 223    | 188       | 269     | 192      | 1,117  |
| TOTAL NUMBER OF BERRIED LOBSTERS w/ V-NOTCH     | 29    | 14    | 121    | 140    | 116       | 171     | 130      | 721    |
| TOTAL NUMBER OF BERRIED LOBSTERS w/o V-NOTCH    | 18    | 20    | 43     | 83     | 72        | 98      | 62       | 396    |
| TOTAL NUMBER OF NON-BERRIED LOBSTERS w/ V-NOTCH | 130   | 94    | 562    | 626    | 742       | 891     | 515      | 3,560  |

Figure 1. Chart showing location of lobster sea sampling ports, 1998.

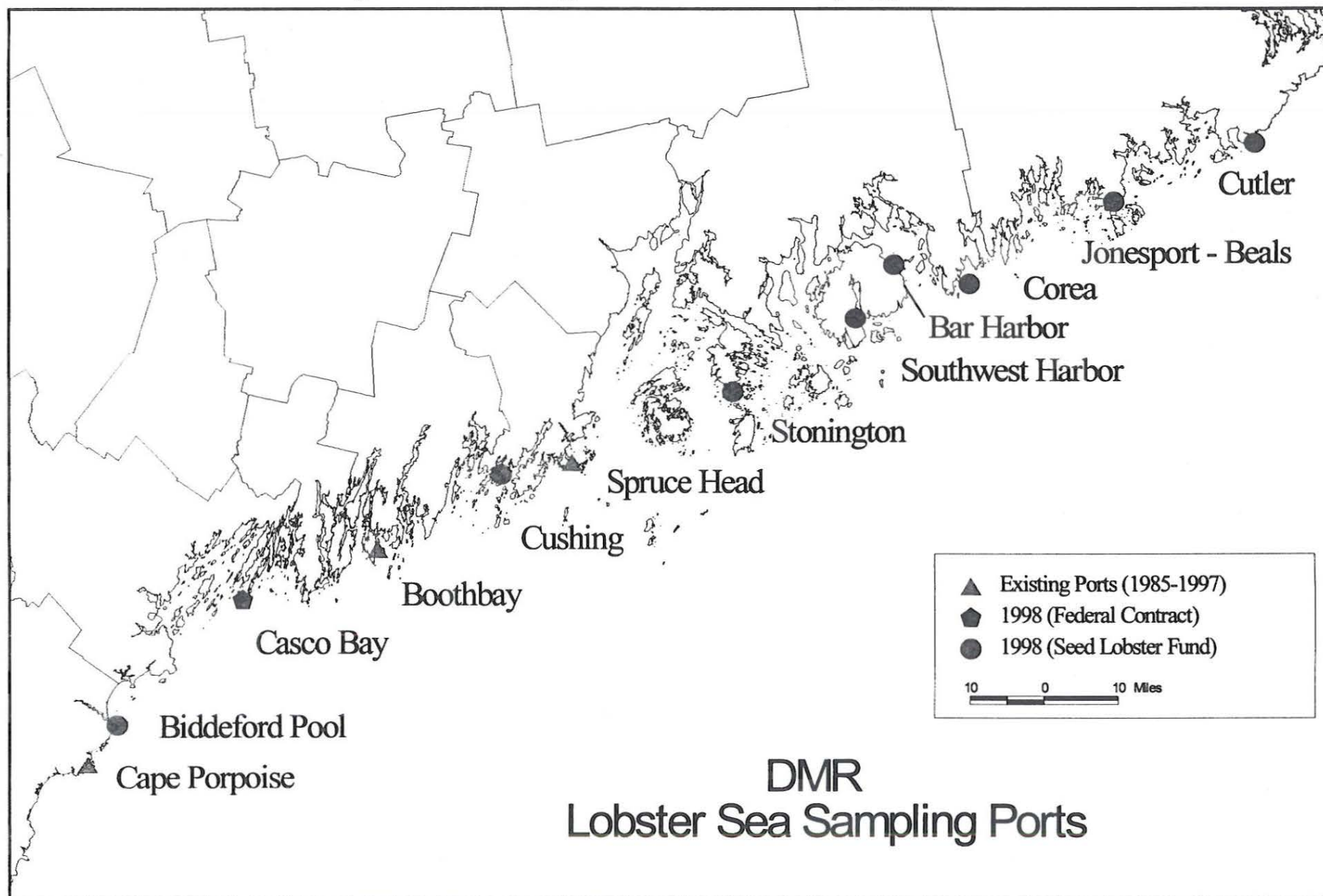


Figure 2. Numbers of berried females with and without a v-notch from sea sampling trips in three geographical regions along the Maine coast, 1998.

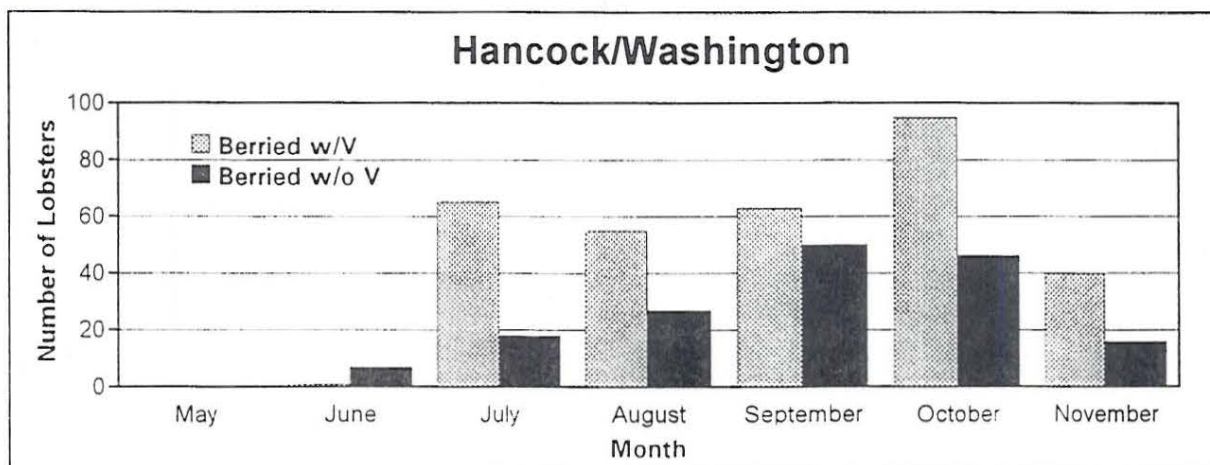
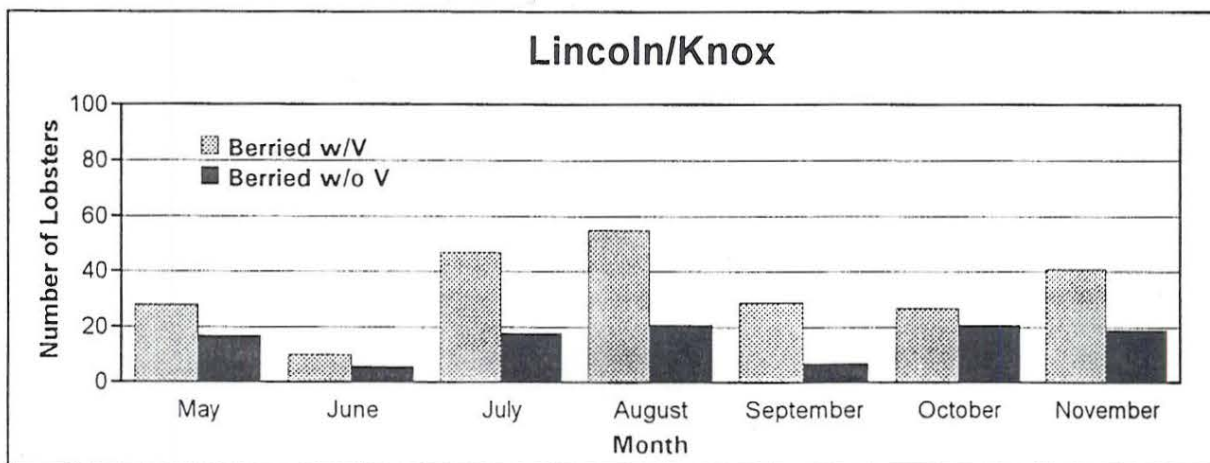
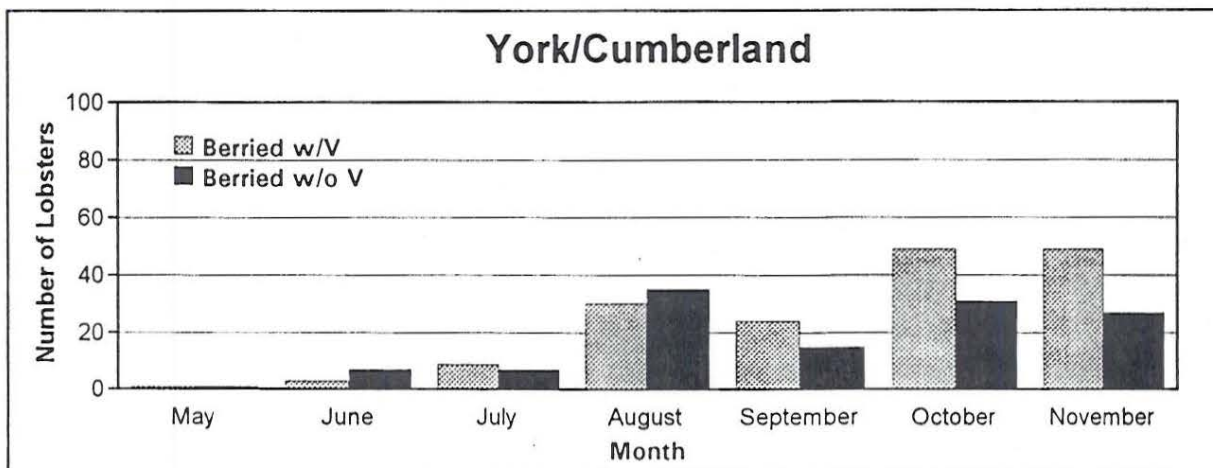
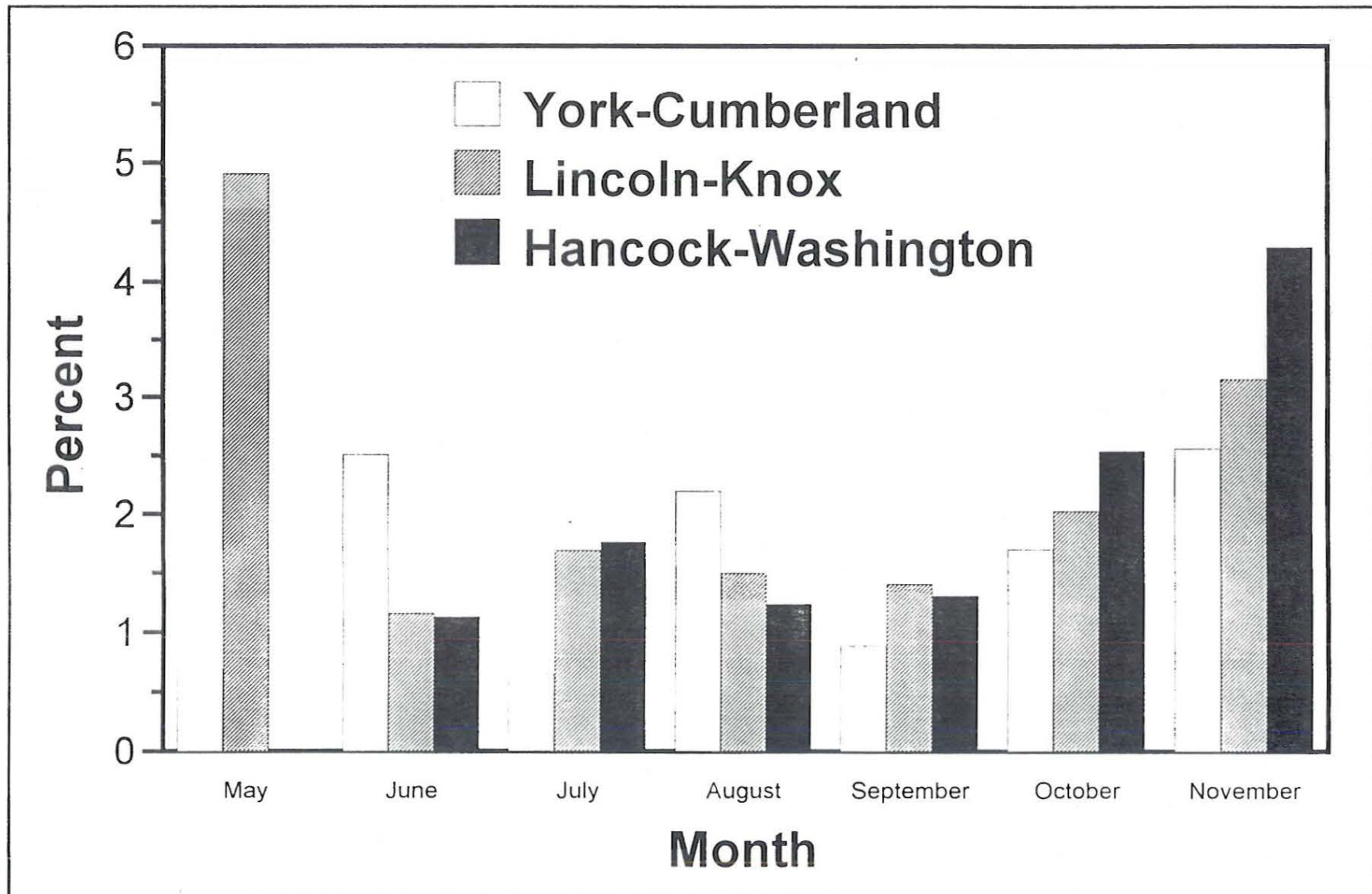


Figure 3. Percent frequency of berried females compared to legal catch from sea sampling trips in three geographical regions along the Maine coast, 1998.







**MAINE DEPARTMENT OF MARINE RESOURCES  
INTERJURISDICTIONAL FISHERIES RESOURCE MONITORING AND  
ASSESSMENT**

**Size at Onset of Maturity in the American lobster (*Homarus americanus*)  
Along the Maine Coast**

**PROJECT NO. 3-IJ-143  
GRANT NO. NA86FI0022**

**BY GLENN E. NUTTING**

### **Abstract**

From 1994 through 1998, male and female American lobsters were collected from three geographical regions along the Maine coast to determine size at onset of maturity. Physiological maturity (presence of spermatophores) in males occurred at approximately 43.5 and 45 mm CL in the central (Pratts Is./ Bailey Is.) and eastern (Winter Harbor) regions, respectively. Propodite volume of the crusher cheliped increased to a greater rate of allometric growth when the male lobster reached maturity. The inflection occurred at approximately 80 mm CL for western (Cape Porpoise) and Downeast males and 90 mm CL for central (Boothbay Harbor) males.

Immature ovaries occurred in females less than 75 mm CL from Cape Porpoise, 85 mm CL from Boothbay Harbor, and 91 mm CL from Downeast. Based on logistic curves sizes at 50% maturity were approximately 87, 89 and 94 mm CL for Cape Porpoise, Boothbay Harbor, and Downeast respectively.

## **Introduction**

A study to determine the size at onset of maturity of both sexes of the American lobster (*Homarus americanus*) along the coast of Maine began in 1994-1995 in the mid-coast region (Boothbay Harbor and Bailey Is.), continuing during 1995-1996 in the western region (Cape Porpoise), and concluding during 1997-1998 in the eastern region (Stonington, Sorrento and Winter Harbor) (Figure 1). A similar study by Krouse (1973) was limited to the Boothbay Harbor area. The objectives of this study were to determine the size at which they become sexually mature based on specific criteria including 1) cheliped dimensions in the males and 2) ovary color, ova size, abdominal width to carapace length ratio, and presence or absence of spermatophores in the seminal receptacle in the females.

## **Methods**

Two hundred fifteen nonovigerous females ranging in size from 60-101 mm CL and 162 males ranging in size from 44-111 mm CL were collected with four-foot commercial traps from the Cape Porpoise lobster boat participating in the sea sampling program. In the Boothbay Harbor area 227 nonovigerous females ranging in size from 65 to 105 mm CL and 252 males ranging in size from 43 to 121 mm CL were collected with three-foot research traps. In the downeast region 247 nonovigerous females ranging in size from 65-111 mm CL and 184 males ranging from 45-100 mm CL were collected from Stonington and Sorrento commercial lobster pounds. All "old" hard shell samples were collected from spring through early fall, west to east respectively, and subsequently examined within two weeks.

To determine maturity in nonovigerous females I used the methodology of Krouse (1973). The presence or absence of sperm cells in the seminal receptacle was determined by extracting material from within the seminal receptacle with a 20 gauge blunt-tipped hypodermic needle, smearing on a glass slide and examining with a Zeiss compound microscope at 640x.

Methodology to determine maturity in males is described by Aiken and Waddy (1989) in which the crusher cheliped length, width and thickness were measured to the nearest millimeter. The volume was also determined by volumetric displacement in which the cheliped was submerged in a graduated cylinder and the displaced water was measured to the nearest milliliter.



The testes of 70 males ranging in size from 36-52 mm CL were collected intertidally at Bailey Island, Pratts Island, and Winter Harbor, and examined for the presence or absence of spermatophores (physiological maturity) using the extraction technique described by Krouse (1973). Sperm cells were identified with a Zeiss compound microscope at 640x.

## **Results and Discussion**

### **Male maturity**

In this study male maturity was based upon the presence or absence of sperm cells and crusher cheliped criteria developed by Aiken and Waddy (1989). I examined the testes of 31 males from the Boothbay Harbor area and determined that all of the males from 50 to 80 mm CL (one male examined at each 1 mm increment) were mature. Since Krouse (1973) determined the 50% maturity level at about 44 mm CL, I examined 34 males hand collected at Bailey and Pratts Islands ranging from 36-50 mm CL to fine tune this critical size. Figure 2 indicates that 50% of these lobsters mature at approximately 43.5 mm CL. The Cape Porpoise 40-50 mm CL sample was too small (n=12) to accurately determine the 50% maturity level, however, the smallest mature male was 42 mm CL. I also examined 36 males ranging from 40-52 mm CL collected at Sand Cove in Winter Harbor and determined 50% maturity to be approximately 45 mm CL.

Templeman (1934) observed that males were unable to mate with considerably larger females. Since most females in all areas mature above the minimum legal size (82.55 mm CL) as discussed in the "female maturity" section, it would be reasonable to assume that pre-recruit males do not significantly contribute reproductively to the natural population.

Several investigators demonstrated an inflection between mature and immature male lobsters by noting relationships between cheliped propodite length against total length (Templeman 1935), crusher cheliped weight against carapace length (Squires 1970), and crusher cheliped weight/ whole weight ratio against carapace length (Ennis 1980). Two major drawbacks to Squires' and Ennis' methodology used as field techniques were 1) a valuable part of the lobster must be removed and 2) some sample weights were determined on small, potentially unstable fishing vessels. Realizing that weight is approximately proportional to volume, Aiken and Waddy (1989) estimated cheliped volume from the length, width, and thickness of the propodite. I

compared their methodology to volumetric displacement, an appropriate methodology in the laboratory. Figures 3 and 4 indicate a high correlation between the two methods for both Cape Porpoise and Boothbay Harbor samples. The bustling activity at the Downeast lobster pounds were not favorable environments for the volumetric displacement methodology.

The “crusher propodite volume”, or CPV, was divided by the cube of the carapace length to produce a straight horizontal line when plotted against carapace length. Aiken and Waddy’s (1989) formula  $100(\text{CPV})/(\text{CL})^3$  was used as a male maturity index which they term the CPI, “Crusher Propodite Index.” CPI values greater than 22-24 are indicative of greater allometric crusher growth, thus a male maturity indicator. Their data indicated the onset of male maturation at approximately 68 mm CL from the warm waters of the Gulf of St. Lawrence compared to 110 mm CL in the Bay of Fundy. Figure 5 indicates inflection points, which indicate the onset of maturity, at approximately 80 mm CL from Cape Porpoise and Downeast, and 90 mm CL from Boothbay Harbor. The extreme inflection at 105 mm CL (Boothbay Harbor) may be due to an inadequate sample size. The number of males ranging from 101 mm to 121 mm CL (n=8) was only 3.2% of the total sample. The Downeast sample size extends only to 100 mm CL due to a malfunction in the sea water intake system, thus destroying several dozen large males >100 mm CL.

### Female maturity

Size frequency histograms of the three ovarian stages of development from Cape Porpoise, Boothbay Harbor, and Downeast (Figures 6a-c) indicated the following:

|                 | <u>CL Size Range (mm) (Percentages)</u> |              |               |
|-----------------|-----------------------------------------|--------------|---------------|
|                 | Immature                                | Developing   | Mature        |
| Cape Porpoise   | 60-85 (46.6)                            | 65-92 (22.7) | 68-101 (30.7) |
| Boothbay Harbor | 65-82 (33.9)                            | 70-94 (44.4) | 79-105 (21.7) |
| Downeast        | 65-91 (29.9)                            | 77-99 (34.6) | 79-110 (35.5) |

Although there was considerable overlap in the size ranges of the ovarian stages, immature ovaries were predominantly in females less than 75 mm CL from Boothbay Harbor, less than 85



mm CL and 91 mm CL from Cape Porpoise and Downeast, respectively. Females with developing ovaries generally ranged from 70-99 mm CL, with one Cape Porpoise female measuring 65 mm CL.

For the most part, Cape Porpoise females >76 mm CL had mature ovaries, although there was one fully mature female (possessed a mature ovary along with the presence of spermatophores in her seminal receptacle) at 68 mm CL. The smallest fully mature female from BBH was 79 mm CL. In 1993, the Boothbay Harbor research traps captured an ovigerous female that measured 77 mm CL. Boothbay Harbor females had mature ovaries gradually increasing in frequency greater than 85 mm CL, similar to observations by Krouse (1973). Mature ovaries from the Downeast samples were predominantly in females larger than 90 mm CL.

Spermatophores, another criterion for maturity, were observed more frequently in seminal receptacles of mature females (typically >89 mm CL) from all areas (see Figures 6a-c). From the Cape Porpoise samples I detected spermatophores in four females (4.6%) that were <75 mm CL, while only 2 (1.7%) females of similar size from Boothbay Harbor and one female (<1%) from Downeast possessed spermatophores. All of the Boothbay Harbor females >89 mm CL had spermatophores, while 11 of 14 (78.6%) and 28 of 34 (82.4%) females from Cape Porpoise and Downeast, respectively, possessed sperm cells.

Females mate in the soft-shelled condition (Templeman, 1934), thus several females that I examined without spermatophores would be incapable of spawning although their ovaries were classified as developing or mature. Krouse (1973) observed that only 5 of 84 (6%) Boothbay Harbor females in the 80-90 mm CL size range were considered fully mature. All 24 of the Boothbay Harbor females in this size range that I examined were considered fully mature. Twenty of 22 (90.9%) Cape Porpoise females were fully mature, whereas the remaining two lobsters (82, 90 mm CL) would not spawn until they shed to 93 and 103 mm CL, respectively, assuming a 14% growth increment. From the Downeast samples only 3 of 38 (7.9%) females measured between 80-90 mm CL, and of those only 2 were fully mature. Six of 34 (17.6%) females >90 mm CL would have to undergo another molt and successfully mate with a male to ensure full maturity.

Templeman (1935) observed that the female lobster's abdomen widens significantly as she matures. Figure 7 shows the ratio of abdominal width to carapace length plotted against carapace length grouped by 5-mm. Inflection points, indicating the commencing of maturity, occurred at

approximately 70 mm CL for all areas. Krouse's (1973) Boothbay Harbor data showed an inflection point at approximately 80 mm CL. Aiken and Waddy (1980) demonstrated that the increase in relative width of the abdomen begins three or more molts before the first egg extrusion. However, we have observed, during sea sampling trips since 1985, sublegal ovigerous females at or below this inflection point. In many graphs of abdominal width/carapace length ratios that are described by Ennis (1980), he points out that inflections and asymptotes are not very distinct, possibly due to sample size or maturation occurring over a wide range of sizes.

Physiological size-maturity relationships, based on ova diameter, were derived for each area (Figure 8). I also included the Canadian Gulf of Maine data, from southwest Nova Scotia sea sampling, for comparison. The graph was composed by Robert Glenn of the Massachusetts Division of Marine Fisheries using a logistic equation incorporated into the ASMFC lobster stock assessment. Sizes at 50% physiological maturity were approximately 87, 89, and 94 mm CL for Cape Porpoise, Boothbay Harbor, and Downeast, respectively.

### Acknowledgments

I thank Butch Bowie and Jason Bartlett for their extremely valuable assistance with the sample collection/ processing and report graphics.

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Figure 1. Maturity sites at three geographic regions along the coast.

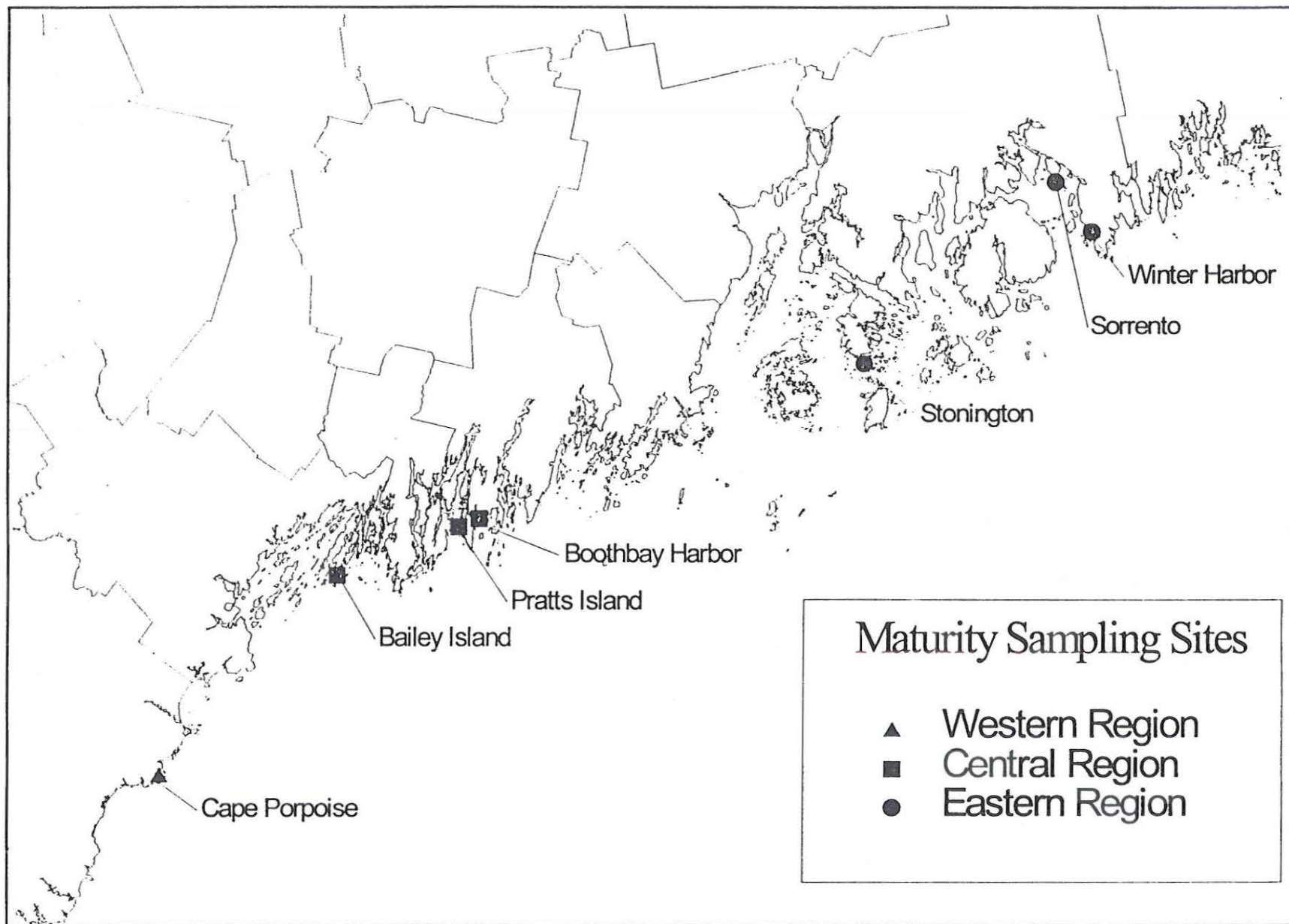


Figure 2. Percent frequency of physiologically mature male lobsters collected intertidally by hand at Pratts Island/Bailey Island and at Winter Harbor.

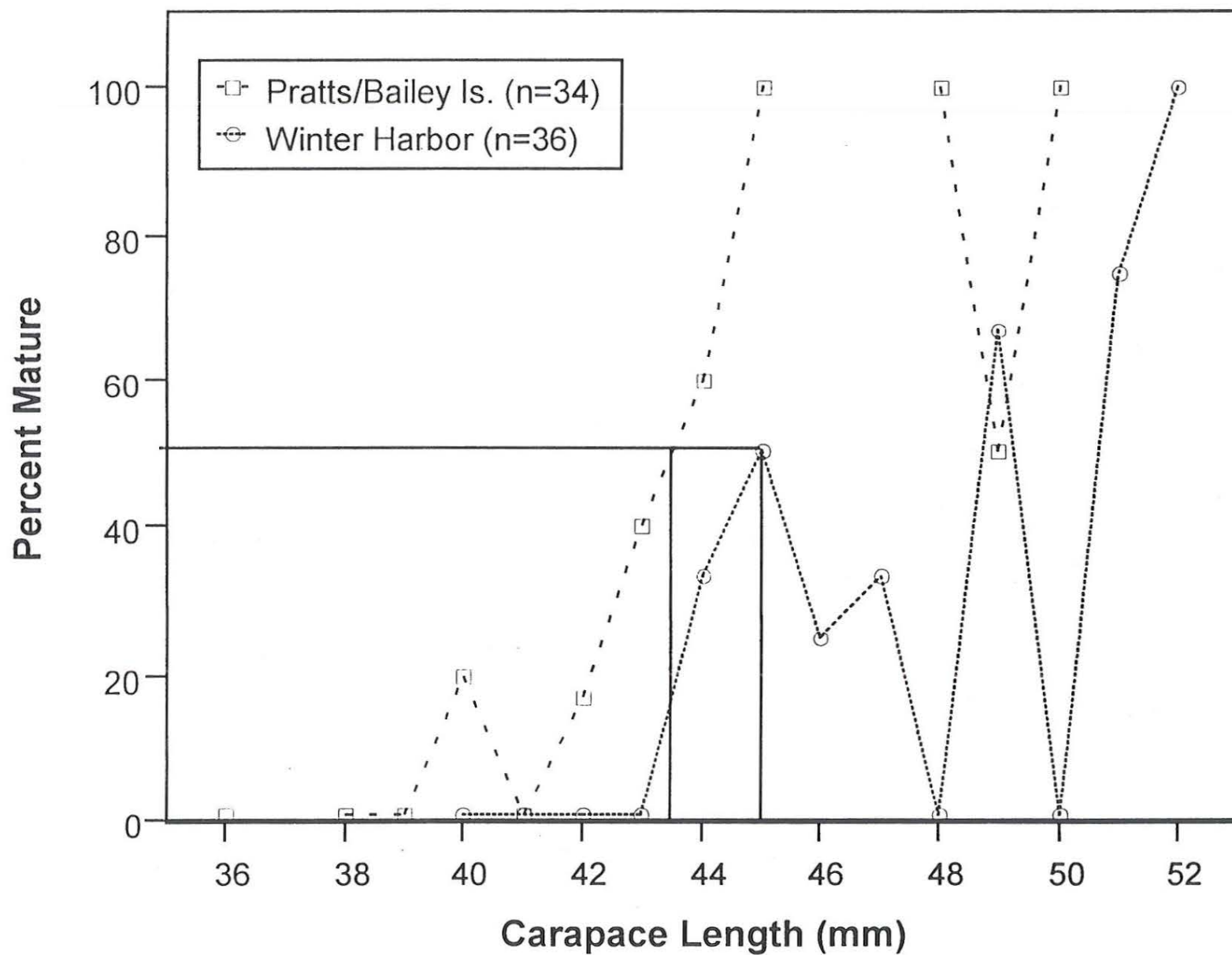


Figure 3. Relation of crusher propodite volume to crusher displacement for male lobsters collected at Cape Porpoise.

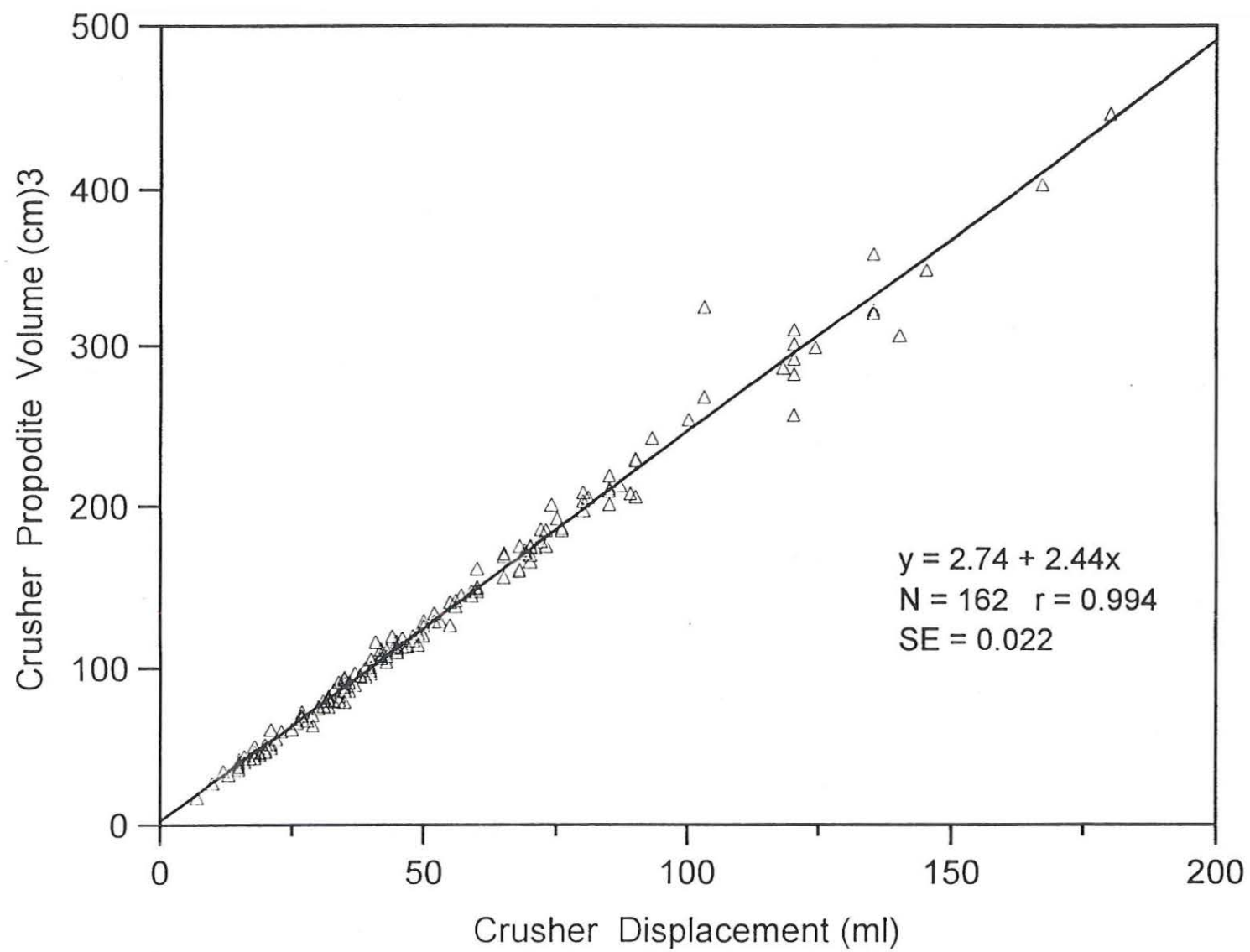




Figure 4. Relation of crusher propodite volume to crusher displacement for male lobsters collected at Boothbay Harbor.

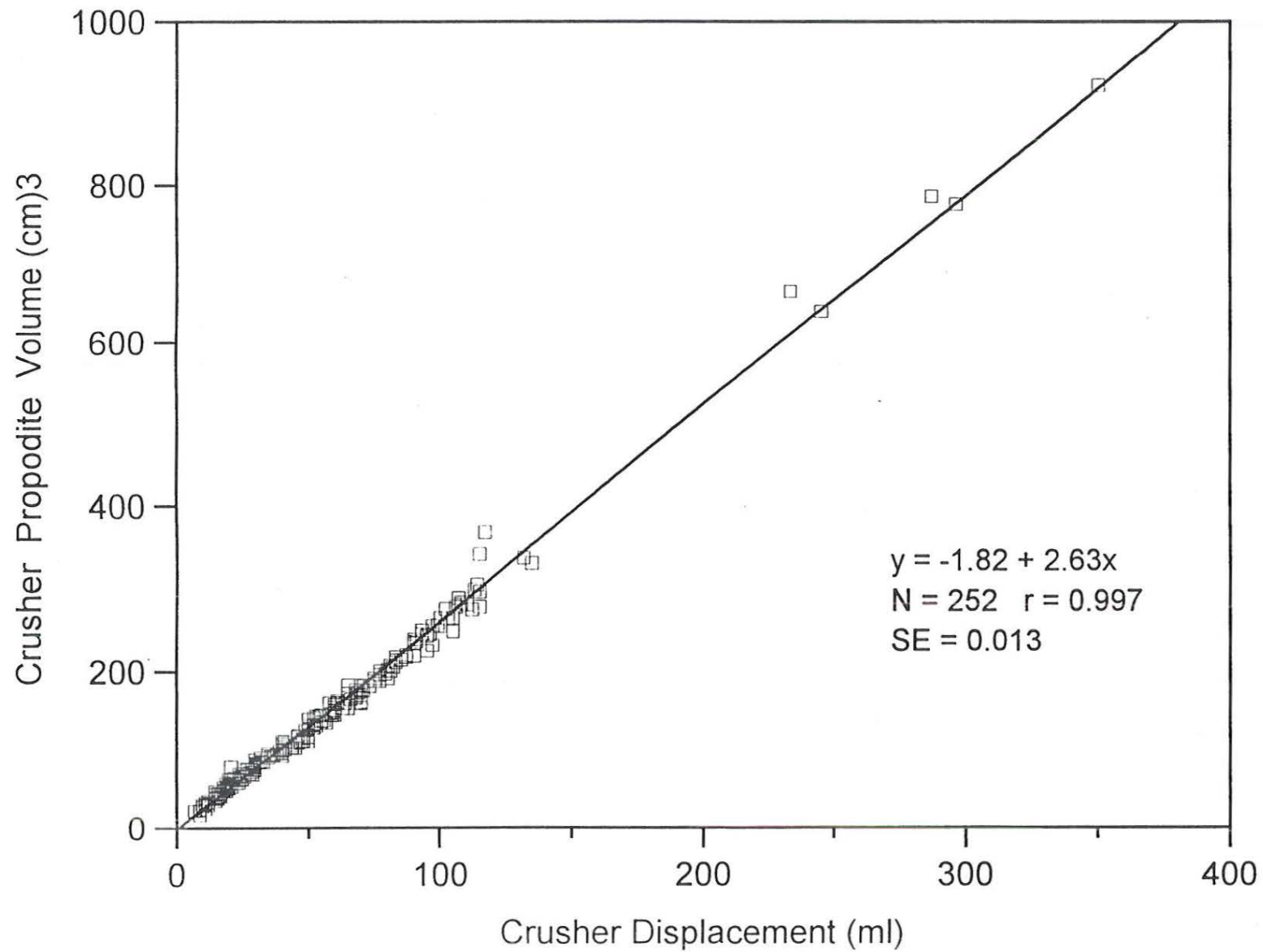


Figure 5. Growth of male crusher cheliped by plotting crusher propodite index against carapace length by 5-mm size classes.

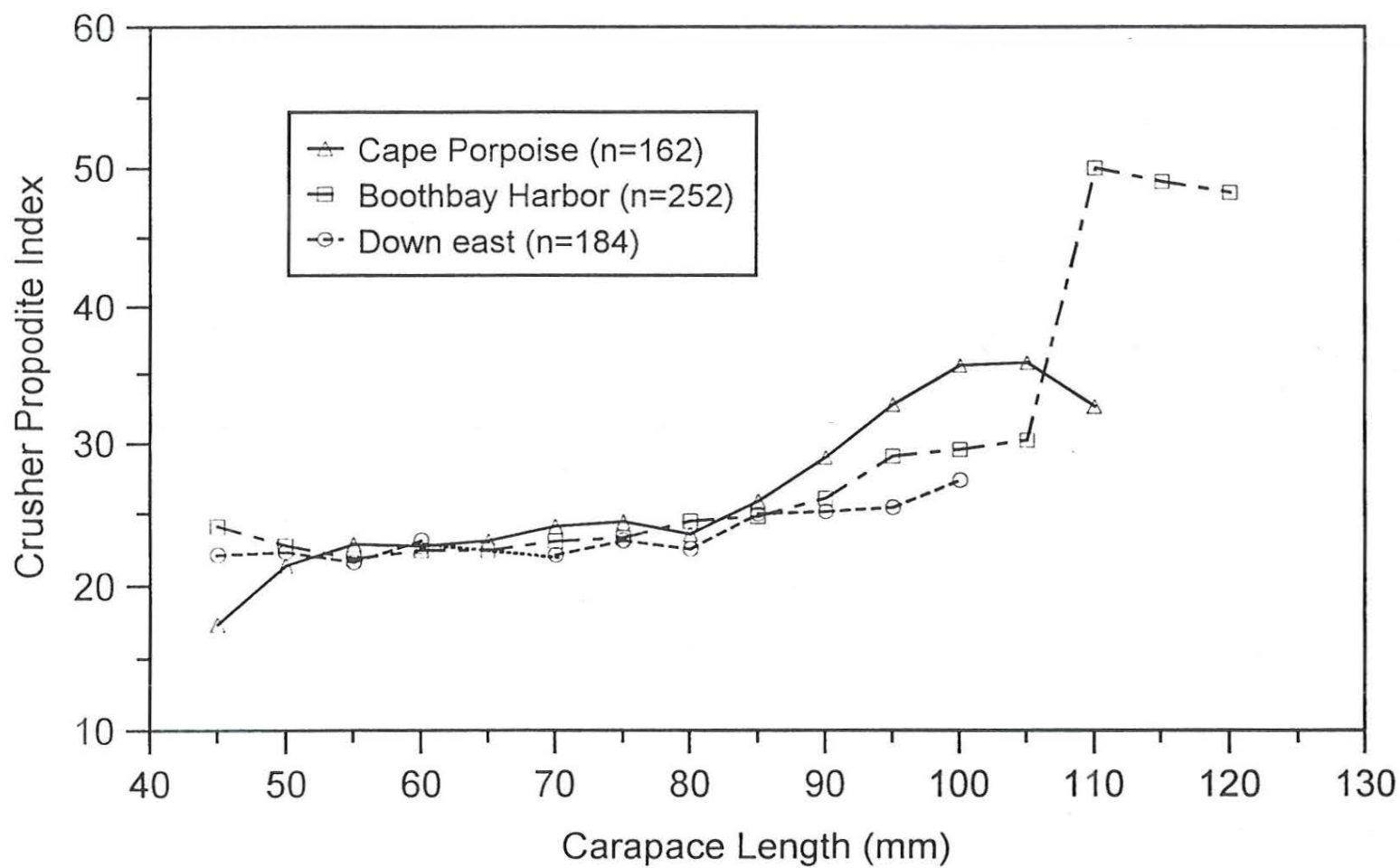


Figure 6a. Percent frequency of the ovarian stages of development and the occurrence of spermatophores in the seminal receptacles of females collected at Cape Porpoise.

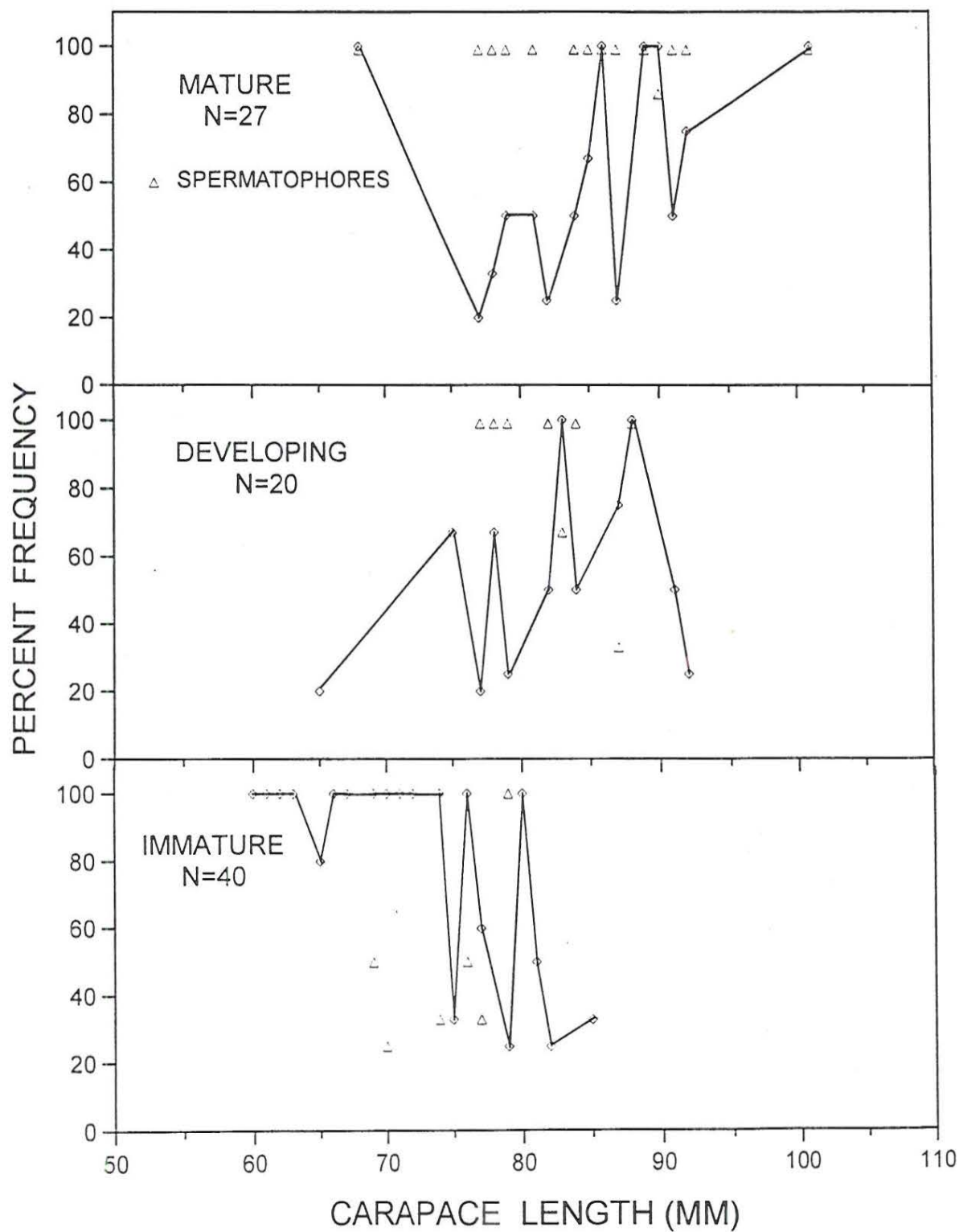


Figure 6b. Percent frequency of the ovarian stages of development and the occurrence of spermatophores in the seminal receptacles of females collected at Boothbay Harbor.

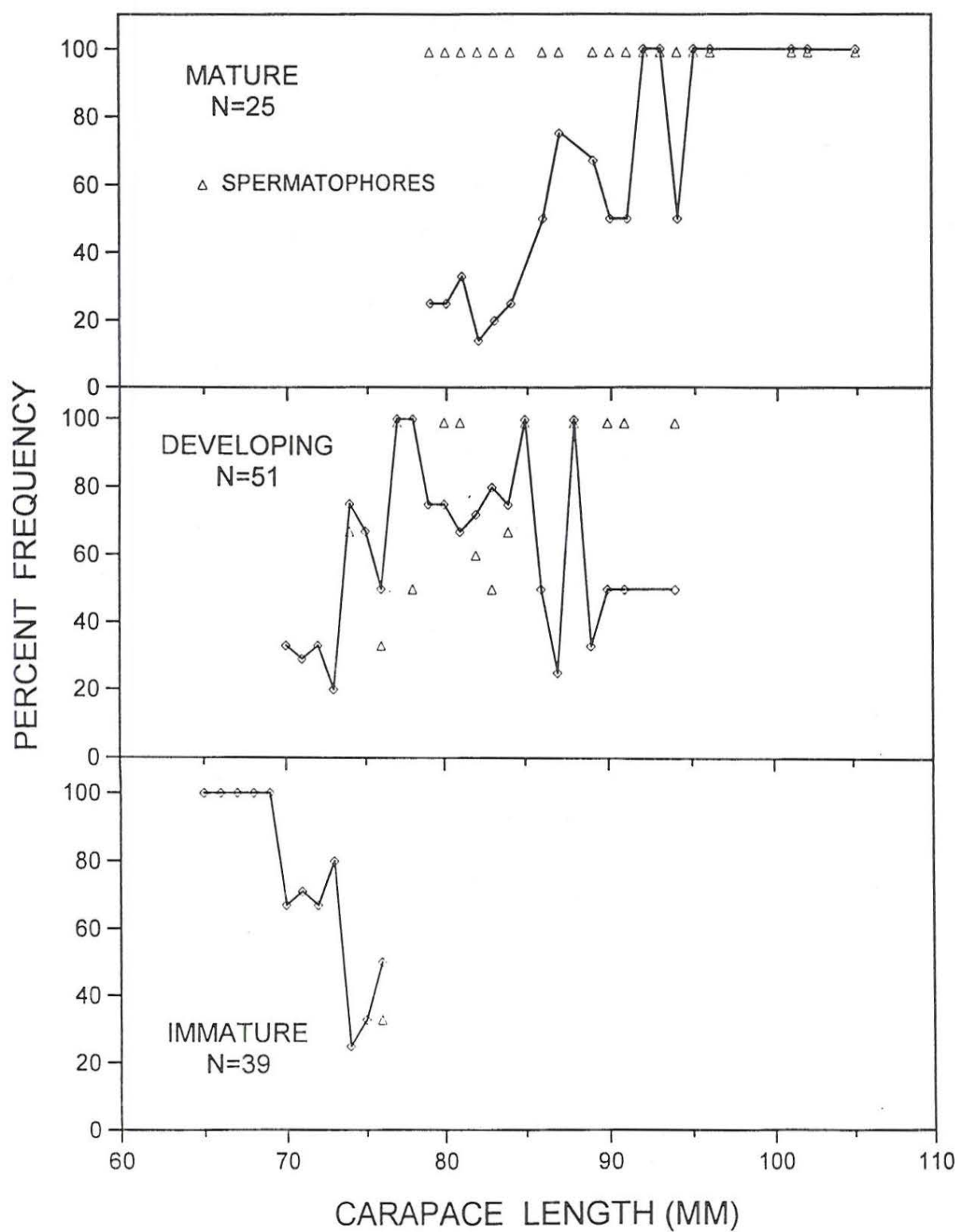




Figure 6c. Percent frequency of the ovarian stages of development and the occurrence of spermatophores in the seminal receptacles of females collected at Stonington and Sorrento.

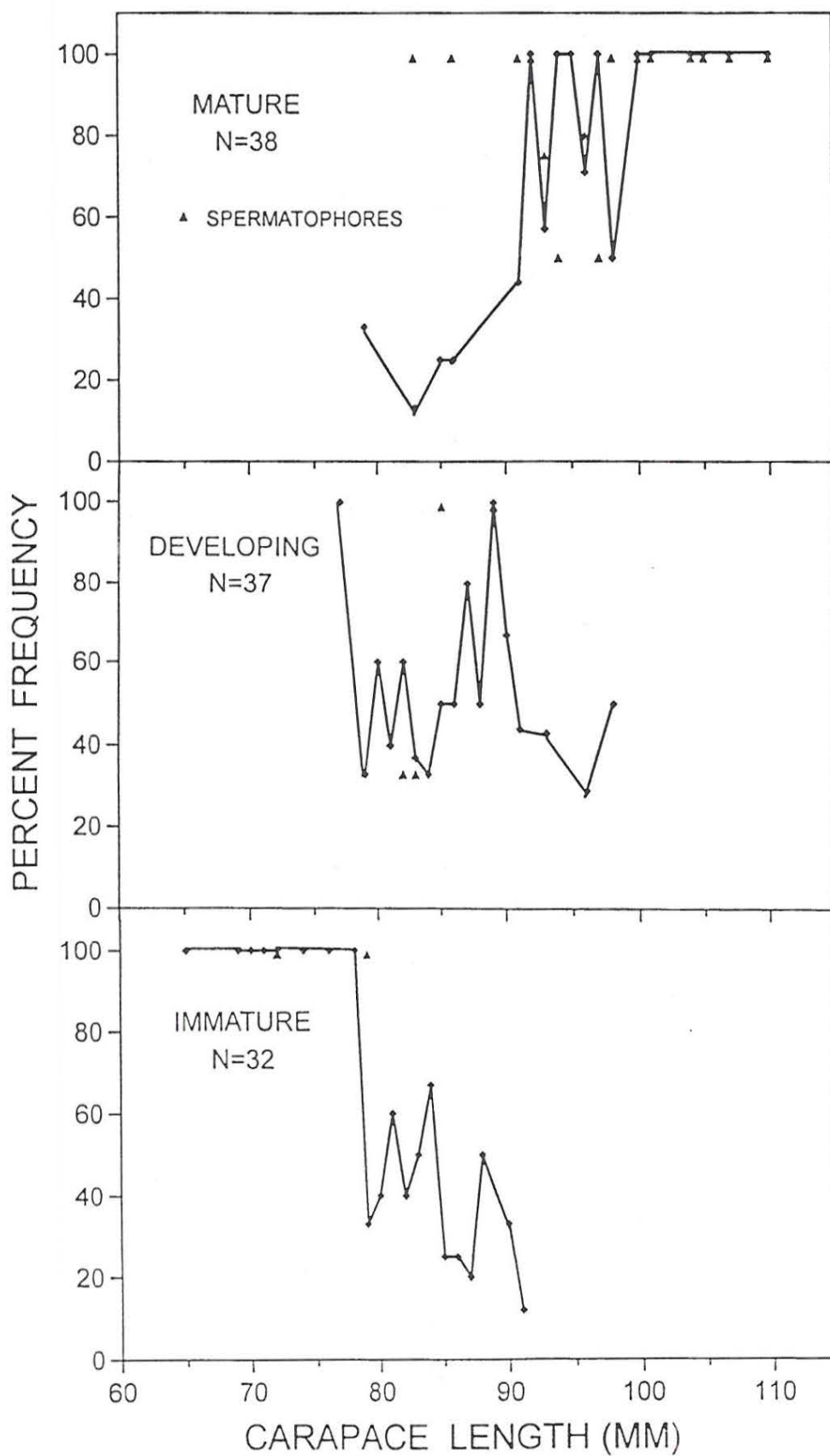


Figure 7. Relation of abdominal width:carapace length ratio to carapace length for female lobsters by 5-mm size classes.

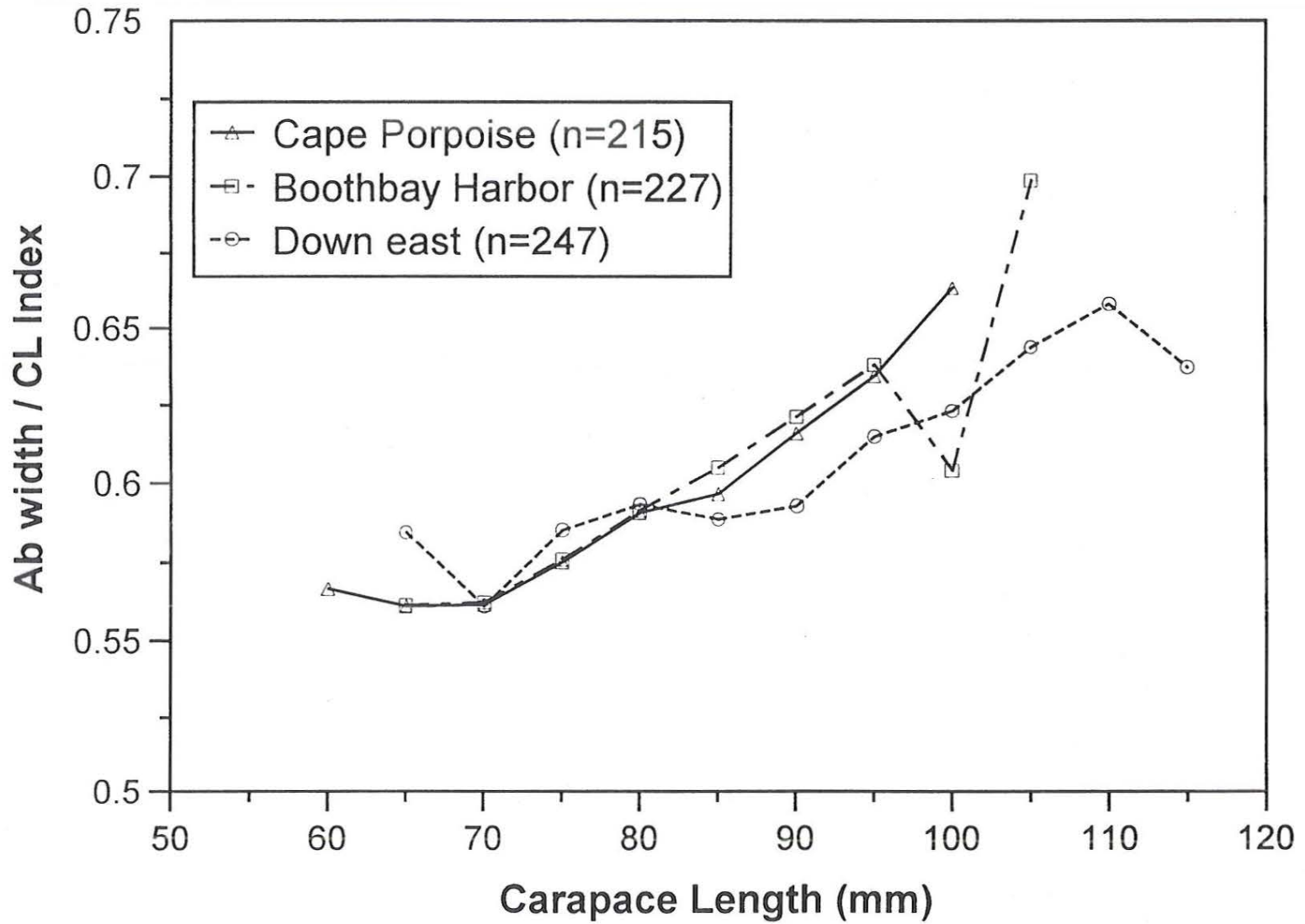


Figure 8. Physiological size-maturity relationships for female lobsters from three geographical regions along the Maine coast and SW Nova Scotia.

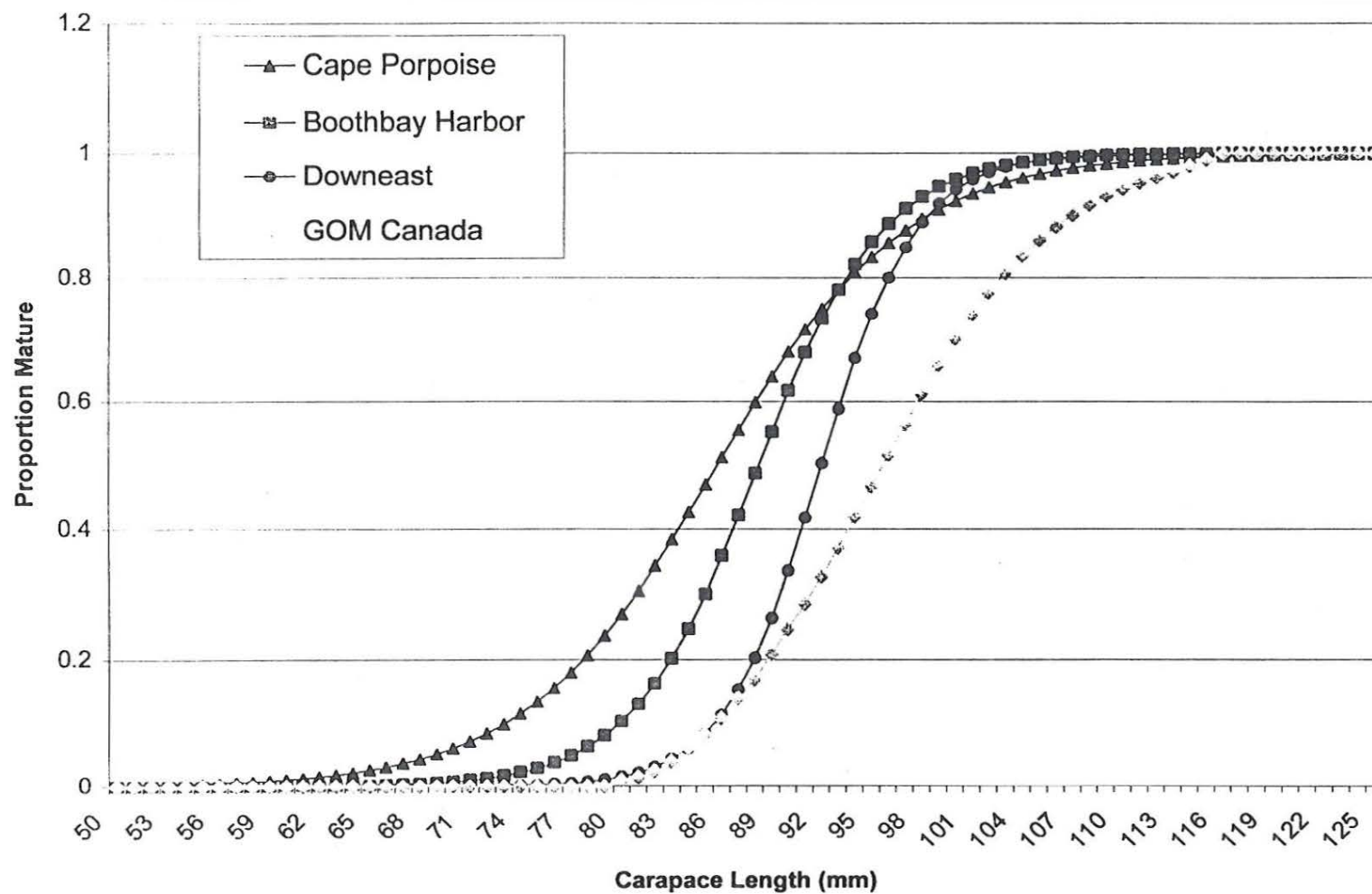
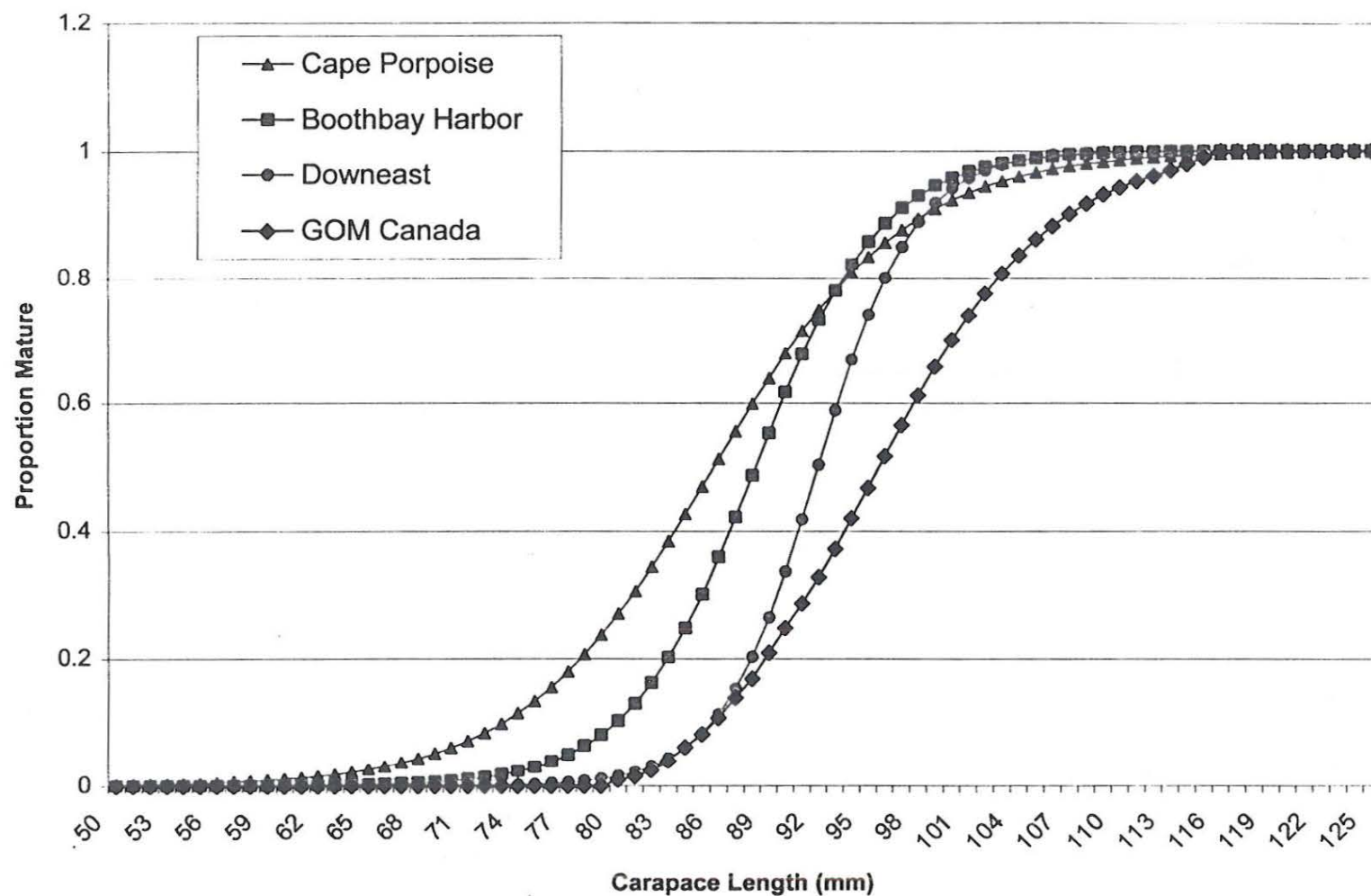


Figure 8. Physiological size-maturity relationships for female lobsters from three geographical regions along the Maine coast and SW Nova Scotia.







**MAINE DEPARTMENT OF MARINE RESOURCES  
INTERJURISDICTIONAL FISHERIES RESOURCE MONITORING AND  
ASSESSMENT**

**LOBSTER - BOTTOM TEMPERATURE MONITORING**

**PROJECT NO. 3-IJ-143  
GRANT NO. NA86FI0022**

**BY KEVIN KELLY**

### **Bottom Temperature Monitoring**

The nearshore ocean bottom temperature monitoring program which began in 1989 continued through 1998. Sea bottom temperature was continuously monitored at two sites off Boothbay Harbor ME in 1998. Depths at the two locations were approximately 14 m (Spruce Point) and 27 m (Ram Island). A third station located off the laboratory dock in West Boothbay Harbor has been monitored since 1991.

Temperature was recorded at 2 hour intervals. Temperature sensors that had been put in place at each site in August 1997 were retrieved by divers and replaced with newly programmed units in September 1998. Data were transferred from the thermographs to a desktop PC for processing and analysis.

January and February 1998 temperatures at Ram Island were quite comparable to the 1993-97 average, but then exceeded this average during March through May (Figure 1). Lowest 1998 temperature was 2.0°C on 11 February, compared to the 1997 low of 2.5°C on 18 February. Late spring was characterized by an abrupt rise in temperature preceding the 1998 maximum of 10.2°C on June 15. This was the earliest date on which we have recorded the annual maximum at Ram Island. This sudden rise and then decline in temperature was likely due to an upwelling event caused by strong northeast winds. The remainder of spring and summer 1998 was characterized by temperatures below the average for the preceding five years. The highest temperature following the aforementioned June event was 10.0°C on 14 September at Ram Island and 12.6°C on 30 August at Spruce Point (Figure 2).

Temperatures at the DMR dock in 1998 were quite comparable to the average over the previous five years (Figure 3). The minimum temperature was 1.8°C on 15 February. The June

upwelling event was characterized by a sudden temperature drop to 5.6°C on 6 June. Maximum temperature of 17.6°C was attained on 10 August.

The minimum temperature range of 5-6°C required for active premolt condition in lobsters (Aiken 1980) was attained during mid May to mid June 1998 at Ram Island. This would indicate that conditions were favorable for lobster molting to begin either at about the normal time or slightly earlier.

### **Length Cohort Analysis**

The length cohort method of obtaining estimates of instantaneous fishing mortality ( $F$ ) (Pope 1972; Jones 1974) was applied to Maine coastal commercial lobster size frequency data. The LCA modifications developed by members of the Lobster Technical Committee of the Atlantic States Marine Fisheries Commission to the length cohort technique (Cadrin and Estrella 1996) were incorporated into this analysis. A molt increment and molt probability growth curve was used to calculate  $\Delta t$ , in place of von Bertalanffy parameters which are inappropriate for describing lobster growth (Estrella and Cadrin 1992).

Size frequencies obtained from the Biological Monitoring Division (ME DMR) commercial port sampling survey were expanded to quarterly Maine lobster landings data provided by the National Marine Fisheries Service office in Portland. Length frequencies were expanded to landings for the 1997 survey year (i.e., the fourth quarter of 1997 and the first three quarters of 1998) using the factor:

$$W_{ik} = \frac{L_{ik}}{S_{ik}}$$



where  $W$  = weighting factor

$i$  = quarter

$k$  = year

$L$  = landings

$S$  = sample weight

Sample weight ( $S$ ) was obtained from the total quarterly weight of all lobsters measured and weighed during the port sampling survey. As in Stock Assessment Workshop (SAW) 16 and 22 LCA's, catch was assumed to occur in August (i.e.,  $T_c = 0.8$ ) (Cadrin and Estrella 1996). Natural mortality ( $M$ ) was assumed to be 0.15. Fishing mortalities of the largest size class (based on DeLury model estimates of SAW 22) were 0.4 for males and 0.2 for females (Cadrin and Estrella 1996).

Fishing mortality of Maine female lobsters (exclusive of V-notched and/or berried lobsters) was 1.270 for the 1997 survey year (Table 1). Female  $F$  for the 1996 survey year was 1.236. By comparison, LCA-based estimates of  $F$  presented at SAW 22 for Gulf of Maine (statistical areas 511-513) females in survey years 1981-93 ranged between a low of 1.095 in 1982 and a high of 1.342 in 1987 (Cadrin and Estrella 1996).

Maine male lobster  $F$  was 1.726 for the 1997 survey year (Table 2). Male  $F$  was 1.703 in the previous survey year. Estimates of  $F$  from LCA presented for Gulf of Maine males at SAW 22 for survey years 1981-93 ranged between a low of 1.494 in 1983 and a high of 1.708 in 1987 (Cadrin and Estrella 1996).

Abundance of males between 83-127 mm CL estimated for the 1997 survey year was 21.2 million (Table 2), compared with 18.6 million in the previous year. Female abundance (exclusive of V-notched and/or berried females) was estimated at 19.0 million (Table 1), compared with 17.7

million in survey year 1996 and 14.5 million in survey year 1995. Catch and abundance were well above the 1981-93 average (Cadrin and Estrella 1996) for Gulf of Maine lobsters in survey year 1997.

### **Lobster Fecundity**

A study of the fecundity of lobsters from coastal Maine was described in Completion Reports covering the period April 1, 1992 through January 31, 1997. Data from this study were used to make comparisons between the fecundity vs. carapace length (CL) relations of lobsters from different sections of the Maine coast, as well as to compare with published data from lobsters from the southern Gulf of Maine (Estrella and Cadrin 1995).

Fecundity vs. CL relations of lobsters were plotted for lobsters from western, central and eastern Maine (Figures 4-6). Graphical comparison of the fecundity vs. CL relations of western, central and eastern Maine areas revealed no apparent differences between these areas (Figure 7). Due to significant differences in size distributions of lobsters collected from the three regions, however, analysis of covariance could not be applied to these data to test for regional variation. Based on the similarity of plots between regions, however, all data from Maine for 1994-96 were combined to compare with the 1987-88 southern Gulf of Maine data of Estrella and Cadrin (1995).

Data from each of three Maine areas were plotted to compare with the southern Gulf of Maine relation (Figures 8-10). There appeared to be no difference between southern Gulf of Maine and coastal Maine data with the exception of central Maine which appeared to have a greater average fecundity at length. Data from central Maine, may not have been entirely

representative of the overall fecundity vs. CL relation due to the somewhat restricted CL distribution of sampled lobsters from that region.

The combined fecundity vs. CL relation for all Maine areas was not significantly different ( $P>0.05$ ) than that for southern Gulf of Maine (Figure 11). It should be noted however that the Maine study represents fecundity of fall-caught females with recently extruded eggs, whereas Estrella and Cadrin (1995) reported fecundity based on spring-caught lobsters with mature eggs closer to hatching. Egg loss between the two egg stages has been reported to be on the order of from 9.6% (Graulich 1991) to 36% (Perkins 1971). Since the data sets represent fecundity at two distinct stages, combining these data to represent coastal Gulf of Maine fecundity may not be advisable.

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Table 1. Length cohort analysis of Maine coastal female lobsters, 1997 survey year (Oct. '97 - Sep. '98).

LENGTH-BASED COHORT ANALYSIS

American lobster

**Maine females, 1997 survey year**

Ft = 0.2

M = 0.15

Tc = 0.8

| Length<br>mm) | Catch<br>(numbers) | Delta-t<br>(y) | Stock<br>Numbers | Mean<br>Number | F/Z         | Z     | F     |
|---------------|--------------------|----------------|------------------|----------------|-------------|-------|-------|
| 113 - 117     | 22,738             | 1.459          | 39,792           |                |             |       |       |
| 108 - 112     | 61,554             | 1.282          | 112,567          | 112,220        | 0.846       | 0.649 | 0.549 |
| 103 - 107     | 98,852             | 1.104          | 232,501          | 210,816        | 0.824       | 0.569 | 0.469 |
| 98 - 102      | 321,260            | 0.927          | 597,882          | 441,212        | 0.879       | 0.828 | 0.728 |
| 93 - 97       | 2,804,859          | 0.750          | 3,600,496        | 1,977,546      | 0.934       | 1.518 | 1.418 |
| 88 - 92       | 6,880,956          | 0.572          | 10,974,508       | 4,930,560      | 0.933       | 1.496 | 1.396 |
| 83 - 87       | 7,416,827          | 0.395          | 19,041,440       | 6,501,051      | 0.919       | 1.241 | 1.141 |
| Total         | 17,607,046         |                |                  | 14,173,407     | Wtd.Ave.F = |       | 1.270 |

Table 2. Length cohort analysis of Maine coastal male lobsters, 1997 survey year (Oct. '97 - Sep. '98).

LENGTH-BASED COHORT ANALYSIS

American lobster

Maine males, 1997 survey year

Ft = 0.4

M = 0.15

Tc = 0.8

| Length<br>(mm) |  | Catch<br>(numbers) | Delta-t<br>(y) | Stock<br>Numbers | Mean<br>Number | F/Z         | Z     | F     |
|----------------|--|--------------------|----------------|------------------|----------------|-------------|-------|-------|
| 123 - 127      |  | 14,233             | 0.782          | 19,570           |                |             |       |       |
| 118 - 122      |  | 36,970             | 0.723          | 59,927           | 33,866         | 0.916       | 1.192 | 1.092 |
| 113 - 117      |  | 61,726             | 0.665          | 128,715          | 70,619         | 0.897       | 0.974 | 0.874 |
| 108 - 112      |  | 90,019             | 0.607          | 230,696          | 119,623        | 0.883       | 0.853 | 0.753 |
| 103 - 107      |  | 59,708             | 0.548          | 305,734          | 153,299        | 0.796       | 0.489 | 0.389 |
| 98 - 102       |  | 539,943            | 0.490          | 879,872          | 341,954        | 0.940       | 1.679 | 1.579 |
| 93 - 97        |  | 5,109,884          | 0.431          | 6,185,022        | 1,952,659      | 0.963       | 2.717 | 2.617 |
| 88 - 92        |  | 6,780,704          | 0.373          | 13,380,160       | 4,144,337      | 0.942       | 1.736 | 1.636 |
| 83 - 87        |  | 7,206,540          | 0.314          | 21,173,656       | 5,869,561      | 0.925       | 1.328 | 1.228 |
| Total          |  | 19,899,727         |                |                  | 12,685,918     | Wtd.Ave.F = |       | 1.726 |

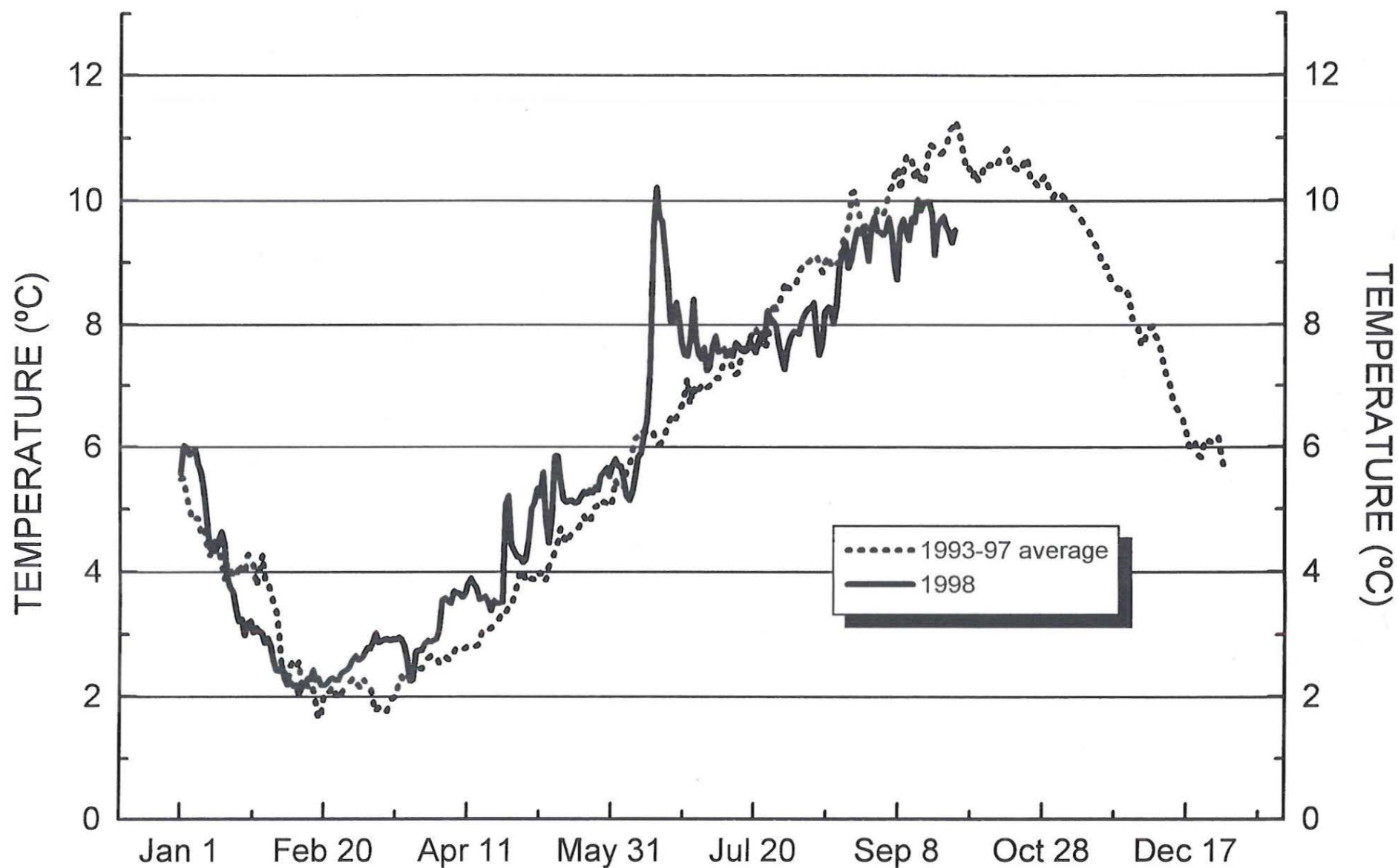


Figure 1. Mean daily sea bottom temperature at Ram Island ME.

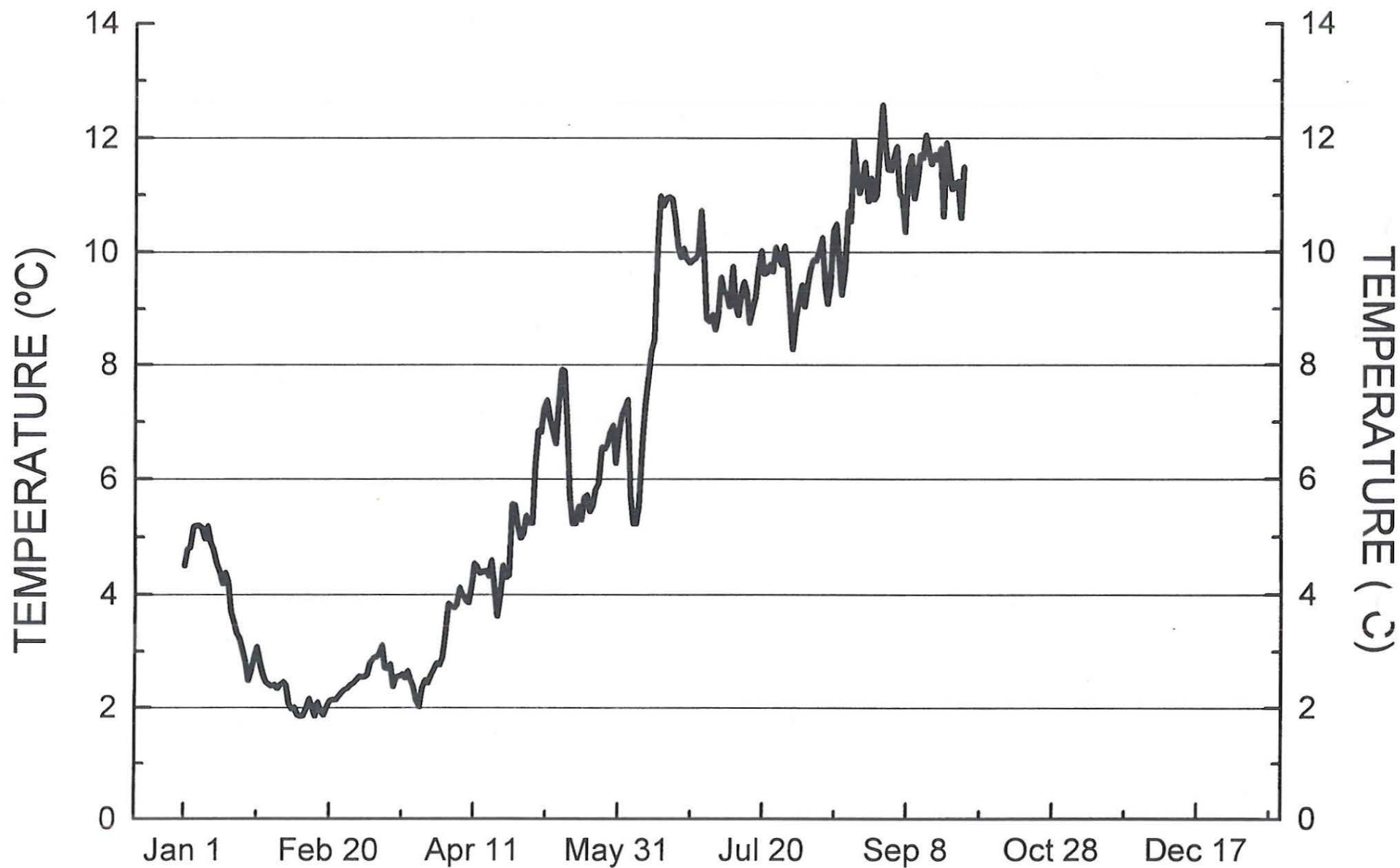


Figure 2. Mean daily sea bottom temperature at Spruce Point ME (1/1/98-9/27/98).



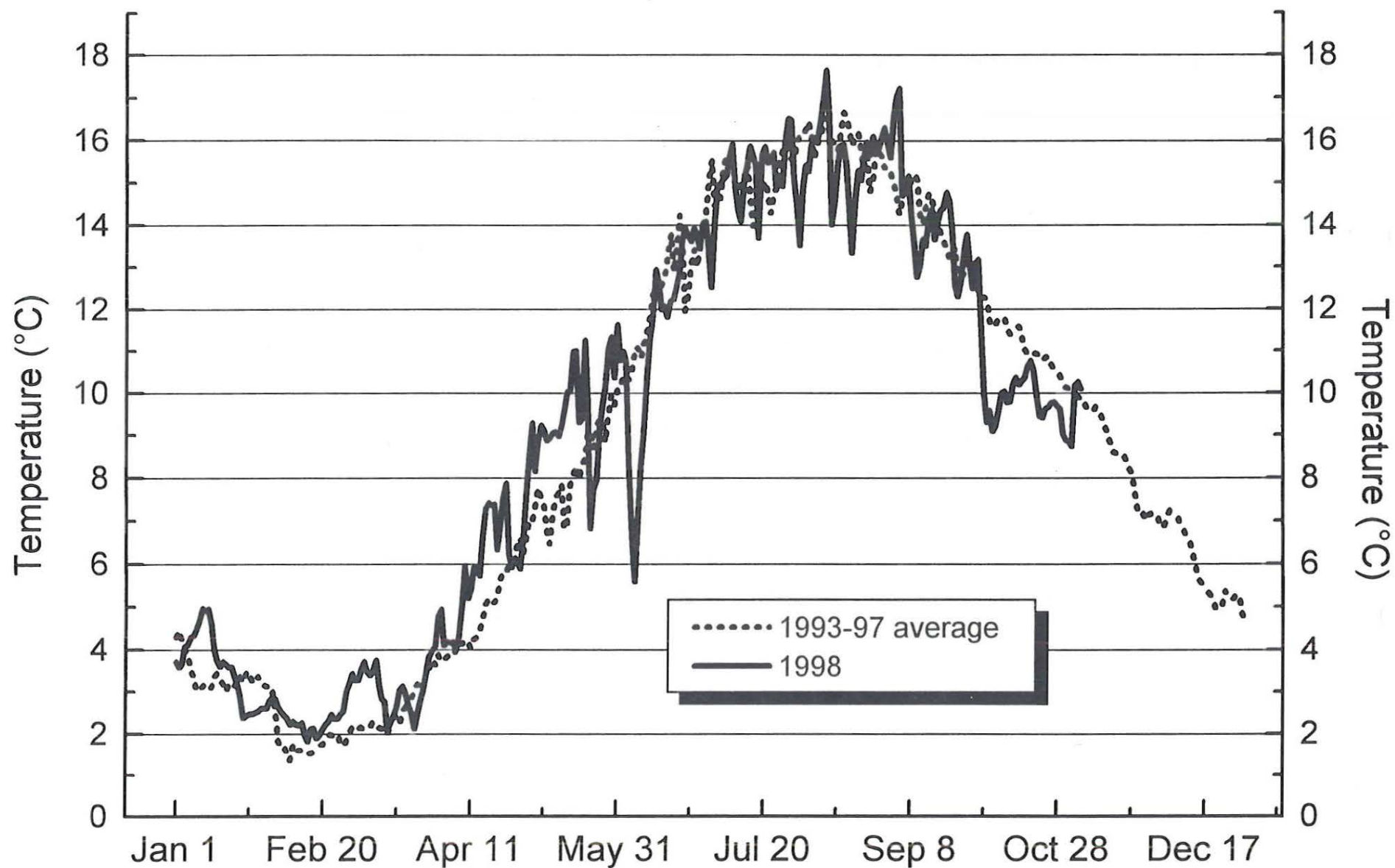


Figure 3. Mean daily sea bottom temperature at DMR Dock at Boothbay Harbor ME.

Figure 4.  
*H. americanus* fecundity  
Western Maine  
1995-96

n = 297

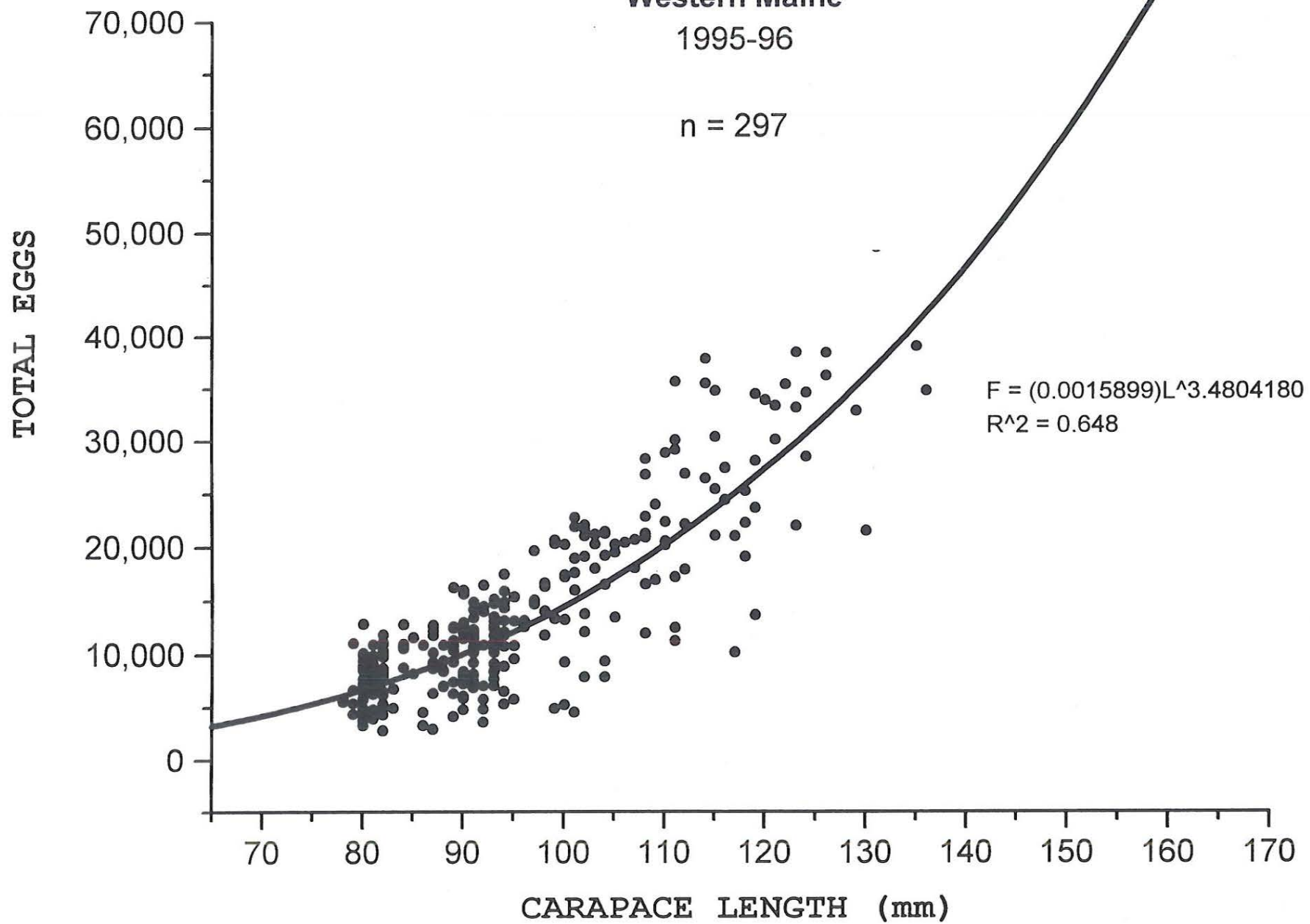


Figure 5.  
*H. americanus* fecundity  
Central Maine  
1994-96

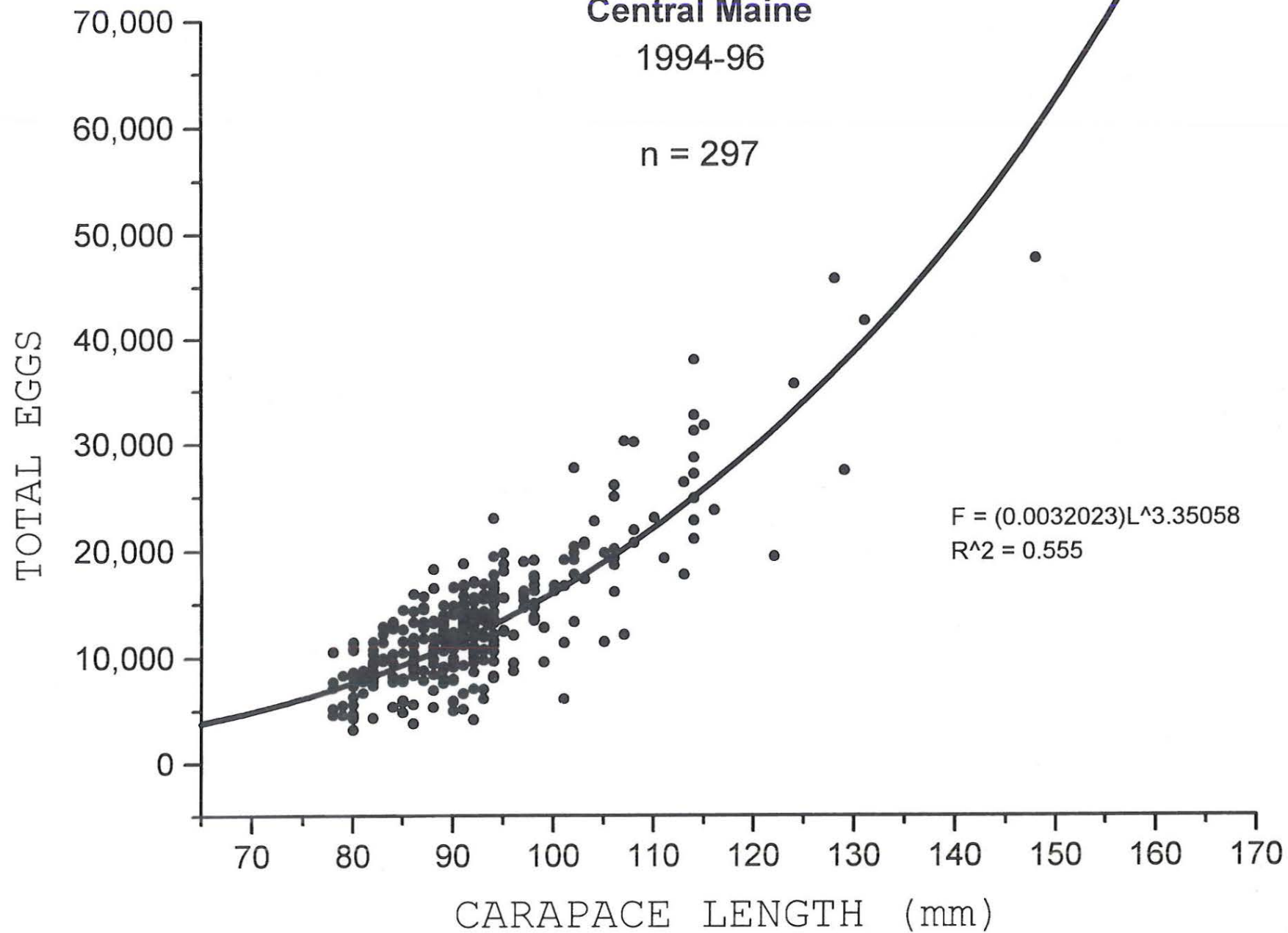


Figure 6.  
*H. americanus* fecundity  
**Eastern Maine**  
1994-96

n = 224

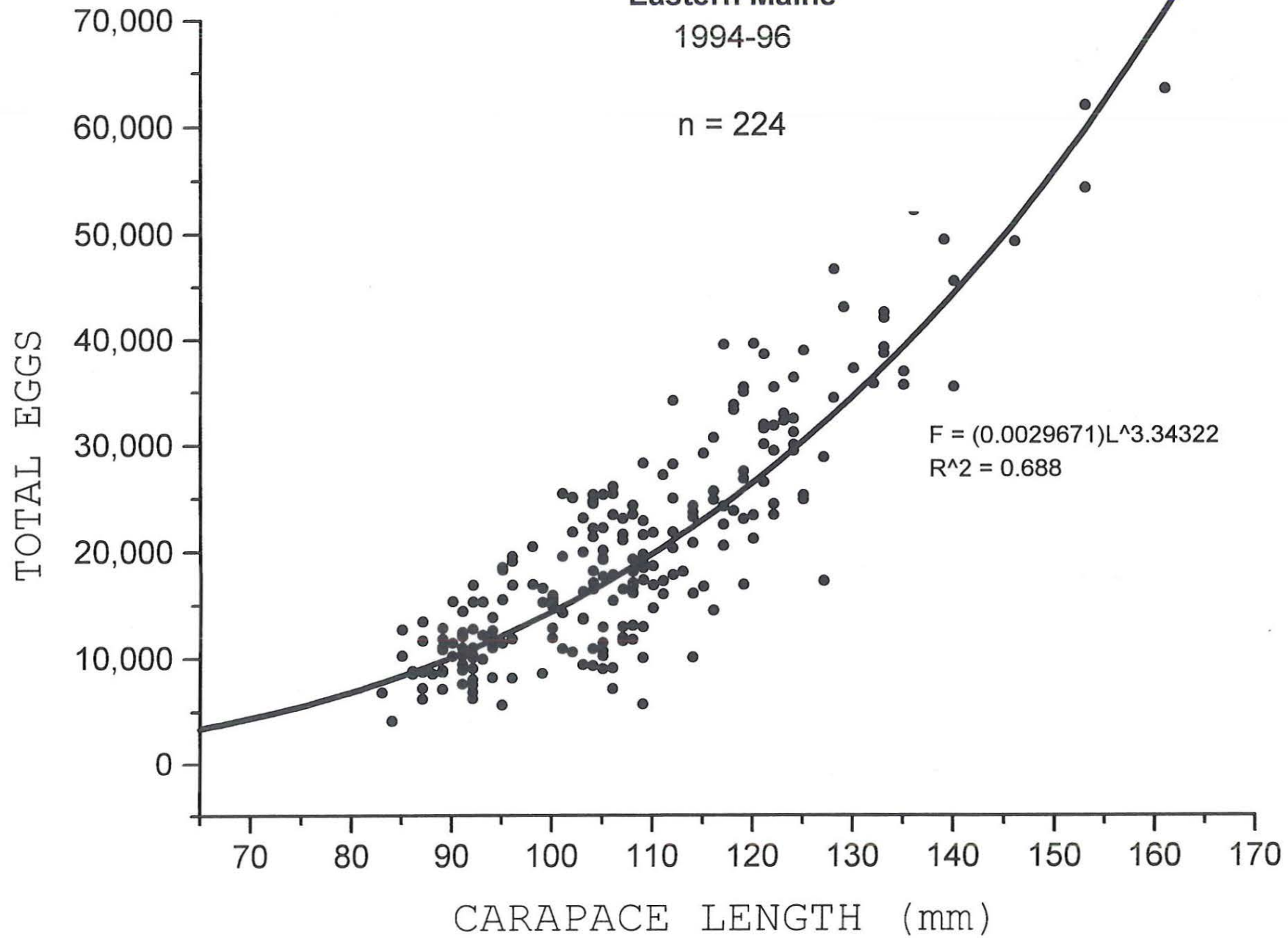




Figure 7.  
*H. americanus* fecundity  
Maine coast 1994-96

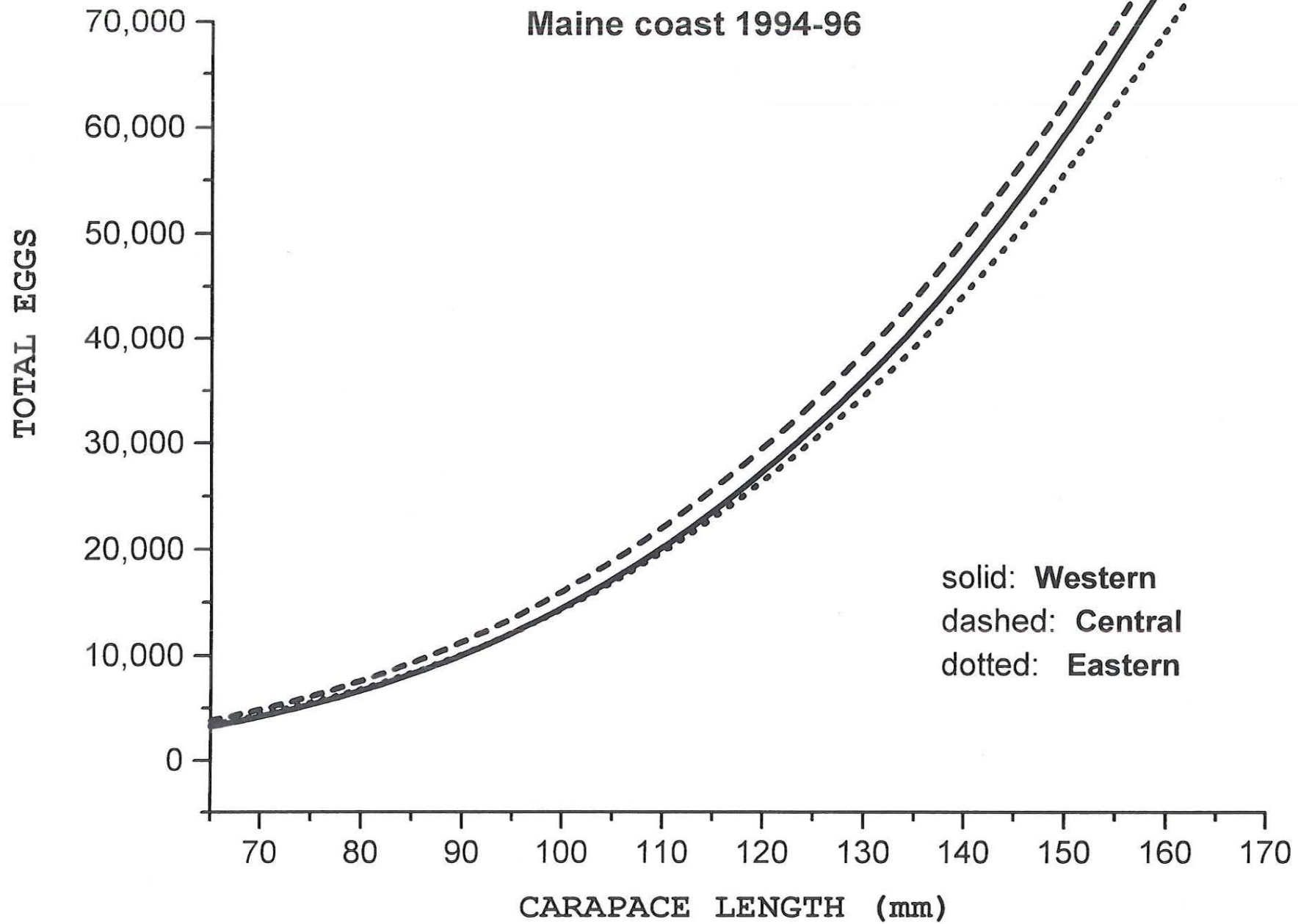


Figure 8.  
*H. americanus* fecundity

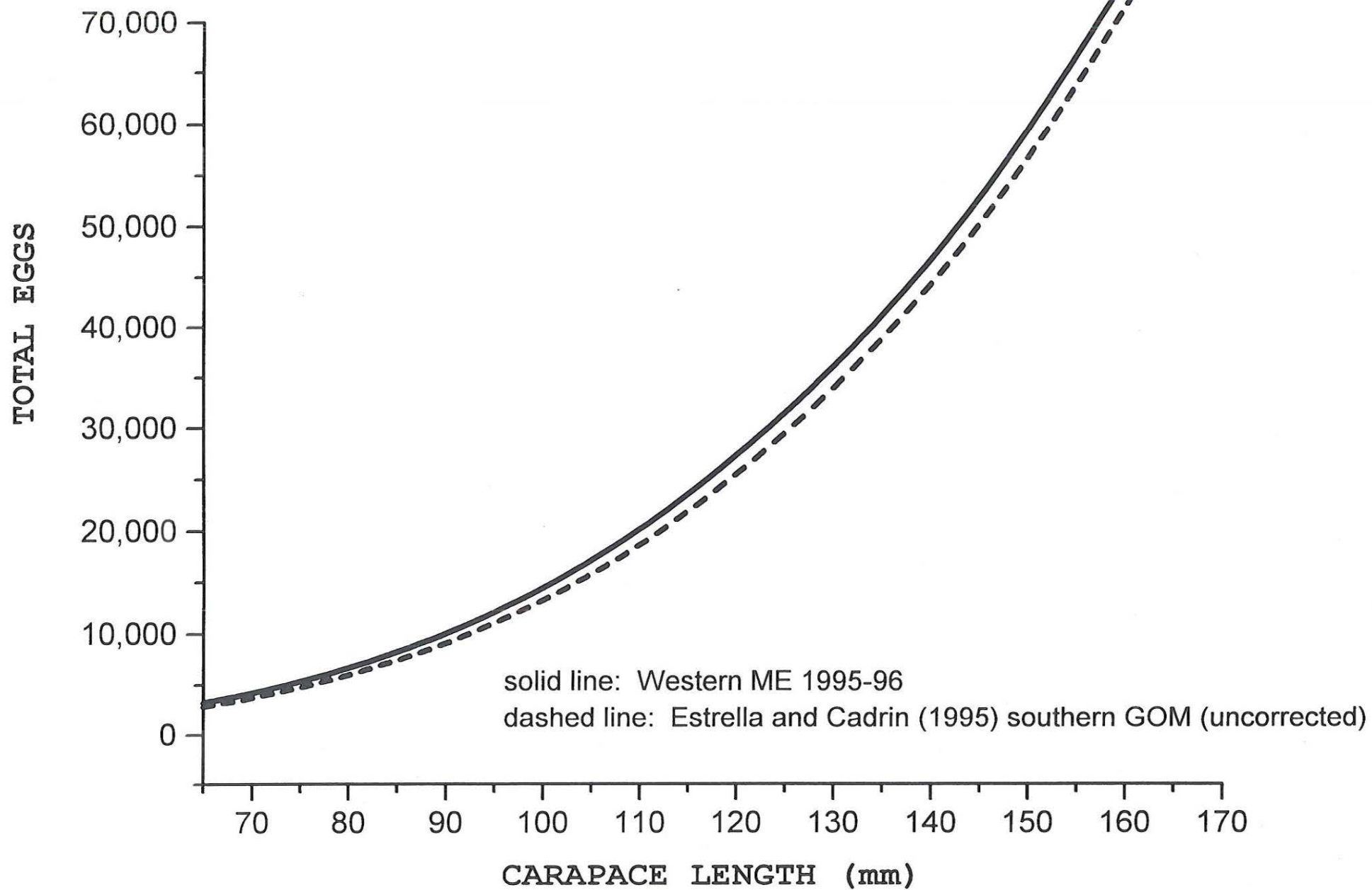


Figure 9.  
*H. americanus* fecundity

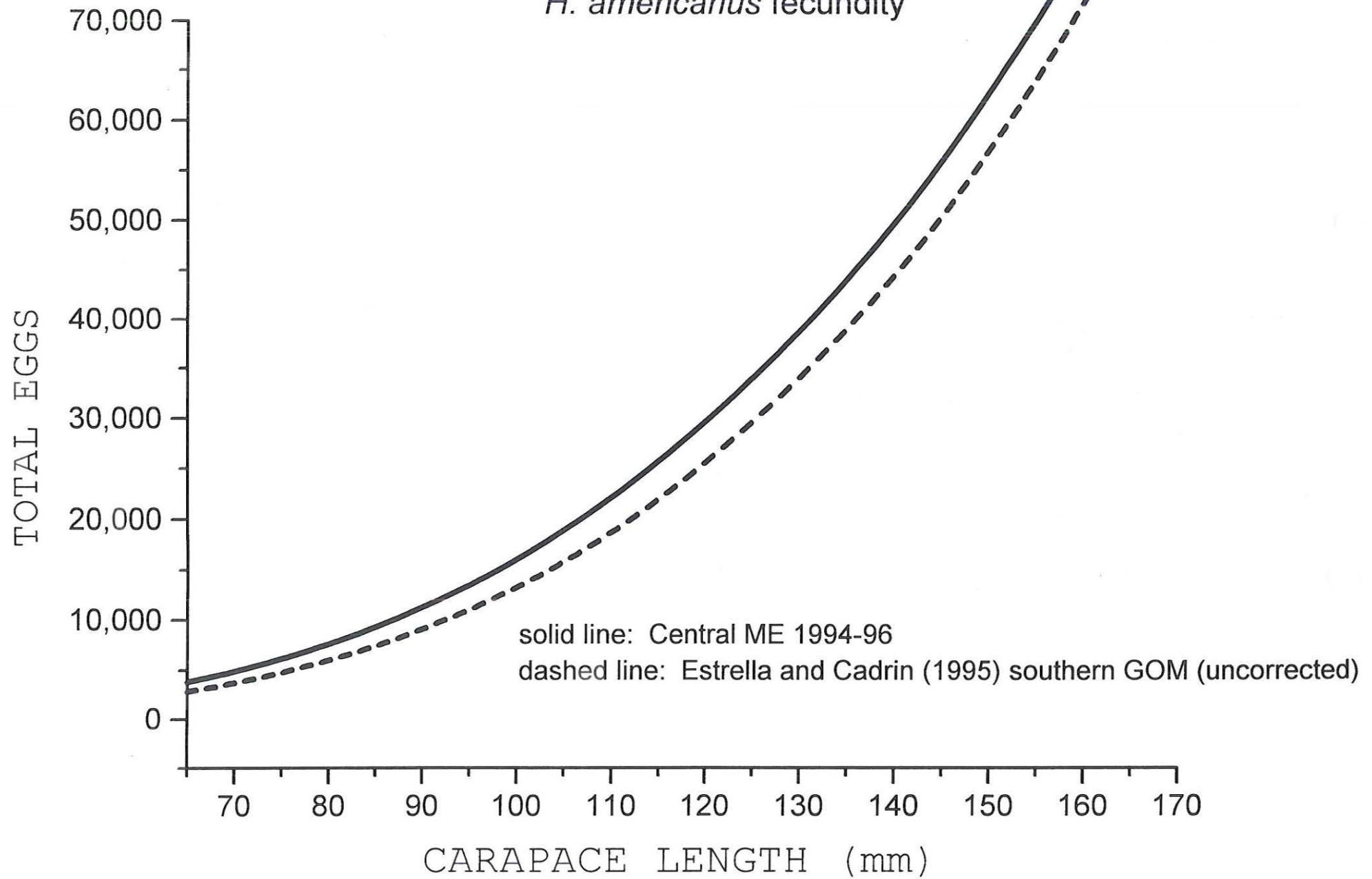


Figure 10.  
*H. americanus* fecundity

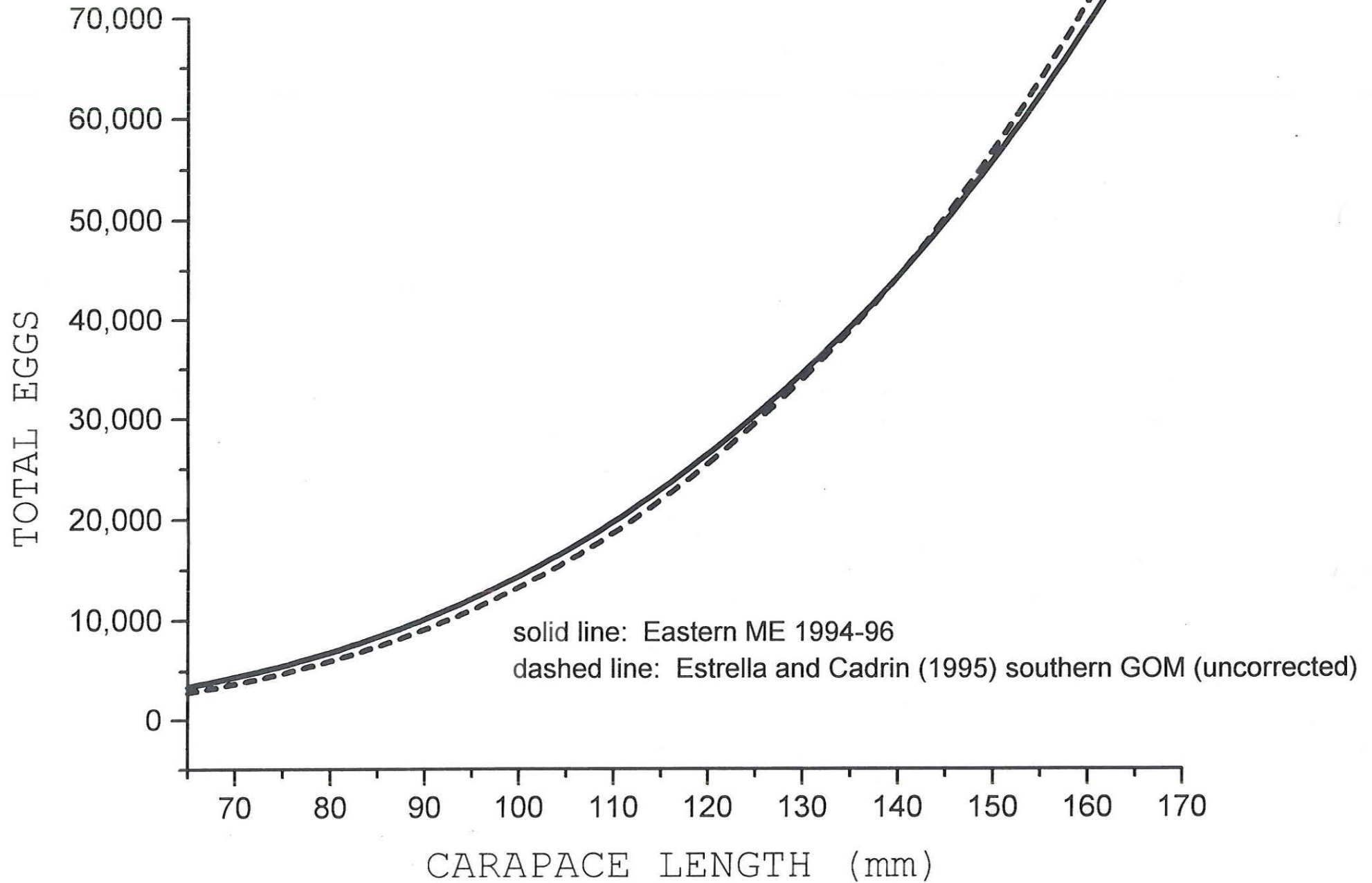
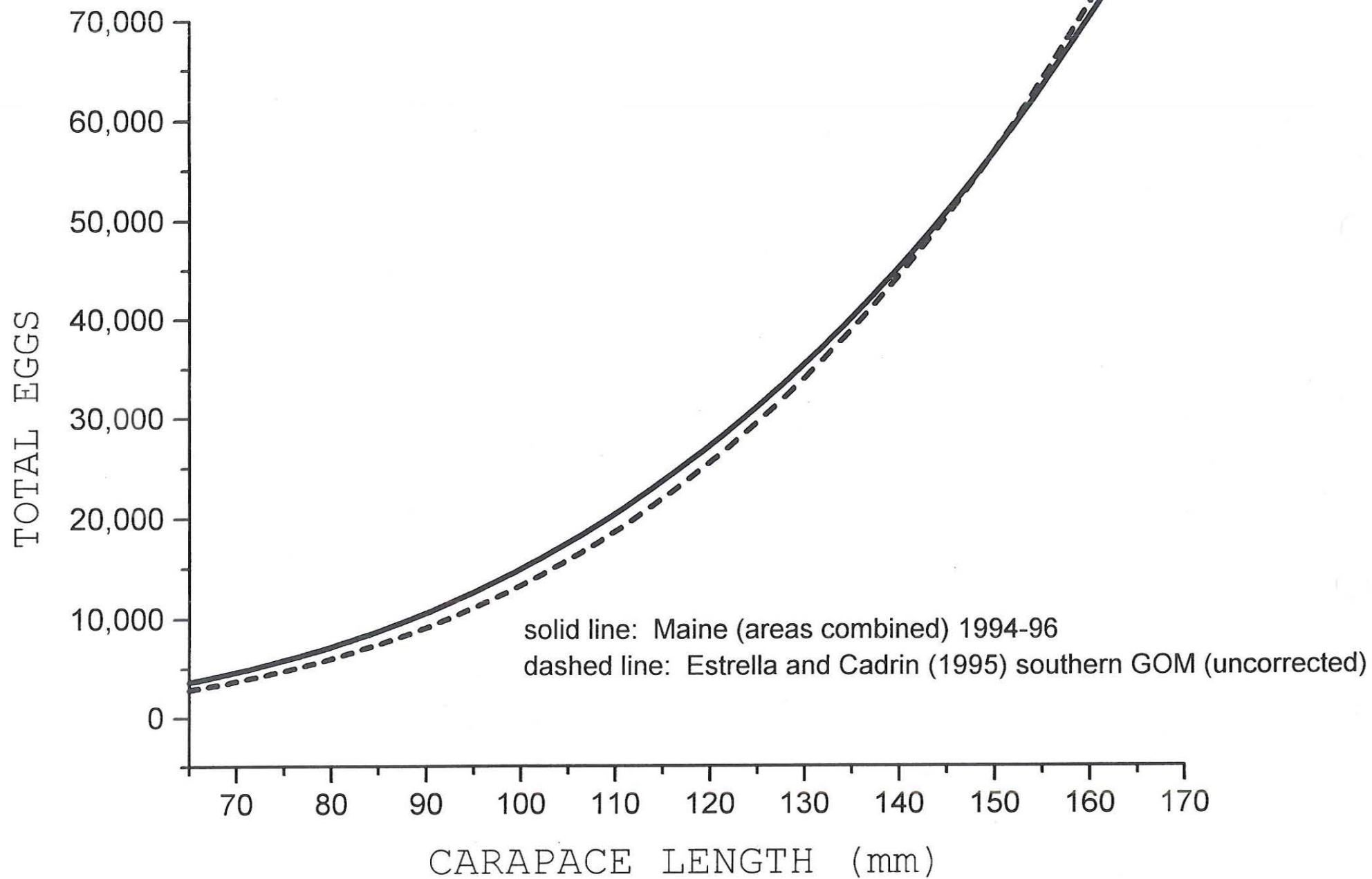




Figure 11.  
*H. americanus* fecundity





**MAINE DEPARTMENT OF MARINE RESOURCES  
INTERJURISDICTIONAL FISHERIES RESOURCE MONITORING AND  
ASSESSMENT**

**LOBSTER DIMILIN STUDY**

**PROJECT NO. 3-IJ-143  
GRANT NO. NA86FI0022**

**BY JAY KROUSE  
AND  
GLENN NUTTING**

## **Dimilin Study**

### **Introduction**

In 1995, the Maine Department of Marine Resources learned that the insecticide diflubenzuron (DFB; trade name Dimilin) had been aerially sprayed onto several islands in Casco Bay to control the larvae of the browntail moth. Because Dimilin is a chitin synthase inhibitor, it is potentially toxic to non target species such as Maine's commercially important crabs and lobsters.

In the spring of 1996 to 1998, DMR cooperated with the Maine Forest Service in monitoring the aerial application of Dimilin to portions of several Casco Bay islands and Falmouth Foreside. The purpose of this report is to present and discuss the findings of the 1998 monitoring activities.

### **Methods**

For the general methodology please see Appendix I in the 1996 DMR Lobster Assessment Annual Report. Test animals were collected in vent disabled wire traps set along the east side of Southport Island during April 1998. The lobsters ranged in size from 53 to 82 mm CL (Figure 3).

On 6 May 1998, assisted by Mike Neelon of Marine Patrol and a local lobster fisher, we set 11 wire cages each containing 6 banded lobsters at 11 different sites in Casco Bay and in the vicinity of Falmouth Foreside (Table 1 and Figure 1). The cages were hauled and a food source provided by area fishers on a weekly basis.

On 19 May the spraying began at 0530 when Lavoie Aerial Applicators applied Dimilin to 350 acres of Falmouth Foreside. The spraying continued in Casco Bay until 0830, as a NW wind increased to 10-15 knots. The spraying was completed the following morning with a favorable 5 knot westerly breeze. The cages were hauled on 10 June and the lobsters were returned to DMR's wet lab. During the holding phase the sea water temperature ranged from 3.9° C to 19.0° C (Figure 2).

### **Results and Discussion**

Of 66 lobsters caged in the sentinel traps during the aerial spraying 65 (one died molting in a cage) were returned to the wet lab's holding tanks for observation. Forty five lobsters (68.2%) died in mid-June due to a malfunction in the sea water intake system. Prior to the



interruption, 7 of the dead lobsters with a molt increment ranging from 8-12% had molted. Of the remaining 17 lobsters (2 died prior to the sea water interruption) one never molted, 15 molted once and 2 of these twice and one died molting shortly following the sea water interruption. Over 88% of the lobsters that survived had molted successfully and nearly 12% molted twice. This compares with 90% and 15%, respectively in 1997. The growth increment (% CL increase), ranging from 7 to 17% and averaging 11.2%, was within normal limits for adolescent phase lobsters.

Since lobster dealers/retailers typically experience shrinkage rates of 5-10%, the two deaths prior to the sea water intake malfunction are within acceptable limits for lobsters held in storage environments.

### **Conclusions**

Although DMR's monitoring program of the Dimilin aerial spraying program revealed no adverse effects on the lobster resource, we remain concerned about the use of any insecticide in close proximity to the marine environment that possibly may impact Maine's valuable lobster resource.

### **Acknowledgments**

We are indebted to lobster fisher Mike Floyd along with his crew for help in deploying and retrieving the sentinel traps and communicating program progress to the fishing community. We are also thankful to Mike Neelon of Marine Patrol for transportation on the P/V Winds.

Table 1. Location and depths of Dimilin study cages, 1998.

| <u>Station No.</u> | <u>Location</u>                   | <u>Depth (feet high tide)</u> | <u>Loran Bearings</u> |
|--------------------|-----------------------------------|-------------------------------|-----------------------|
| 1                  | Long Is.                          | 18                            | 13244.4<br>26044.6    |
| 7                  |                                   | 15                            | 13252.6<br>26034.6    |
| 10                 | Great Diamond Is.                 | 12                            | 13259.9<br>26034.5    |
| 11                 |                                   | 18                            | 13266.0<br>26038.0    |
| 2                  | Sunset Pt.<br>(Falmouth Foreside) | 9                             | 13225.5<br>26053.1    |
| 9                  | Cousins Is.                       | 9.5                           | 13217.8<br>26040.6    |
| 4                  | Chebeague Is.                     | 8.6                           | 13198.9<br>26029.2    |
| 3                  |                                   | 9.8                           | 13215.3<br>26023.3    |
| 5                  |                                   | 12                            | 13226.7<br>26028.9    |
| 8                  | Stave Is.                         | 10.3                          | 13211.1<br>26015.6    |
| 6                  | Cliff Is.                         | 18                            | 13232.1<br>26014.6    |

Table 2. Size and growth information on sublegal lobsters placed in wire cages around several Casco Bay islands and off Sunset Pt. (Falmouth Foreside) aerially sprayed with the insecticide Dimilin ® in May 1998.

| Station no. | Depth (MLW) | Initial CL (mm) | Sex | 1 <sup>st</sup> molt date | 1 <sup>st</sup> molt CL (mm) | CL % increase | Cull | Remarks                                          | 2 <sup>nd</sup> molt date | 2 <sup>nd</sup> molt CL (mm) | CL% increase |
|-------------|-------------|-----------------|-----|---------------------------|------------------------------|---------------|------|--------------------------------------------------|---------------------------|------------------------------|--------------|
| 1           | 18 feet     | 56              | F   |                           |                              |               |      | Died 06-22-98                                    |                           |                              |              |
|             |             | 64              | M   | 06-30-98                  | 72                           | 13%           |      | Died 07-17-98                                    |                           |                              |              |
|             |             | 69              | F   |                           |                              |               |      | Died 06-22-98                                    |                           |                              |              |
|             |             | 71              | F   |                           |                              |               |      | Died 06-22-98                                    |                           |                              |              |
|             |             | 75              | M   | 06-26-98                  | 84                           | 12%           |      | Released 01-19-99                                |                           |                              |              |
|             |             | 80              | F   |                           |                              |               |      | Died 06-22-98                                    |                           |                              |              |
| 2           | 9 feet      | 53              | F   |                           |                              |               |      | Died 06-22-98                                    |                           |                              |              |
|             |             | 61              | F   | 07-27-98                  | 68                           | 11%           |      | Released 01-19-99                                | 12-13-98                  | 78                           | 15%          |
|             |             | 67              | M   |                           |                              |               |      | Died 06-22-98                                    |                           |                              |              |
|             |             | 73              | F   | 07-20-98                  | 82                           | 12%           |      | Released 01-19-99                                |                           |                              |              |
|             |             | 78              | M   |                           |                              |               |      | Died 06-22-98                                    |                           |                              |              |
|             |             | 81              | M   | 06-22-98                  | 89                           | 10%           |      | Released 01-19-99                                |                           |                              |              |
| 3           | 9.8 feet    | 59              | F   | 08-31-98                  | 66                           | 12%           |      | Released 01-19-99                                |                           |                              |              |
|             |             | 62              | F   | 08-03-98                  | 68                           | 10%           |      | Released 01-19-99                                |                           |                              |              |
|             |             | 67              | F   |                           |                              |               |      | Died 06-02-98                                    |                           |                              |              |
|             |             | 70              | M   | 07-20-98                  | 75                           | 7%            |      | Died 10-28-98                                    |                           |                              |              |
|             |             | 73              | M   |                           |                              |               |      | Died 06-22-98                                    |                           |                              |              |
|             |             | 79              | M   | 06-12-98                  | 88                           | 11%           |      | Died 06-22-98                                    |                           |                              |              |
| 4           | 8.6 feet    | 59              | M   |                           |                              |               |      | Died 06-22-98                                    |                           |                              |              |
|             |             | 64              | M   |                           |                              |               |      | Died 06-09-98                                    |                           |                              |              |
|             |             | 68              | F   |                           |                              |               |      | Died 06-22-98                                    |                           |                              |              |
|             |             | 71              | F   |                           |                              |               |      | Died 06-22-98                                    |                           |                              |              |
|             |             | 78              | M   | 06-16-98                  | 87                           | 12%           |      | Died 06-22-98                                    |                           |                              |              |
|             |             | 81              | F   |                           |                              |               |      | Died 06-22-98                                    |                           |                              |              |
| 5           | 12 feet     | 56              | M   | 07-24-98                  | 61                           | 9%            |      | Released 01-19-99                                |                           |                              |              |
|             |             | 61              | F   | 09-06-98                  | 68                           | 11%           |      | Released 01-19-99, lost left crusher during molt |                           |                              |              |
|             |             | 66              | F   | 07-28-98                  | 73                           | 11%           |      | Released 01-19-99                                |                           |                              |              |
|             |             | 70              | M   |                           |                              |               |      | Died 06-22-98                                    |                           |                              |              |
|             |             | 74              | F   |                           |                              |               |      | Died 06-22-98                                    |                           |                              |              |
|             |             | 79              | M   |                           |                              |               |      | Died 06-22-98                                    |                           |                              |              |

| Station no. | Depth (MLW) | Initial CL (mm) | Sex | 1 <sup>st</sup> molt date | 1 <sup>st</sup> molt CL (mm) | CL % increase | Cull | Remarks                                       | 2 <sup>nd</sup> molt date | 2 <sup>nd</sup> molt CL (mm) | CL% increase |
|-------------|-------------|-----------------|-----|---------------------------|------------------------------|---------------|------|-----------------------------------------------|---------------------------|------------------------------|--------------|
| 6           | 18 feet     | 55              | F   |                           |                              |               |      | Died 06-22-98                                 |                           |                              |              |
|             |             | 63              | F   |                           |                              |               |      | Died 06-22-98                                 |                           |                              |              |
|             |             | 68              | M   |                           |                              |               |      | Died 06-22-98                                 |                           |                              |              |
|             |             | 71              | M   |                           |                              |               |      | Died 06-22-98                                 |                           |                              |              |
|             |             | 77              | M   | 06-12-98                  | 85                           | 10%           |      | Died 06-22-98                                 |                           |                              |              |
|             |             | 80              | F   |                           |                              |               |      | Died 06-22-98                                 |                           |                              |              |
| 7           | 15 feet     | 54              | M   | 08-03-98                  | 61                           | 13%           |      | Released 01-19-99                             |                           |                              |              |
|             |             | 62              | M   |                           |                              |               |      | Died 06-22-98                                 |                           |                              |              |
|             |             | 65              | F   |                           |                              |               |      | Died 06-22-98                                 |                           |                              |              |
|             |             | 72              | M   |                           |                              |               |      | Died 06-22-98                                 |                           |                              |              |
|             |             | 77              | M   |                           |                              |               |      | Molted and was eaten while caged in Casco Bay |                           |                              |              |
|             |             | 82              | F   |                           |                              |               |      | Died 06-22-98                                 |                           |                              |              |
| 8           | 10.3 feet   | 58              | M   | 06-29-98                  | 65                           | 12%           |      | Released 01-19-99                             | 11-19-98                  | 76                           | 17%          |
|             |             | 60              | M   | 08-05-98                  | 66                           | 10%           |      | Released 01-19-99                             |                           |                              |              |
|             |             | 66              | M   | 06-18-98                  | 71                           | 8%            |      | Died 06-22-98                                 |                           |                              |              |
|             |             | 71              | F   |                           |                              |               |      | Did not molt                                  |                           |                              |              |
|             |             | 71              | M   |                           |                              |               |      | Died while molting 06-29-98                   |                           |                              |              |
|             |             | 80              | F   | 06-19-98                  | 88                           | 9%            |      | Died 06-22-98                                 |                           |                              |              |
| 9           | 9.5 feet    | 58              | M   |                           |                              |               |      | Died 06-22-98                                 |                           |                              |              |
|             |             | 65              | M   |                           |                              |               |      | Died 06-22-98                                 |                           |                              |              |
|             |             | 66              | F   |                           |                              |               |      | Died 06-22-98                                 |                           |                              |              |
|             |             | 72              | F   |                           |                              |               |      | Died 06-22-98                                 |                           |                              |              |
|             |             | 74              | F   |                           |                              |               |      | Died 06-22-98                                 |                           |                              |              |
|             |             | 82              | M   |                           |                              |               |      | Died 06-22-98                                 |                           |                              |              |
| 10          | 12 feet     | 58              | F   |                           |                              |               |      | Died 06-22-98                                 |                           |                              |              |
|             |             | 63              | F   |                           |                              |               |      | Died 06-22-98                                 |                           |                              |              |
|             |             | 65              | M   | 06-09-98                  | 72                           | 11%           |      | Died 06-22-98                                 |                           |                              |              |
|             |             | 72              | M   |                           |                              |               |      | Died 06-22-98                                 |                           |                              |              |
|             |             | 77              | F   |                           |                              |               |      | Died 06-22-98                                 |                           |                              |              |
|             |             | 80              | F   |                           |                              |               |      | Died 06-22-98                                 |                           |                              |              |



Table 2. (cont.)

| Station no. | Depth (MLW) | Initial CL (mm) | Sex | 1 <sup>st</sup> molt date | 1 <sup>st</sup> molt CL (mm) | CL % increase | Cull | Remarks           | 2 <sup>nd</sup> molt date | 2 <sup>nd</sup> molt CL (mm) | CL% increase |
|-------------|-------------|-----------------|-----|---------------------------|------------------------------|---------------|------|-------------------|---------------------------|------------------------------|--------------|
| 11          | 18 feet     | 58              | F   |                           |                              |               |      | Died 06-22-98     |                           |                              |              |
|             |             | 62              | F   |                           |                              |               |      | Died 08-24-98     |                           |                              |              |
|             |             | 69              | F   |                           |                              |               |      | Died 06-22-98     |                           |                              |              |
|             |             | 73              | M   | 09-03-98                  | 81                           | 11%           |      | Released 01-19-99 |                           |                              |              |
|             |             | 77              | F   |                           |                              |               |      | Died 06-22-98     |                           |                              |              |
|             |             | 79              | M   | 06-04-98                  | 88                           | 11%           |      | Died 06-22-98     |                           |                              |              |

Figure 1. Chart of Casco Bay showing location of Dimilin study traps 1998.

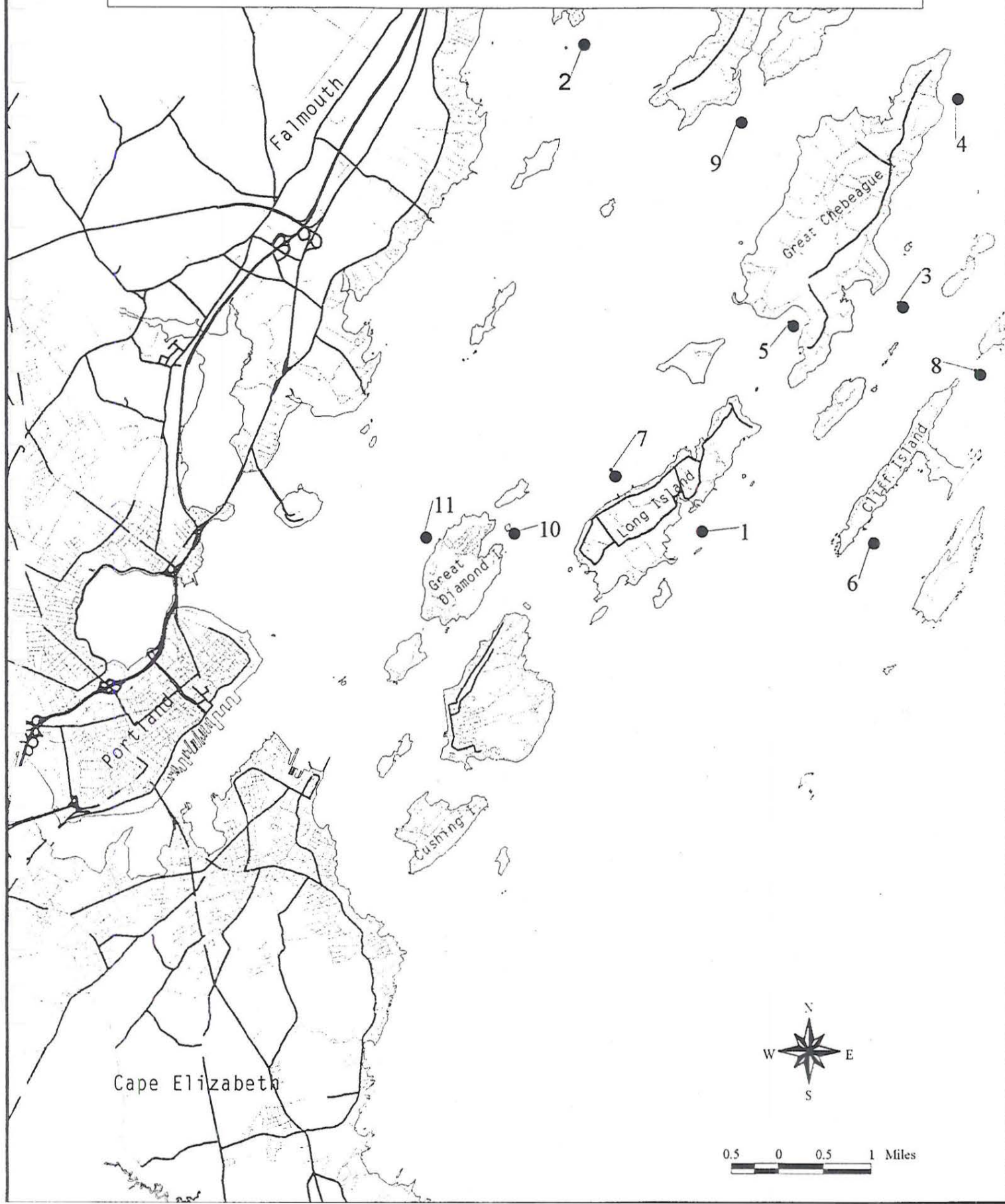


Figure 2. Ambient water temperature range of the Dimilin study holding tanks from June 11, 1998 through February 5, 1999.

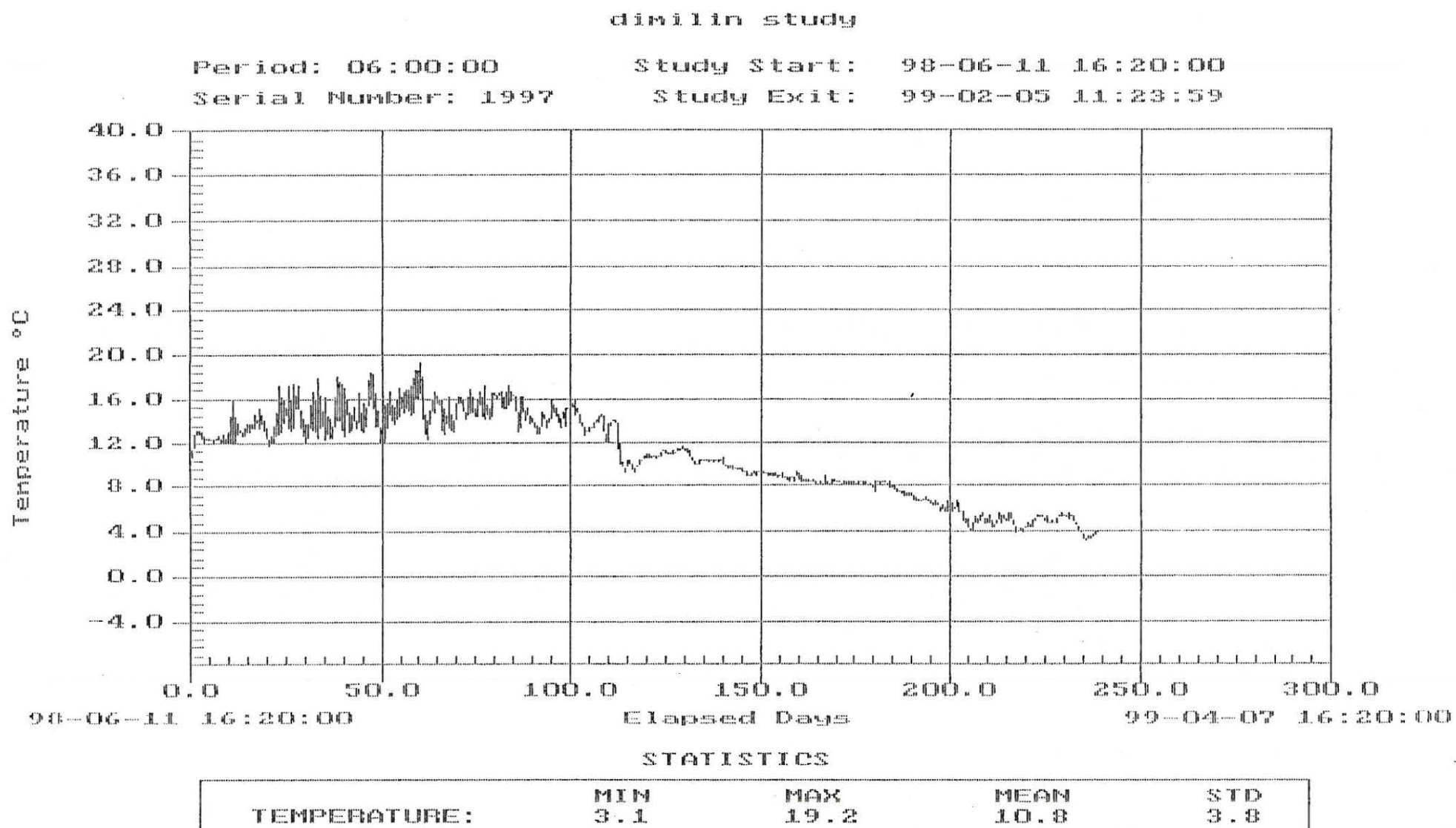


Figure 3. Size composition of sublegal lobsters caught in Boothbay Harbor Region and placed in wire cages around several Casco Bay islands and Falmouth Foreside, May 1998.

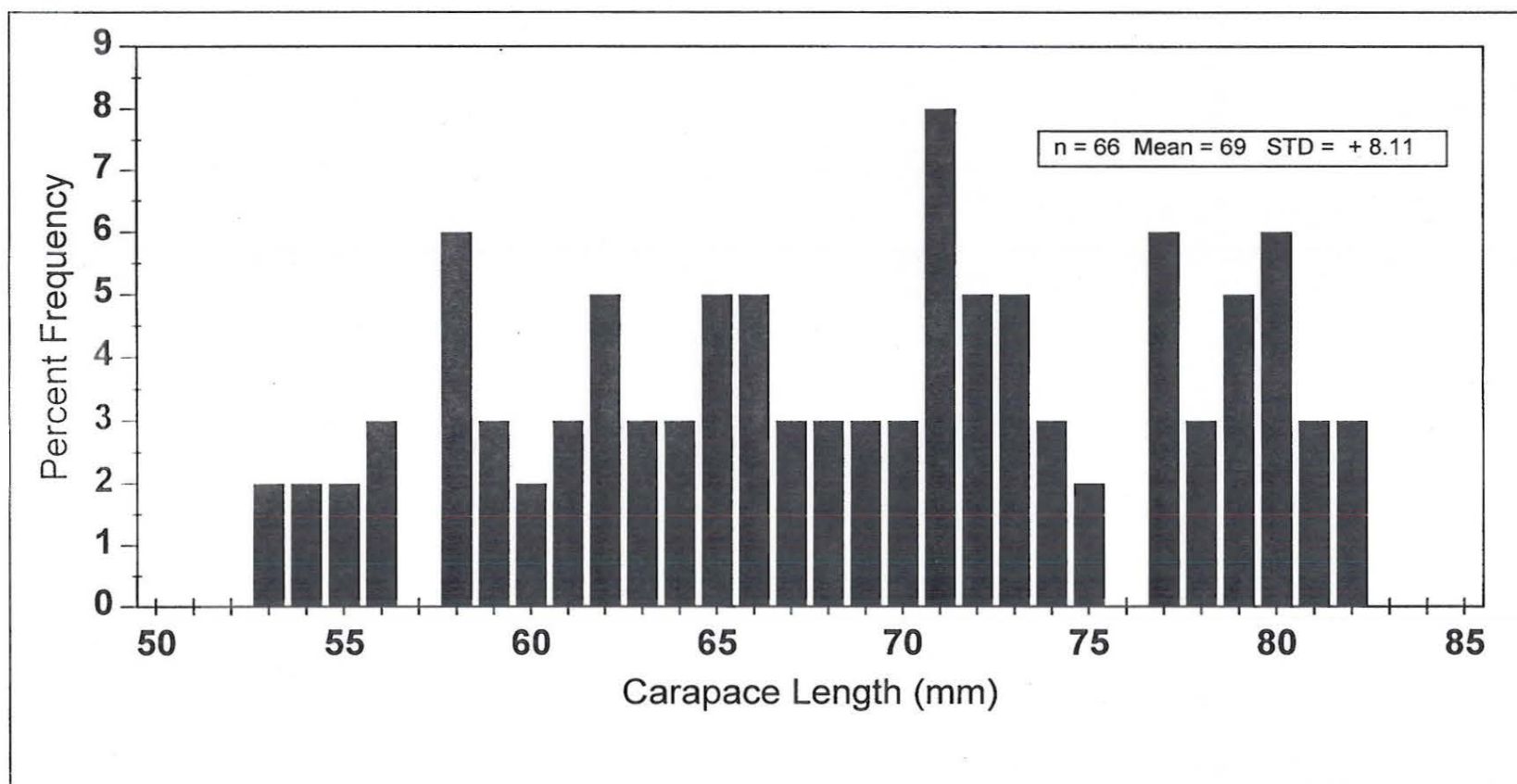
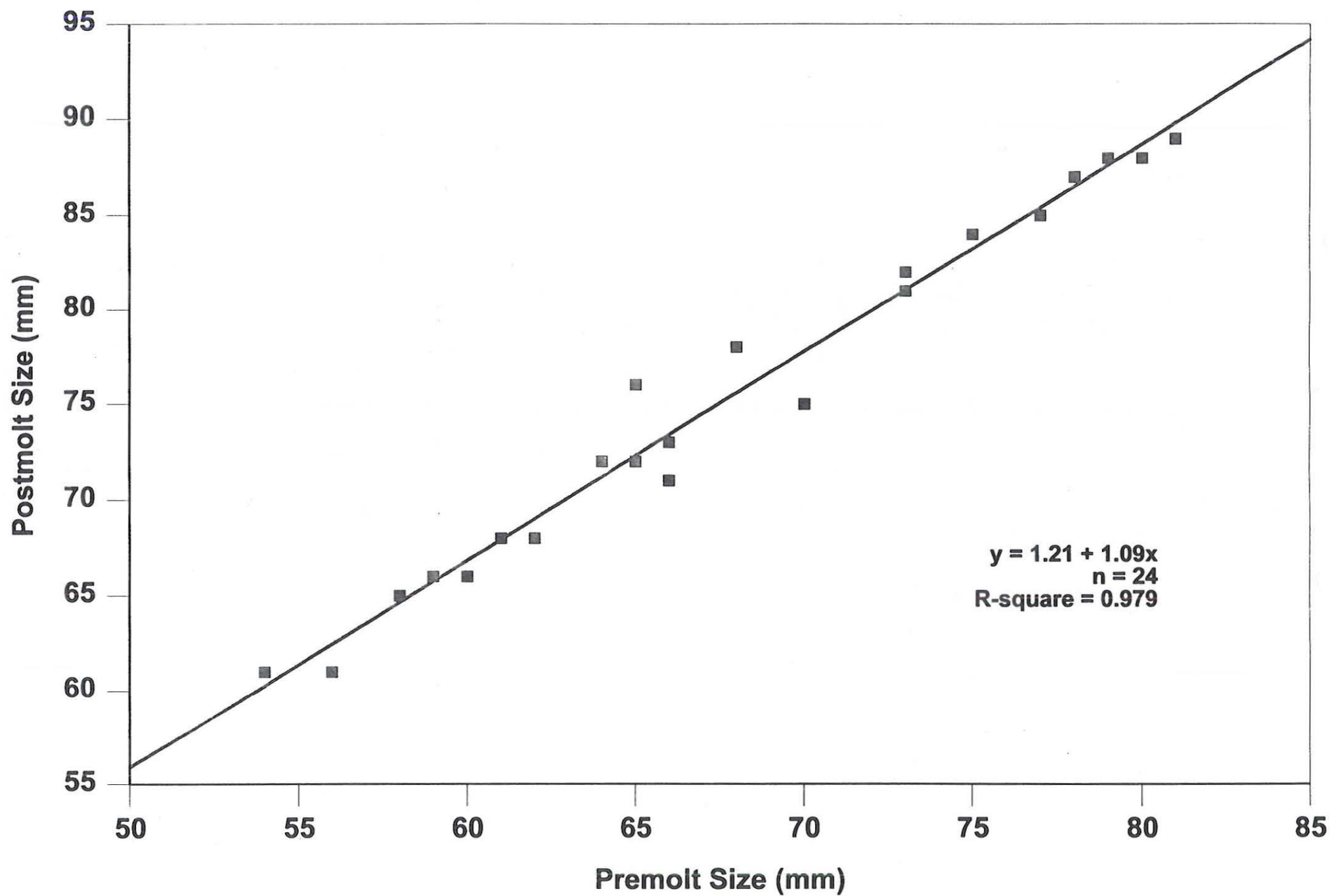




Figure 4. Relation of postmolt (Y) to premolt (X) carapace lengths for American lobsters of sentinel study held in the wet laboratory.





SHRIMP

**MAINE DEPARTMENT OF MARINE RESOURCES  
INTERJURISDICTIONAL FISHERIES RESOURCE MONITORING AND  
ASSESSMENT**

**COMMERCIAL SHRIMP PORT SAMPLING  
PROJECT NO. 3-IJ-143  
GRANT NO. NA86FI0022**

**COMPLETION REPORT  
JANUARY 1 THROUGH DECEMBER 31, 1998**

**BY STUART SHERBURNE  
AND  
MARILYN BOLEN**



IJF Annual Report for January 1, 1998 - December 31, 1998 for Commercial Shrimp  
Port Sampling.

The calendar year January 1, 1998 - December 31, 1998 includes portions of two different shrimp seasons, the 1997 -1998 season, which was from December 8, 1997 - May 22, 1998 and the 1998 -1999 season, which is from December 15, 1998 - May 25, 1999.

Included here is a portion of the 1997 -1998 season, January 1 - May 22, and a portion of the 1998 -1999 season, December 15 - 23, 1998. Each portion will be reported on separately because of the differences in the fishery during each of the seasons.

January 1 - May 22, 1998

The Department of Marine Resources shrimp port sampling team consisted of Stuart Sherburne, Marilyn Bolen and Tracey Riggins. Assistance from NMFS Port Agents Peter Marckoon in Rockland and Michael Doane in Portland enhanced our sampling and interviewing efforts.

From January 1, 1998 to May 22, 1998 (the last day of shrimp season) 205 shrimp samples and corresponding captain interviews were obtained from 197 draggers (104 different draggers) and 8 trappers at 23 different dealer locations from Portsmouth, NH to Winter Harbor, Maine. The shrimp samples came from 71 different fishing grounds. Fifty-seven samples were collected in January at 15 dealer locations from Portsmouth, NH to Southwest Harbor, ME; 52 in February at 11 dealer locations from Portsmouth, NH to Winter Harbor, ME; 42 in March at 8 dealer locations from Portland to Southwest Harbor; 34 in April at 12 dealer locations from Kennebunkport to Southwest Harbor and 20 in May at 3 dealer locations from Kennebunkport to Southwest Harbor.

The length range of the boats sampled was 29' - 90'. The average daily catch and average catch per unit of effort (CPUE), expressed in lbs/hr drag time, per dragger in January was 1354.3 lbs/day, 177 lbs/hr; February 1342.5 lbs/day, 152.1 lbs/hr; March 11163.1 lbs/day, 137.0 lbs/hr; April 900.2 lbs/day, 112.4 lbs/hr and May 1770.0 lbs/day, 169.6 lbs/hr.

The average daily catch for the 197 draggers was 1326.8 lbs with an average CPUE of 152.6 lbs/hr drag time. For the 8 trappers, the total catch was 3,132 lbs with an average catch lbs/trap/day of 0.19 lbs. (From January 1, 1997 - May 31, 1997, 206 draggers sampled had an average daily catch of 1642.9 lbs with an average CPUE of 194.6 lbs/hr drag time).

Although dragger catches were generally lower than that for the '96 -'97 season, the average price was generally higher. During January the shrimp were of large size and appeared in excellent condition. The boat price ranged from \$.90 - \$1.30/lb, depending on the dealer. During February shrimp brought \$1.00 - \$1.08 at most ports sampled. During the 2 week season allowed in March the boat price varied between \$.80 - \$1.05/lb. During April boat prices ranged between a low of \$.20/lb (due to the small size of the shrimp) to a

January 1 -May 22, 1998 (continued)

high of \$1.00/lb. Boat prices during May fluctuated widely due to boats bringing in 3 day catches of varied quality.

Shrimp were processed in the laboratory in order to generate sex-specific length frequency distributions, thus providing information on the size and age composition of the catch from different fishing grounds. Thirteen samples of fully egged shrimp, taken from various fishing grounds from off Portland to Southwest Harbor during January, were saved for possible fecundity studies.

Enclosed are detailed monthly reports for January, 1998; February, 1998; March, 1998; April, 1998 and May, 1998.

Also enclosed is a table that shows results for 15 different entities calculated for each month from January through May and for that time period as a whole. The entities include: 1) the number of dealers visited and range of locations along the coast, 2) number of samples collected, 3) number of different draggers sampled, 4) number of different trappers sampled, 5) length range of the boats sampled 6) number of fishing grounds that the samples came from, 7) total catch in lbs for draggers, 8) total catch in lbs for trappers, 9) number of dragger boat days, 10) draggers average catch/day in lbs, 11) total hours drag time, 12) lbs/hr drag time, 13) total number of traps hauled, 14) total set over days and 15) lbs/trap/day.

Laboratory work on the port samples is in progress. A summary by month, length and developmental stage is not included since the data for December 1997 through May 1998 has already been made available to ASMFC for the fall assessment. The only other data covered by this report would be for the December 15-23, 1998 period. We will continue to make this data available to the ASMFC Northern Shrimp Technical Committee.



### Commercial Shrimp Port Sampling. Monthly Report for January, 1998.

During January, 1998, 57 shrimp samples and corresponding captain interviews were obtained from 50 different draggers (4 draggers were sampled twice during the month) and 3 trappers landing at 15 dealer sites from Portsmouth, N.H. to Southwest Harbor, Maine. The average daily catch for the draggers was 1354.3 lbs with an average CPUE of 177 lbs/hr drag time. The 3 trappers had hauled 246 traps for an average catch of 0.27 lbs/trap/day. ( In comparison, during January, 1997, 64 samples obtained from draggers had an average daily catch of 1615.1 lbs and an average CPUE of 223.6 lbs/hr. Three trappers sampled in January, 1997 had hauled 440 traps for an average catch of 0.11 lbs/trap/day.)

Boats were sampled at the following 15 dealer locations in January: Wotton's Lobster, Boothbay Harbor; Shaw's Wharf, New Harbor; South Bristol Fisherman's Co-op; Osier's Seafood, South Bristol; the Portland Fish Exchange; Mike Farrin's Wharf, South Bristol; Beal's Lobster Pier, Southwest Harbor; Robinson's Wharf, Southport; Hunt's Wharf, Sebasco; Small Point Fisheries, Phippsburg; Reilly's Sea Products, South Bristol; Eugley's Wharf, South Bristol; Thorbjornson's Wharf, Port Clyde; Resource Trading Company, Portland and the Portsmouth, N.H. Fisherman's Co-op. The length range of the boats sampled was 33' - 90'.

The highest CPUE in January, 1998, of 54 dragger samples, was 349.3 lbs/hr drag time by the 36' Mark A out of Southwest Harbor on January 22 which landed 2445 lbs after 7 hours total drag time in 45 fathoms east of Isle Au Haut. (The highest CPUE in January, 1997, of 64 dragger samples, was 807.0 lbs/hr by the 51' Leslie & Jessica out of Port Clyde on January 9 which landed 6,860 lbs after 8.5 hrs drag time in 40 fathoms west of Monhegan Island. This was also the highest 1 day catch of the boats sampled in January, 1997.) The highest 1 day catch in January, 1998, of the boats sampled, was 2,540 lbs by the 72' Jubilee out of Portland on January 28 after dragging the Edge of Bottom for 8 hours in 55 fathoms for a CPUE of 317.5 lbs/hr.

The shrimp samples obtained in January came from 30 individual fishing grounds. The shrimp were of large size and appeared in excellent condition. The boat price ranged from \$.90 - \$1.30/lb, depending on the dealer.

Processing of samples continued in the laboratory to determine the size and age composition and other biological attributes of the catch. Thirteen samples of fully eggged shrimp from off Boothbay Harbor, Pemaquid, Portland, South Bristol, New Harbor, Southport and Southwest Harbor have been saved for fecundity studies. The fishing grounds represented are: The Kettle, Pemaquid Channel, E & S of Pumpkin Island, Long Hill, Wood Island, SW of the Pasture, Hump Sand (SSE of Outer Heron Island), below Southport Island and east of Isle Au Haut.

### Commercial Shrimp Port Sampling. Monthly Report for February, 1998.

The shrimp catch still continues to be down in February, 1998 compared with last year but the price remains higher, bringing \$1.00 - \$1.08 at most ports sampled.

During February, 1998, 52 shrimp samples and corresponding captain interviews were obtained from 44 different shrimp draggers (4 draggers were sampled twice during the month) and 4 different shrimp trappers at 11 dealer sites from Portsmouth, N.H. to Winter Harbor, Maine. The average daily catch for the draggers was 1342.5 lbs with an average CPUE of 152.1 lbs/hr drag time. The 4 trappers had hauled 450 traps for an average catch of 0.62 lbs/trap/day. (In comparison, during February, 1997, 43 samples obtained from draggers had an average daily catch of 2,006 lbs and an average CPUE of 235.8 lbs/hr. Seven trappers sampled in February, 1997 had hauled 1040 traps for an average catch of 0.26 lbs/trap/day.)

Boats were sampled at the following 11 dealer locations in February, 1998: Cundy's Harbor Wharf; Pemaquid Fisherman's Co-op; Wotton's Lobster, Boothbay Harbor; Winter Harbor Co-op; Mike Farrin's Wharf, South Bristol; South Bristol Fisherman's Co-op; Osier's Seafood, South Bristol; Cape Porpoise Pier; Thorbjornson's Wharf, Port Clyde; the Portland Fish Exchange and the Portsmouth, N. H. Fisherman's Co-op. The length range of the boats sampled was 29' - 87'.

The highest CPUE in February, 1998, of 48 dragger samples, was 324.1 lbs/hr by the 42' Dustin & Ebony out of Winter Harbor on February 9 which landed 2,269 lbs after 7 hrs total drag time in 38 fathoms at Clarks Rock outside of Frenchman Bay. This was the captain's first day of shrimping this season as he had been scalloping until now. (The highest CPUE in February, 1997, of 43 dragger samples, was 669.3 lbs/hr by the 71' Elizabeth NB out of Portland on February 21 which landed 4,518 lbs after 6.75 hrs total drag time in 50 fathoms off Cape Elizabeth. This was also the highest 1 day catch of the boats sampled in February, 1997.) The highest 1 day catch in February, 1998, of the boats sampled, was 2,512 lbs by the 63' Paulo Marc out of South Bristol on February 17 after dragging at Little Jeffreys for 9 hrs in 48-50 fathoms for a CPUE of 279.1 lbs/hr.

The shrimp obtained from the 52 sampled vessels (draggers and trappers) came from 29 individual fishing grounds. On processing samples in the laboratory, a few unusually small egg-bearing shrimp (*P. borealis*) were noticed in some of the catches. These shrimp are being saved for fecundity studies.



### Commercial Shrimp Port Sampling. Monthly Report for March, 1998.

Shrimp season in March, 1998 was restricted to the 1st 2 weeks of the month. During this time 42 shrimp samples and corresponding captain interviews were obtained from 36 different draggers (5 draggers were sampled twice during the month) and 1 trapper at 8 different dealer locations from Portland to Southwest Harbor. The average daily catch for the draggers was 1163.1 lbs with an average CPUE of 137.0 lbs/hr drag time. ( This is lower than for March, 1997 when 43 draggers had an average daily catch of 1543 lbs with an average CPUE of 175 lbs/hr.) The trapper had hauled 67 traps on a 4 night set for 526 lbs for an average catch of 2.0 lbs/trap/day.

Boats were sampled at the following 8 dealers in March: Reilly's Sea Products, South Bristol; Wotton's Lobster, Boothbay Harbor; Beal's Lobster Pier, Southwest Harbor; Eugley's Wharf, South Bristol; Thorbjornson's Wharf, Port Clyde; Resource Trading Company, Portland; Shaw's Wharf, New Harbor and Osier's Seafood, South Bristol. The length of the boats sampled was 35'-65'.

The highest CPUE in March, 1998, of 41 dragger samples, was 317.8 lbs/hr by the 42' Hilda & Helen out of Port Clyde on March 4 which landed 2860 lbs (also the highest 1 day catch of the boats sampled) after 9 hrs total drag time in 80 fathoms 12 miles SW of Monhegan Island. (The highest CPUE in March, 1997, of 43 dragger samples, was 407.5 lbs/hr by the 50' Sirius out of Port Clyde on March 4 which landed 3260 lbs after 8 hrs total drag time in 75 fathoms 10 miles south of Monhegan Island. This was also the highest 1 day catch of the boats sampled in March, 1997.)

The 42 shrimp samples came from 21 individual fishing grounds, thus a good cross section of fishing effort was obtained during the 2 week season allowed in March. The boat price varied between \$.80-\$1.05/lb. Processing of samples continued in the laboratory to determine the size and age composition and other biological attributes of the catch. Shrimp season resumes on April 1.

### April 1998 Shrimp Port Sampling Summary

A total of 34 shrimp samples were collected from 27 individual draggers ( 7 draggers were sampled twice during the month) at 12 dealer locations from Kennebunkport to Southwest Harbor during the month of April. The vessels ranged from 35' - 77' in length. Samples came from 12 different fishing grounds, 7 new grounds not previously sampled this season, which makes 76 different fishing grounds sampled from December 8, '97- April 30, '98.

Two of the vessels sampled made 3 day fishing trips, 4 vessels made 2 day trips, while the remaining 28 vessels fished for 1 day each. The 3 day catches were 4318 lbs and 5347 lbs with both boats fishing the Jeffreys Ledge area. Catches from the vessels making 2 day trips ranged from 1112 lbs - 2680 lbs. The highest catch from the 4 draggers making 2 day trips came from 3 Dory Ridge, while the other 3 boats fished on and around Jeffreys Ledge. The vessel with the highest 1 day catch for the month also had the highest CPUE. It landed 2447 lbs of shrimp from Doggett's, and had a CPUE of 407.8 lbs/hr. However, the captain received only \$.20/lb for his efforts due to the small size of the shrimp.

The average daily catch for the above 34 draggers was 900.2 lbs with an average CPUE of 112.4 lb/hr drag time compared to April, 1997 when 34 draggers sampled from Kennebunk to Southwest Harbor had an average daily catch of 1593.0 lbs with an average CPUE of 176.0 lbs/hr.

Boats were sampled at the following 12 dealers in April : Wotton's Lobster, Boothbay Harbor; Beal's Lobster Pier, Southwest Harbor; C.H. Rich Co., Bass Harbor; New Fin, Port Clyde; Thorbjornson's Wharf, Port Clyde; Portland Fish Exchange, Portland; Resource Trading Co., Portland; Southwest Harbor Lobster & Fish, Southwest Harbor; Mike Farrin's Wharf, South Bristol; Cape Porpoise Pier, Cape Porpoise; Osier's Seafood, South Bristol and Kennebunkport Pier, Kennebunkport.

Boat prices for the month ranged between a low of \$.20/lb to a high of \$1.00/lb.



### Shrimp Port Sampling Summary for May, 1998

Catches during April were disappointing so a lot of shrimp draggers left the fishery. However, the draggers that remained in the fishery during May had the highest average daily catch of the draggers sampled for any month of this season.

During May a total of 20 shrimp samples and corresponding captain interviews for catch information were obtained from 17 different draggers (3 draggers were sampled twice during the month) at 3 dealers: Port Lobster, Kennebunk; Resource Trading Co., Portland and Southwest Harbor Lobster & Fish Unlimited. Lengths of the draggers ranged from 36' - 87'. Samples came from the following 5 fishing grounds: Jeffreys Basin, Jeffreys Ledge, Mt. Desert Rock, New Ledge (Platts Bank) and north of Three Dory Ridge. The average daily catch was 1770.0 lbs while the average CPUE was 169.6 lbs/hr. (The average daily catch for 34 draggers sampled in April was only 900.2 lbs with an average CPUE of 112.4 lbs/hr).

On May 5, two draggers sampled at RTC had 2 day catches of 3720 and 4092 lbs with an average catch/boat of 3906 lbs. The range of catches in lbs/hr was 169.1 - 227.3 with an average CPUE/boat of 195.3 lbs/hr. The catches came from Jeffreys Basin at 75 - 100 fathoms.

On May 6, six shrimp draggers were sampled at RTC - 5 draggers had 3 day trips and 1 dragger had a 1.5 day trip. The range of catches in lbs for the 5 draggers was 3460 - 7385, the average catch/boat was 5045.6 lbs, the range of catches in lbs/hr was 111.7 - 246.2, while the average CPUE was 159.7 lbs/hr. The dragger on the 1.5 day trip had a total catch of 3737 lbs and an average CPUE of 207.6 lbs/hr. The catches came from Jeffreys Basin at 65 - 85 fathoms and Jeffreys Ledge at 80 fathoms.

On May 13, a 36' dragger, the only boat shrimping out of Southwest Harbor in May, had fished at Mt. Desert Rock at 70 fathoms and had a 1 day catch of 1056 lbs with an average CPUE of 150.9 lbs/hr. Shrimp were of good quality and the captain reported that he had caught more shrimp this season than last season.

On May 14, a 47' boat at Kennebunkport that had fished the shore side of Jeffreys Basin at 75 fathoms had a 1 day catch of 2641 lbs with a CPUE of 293.4 lbs/hr. Shrimp appeared to be of good quality and count.

The last sampling trip of the season was on May 20 to Resource Trading Co. in Portland where 10 draggers were sampled. Two draggers had 2 day trips while 8 had 3 day trips. One of the draggers on a 2 day trip had fished Platts Bank at 75 - 85 fathoms and had a catch of 3733 lbs with a CPUE of 186.6 lbs/hr. The other dragger fished the Fingers of Jeffreys at 70 - 80 fathoms and caught 4427 lbs with a CPUE of 164.0 lbs/hr. The 8 draggers on 3 day trips had catches ranging from 2594 - 8875 lbs, an average catch/boat of 5094 lbs, a range of catches in lbs/hr of 96.1 - 268.9 and an average CPUE/boat of 164.3 lbs/hr. Five boats had fished the Jeffreys Ledge area at 75 - 85

(May 1998 Monthly Report continued)

fathoms while 3 had fished north of Three Dory Ridge at 80 - 95 fathoms. The biggest catch came from Jeffreys Ledge. Shrimp varied in quality between boats - the boat with the largest catch unloaded some of the worst looking shrimp the Wharf Manager had seen. The 44' boat apparently did not have enough ice on board to adequately preserve the quality of some of the 8875 lb catch.



# Commercial Shrimp Port Sampling, January 1, 1998 - May 22, 1998

| Boats                                  |                                                              |                            |                              |                            |                         |                                       |          |                         |                                       |                           |                     |                            |                           |                        |      |
|----------------------------------------|--------------------------------------------------------------|----------------------------|------------------------------|----------------------------|-------------------------|---------------------------------------|----------|-------------------------|---------------------------------------|---------------------------|---------------------|----------------------------|---------------------------|------------------------|------|
| # Dealers<br>Visited &<br>Locations *1 | #<br>Samples<br>Collected                                    | #<br>Draggers<br>Sampled*2 | #<br>Trappers<br>Sampled     | Length<br>Range<br>(ft)    | #<br>Fishing<br>Grounds | Total<br>Catch (lbs)<br>Draggers      | Trappers | Dragger<br>Boat<br>Days | Draggers<br>Av. Catch<br>Per Day(lbs) | Total Hrs<br>Drag<br>Time | Lbs/hr<br>Drag Time | Total #<br>Traps<br>Hauled | Total<br>Set Over<br>Days | Lbs/Trap<br>Per<br>Day |      |
| Jan.<br>1998                           | 15<br>Portsmouth<br>to SW<br>Harbor                          | 57                         | 50                           | 3                          | 33'-90'                 | 30                                    | 73,135   | 731                     | 54                                    | 1,354.3                   | 413.1               | 177.0                      | 246                       | 11                     | 0.27 |
| Feb.<br>1998                           | 11<br>Portsmouth<br>to Winter<br>Harbor                      | 52                         | 42                           | 4                          | 29'-87'                 | 29                                    | 64,441   | 1,875                   | 48                                    | 1,342.5                   | 423.7               | 152.1                      | 450                       | 6.75                   | 0.62 |
| March<br>1998                          | 8<br>Portland<br>to SW<br>Harbor                             | 42                         | 36                           | 1                          | 35'-65'                 | 21                                    | 47,687   | 526                     | 41                                    | 1,163.1                   | 348                 | 137.0                      | 67                        | 4                      | 2.0  |
| April<br>1998                          | 12<br>Kennebunk<br>port to SW<br>Harbor                      | 34                         | 27                           | 0                          | 35'-77'                 | 12                                    | 37,807   | 0                       | 42                                    | 900.2                     | 336.3               | 112.4                      | 0                         | 0                      | 0    |
| May<br>1998                            | 3<br>Kennebunk<br>port to SW<br>Harbor                       | 20                         | 17                           | 0                          | 36'-87'                 | 5                                     | 89,386   | 0                       | 50..5                                 | 1,770.0                   | 527                 | 169.6                      | 0                         | 0                      | 0    |
| Totals:                                | 23<br>different<br>dealers<br>Portsmouth to<br>Winter Harbor | 205                        | 104<br>different<br>draggers | 8<br>different<br>trappers | 29'-90'                 | 71<br>different<br>fishing<br>grounds | 312,456  | 3,132                   | 235.5                                 | 1326.8                    | 2048.1              | 152.6                      | 763                       | 21.75                  | 0.19 |

\*1 Dealers visited more than one time in any given month are only counted once.

\*2 Some draggers were sampled more than once in a given month. Hence the number of samples collected exceeds the number of different draggers sampled.

Commercial Shrimp Port Sampling. December 15 - 23, 1998

Port sampling of the 1998-1999 commercial shrimp season began on December 15, the opening day of the fishery. This season's main sampling team consists of Stuart Sherburne and Marilyn Metcalfe of DMR, Boothbay Harbor and Port Agent Peter Marckoon of the NMFS office in Rockland, Maine. Marcy Lucas, who was just hired in DMR's aquaculture program, will be assisting 1 day/week in field work and/or laboratory processing.

During the 7 days allowed for shrimping between December 15 - 23, shrimp samples and corresponding captain interviews for catch information were obtained from 15 draggers at 6 dealers from Portsmouth, NH to Port Clyde. Loss of several fishing days because of gale and storm force winds, gear problems, slime coating the nets and thereby reducing optimum towing speed, relatively high counts (# shrimp/lb) and lower prices than last year discouraged shrimpers during the opening days of the season. One dealer from South Bristol, after only 5 days into the season, asked if DMR was planning to close the fishery.

This dealer had a boat bring in 100 count shrimp that sold for \$.30/lb.

Draggers were sampled at the following dealer locations: Portsmouth, NH Fisherman's Co-op; Port Lobster, Kennebunkport Pier; Seahorse Lobster & Fish, Phippsburg; Wotton's Lobster, Boothbay Harbor; Eugley's Wharf, South Bristol and Thorbjornson's Wharf, Port Clyde. The length of the sampled vessels ranged from 35 to 54 feet; the sampled catches ranged from a low of 332 lbs to a high of 2350 lbs; the average daily catch was 1189.6 lbs; the range of catches in lbs/hr drag time (catch per unit of effort or CPUE) was 55.3 - 291.2 and the average CPUE was 154.8 lbs/hr.

(December 1998's average daily catch and CPUE's are lower than for December, 1997 when 44 draggers sampled during the 13 available shrimping days had an average daily catch of 1458.1 lbs, the range of catches in lbs/hr drag time was 54.8 - 484.7 and the average CPUE was 179.2 lbs/hr). (Refer to the enclosed table comparing the December 1997 to the December 1998 fishery).

The shrimp samples came from a good variety of fishing grounds: off Boon Island, Jeffreys Basin, Tanta, Kettle Bottom, Sagadahoc, 7 -10 miles S of Monhegan Island and 8 miles SW of Monhegan Is.

Boat prices generally ranged from \$.60 - \$.87/lb, depending on the dealer and count (#/lb). This was \$.30/lb lower than last season in December.

Shrimp are being processed in the laboratory in order to generate sex-specific length frequency distributions, thus providing information on the size and age composition of the catch from different fishing grounds. Fully egged females are being saved for a fecundity study.

**Commercial Shrimp Port Sampling Comparison Table**

(comparing December 1997 to December 1998)

|                         | <b># Dealers<br/>Visited</b> | <b># Samples<br/>Collected</b> | <b># Different<br/>Draggers<br/>Sampled</b> | <b>Length<br/>Range<br/>in feet</b> | <b># Fishing<br/>Grounds</b> | <b>Total<br/>Catch in<br/>Lbs.</b> | <b>Average<br/>Catch/Day<br/>in Lbs.</b> | <b>Total Hours<br/>Drag Time</b> | <b>Lbs./Hr.<br/>Drag Time</b> |
|-------------------------|------------------------------|--------------------------------|---------------------------------------------|-------------------------------------|------------------------------|------------------------------------|------------------------------------------|----------------------------------|-------------------------------|
| <b><u>Dec. 1997</u></b> | 7                            | 44                             | 39                                          | 35'-90'                             | 20                           | 64,155                             | 1,458.1                                  | 358.0                            | 179.2                         |
| <b><u>Dec. 1998</u></b> | 6                            | 15                             | 15                                          | 35'-54'                             | 7                            | 17,844                             | 1,189.6                                  | 115.2                            | 154.8                         |

Note: In December 1997 , a total of 13 fishing days were allowed in the shrimp fishery. In December 1998, the total allowable number of fishing days was reduced to 7.



Dealer samples list January 1, 1998 - May 22, 1998 and December 15 - 23, 1998

A list of 23 shrimp dealers where 205 shrimp samples were obtained from January 1, 1998 - May 22, 1998 with the total visits to each dealer, the number of samples obtained at each visit (number of boats sampled) and the total number of samples obtained at each dealer.

| <u>Dealer</u>                        | <u>No. Visits</u> | <u>Samples collected/visit</u> | <u>Total samples</u> |
|--------------------------------------|-------------------|--------------------------------|----------------------|
| 1 Portland Fish Exchange             | 3                 | 8, 5, 2                        | 15                   |
| 2 Thorbjornson's, Port Clyde         | 7                 | 5, 4, 5, 7, 7, 6, 3            | 37                   |
| 3 Wotton's Lobster, BBH              | 5                 | 3, 4, 3, 2, 1                  | 13                   |
| 4 Resource Trading Co., Portland     | 7                 | 8, 6, 3, 7, 2, 6, 10           | 42                   |
| 5 Cundy's Harbor Wharf               | 1                 | 11                             | 11                   |
| 6 Osier's Seafood, South Bristol     | 5                 | 1, 3, 4, 3, 1                  | 12                   |
| 7 Eugley's Wharf, South Bristol      | 2                 | 4, 2                           | 6                    |
| 8 Cape Porpoise Pier                 | 2                 | 2, 2                           | 4                    |
| 9 Reilly's Sea Products, So. Bristol | 2                 | 3, 4                           | 7                    |
| 10 Beal's Lobster Pier, SW Harbor    | 4                 | 2, 2, 1, 1                     | 6                    |
| 11 South Bristol Co-op               | 3                 | 5, 1, 4                        | 10                   |
| 12 Hunt's Wharf, Sebasco             | 1                 | 1                              | 1                    |
| 13 Pemaquid Fishermen's Co-op        | 1                 | 2                              | 2                    |
| 14 Shaw's Wharf, New Harbor          | 3                 | 1, 2, 9                        | 12                   |
| 15 Small Point Fisheries             | 1                 | 1                              | 1                    |
| 16 Mike Farrin's, South Bristol      | 4                 | 3, 3, 1, 1                     | 8                    |
| 17 Portsmouth, N.H. Co-op            | 2                 | 1, 3                           | 4                    |
| 18 Robinson's Wharf, Southport       | 1                 | 2                              | 2                    |
| 19 Winter Harbor Co-op               | 1                 | 1                              | 1                    |
| 20 So'west Hbr Lobster & Fish, Unl.  | 3                 | 1, 1, 1                        | 3                    |
| 21 C.H. Rich, Bass Harbor            | 1                 | 1                              | 1                    |
| 22 New Fin, Port Clyde               | 1                 | 3                              | 3                    |
| 23 Kennebunkport Pier                | 2                 | 3, 1                           | 4                    |
|                                      | -----             |                                | -----                |
|                                      | 62                |                                | 205                  |

A list of the 6 shrimp dealers where 15 samples were obtained from December 15 - December 23, 1998 with the total visits to each dealer, the number of samples obtained at each visit (number of boats sampled) and the total number of samples obtained at each dealer.

| <u>Dealer</u>                  | <u>No. Visits</u> | <u>Samples collected/visit</u> | <u>Total samples</u> |
|--------------------------------|-------------------|--------------------------------|----------------------|
| 1 Wotton's Lobster, BBH        | 2                 | 1, 1                           | 2                    |
| 2 Thorbjornson's, Port Clyde   | 1                 | 6                              | 6                    |
| 3 Port Lobster, Kennebunkport  | 1                 | 3                              | 3                    |
| 4 Portsmouth, NH Co-op         | 1                 | 1                              | 1                    |
| 5 Eugley's Wharf, S. Bristol   | 1                 | 2                              | 2                    |
| 6 Seahorse Lob & Fish, Phipps. | 1                 | 1                              | 1                    |
|                                | -----             |                                | -----                |
|                                | 7                 |                                | 15                   |





# SEA URCHINS

**MAINE DEPARTMENT OF MARINE RESOURCES  
INTERJURISDICTIONAL FISHERIES RESOURCE MONITORING AND  
ASSESSMENT**

**COMMERCIAL PORT SAMPLING AND MANAGEMENT OF  
GREEN SEA URCHINS (*STRONGYLOCENTROTUS DROEBACHIENSIS*)  
ALONG THE MAINE COAST**

**Project No. 3-IJ-143**

**Contract No. NA86FI0022**

**COMPLETION REPORT**

**January 1 through December 31, 1998**

**by Edwin P. Creaser  
and  
Margaret Hunter**

## Commercial Port Sampling Program

### Commercial port sampling data collection

The commercial sea urchin port sampling program was initiated during the 1994/1995 season. No surcharge money was available to fund travel by a part-time assistant, so interviews were collected coastwide by phone and no size information was recorded. A full time sea urchin position was created early during the 1995/1996 season and it became possible to collect interview and size information from a commercial port sampling program conducted at buying stations along the entire coast. We attempted to sample twice/week and buying stations were selected randomly. Sampling activities were confined to locations where at least 5-7 harvesters unloaded their catches. Throughout the 1995/1996 sampling season, a substantial amount of time and thought was devoted to: locating buying stations, acquainting ourselves with key buying station personnel, refining interview questions where possible, learning to rapidly process samples for diameter and weight, and developing sampling strategies for unusual sampling situations we encountered.

During the 1996/1997 commercial port sampling season, we improved the methodology involved in the selection of buying/ sampling stations and the collection of catch, effort, CPUE, size (diameter, weight), external sex determination. We also developed a grading system (1-3) for the condition of the urchins measured. An attempt was made to proportionally allocate the number of buying stations sampled within each county (York, Cumberland, Hancock, Washington) or combination of counties (Sagadahoc/ Lincoln, Knox/ Waldo). More interviews and samples were obtained in counties with more buying stations. The sampling of urchin landings by proportional allocation is complicated by a constant change in the numbers and locations of buying stations during the course of the season; buyers enter and leave the fishery, move the locations of their buying stations, and change the numbers of sub-buying stations, and we never know for certain how many active buyers there are in each county at one point in time.

The coast of Maine has been divided into two Zones in order to (1) control urchin harvesting effort and (2) establish harvesting seasons which are based upon the urchin reproductive cycle. Spawning occurs earlier in Western Maine (Zone 1) and Zone 1 opens and closes sooner than Zone 2 because the product (uni) is not desirable during spawning. The division line between Zone 1 and Zone 2 occurs in Penobscot Bay (Figure 1) with York, Cumberland, Sagadahoc/ Lincoln, and Knox/ Waldo Counties in Zone 1, and Hancock and Washington Counties in Zone 2. We attempted to sample two buying stations per week (one in each zone), during weather conditions when harvesters were active. We also attempted to sample a different buying station during each trip but sometimes this was not possible because some of the western counties have few buying stations. The commercial port sampling procedure outlined above was used during the 1996/1997 and 1997/1998 sampling seasons.

During the 1997/1998 season, port samplers interviewed 384 divers and 67 draggers. The breakdown of diver interviews by county was York (18), Cumberland (16), Sagadahoc/Lincoln (57), Knox/Waldo (111), Hancock (78), Washington (104). Dragger interviews were Knox/Waldo (12), Hancock (5), Washington (50). Port samplers also measured and weighted 9274



urchins from 464 catches (3240 urchins from 162 catches in Zone 1 and 5954 urchins from 298 catches in Zone 2).

#### Catch, effort, CPUE, and size information from interviews and samples

A summary of information recorded from diver and dragger interviews during the 1997/1998 season is shown in Tables 1 and 2 respectively. Table 1 shows that the mean (average) diver age is 33.5, the mean diver harvest depth is 9.3 - 27.3 ft, the mean catch per diver day is 587.8 lbs, the mean percent roe is 13.9%, and the mean number of bottom hours is 3.6. Table 2 shows that the mean boat length is 35.1 ft, the mean dragger harvest depth is 15.9 - 57.0 ft, the mean catch per dragger day is 607.9 lbs, the mean percent roe is 12.7%, the mean numbers of hours fished is 6.0, the mean number of minutes per tow is 9.0, and the mean number of tows per day is 35.5. Other important parameters are also listed in Tables 1 and 2. Selected information recorded above for the 1997/1998 season is compared with previous seasons in Table 3.

CPUE for both divers and draggers, is presented in Table 4 and Figure 2 (A,B). A comparison of the lbs per bottom hour summarized from diver interviews conducted during four harvesting seasons, clearly shows that the CPUE has declined in every coastal county except (possibly) York Co. The apparent increase in CPUE in York Co. may result from (1) an erroneous estimate from small sample size (2) diving deeper to reach high concentrations of lower quality (lower % roe) urchins, and (3) an intense survey to locate urchin beds which were previously missed. It is difficult to draw conclusions from dragger CPUE information (Figure 2B) because of small sample size.

Corrected size (diameter) frequency distribution information summarized from samplings of the commercial catch, are shown in Figures 3(A) (Zone 1), 3(B) (Zone 2) and 3(C) (combined data). Figure 3 shows that 3% and 4% of the landed catch (in numbers) in Zone 1 and 2 respectively, are undersized (less than 2 inches in diameter). These percentages are well within the 10% allowable tolerance limits for the 2 inch size restriction. If the legal diameter of urchins was increased to 2 1/8" or 2 1/4" in Zone 1, the landings in numbers would be reduced by 10% and 28% respectively. Similarly, if the legal diameter of urchins was increased to 2 1/8" or 2 1/4" in Zone 2, the landings in numbers would be reduced by 13% and 29% respectively. An increase in the minimum legal size and a maximum size limit (no size yet specified) have been discussed by the Sea Urchin Zone Council as possible future restrictions. An increase in the minimum legal size would allow more urchins to spawn more than once prior to harvest and a maximum size limit might allow urchins with the greatest volume of eggs and sperm to spawn and produce large numbers of larvae. It is unknown whether an increase in the minimum size limit would result in an increase in discard mortality but we suspect that it would not, based upon recent hearsay that an increasing number of divers are culling their catches on the bottom.

## Landings

It is well known from evidence found in "kitchen middens" that Maine's aboriginal inhabitants consumed sea urchins. In more recent times, the first actual records of sea urchin landings occurred in 1929. Between 1937-1986, sea urchin landings varied between 3,008 and 180,085 lbs valued between \$306.00 and \$9,078.00. These urchins were shipped to Chicago, Boston, and New York City (Fulton Fish Market) where they were purchased by ethnic groups of Italian, Spanish, Portuguese, German, Greek, and French descent. Beginning in the mid 70s, the Japanese were expressing considerable interest in North American urchins and by 1986, the value of sea urchins was increasing rapidly. During 1987, the sea urchin fishery in Maine expanded rapidly as a result of Japanese interest in our product. Table 5 show that landings peaked in 1993 at 42 million lbs and value peaked in 1995 at \$36 million. The fishery has steadily declined since then as a result of overfishing as well as size restrictions, and a shortened season.



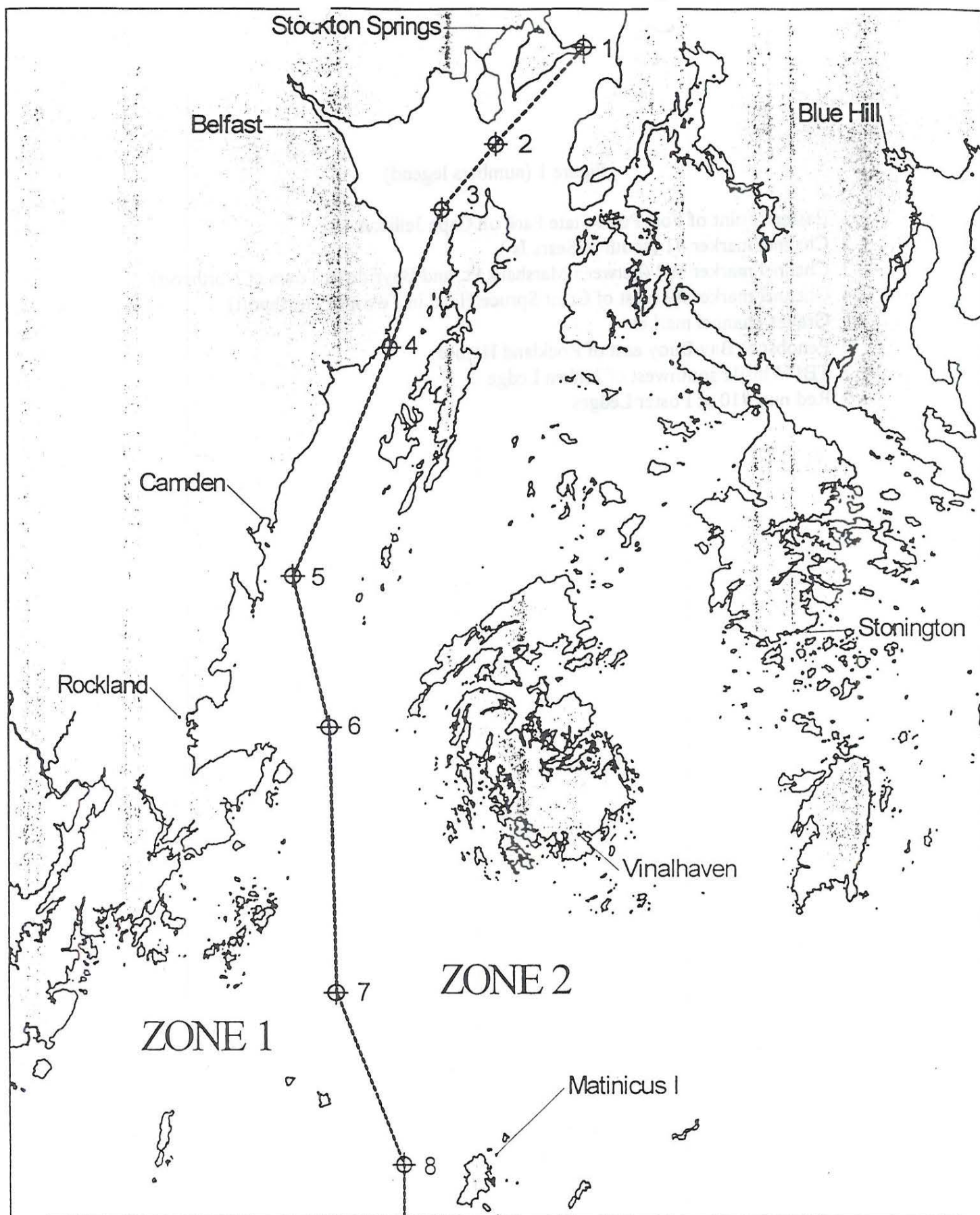


Figure 1. The Zone 1 - Zone 2 boundary through Penobscot Bay.  
(see following numbers legend)

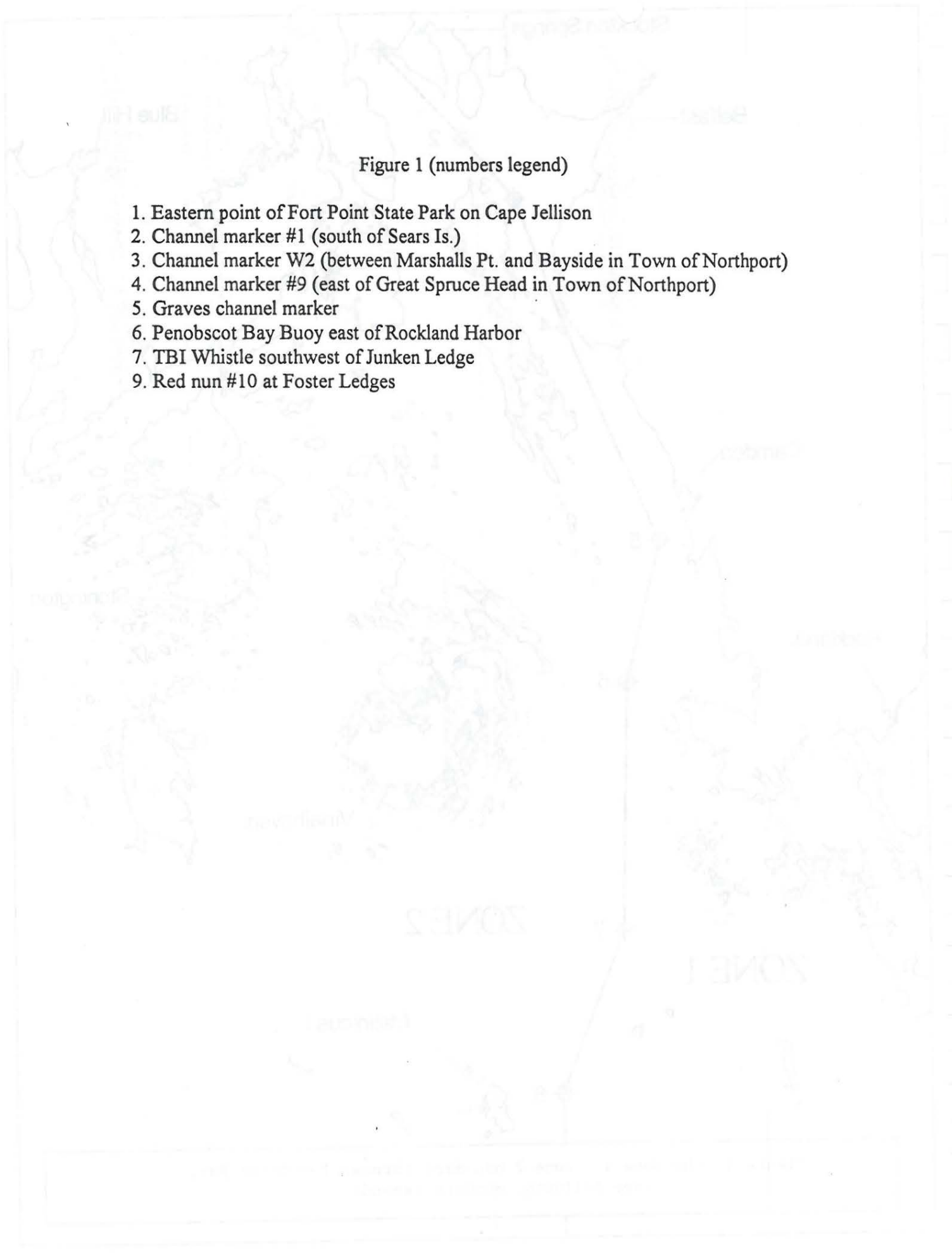
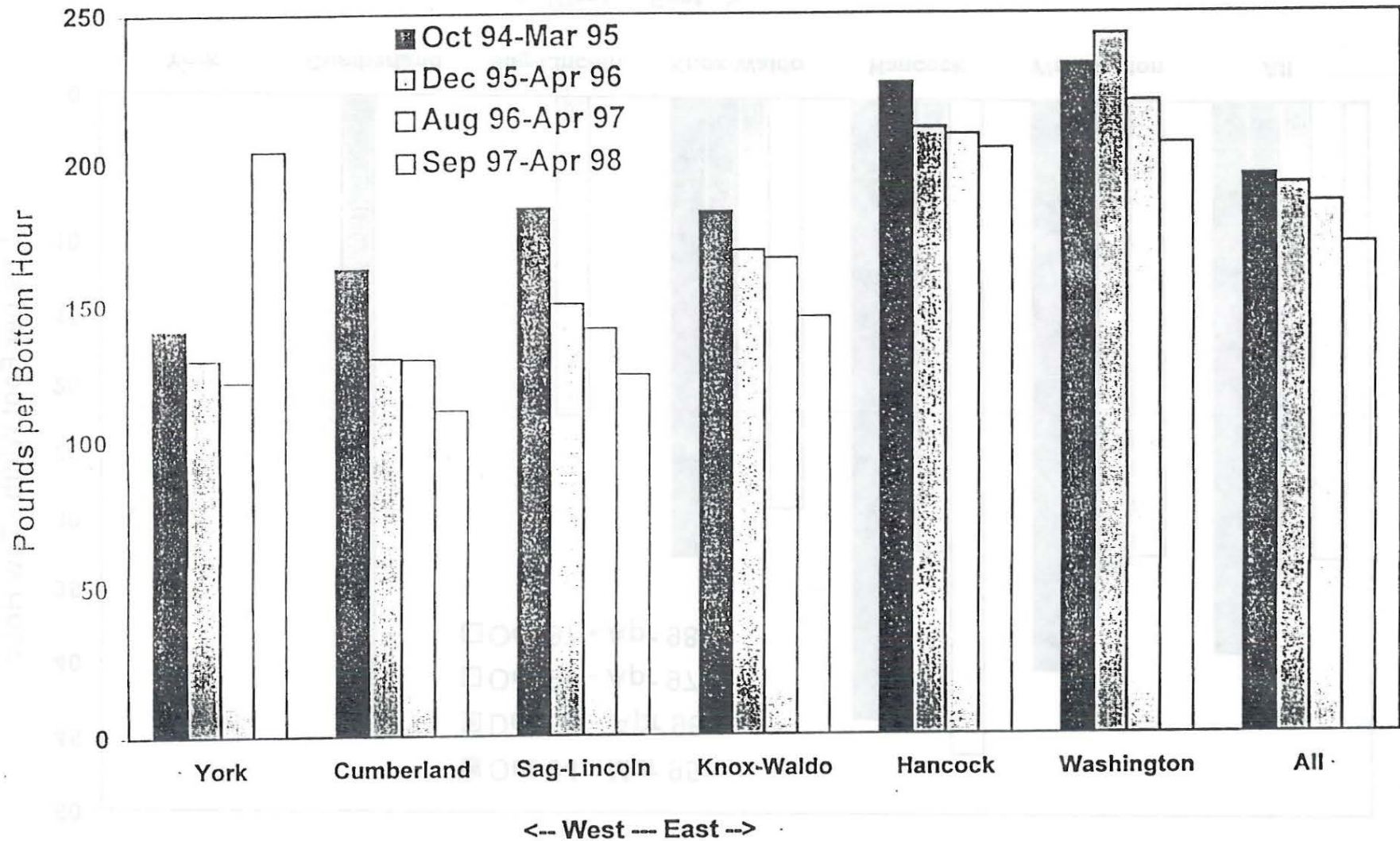


Figure 1 (numbers legend)

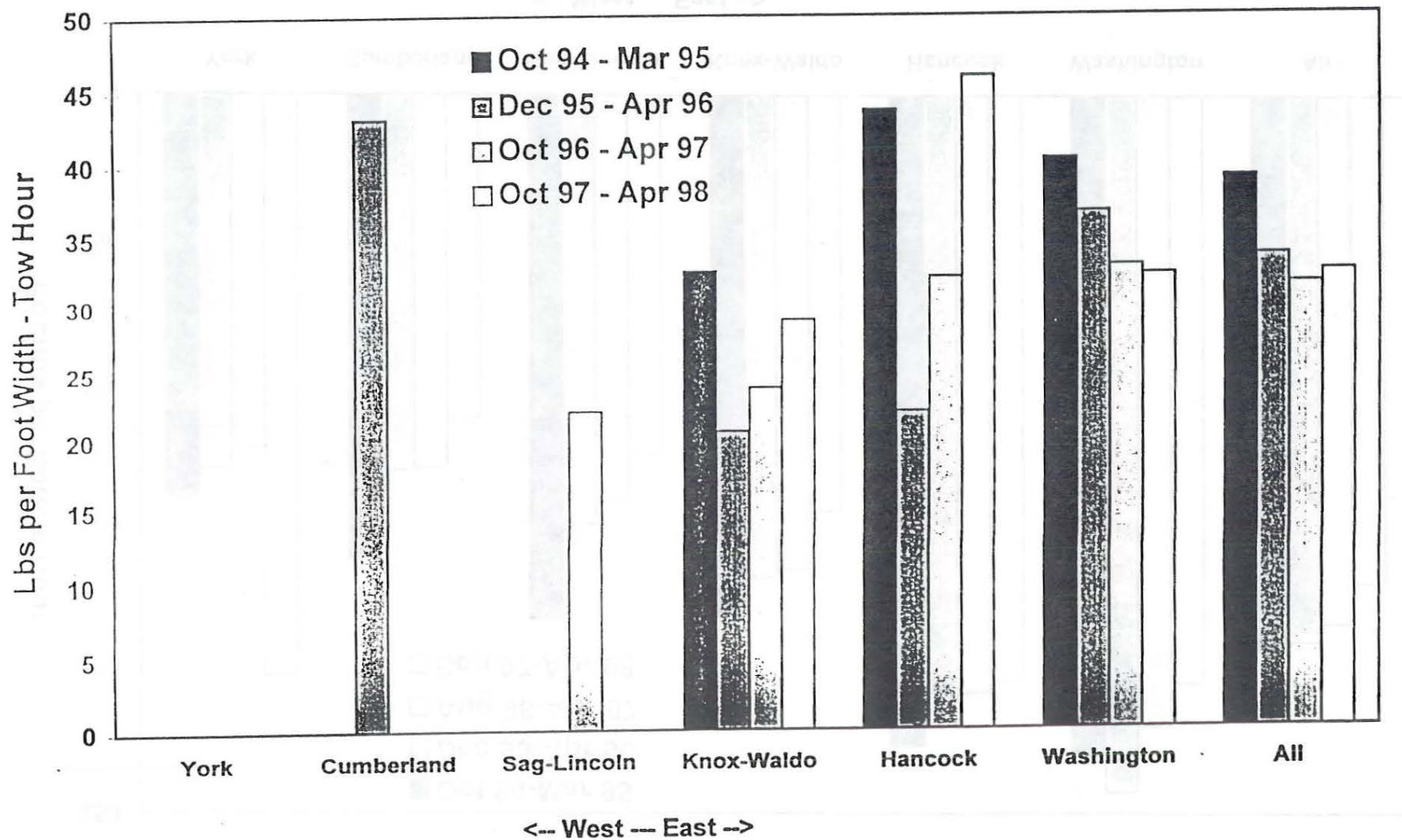
1. Eastern point of Fort Point State Park on Cape Jellison
2. Channel marker #1 (south of Sears Is.)
3. Channel marker W2 (between Marshalls Pt. and Bayside in Town of Northport)
4. Channel marker #9 (east of Great Spruce Head in Town of Northport)
5. Graves channel marker
6. Penobscot Bay Buoy east of Rockland Harbor
7. TBI Whistle southwest of Junken Ledge
9. Red nun #10 at Foster Ledges



# Maine Sea Urchin Diver Catch/Effort by Year and County



## Maine Sea Urchin Dragger Catch/Effort by Year and County



(B)

# Maine Sea Urchin Diameters, Zone 1 from Sampled Catches\*, 1997 - 1998

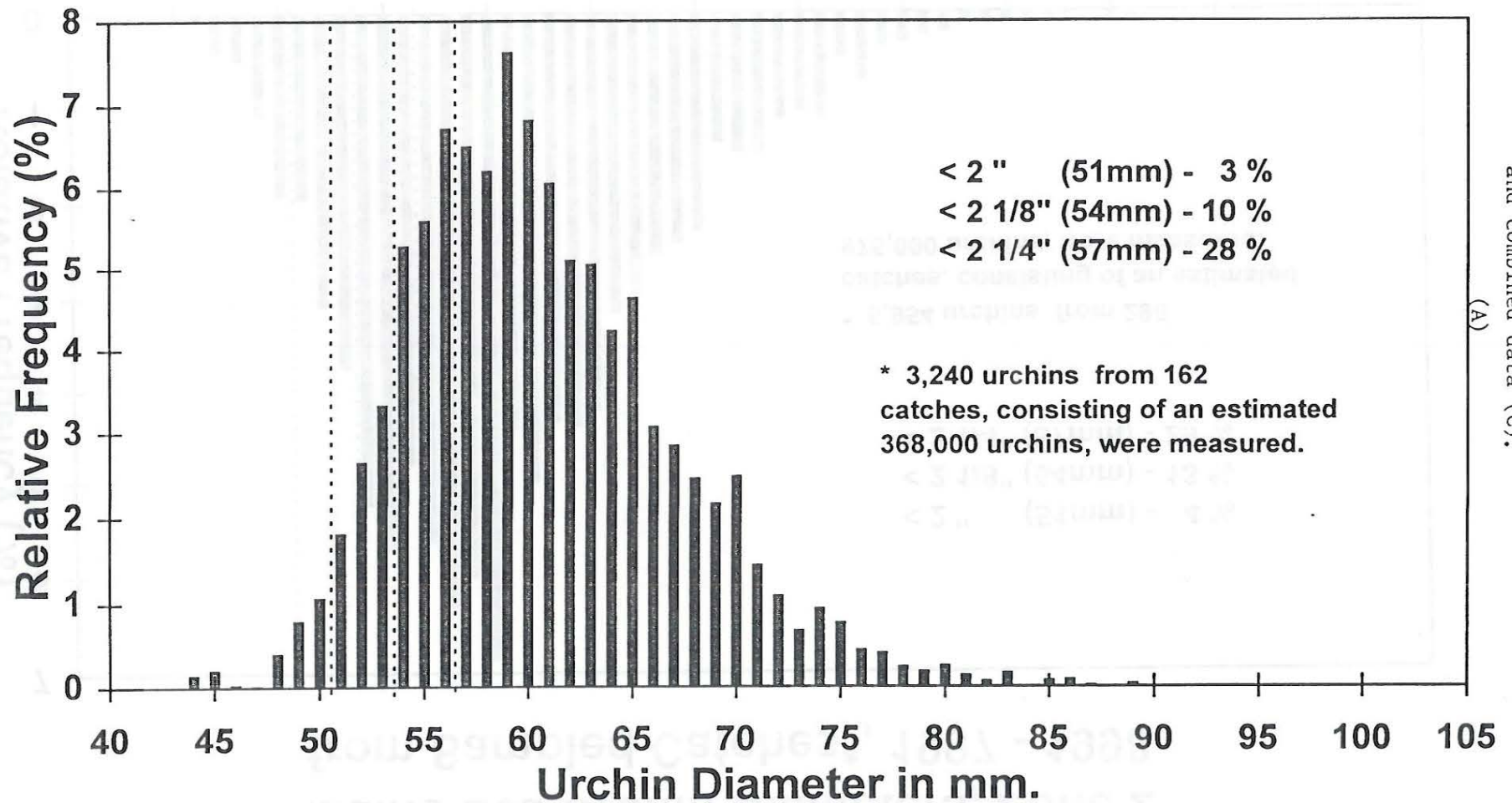
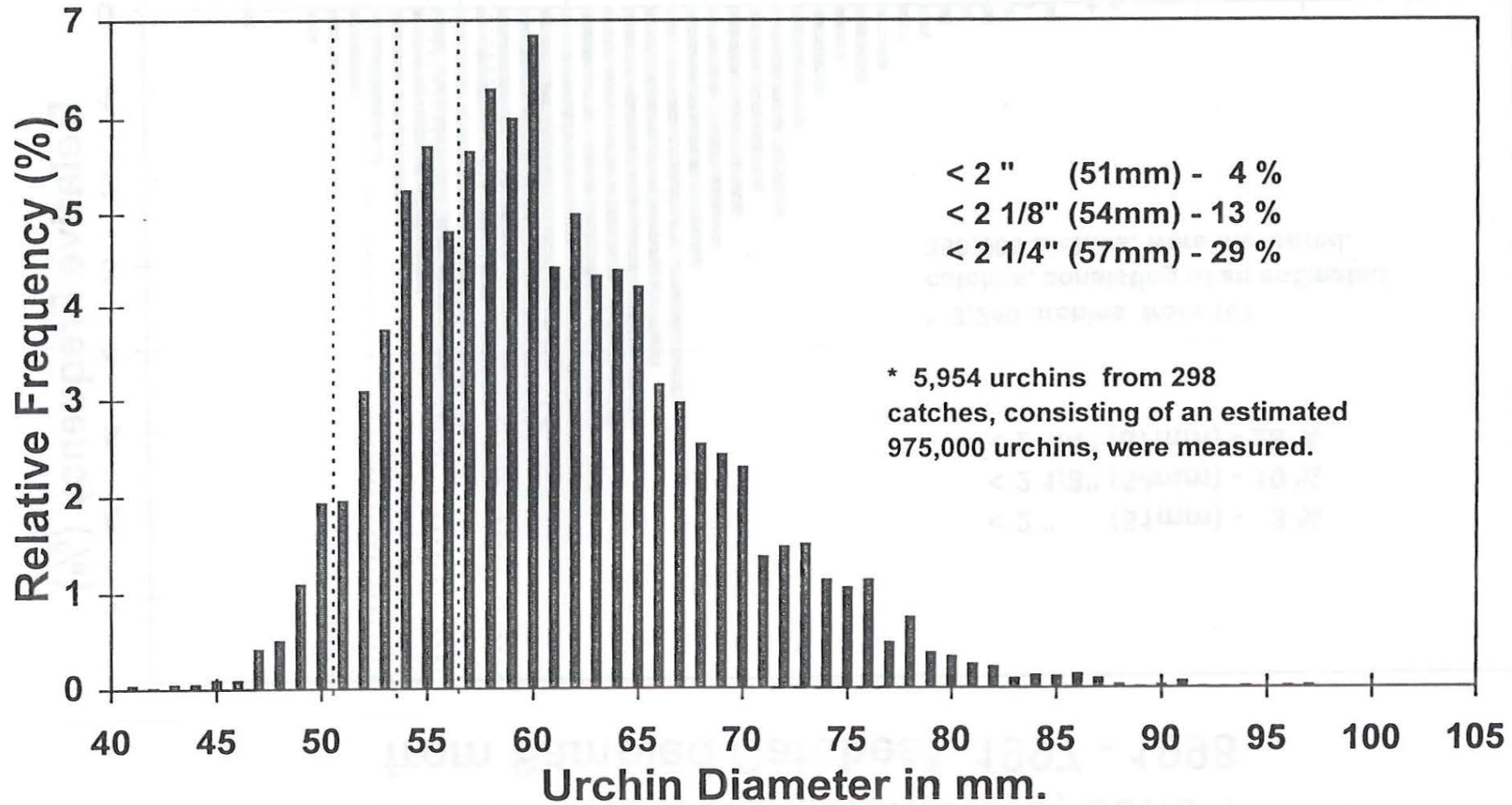


Figure 3  
Urchin diameters from catches sampled in Zone 1 (A), Zone 2 (B)  
and combined data (C).



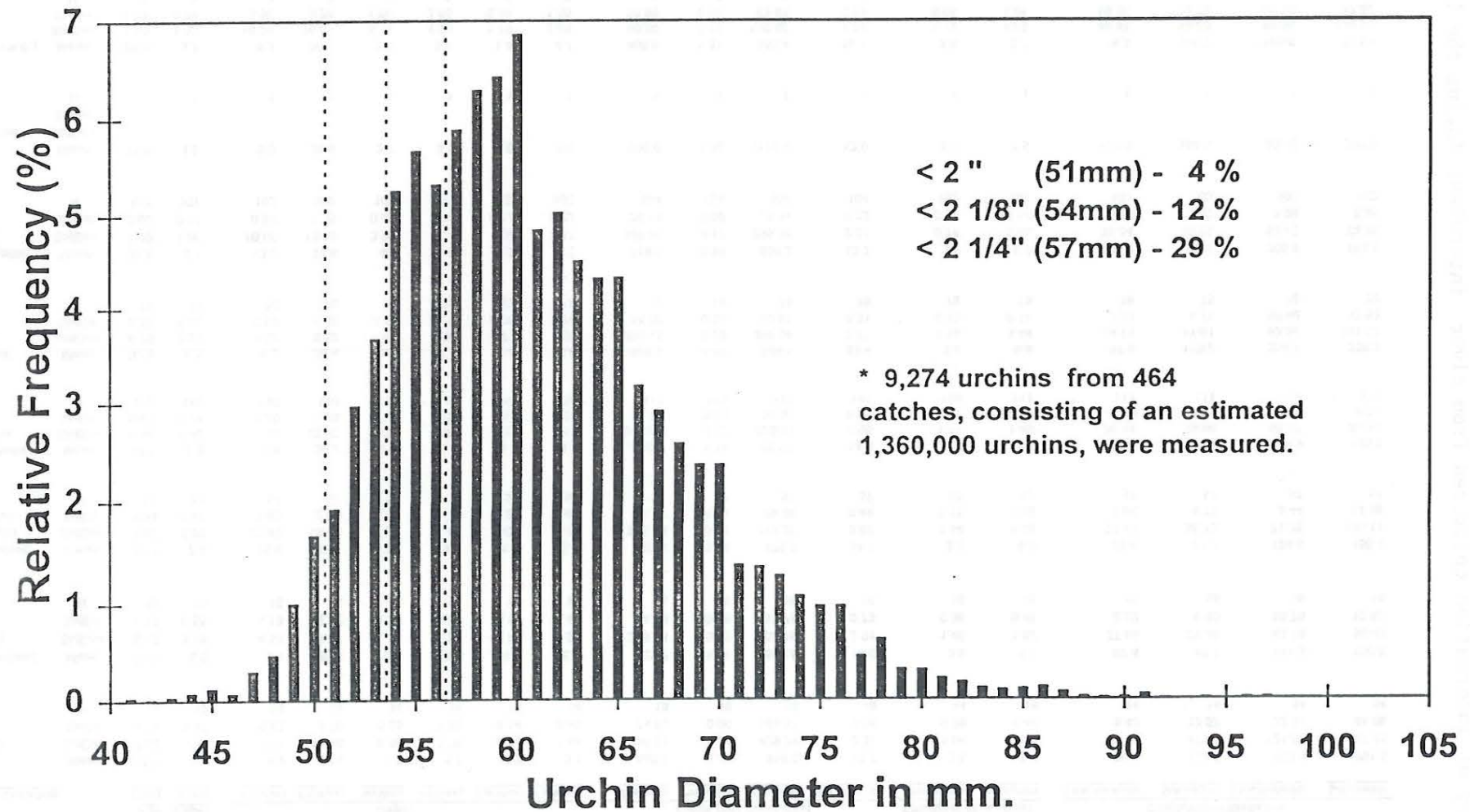
## Maine Sea Urchin Diameters, Zone 2 from Sampled Catches\*, 1997 - 1998



(B)



## Maine Sea Urchin Diameters from Sampled Catches\*, 1997 - 1998



# Maine Sea Urchin Diver Catch/Effort Summary for 1997-1998

| Catch Location                     |        | Age<br>(Yrs) | Exper<br>(Yrs) | Depth   |         |        |        |         |         | Catch (per Diver-Day) |          |           |           | Effort(per Diver-Day) |         | Catch/Effort Statistics |           |            |           |
|------------------------------------|--------|--------------|----------------|---------|---------|--------|--------|---------|---------|-----------------------|----------|-----------|-----------|-----------------------|---------|-------------------------|-----------|------------|-----------|
|                                    |        |              |                | Ft(Min) | Ft(Max) | M(Min) | M(Max) | Fa(Min) | Fa(Max) | Pounds                | Price/Lb | Value(\$) | Net Roe % | BottomHrs             | AwayHrs | Lbs/AwayHr              | \$/AwayHr | Lbs/BoatHr | \$/BoatHr |
| York<br>County                     | Mean   | 35.7         | 7.1            | 4.2     | 18.6    | 1.3    | 5.7    | 0.7     | 3.1     | 665.6                 | 1.42     | 918.0     | 13.7      | 3.6                   | 7.4     | 90.1                    | 131.5     | 203.9      | 291.3     |
|                                    | StdDev | 7.66         | 1.71           | 3.07    | 10.10   | 0.94   | 3.08   | 0.51    | 1.68    | 316.21                | 0.24     | 429.24    | 2.37      | 1.04                  | 1.81    | 31.49                   | 47.02     | 121.86     | 167.85    |
|                                    | StdErr | 1.91         | 0.47           | 0.82    | 2.70    | 0.25   | 0.82   | 0.14    | 0.45    | 74.53                 | 0.06     | 101.17    | 0.56      | 0.28                  | 0.48    | 8.42                    | 12.57     | 32.57      | 44.86     |
|                                    | N      | 16           | 13             | 14      | 14      | 14     | 14     | 14      | 14      | 18                    | 18       | 18        | 18        | 14                    | 14      | 14                      | 14        | 14         | 14        |
| Cumberland<br>County               | Mean   | 36.0         | 6.9            | 9.1     | 30.4    | 2.8    | 9.3    | 1.5     | 5.1     | 423.2                 | 1.41     | 559.8     | 14.0      | 3.9                   | 6.3     | 67.4                    | 89.1      | 111.3      | 150.8     |
|                                    | StdDev | 6.12         | 2.18           | 4.54    | 11.67   | 1.38   | 3.56   | 0.76    | 1.94    | 219.83                | 0.32     | 255.16    | 2.91      | 1.46                  | 1.82    | 27.66                   | 25.59     | 43.18      | 50.49     |
|                                    | StdErr | 1.53         | 0.55           | 1.13    | 2.92    | 0.35   | 0.89   | 0.19    | 0.49    | 54.96                 | 0.08     | 63.79     | 0.73      | 0.36                  | 0.46    | 6.92                    | 6.40      | 10.79      | 12.62     |
|                                    | N      | 16           | 16             | 16      | 16      | 16     | 16     | 16      | 16      | 16                    | 16       | 16        | 16        | 16                    | 16      | 16                      | 16        | 16         | 16        |
| Sagadahoc<br>- Lincoln<br>Counties | Mean   | 32.4         | 7.8            | 10.9    | 30.4    | 3.3    | 9.3    | 1.8     | 5.1     | 387.5                 | 1.24     | 475.9     | 14.7      | 3.3                   | 6.0     | 66.0                    | 81.3      | 124.6      | 156.1     |
|                                    | StdDev | 7.85         | 5.09           | 12.05   | 18.03   | 3.67   | 5.49   | 2.01    | 3.00    | 182.08                | 0.31     | 219.37    | 3.67      | 1.14                  | 1.48    | 27.48                   | 35.73     | 71.25      | 110.11    |
|                                    | StdErr | 1.04         | 0.67           | 1.60    | 2.39    | 0.49   | 0.73   | 0.27    | 0.40    | 24.12                 | 0.04     | 29.06     | 0.49      | 0.15                  | 0.20    | 3.64                    | 4.73      | 9.44       | 14.58     |
|                                    | N      | 57           | 57             | 57      | 57      | 57     | 57     | 57      | 57      | 57                    | 57       | 57        | 57        | 57                    | 57      | 57                      | 57        | 57         | 57        |
| Knox-Waldo<br>Counties             | Mean   | 33.7         | 6.8            | 7.8     | 26.2    | 2.4    | 8.0    | 1.3     | 4.4     | 517.7                 | 1.31     | 665.0     | 14.0      | 3.7                   | 7.4     | 70.6                    | 89.8      | 145.9      | 185.8     |
|                                    | StdDev | 6.48         | 2.48           | 7.35    | 12.92   | 2.24   | 3.94   | 1.22    | 2.15    | 241.62                | 0.32     | 325.63    | 2.66      | 1.11                  | 1.49    | 30.44                   | 39.08     | 66.97      | 86.40     |
|                                    | StdErr | 0.62         | 0.24           | 0.70    | 1.23    | 0.21   | 0.38   | 0.12    | 0.21    | 22.93                 | 0.03     | 30.91     | 0.25      | 0.11                  | 0.14    | 2.89                    | 3.71      | 6.39       | 8.24      |
|                                    | N      | 110          | 110            | 110     | 110     | 110    | 110    | 110     | 110     | 111                   | 111      | 111       | 111       | 110                   | 111     | 111                     | 111       | 110        | 110       |
| Hancock<br>County                  | Mean   | 32.9         | 6.1            | 6.2     | 20.4    | 1.9    | 6.2    | 1.0     | 3.4     | 678.5                 | 1.17     | 789.1     | 13.4      | 3.5                   | 6.9     | 97.9                    | 113.2     | 204.3      | 236.3     |
|                                    | StdDev | 6.75         | 2.28           | 4.62    | 9.52    | 1.41   | 2.90   | 0.77    | 1.59    | 300.25                | 0.25     | 358.68    | 2.77      | 1.15                  | 1.44    | 34.71                   | 41.61     | 92.56      | 111.57    |
|                                    | StdErr | 0.76         | 0.26           | 0.52    | 1.08    | 0.16   | 0.33   | 0.09    | 0.18    | 34.00                 | 0.03     | 40.61     | 0.31      | 0.13                  | 0.16    | 3.93                    | 4.71      | 10.48      | 12.63     |
|                                    | N      | 78           | 78             | 78      | 78      | 78     | 78     | 78      | 78      | 78                    | 78       | 78        | 78        | 78                    | 78      | 78                      | 78        | 78         | 78        |
| Washington<br>County               | Mean   | 33.8         | 6.1            | 13.0    | 32.8    | 4.0    | 10.0   | 2.2     | 5.5     | 718.6                 | 0.91     | 650.2     | 13.7      | 3.5                   | 6.7     | 109.3                   | 98.7      | 205.8      | 185.1     |
|                                    | StdDev | 7.02         | 1.76           | 10.05   | 13.59   | 3.06   | 4.14   | 1.67    | 2.27    | 303.30                | 0.19     | 295.08    | 2.21      | 0.74                  | 1.45    | 38.84                   | 36.85     | 83.42      | 74.28     |
|                                    | StdErr | 0.69         | 0.17           | 0.99    | 1.35    | 0.30   | 0.41   | 0.17    | 0.22    | 29.74                 | 0.02     | 28.94     | 0.22      | 0.07                  | 0.14    | 3.83                    | 3.63      | 8.26       | 7.35      |
|                                    | N      | 104          | 101            | 102     | 102     | 102    | 102    | 102     | 102     | 104                   | 104      | 104       | 104       | 102                   | 103     | 103                     | 103       | 102        | 102       |
| New<br>Hampshire                   | Mean   | 31.0         | 4.0            | 9.0     | 30.0    | 2.7    | 9.1    | 1.5     | 5.0     | 900.0                 | 1.30     | 1170.0    | 12.0      | 3.0                   | 7.5     | 120.0                   | 156.0     | 300.0      | 390.0     |
|                                    | StdDev |              |                |         |         |        |        |         |         |                       |          |           |           |                       |         |                         |           |            |           |
|                                    | StdErr |              |                |         |         |        |        |         |         |                       |          |           |           |                       |         |                         |           |            |           |
|                                    | N      | 1            | 1              | 1       | 1       | 1      | 1      | 1       | 1       | 1                     | 1        | 1         | 1         | 1                     | 1       | 1                       | 1         | 1          | 1         |
| Canada (N.B.)                      | Mean   | 27.0         | 3.7            | 8.3     | 26.7    | 2.5    | 8.1    | 1.4     | 4.4     | 406.6                 | 1.31     | 535.4     | 16.1      | 2.8                   | 5.7     | 78.3                    | 105.2     | 165.6      | 223.4     |
|                                    | StdDev | 1.00         | 1.53           | 10.21   | 16.07   | 3.11   | 4.90   | 1.70    | 2.68    | 50.20                 | 0.15     | 110.07    | 1.54      | 1.13                  | 1.76    | 33.87                   | 53.23     | 88.86      | 134.91    |
|                                    | StdErr | 0.58         | 0.88           | 5.90    | 9.28    | 1.80   | 2.83   | 0.98    | 1.55    | 28.99                 | 0.09     | 63.55     | 0.89      | 0.65                  | 1.01    | 19.55                   | 30.73     | 51.30      | 77.89     |
|                                    | N      | 3            | 3              | 3       | 3       | 3      | 3      | 3       | 3       | 3                     | 3        | 3         | 3         | 3                     | 3       | 3                       | 3         | 3          | 3         |
| All<br>Combined                    | Mean   | 33.5         | 6.6            | 9.3     | 27.3    | 2.8    | 8.3    | 1.5     | 4.6     | 587.8                 | 1.18     | 665.9     | 13.9      | 3.6                   | 6.8     | 86.6                    | 97.5      | 171.9      | 194.8     |
|                                    | StdDev | 6.94         | 2.86           | 8.80    | 14.02   | 2.68   | 4.27   | 1.47    | 2.34    | 292.54                | 0.32     | 330.46    | 2.75      | 1.05                  | 1.57    | 37.62                   | 40.20     | 86.79      | 101.17    |
|                                    | StdErr | 0.35         | 0.15           | 0.45    | 0.72    | 0.14   | 0.22   | 0.08    | 0.12    | 14.85                 | 0.02     | 16.78     | 0.14      | 0.05                  | 0.08    | 1.92                    | 2.05      | 4.45       | 5.18      |
|                                    | N      | 385          | 379            | 381     | 381     | 381    | 381    | 381     | 381     | 388                   | 388      | 388       | 388       | 381                   | 383     | 383                     | 383       | 381        | 381       |

# Table 2 Maine Seining Dragger Catch/Effort Summary for 1997-1998

A summary of information collected from dragger interviews during the 1997/1998 season.

Table 2

| Catch Location         |        | Boat<br>(Ft) | No. of<br>Crew | Depth   |         |        |        |         |         | Catch (per Dragger-Day) |          |           |           |
|------------------------|--------|--------------|----------------|---------|---------|--------|--------|---------|---------|-------------------------|----------|-----------|-----------|
|                        |        |              |                | Ft(Min) | Ft(Max) | M(Min) | M(Max) | Fa(Min) | Fa(Max) | Pounds                  | Price/Lb | Value(\$) | Net Roe % |
| Knox-Waldo<br>Counties | Mean   | 33.3         | 2.0            | 13.9    | 42.6    | 4.2    | 13.0   | 2.3     | 7.1     | 561.8                   | 0.98     | 564.5     | 11.4      |
|                        | StdDev | 5.10         | 0.43           | 11.25   | 12.90   | 3.43   | 3.93   | 1.88    | 2.15    | 346.19                  | 0.16     | 411.00    | 1.69      |
|                        | StdErr | 1.47         | 0.12           | 3.25    | 3.72    | 0.99   | 1.14   | 0.54    | 0.62    | 99.94                   | 0.05     | 118.65    | 0.49      |
|                        | N      | 12           | 12             | 12      | 12      | 12     | 12     | 12      | 12      | 12                      | 12       | 12        | 12        |
| Hancock<br>County      | Mean   | 33.6         | 2.2            | 18.2    | 39.0    | 5.5    | 11.9   | 3.0     | 6.5     | 715.8                   | 0.94     | 655.7     | 11.2      |
|                        | StdDev | 0.55         | 0.45           | 15.85   | 28.15   | 4.83   | 8.58   | 2.64    | 4.69    | 395.97                  | 0.17     | 341.07    | 1.79      |
|                        | StdErr | 0.24         | 0.20           | 7.09    | 12.59   | 2.16   | 3.84   | 1.18    | 2.10    | 177.08                  | 0.07     | 152.53    | 0.80      |
|                        | N      | 5            | 5              | 5       | 5       | 5      | 5      | 5       | 5       | 5                       | 5        | 5         | 5         |
| Washington<br>County   | Mean   | 35.7         | 2.2            | 16.2    | 62.3    | 4.9    | 19.0   | 2.7     | 10.4    | 608.2                   | 0.90     | 511.4     | 13.2      |
|                        | StdDev | 3.87         | 0.45           | 12.28   | 32.38   | 3.74   | 9.87   | 2.05    | 5.40    | 331.86                  | 0.40     | 345.83    | 3.80      |
|                        | StdErr | 0.55         | 0.06           | 1.74    | 4.58    | 0.53   | 1.40   | 0.29    | 0.76    | 46.47                   | 0.06     | 48.43     | 0.53      |
|                        | N      | 50           | 50             | 50      | 50      | 50     | 50     | 50      | 50      | 51                      | 51       | 51        | 51        |
| All<br>Combined        | Mean   | 35.1         | 2.2            | 15.9    | 57.0    | 4.9    | 17.4   | 2.7     | 9.5     | 607.9                   | 0.91     | 531.4     | 12.7      |
|                        | StdDev | 4.06         | 0.45           | 12.22   | 30.62   | 3.73   | 9.33   | 2.04    | 5.10    | 335.37                  | 0.36     | 354.38    | 3.48      |
|                        | StdErr | 0.50         | 0.05           | 1.49    | 3.74    | 0.46   | 1.14   | 0.25    | 0.62    | 40.67                   | 0.04     | 42.97     | 0.42      |
|                        | N      | 67.00        | 67.00          | 67.00   | 67.00   | 67.00  | 67.00  | 67.00   | 67.00   | 68.00                   | 68.00    | 68.00     | 68.00     |

| Catch Location         |        | Effort (per Dragger-Day) |          |          |          |         |            |         |         |           | Catch/Effort Statistics |          |          |             |             |            |          |          |             |            |
|------------------------|--------|--------------------------|----------|----------|----------|---------|------------|---------|---------|-----------|-------------------------|----------|----------|-------------|-------------|------------|----------|----------|-------------|------------|
|                        |        | Width(ft)                | Width(M) | Fish Hrs | Mins/Tow | Tows/Hr | Total Tows | Tow Hrs | Man-Hrs | Ft-TowHrs | Lbs/TowHr               | Kg/TowHr | Lb/ManHr | Lb/Ft-TowHr | Kg/Ft-TowHr | Kg/M-TowHr | \$/TowHr | \$/ManHr | \$/Ft-TowHr | \$/M-TowHr |
| Knox-Waldo<br>Counties | Mean   | 4.8                      | 1.5      | 5.7      | 14.1     | 3.6     | 20.3       | 4.2     | 15.2    | 19.8      | 136.5                   | 61.9     | 36.2     | 28.9        | 13.1        | 43.0       | 131.4    | 38.1     | 28.1        | 92.2       |
|                        | StdDev | 0.59                     | 0.18     | 1.60     | 5.23     | 2.18    | 12.83      | 1.67    | 4.27    | 8.04      | 61.49                   | 27.89    | 17.76    | 13.50       | 6.12        | 20.09      | 60.40    | 20.65    | 14.05       | 46.10      |
|                        | StdErr | 0.17                     | 0.05     | 0.46     | 1.51     | 0.63    | 3.70       | 0.48    | 1.23    | 2.32      | 17.75                   | 8.05     | 5.13     | 3.90        | 1.77        | 5.80       | 17.44    | 5.96     | 4.08        | 13.31      |
|                        | N      | 12                       | 12       | 12       | 12       | 12      | 12         | 12      | 12      | 12        | 12                      | 12       | 12       | 12          | 12          | 12         | 12       | 12       | 12          | 12         |
| Hancock<br>County      | Mean   | 4.9                      | 1.5      | 5.2      | 9.5      | 4.9     | 25.9       | 4.1     | 16.1    | 21.6      | 230.7                   | 104.6    | 58.4     | 45.9        | 20.8        | 68.3       | 206.0    | 50.7     | 41.2        | 131.4      |
|                        | StdDev | 0.65                     | 0.20     | 2.26     | 1.12     | 0.74    | 9.81       | 1.85    | 5.17    | 11.25     | 111.61                  | 50.63    | 34.79    | 23.00       | 10.43       | 34.23      | 79.79    | 22.59    | 17.95       | 58.90      |
|                        | StdErr | 0.29                     | 0.09     | 1.13     | 0.50     | 0.33    | 4.90       | 0.92    | 2.59    | 5.62      | 55.81                   | 25.31    | 17.40    | 11.50       | 5.22        | 17.12      | 39.90    | 11.30    | 8.98        | 29.45      |
|                        | N      | 5                        | 5        | 4        | 5        | 5       | 4          | 4       | 4       | 4         | 4                       | 4        | 4        | 4           | 4           | 4          | 4        | 4        | 4           | 4          |
| Washington<br>County   | Mean   | 5.3                      | 1.6      | 6.2      | 7.7      | 6.5     | 40.0       | 4.3     | 17.2    | 22.9      | 170.7                   | 77.4     | 37.6     | 32.3        | 14.6        | 48.0       | 137.5    | 30.5     | 25.9        | 85.0       |
|                        | StdDev | 0.66                     | 0.20     | 1.70     | 4.12     | 3.02    | 23.67      | 1.73    | 5.61    | 9.67      | 138.40                  | 62.78    | 21.08    | 25.09       | 11.38       | 37.34      | 115.36   | 19.22    | 20.94       | 68.70      |
|                        | StdErr | 0.09                     | 0.03     | 0.24     | 0.58     | 0.43    | 3.35       | 0.24    | 0.79    | 1.37      | 19.57                   | 8.88     | 2.98     | 3.55        | 1.61        | 5.28       | 16.31    | 2.72     | 2.96        | 9.72       |
|                        | N      | 50                       | 50       | 50       | 50       | 50      | 50         | 50      | 50      | 50        | 50                      | 50       | 50       | 50          | 50          | 50         | 50       | 50       | 50          | 50         |
| All<br>Combined        | Mean   | 5.1                      | 1.6      | 6.0      | 9.0      | 5.8     | 35.5       | 4.3     | 16.7    | 22.2      | 168.2                   | 76.3     | 38.6     | 32.5        | 14.7        | 48.4       | 140.5    | 32.7     | 27.2        | 89.4       |
|                        | StdDev | 0.67                     | 0.20     | 1.71     | 4.81     | 2.98    | 22.77      | 1.70    | 5.35    | 9.42      | 126.82                  | 57.53    | 21.69    | 23.31       | 10.57       | 34.68      | 105.97   | 20.00    | 19.81       | 64.98      |
|                        | StdErr | 0.08                     | 0.02     | 0.21     | 0.59     | 0.36    | 2.80       | 0.21    | 0.66    | 1.16      | 15.61                   | 7.08     | 2.67     | 2.87        | 1.30        | 4.27       | 13.04    | 2.46     | 2.44        | 8.00       |
|                        | N      | 67                       | 67       | 66       | 67       | 67      | 66         | 66      | 66      | 66        | 66                      | 66       | 66       | 66          | 66          | 66         | 66       | 66       | 66          | 66         |



Table 3

A summary of selected information collected from diver and dragger interviews during 1995/1996, 1996/1997, and 1997/1998 sampling seasons.

| <u>Divers</u>                                 | <u>1995/1996</u>                  | <u>1996/1997</u>                  | <u>1997/1998</u>                  |
|-----------------------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|
| Mean diver age $\pm$ ISE                      | 32.3 $\pm$ .49                    | 32.8 $\pm$ .34                    | 33.5 $\pm$ .35                    |
| Mean range of harvest depths (ft) $\pm$ ISE   | 14.5 $\pm$ .72 - 31.7 $\pm$ .97   | 8.4 $\pm$ .37 - 24.5 $\pm$ .64    | 9.3 $\pm$ .45 - 27.3 $\pm$ .72    |
| Mean catch (lbs) per diver day $\pm$ ISE      | 558.7 $\pm$ 23.76                 | 606.7 $\pm$ 14.79                 | 587.8 $\pm$ 14.85                 |
| Mean % roe $\pm$ ISE                          | 13.3 $\pm$ .28                    | 12.2 $\pm$ .11                    | 13.9 $\pm$ .14                    |
| Mean no. bottom hrs. $\pm$ ISE                | 3.0 $\pm$ .08                     | 3.4 $\pm$ .05                     | 3.6 $\pm$ .05                     |
| <u>Draggers</u>                               |                                   |                                   |                                   |
| Mean boat length ( $\pm$ ISE)                 | 34.3 $\pm$ .62                    | 35.1 $\pm$ .40                    | 35.1 $\pm$ .50                    |
| Mean range of harvest depths ( $\pm$ ISE)     | 18.1 $\pm$ 2.54 - 43.6 $\pm$ 3.56 | 22.6 $\pm$ 3.04 - 54.8 $\pm$ 3.96 | 15.9 $\pm$ 1.49 - 57.0 $\pm$ 3.74 |
| Mean catch (lbs) per dragger day ( $\pm$ ISE) | 444.3 $\pm$ 35.21                 | 526.6 $\pm$ 40.78                 | 607.9 $\pm$ 40.67                 |
| Mean % roe ( $\pm$ ISE)                       | 15.2 $\pm$ .63                    | 13.4 $\pm$ .47                    | 12.7 $\pm$ .42                    |
| Mean no. of hrs. fished ( $\pm$ ISE)          | 5.01 $\pm$ .27                    | 5.4 $\pm$ .23                     | 6.0 $\pm$ .21                     |
| Mean minutes per tow ( $\pm$ ISE)             | 8.33 $\pm$ .59                    | 7.4 $\pm$ .35                     | 9.0 $\pm$ .59                     |
| Mean no. of tows per day ( $\pm$ ISE)         | 30.88 $\pm$ 3.02                  | 34.5 $\pm$ 2.01                   | 35.5 $\pm$ 2.80                   |



Table 4  
Diver and dragger CPUE information by county during the 94/95, 95/96, 96/97, and 97/98 seasons.

**Maine Sea Urchin Catch per Unit Effort  
1994-95 vs 1995-96 vs 1996-1997 vs 1997-1998**

| County of Catch   | Diver Lbs per Bottom Hour |       |     |                     |       |     |                     |       |     |                     |       |     |
|-------------------|---------------------------|-------|-----|---------------------|-------|-----|---------------------|-------|-----|---------------------|-------|-----|
|                   | Oct 1994 - Mar 1995       |       |     | Dec 1995 - Apr 1996 |       |     | Aug 1996 - Apr 1997 |       |     | Sep 1997 - Apr 1998 |       |     |
|                   | Mean                      | +S.E. | N   | Mean                | +S.E. | N   | Mean                | +S.E. | N   | Mean                | +S.E. | N   |
| York              | 141.2                     | 9.60  | 19  | 130.2               | 22.14 | 8   | 122.0               | 13.32 | 18  | 203.9               | 32.57 | 14  |
| Cumberland        | 163.6                     | 13.93 | 42  | 130.8               | 14.03 | 28  | 130.4               | 11.31 | 27  | 111.3               | 10.79 | 16  |
| Sagadahoc-Lincoln | 184.7                     | 10.72 | 76  | 150.9               | 11.80 | 38  | 141.7               | 8.14  | 47  | 124.6               | 9.44  | 57  |
| Knox-Waldo        | 183.4                     | 10.43 | 88  | 170.0               | 13.69 | 27  | 167.2               | 7.27  | 101 | 145.9               | 6.39  | 110 |
| Hancock           | 226.4                     | 10.47 | 71  | 211.2               | 17.49 | 29  | 208.9               | 7.76  | 110 | 204.3               | 10.48 | 78  |
| Washington        | 232.7                     | 20.90 | 42  | 242.7               | 13.43 | 80  | 220.0               | 8.17  | 122 | 205.8               | 8.26  | 102 |
| All               | 195.4                     | 5.54  | 341 | 192.4               | 7.19  | 213 | 186.1               | 4.09  | 425 | 171.9               | 4.45  | 381 |

| County of Catch   | Dragger Lbs per Foot Width - Tow Hour |       |    |                     |       |    |                     |       |    |                     |       |    |
|-------------------|---------------------------------------|-------|----|---------------------|-------|----|---------------------|-------|----|---------------------|-------|----|
|                   | Oct 1994 - Mar 1995                   |       |    | Dec 1995 - Apr 1996 |       |    | Oct 1996 - Apr 1997 |       |    | Oct 1997 - Apr 1998 |       |    |
|                   | Mean                                  | +S.E. | N  | Mean                | +S.E. | N  | Mean                | +S.E. | N  | Mean                | +S.E. | N  |
| York              | -                                     | -     | 0  | -                   | -     | 0  | -                   | -     | 0  | -                   | -     | 0  |
| Cumberland        | -                                     | -     | 0  | 43.1                | 18.85 | 3  | -                   | -     | 0  | -                   | -     | 0  |
| Sagadahoc-Lincoln | -                                     | -     | 0  | -                   | -     | 0  | 22.1                | -     | 1  | -                   | -     | 0  |
| Knox-Waldo        | 32.5                                  | 4.77  | 17 | 20.6                | 5.19  | 9  | 23.9                | 4.66  | 10 | 28.9                | 3.90  | 12 |
| Hancock           | 43.6                                  | 11.89 | 24 | 22.1                | 3.26  | 3  | 32.1                | 4.84  | 12 | 45.9                | 11.50 | 4  |
| Washington        | 40.3                                  | 6.59  | 20 | 36.7                | 6.74  | 41 | 32.9                | 3.13  | 62 | 32.3                | 3.55  | 50 |
| All               | 39.1                                  | 5.13  | 63 | 33.7                | 5.14  | 56 | 31.6                | 2.45  | 85 | 32.5                | 2.87  | 66 |

Table 5

## Sea Urchin Landings and Value

|      | <u>Landings (lbs)</u> | <u>Value (\$)</u> | <u>Price/lb</u> |
|------|-----------------------|-------------------|-----------------|
| 1987 | 1,440,161             | 236,391.00        | 0.16            |
| 1988 | 6,221,604             | 1,758,805.00      | 0.28            |
| 1989 | 9,657,158             | 3,698,038.00      | 0.38            |
| 1990 | 13,227,430            | 5,955,975.00      | 0.45            |
| 1991 | 20,535,411            | 11,158,425.00     | 0.54            |
| 1992 | 26,739,442            | 15,322,447.00     | 0.57            |
| 1993 | 42,141,138            | 27,103,054.00     | 0.64            |
| 1994 | 38,295,612            | 33,081,336.00     | 0.86            |
| 1995 | 34,690,310            | 36,154,579.00     | 1.04            |
| 1996 | 25,839,600            | 28,983,365.00     | 1.12            |
| 1997 | 19,054,543            | 20,703,723.00     | 1.09            |

### Urchin Dealer/Processor Logbook Program, 1997-1998 Season

All sea urchin buyers and processors who buy urchins from harvesters in Maine, are required to maintain and submit log books in accordance with Title 12 - Chapter 623 §6759-S and DMR regulation Chapter 26.10. Failure to maintain a log book is a Class D crime. Logbook data are protected by the confidentiality provisions of Chapter 607 §6173.

We recorded the status of 66 buyers and 20 processors, at the end of the 1997/1998 season. About 36 of these were not buying urchins directly from harvesters in Maine; they were either buying in Canada, not buying at all, just trucking, or buying solely from other buyers. The remaining 50 dealers (and processors), who buy directly from harvesters, sent in a total of 298 monthly logbooks describing 33,712 lots of urchins purchased. Each description includes date, transaction location, license no., harvest method, pounds purchased, % roe (and test method) and price per lb.

A great deal of effort was expended in recording and tracking dealer compliance. If a logbook had not been received from a dealer by the 15th of the following month, a reminder was sent. It was not unusual for over half the dealers to be delinquent. Dealers who were more than two months late were reported to the Marine Patrol. Data from logbooks were entered, checked, and summarized to make many calculations and analysis of importance in sea urchin fishery management including:

- Landings in pounds and value in dollars per month by county and harvest method.
- Urchin roe content by month, location (zone) and harvest method.
- Daily price fluctuations.
- Numbers of harvester-fishing days, and number of active harvesters.
- Average harvester catch size.

### Sea Urchin Drag Study

The sea urchin drag study, recommended by both the Sea Urchin Zone Council and the Dept. of Marine Resources Advisory Council, consists of two parts; one conducted by DMR personnel and one contracted to Bigelow Laboratory personnel. The DMR study has been completed and a copy of the report entitled "Department of Marine Resources Sea Urchin Drag Study Report" by Edwin Creaser and Wayne Weeks, dated November 1998, is included as Appendix A.

Substantial progress has been reported for the contracted portion of the study which documents changes in the bottom habitat (flora, infauna, epifauna, physical structure) resulting from the use of different types of sea urchin drag gear (chain sweep, pipe drag, urchin drag). The final report on this study has not yet been received.

Information from both studies will provide useful information for recommending environmentally friendly drag gear types/ modifications which will have the least negative impact on the fishery and habitat.

### **Sea Urchin Tag Development Study**

An attempt to develop a highly visible, external, tagging method for green sea urchins was initiated in 1993. Initial attempts to solve this problem involved the use of rubber bands and cinch tags (which never remained in position for more than a few hours), colored nail polish and plastigrip (which abruptly peeled off), tags which perforated the test such as T-bar spaghetti tags and nylon and stainless steel screws (the use of which always eventually ended in death), tags glued to the surface of the test with superglue (which always resulted in a quick death), a drop of silver nitrate placed on a portion of the test rendered spineless with a pencil eraser (the resulting gray spot faded with time) and tags attached to the test with dental adhesives (which, despite many modifications in attachment, did not remain attached for suitable periods of time). No further attempts to develop a highly visible external tagging method will be undertaken until additional personnel are available to vigorously pursue this problem.



**Department of Marine Resources**  
**Sea Urchin Drag Study Report**

**Edwin P. Creaser**

**Wayne Weeks**

**November 1998**

Dept. of Marine Resources  
Sea Urchin Drag Study Report

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Wayne Weeks

Introduction

Considerable discussion has been voiced in recent years regarding the possible negative impact of sea urchin drag gear types upon the viability of legal and sublegal sea urchins (and other valuable marine resources) as well as the benthic sea urchin habitat itself. These concerns prompted the Sea Urchin Zone Council (SUZC) to unanimously recommend (11/14/96) that "... **DMR use some of the research fund to study the effects of urchin dragging.**" Information has been compiled and analyzed from three sources in an attempt to evaluate urchin dragging and recommend gear types/ modifications which are "ecologically/ environmentally friendly". These three sources include (1) information on the "condition" of urchins recorded during commercial port sampling of the dive and drag catch, (2) a DMR drag study involving sea samplers who rode commercial urchin draggers and collected information on the boats, drag types, and tows and (3) a drag/ habitat study, contracted to Bigelow lab personnel, which recorded the effects of dredges on the benthic urchin habitat. Results obtained from commercial port sampling studies (1) and sea sampling (2) above will be addressed in this report.

A rational discussion of sea urchin dragging is not possible without knowledge of the dredge types used in this fishery. Most drags can be categorized into one of four distinct types. A fifth category (hybrids) has been added as a "catch all" for drags which cannot be categorized. Sea urchin drag gear types are described as follows.

Chain Sweeps

Chain sweeps (Figure 1) are heavy drags used in the scallop fishery. The towing cable is attached to a heavy head bail which, in turn, is attached directly to the lower corners of a frame consisting of a dive or pressure plate (top) and a cutting bar (bottom). Some variations do not include the cutting bar. Generally, skids (shoes) are present on the bottom of the dredge near each end of the cutting bar. Several heavy fishing chains (sweep chains) are hung in an arc from either side of the back of the frame. Lighter rock chains are attached to the cutting bar and hung parallel to one another between the fishing chains, creating chain windows of various sizes. Chain sweeps are modified for the harvest of sea urchins with the addition of "built up" skids and the use of lighter rock chains which are positioned closer together. The bag of the dredge is attached to the main fishing (sweep) chain (on the underside of the dredge) and consists of steel rings. The top of the bag is usually constructed of netting (forward) and rings (aft). Urchins are removed through a clubfoot at the lower end of the dredge.

Pipe Drags

Pipe drags (Figure 2) were designed as light urchin drags which could be wound up on a net reel. They are popular in a small section of coast (mostly Muscongus Bay). The towing cable



is attached to several short lengths of chain which, in turn, are attached directly to a heavily constructed axle with a wheel on either end. These wheels may or may not turn. The body of the drag, which consists of light fishing chains (fastened across) and rock chains (fastened lengthwise), is hung squarely or rectangularly from the axle. The top side of the drag body, constructed of netting, is also attached directly to the axle. No opening therefore exists at the forward end of the body and all urchins enter the drag through chain windows formed between the fishing and rock chains. The bag is constructed of netting with some type of chafing gear (poly, rope, rubber, rings, etc.) on the underside. The bag terminates in either a clubfoot or a cod end.

### "Urchin" Drags

"Urchin" drags (Figure 3) are lightly constructed drags designed specifically for harvesting sea urchins. Many variations of this gear type exist and no two are constructed exactly alike. The towing cable is attached to a light head bail which in turn is attached to the bottom of a lightly constructed frame. Rock stops may or may not be welded across the frame opening. Various numbers of leaf springs or flat bar are welded to the underside of the bail to act as skids. Wheels (cookies), may be attached to the frame and/or head bail in various locations. These attachments help keep the head bail up off the bottom. The bottom side of the drag body, which consists of light fishing chains (fastened across) and rock chains (fastened lengthwise), is hung squarely or rectangularly from the underside of the frame. Urchins enter the drag through chain windows formed between the fishing and rock chains. The top side of the drag body is constructed of netting. The bag is constructed of netting with some type of chafing material (poly, rope, rubber, rings, etc.) on the underside and it terminates in either a clubfoot or a cod end.

### Runtz Drags

The Runtz drag (Figure 4) was originally designed for the harvest of periwinkles. The towing cable is attached to several short chains which in turn are attached to a support rod or bar welded across the front end of the dredge frame. Wheels (cookies) may be associated with this support rod or bar. Runtz drag types are easily identified by the unique design of the frame and skids. Skid plates or rods of various numbers and dimensions, are wrapped entirely around the front of the drag frame. The bottom side of the drag body, which consists of light fishing and rock chains, is hung squarely or rectangularly from either the forward or back portion of the drag frame. Urchins enter the drag through chain windows formed between the fishing and rock chains and the skid plates or bars. The top side of the drag body is usually constructed of netting but portions may be constructed from other materials as well. The bag is constructed of netting with some type of chafing gear (poly rope, rubber, rings, etc.) on the underside and it terminates in either a clubfoot or cod end.

### Hybrids

The "hybrid" category includes drags with characteristics of both light urchin drags and heavy scallop type chain sweeps, as well as "odd ball" types which do not appear to fit into any category already described. Examples of drags which belong in this category would include: light



framed urchin drags with heavy sweep chains; heavy chainsweep bails in front of light, square hung, drag bodies; rock drag frames (a type of scallop gear) with sweep chains; drags with one sweep chain and chain windows of different sizes; and drags with skids the entire length of the dredge body.

#### **Drag impact observations on sea urchins recorded during port sampling studies**

We relied upon a dragger captain's statement as to whether his drag would be very broadly classified as a modified scallop type chain sweep or a sea urchin drag of some other type, during commercial drag interviews. It was not possible to categorize other types of drags used in the sea urchin fishery (pipe, "urchin", Runtz) because (1) time restraints during commercial port sampling do not permit visual inspection of drag gear and (2) it is not possible to inspect drag gear at buying stations which are frequently not located near the shore.

Commercial sampling of the catch from draggers (towing chain sweeps and other types of drags used in the fishery) and divers, routinely involved the random selection of 20 sea urchins from each harvester lot sold to the buyer. The information recorded by a DMR port sampler for each urchin sampled included: diameter, weight, sex, and condition. Condition factors of 1, 2, 3 were somewhat subjective in nature. A condition factor of 1 (CF1) indicated that the urchin appeared uninjured (active movement of spines and podia, minimal spine loss, no bare spots) and there was no reason to doubt that it would survive if released immediately. A condition factor of 3 (CF3) indicated that the urchin appeared so severely damaged (little movement of spines and podia, considerable spine loss, perforated test, large bald areas) that there was no reason to believe that it would live if released immediately. A condition factor of 2 (CF2) indicated that there was some damage to the individual and no way to determine if the individual would live or die.

A summary of the sea urchin condition factors (CF1, CF2, CF3) recorded by commercial port samplers during the 1996/1997 and 1997/1998 urchin seasons, is presented in Table 1. It is evident from these data that 74-79% of the urchins harvested by chain sweep(s), 83-86% of urchins harvested by other sea urchin drag gear types, and 99% of the urchins harvested by diving are CF1. **These results show that diving has the least negative impact on the condition of landed urchins, chainsweeps have the greatest negative impact, and other urchin drag gear types fall somewhere between these two extremes.**

#### **Drag impact observations on sea urchins recorded during sea sampling studies**

A drag study conducted by two sea samplers who rode commercial sea urchin draggers and collected information on boats, dredges, and tows, was initiated on 2/27/97. The combined responsibilities of these two sea samplers (coordinating trips, riding boats, and collecting information) proved impractical and sea samplers only completed 3 trips between 2/27/97-4/4/97 (the end of the season for Zone 2 draggers). Efforts to continue sea sampling during the 1997/1998 season were renewed when representatives of the Marine Resources Advisory Council



expressed concern over a proposed early start to the drag fishery season and the DMR Commissioner requested that a commitment be made to continue and complete the sea urchin drag study. The new study was modified to include a coordinator (Wayne Weeks), who phoned commercial drag fishermen and arranged trips, and two sea samplers; John Elwell (Zone 1) and Debrae Bishop (Zone 2). The credibility of this study is, in the senior author's opinion, enhanced by the qualifications of the coordinator and sea samplers. Wayne Weeks has had extensive experience in drag fisheries for urchins, scallops, Irish sea moss, shrimp, mussels, groundfish and whiting. He has also been a lobsterman (22 years), crabber, tuna fisherman, clammer, urchin tender, and elver fisherman. He is very familiar with long lines, tub trawls, and gillnets as well. He has been a NOAA observer for both the gillnet and pair trawl fisheries and a DMR observer on Russian processing vessels. John Elwell has had extensive experience as a lobster fisherman and has been involved in the drag fisheries for urchins and scallops. Debrae Bishop has had experience in the sea urchin dive fishery in Maine and the salmon gillnet and seine fishery in Alaska. She also has had some experience with the eel, mussel, groundfish, and lobster fisheries. She has been a NOAA observer for both the Northeast and Alaska regions and a DMR observer for the foreign herring fishery.

A summary of the sea urchin drag trips monitored by DMR sea samplers is shown in Table 2. Sea samplers collected information from 515 tows during 64 sea sampling trips. The proportions of each basic drag gear type sampled (chain sweep, pipe drag, "urchin" drag, Runtz drag, hybrid), roughly reflect the proportions of these drag gear types involved in the fishery and the willingness of different dragger type captains to allow sea samplers on board. An exception to this was the chain sweep. Many chain sweeps are licensed for urchins but urchins are by-catch while dragging for scallops. On four occasions, chain sweep operators were encountered who did not wish to cooperate in the study. Twenty-three trips were made in Zone 1 and forty-one in Zone 2. These 64 trips originated from 23 ports in Cumberland (1), Sagadahoc (3), Lincoln (3), Knox (16), Hancock (17), and Washington (24) Counties.

All field information was recorded on three drag survey forms entitled Boat, Dredge, and Tow (Table 3 A.B.C.). Recorded information was then entered on three Microsoft Excel spreadsheets.

#### **The analysis of drag impact observations on sea urchins recorded during sea sampling studies**

The analysis of drag data collected from 66 drags (no two constructed alike) assigned to 5 category types, is no easy task. It is complicated by such variables as: large differences in the numbers of drags observed in each drag category; differences in the subjective interpretations of different sea samplers on different boats; differences in the numbers of tows compared between boats; variations in bottom type, tow time, wind speed, wind direction, tow speed, sea state; probably variations in sea urchin abundance and even the presence or absence of sea cucumbers which cushion urchins in the drag bag. In our opinion, the presence of these variables negates the possibility of a sophisticated statistical analysis. Instead, we elected to simplify the analysis as much as possible by plotting mean values for the percent of critically damaged adult and juvenile sea urchins in each series of tows (recorded by one sea sampler on one trip using one gear type)



against a selected series of dredge characteristics (dredge type, mean tow length, mean percent fist sized and greater stones, dredge weight, dredge width, chain window size, mean depth fished, and the presence of wheels/ skids) and inspect the resulting scatter diagrams for trends which might suggest some relationship. The results of these inspections reveal the following.

The relationship between the percent of critically damaged urchins and the type of drag

The relationship of percent critically damaged urchins to drag type is shown in Figure 5. It is evident that chain sweep catches are most variable and anywhere between 0-25% of the chain sweep catches and 0-15% of the hybrid, Runtz, and urchin catches, were critically damaged. Although pipe drag observations were few in number, the results consistently show that <5% were critically damaged.

The relationship between the percent of critically damaged urchins and the mean duration of drag tows

The relationship of percent critically damaged urchins to the mean duration of drag tows, is shown in Figure 6. It is evident that the duration of most tows does not exceed 11-12 minutes. Although chain sweep tows did not exceed 8 minutes, the variation in the percent of critically damaged urchins was greatest (0-24%). The data also shows that, regardless of the duration of the tows for pipe drags, few critically damaged urchins were reported. Results presented in Figure 6 do not confirm the belief that lengthy tows produce progressively more critically damaged urchins; dredge type probably has a bearing on the results.

The relationship between the size of chain windows and the percent of the catch consisting of fist sized and greater rocks

It seems reasonable to assume that the greater the size (sq. in.) of the chain windows (on the underside of the drag body), the more likely it becomes that the catch will consist of a greater percent of rocks which are fist sized or greater. This cannot be shown from the data presented in Figure 7. It is evident that few rocks which are fist sized and greater, were recorded from pipe and Runtz drags. It is also evident that there is great variation in the percent of rocks entering "urchin" type drags. Chain sweeps were not included in this plot because chain windows, in chain sweeps, are variable in size and irregular in shape, making it impractical to measure them.

The relationship between the percent of critically damaged urchins and the size of chain windows

It would seem logical to assume that an increase in the size of chain windows would result in an increase in the percent of fist sized and greater rocks, and this in turn would result in an increase in the percent of critically damaged urchins. Since a relationship between the size of chain windows and the percent of fist sized and greater rocks is not evident in Figure 7, it is not surprising that a relationship between the size of chain windows and the percent of critically damaged urchins (Figure 8) is also elusive. We are perplexed by this observation - a relationship between chain window size, the percent of fist sized and greater rocks, and the percent of critically damaged urchins should exist.

#### The relationship between the percent of critically damaged urchins and the weight of the drag

One would suspect that the percent of critically damaged urchins present would increase in heavier drags. The results in Figure 9 do not confirm this. The data does show that little critical damage is evident from lightweight pipe and Runtz drags. Figure 9 also shows that, although the greatest percent of critically damaged urchins were recorded from the heaviest chain sweep, the remainder of the heavy chainsweeps produced results which were similar to the lighter weight drags.

#### The relationship between the percent of critically damaged urchins and the width of the drag

The relationship of percent critically damaged urchins to the width of the drag is shown in Figure 10. Figure 10 suggests that a direct relationship may exist between the increased width of "urchin" drags and an increase in the percent of critically damaged urchins. Runtz and pipe drags on the other hand, show no such increase with increased drag width. A chain sweep of 66 inches width was responsible for the highest percent of critically damaged urchins.

#### The relationship between the percent of critically damaged urchins and the mean depth of dragging

The relationship between the percent of critically damaged urchins and the mean depth recorded during dragging is shown in Figure 11. The results suggest that there might be a slight decline in the percent of critically damaged urchins as "urchin" drags are fished deeper. Although chain sweep observations were few in number, the results show that the greatest percent of critically damaged urchins were attributed to a chain sweep fishing at a mean depth of 20 ft. A progressively lower percent of critically damaged urchins were recorded from chain sweeps fishing in progressively deeper water (up to 40 ft). Little critical damage to urchins was reported from pipe drags fished in 8-30 ft of water.

#### The relationship between the percent of critically damaged urchins and the presence/ absence of wheels/ skids on the drag

One might assume that any device (wheels/ skids) which raised the frame of a drag up off the sea bed would result in the accumulation of fewer rocks and other abrasive material, and a reduction in the percent of critically damaged urchins. Figure 12 does not confirm this assumption; the presence or absence of raised frames does not appear to alter the percent of critically damaged urchins. It is noteworthy that a chain sweep with raised frame (skids) was responsible for the highest percent of critically damaged urchins.

### **Lobster bycatch**

It was apparent, from the onset of the sea sampling study, that time restraints would not allow sea samplers to identify and weigh specific genus/species comprising animal and plant categories. However, when it became evident that the DMR Advisory Council was specifically



interested in the abundance, size, and condition of lobsters encountered during the drag study, an effort was made to document the observations of sea samplers despite harvester sensitivity to the drag/ lobster conflict issue.

One sea sampler reported that lobsters were not commonly encountered during the drag study. He estimated one lobster for every 7-8 tows and noted that lobsters encountered were small in size. The highest concentrations (one lobster for every 3-6 tows) were reported at Cutler and Owls Head. The second sea sampler also stated that lobsters were not commonly encountered and were usually crayfish sized. She estimated one small lobster for every 3-4 tows. The highest concentrations were recorded at Isle au Haut on 12/10/98 when 2-20 small lobsters were recorded on each of 6 tows. She also recorded 3-4 small lobsters per tow in the vicinity of Islesboro and Vinalhaven early during the urchin season. Damage to small lobsters was minimal. Only a few were observed with missing claws. Throughout the study, one dead lobster (44 mm) was recorded on 4/13/98 from a chain sweep.

### Recommendations

The intent of this drag study was never to outlaw drags used to harvest urchins. Indeed, good arguments both for and against their continued use have been aired. Drags, for instance, miss many urchins (on vertical surfaces, in crevices, under rocks, etc.) whereas divers are capable of harvesting nearly every visible urchin at shallow depths. Some drags, on the other hand, probably have a profound negative impact on the flora, fauna, and habitat associated with the bottom. It is also apparent from commercial sampling observations, that many sea urchin drag catches are excellent in quality and indistinguishable from dive catches.

Despite the many shortcomings of this study (previously mentioned), it is evident that different categories of drags appear to impact urchin quality to different degrees and it would seem prudent to recommend gear types/modifications which would result in the harvest of the smallest percent of critically damaged legal and sublegal urchins and hopefully impact the urchin habitat least. With this objective in mind, we will comment on (1) problems associated with chain sweeps, (2) the assets of pipe drags, (3) possible pipe drag modifications which would allow fishing in fast currents and deep water, and (4) the desirability of reinstating the DMR Fisheries Technology Services Division (previous directors were Ken Honey, Bob Spencer, Phil Averill) to deal with problems associated with gear and gear development. All comments will reflect on the need for additional studies.

#### Chain sweep problems

Information recorded to date (although limited in quantity) suggests that chainsweeps (Figure 1) are probably the least desirable means of harvesting urchins. Condition factors recorded by commercial port samplers, indicate that 21-26% of the commercial sized urchins harvested by chain sweeps during the 1996/1997 and 1997/1998 urchin seasons were CF2 and CF3 and there is no reason to believe that discarded sublegals fared any better. The limited information recorded from sea samplers indicated that the percentages of critically damaged legal and sublegal urchins, were most variable from chain sweeps. Despite their imperfections,



fishermen believe that heavy gear (the chainsweep) is essential to work at all stages of the rapid tidal currents encountered in Washington Co. They also believe that heavy gear is essential to work the deep beds (100-200 ft) containing high roe quality urchins along the Grand Manan Channel.

#### Pipe drag assets

The pipe drag (Figure 2) was designed specifically for urchin dragging by Paul Palino (Round Pond) and David Audio (Medomak). Although sea samplers only encountered pipe drags in limited numbers, it is noteworthy that (1) less than 5% of the urchins were critically damaged, (2) tow lengths up to 25 minutes produced few critically damaged urchins, (3) few rocks which were fist sized and greater were recorded from pipe (and Runtz) drags, and (4) differences in the size of pipe drag chain windows appear to have little effect upon the percent of critically damaged urchins.

Low mortality may be indirectly related to the manner in which the drag is constructed. No opening exists at the forward end of the drag body because both the top and bottom of the drag are attached to the axle. Everything therefore enters the drag through the chain windows. It is also important to note that the front of the pipe drag is raised up off the bottom on cookies or wheels which are either fixed or turn - greatly reducing their impact on the bottom habitat.

#### Possible pipe drag modifications for fishing deep/fast currents

It is the authors' belief that the use of chainsweeps for harvesting urchins should cease as soon as a viable substitute has been developed. The pipe drag could be modified to meet this need. The added weight required to fish in deep water and/or fast currents could be accomplished by the addition of a weighted cylinder. The weighted cylinder would consist of a small pipe within a large pipe and the space between the 2 pipes would be filled with cement or concrete. An axle would be inserted through the smaller pipe and wheels (which turn) would be added to both ends of the axle. The drag body would be attached to the cylinder and pulled behind it in typical pipe drag fashion. This heavy pipe drag would roll along the bottom on wheels and theoretically have minimal environmental impact. A lighter version of the same gear could also be constructed (no cement or concrete between the 2 pipes). Axle, wheels, and drag body could then be switched back and forth between light and heavy versions.

#### Reinstating DMR's Fisheries Technology Services Division

The drag study reported in this manuscript was designed and initiated with the belief that only information collected in conjunction with commercial harvesters, using commercial gear, on commercial fishing boats, during commercial fishing trips, would be considered valid by harvesters. Unfortunately, information collected with this approach, is influenced by such a multitude of variables (previously stated), that it becomes extremely difficult to interpret the results, and the need for a different approach is strongly suggested.

Future studies need to be contracted with a fisherman and his boat using one representative of each gear type (chain sweep, pipe drag, Runtz drag, urchin drag-omit the hybrids), which is not modified during any one set of experiments. The same standard bottom types (sandy, mud, cobble, boulder, etc., selected by DMR) should be used over and over again in each set of experiments and an effort should be made to standardize factors such as the numbers of tows using each gear type, tow length or time, tow speed, tidal condition, depth, and urchin abundance on the bottom.

The development/ modification of drag gear types which are "environmentally friendly" during the harvest of urchins (and other marine resources as well) dictates an all out effort which is directed specifically toward this goal (and none other) by a group of gear specialists (possibly engineers) working with fishermen. DMR should reactivate the Gear Development Division (previously called the Fisheries Technology Services Division) which was eliminated during State down sizing, and proceed in solving gear related problems. Sea urchin gear development studies within the Gear Development Division should include investigations of (1) wheels on drags (pipe drags), (2) differences in harvested sea urchin condition factors resulting from flush (as opposed to loose) attachment of sweep chains to rock chains, (3) the smallest chain window size which can be used effectively for urchins, and (4) the smallest effective chain sizes for sweep and rock chains used on sea urchin drag gear.

Table 1

**Sea Urchin Port Sampling  
Summary of Condition Factors**

| Source of<br>Urchins    | 1996/1997 Season  |       |       |      | 1997/1998 Season  |       |       |      |
|-------------------------|-------------------|-------|-------|------|-------------------|-------|-------|------|
|                         | % of Urchins with |       |       | N    | % of Urchins with |       |       | N    |
|                         | Condition Factor  |       |       |      | Condition Factor  |       |       |      |
|                         | 1                 | 2     | 3     |      | 1                 | 2     | 3     |      |
| Divers                  | 99.18             | 0.27  | 0.55  | 8776 | 98.53             | 0.25  | 1.23  | 7734 |
| All Draggers Combined   | 82.16             | 11.77 | 6.07  | 1878 | 82.00             | 9.27  | 8.73  | 1500 |
| All Chain Sweeps        | 74.43             | 15.72 | 9.85  | 598  | 78.53             | 9.41  | 12.06 | 340  |
| Chain Sweeps (Directed) | 72.20             | 17.36 | 10.44 | 478  | 75.50             | 11.00 | 13.50 | 200  |
| Chain Sweeps (By-Catch) | 83.33             | 9.17  | 7.50  | 120  | 82.86             | 7.14  | 10.00 | 140  |
| Other Urchin Drags      | 85.98             | 9.67  | 4.34  | 1220 | 82.82             | 9.36  | 7.82  | 1100 |

Condition Factor:   1 = uninjured, would definitely survive  
                           2 = injured, might live or die  
                           3 = mortally injured, would definitely die



Table 2

## Summary of sea urchin drag trips.

Drag Trip Summary

| <u>Trip No.</u> | <u>Date</u> | <u>BOAT</u><br><u>Boat Name</u> | <u>Length</u> | <u>Port</u>    | <u>County</u> | <u>Zone</u> | <u>Drag Type</u> | <u>No. Tows</u> | <u>Observer</u> |
|-----------------|-------------|---------------------------------|---------------|----------------|---------------|-------------|------------------|-----------------|-----------------|
| 1               | 2/27/97     | Miss Moonlight                  | 38.0          | Rockland       | Knox          | 1           | Urchin           | 11              | Etwell - Weeks  |
| 2               | 2/28/97     | Miss Moonlight                  | 38.0          | Rockland       | Knox          | 1           | Urchin           | 14              | Etwell - Weeks  |
| 3               | 3/3/97      | Lizzy B                         | 29.0          | Cundy's Hbr.   | Cumb.         | 1           | Urchin           | 11              | Etwell - Weeks  |
| 4               | 10/7/97     | Black Sheep                     | 37.0          | Lubec          | Wash          | 2           | Urchin           | 9               | Bishop          |
| 5               | 10/8/97     | Kadie & Karl                    | 35.0          | Lubec          | Wash          | 2           | Urchin           | 10              | Bishop          |
| 6               | 10/1/97     | Monica & Melodie                | 38.0          | NE Harbor      | Hancock       | 2           | Urchin           | 10              | Bishop          |
| 7               | 10/14/97    | Katie Sue                       | 38.0          | NE Harbor      | Hancock       | 2           | Urchin           | 10              | Bishop          |
| 8               | 10/28/97    | Alyssa Ann                      | 34.6          | Whiting River  | Wash          | 2           | Urchin           | 9               | Bishop          |
| 9               | 10/29/97    | Simone & Rachael                | 35.0          | Lubec          | Wash          | 2           | Urchin           | 10              | Bishop          |
| 10              | 10/30/97    | Nasty                           | 36.0          | Whiting River  | Wash          | 2           | Chain Sweep      | 9               | Bishop          |
| 11              | 11/10/97    | Lindy May                       | 37.0          | Whiting River  | Wash          | 2           | Chain Sweep      | 8               | Bishop          |
| 12              | 11/11/97    | Dan & Dave                      | 30.0          | Lubec          | Wash          | 2           | Urchin           | 2               | Bishop          |
| 13              | 11/13/97    | Lil Josh                        | 28.0          | Stonington     | Hancock       | 2           | Urchin           | 3               | Bishop          |
| 14              | 11/18/97    | Tonna P                         | 30.0          | Brooksville    | Hancock       | 2           | Urchin           | 10              | Bishop          |
| 15              | 11/20/97    | Michele Marie                   | 34.0          | Stonington     | Hancock       | 2           | Runtz            | 10              | Bishop          |
| 16              | 11/26/97    | Andrea Marie                    | 25.0          | Blue Hill      | Hancock       | 2           | Hybrid           | 10              | Bishop          |
| 17              | 11/10/97    | Susan-Jessica                   | 40.0          | Port Clyde     | Knox          | 1           | Urchin           | 3               | Etwell          |
| 18              | 11/11/97    | Odysseus                        | 38.0          | Camden         | Knox          | 1           | Urchin           | 7               | Etwell          |
| 19              | 11/20/97    | Daystar                         | 43.0          | Port Clyde     | Knox          | 1           | Urchin           | 6               | Etwell          |
| 20              | 11/26/97    | Bad Boyz II                     | 38.0          | Port Clyde     | Knox          | 1           | Urchin           | 9               | Etwell          |
| 21A             | 10/31/97    | Deidre Marie                    | 36.0          | Whiting River  | Wash          | 2           | Chain Sweep      | 3               | Bishop          |
| 21B             | 10/31/97    | Deidre Marie                    | 36.0          | Whiting River  | Wash          | 2           | Urchin           | 5               | Bishop          |
| 22              | 11/4/97     | Deuces Wild                     | 31.0          | Stonington     | Hancock       | 2           | Urchin           | 10              | Bishop          |
| 23              | 12/4/97     | N/A                             | 36.0          | Camden         | Knox          | 1           | Hybrid           | 9               | Etwell          |
| 24              | 12/9/97     | Martha J                        | 32.0          | Bremen         | Lincoln       | 1           | Pipe             | 6               | Etwell          |
| 25              | 12/10/97    | Denise's Way                    | 23.0          | Sebasco        | Sagad hoc     | 1           | Hybrid           | 3               | Etwell          |
| 26              | 12/4/97     | Stay-Sea                        | 34.0          | Naskeag        | Hancock       | 2           | Hybrid           | 10              | Bishop          |
| 27              | 12/9/97     | Hard Money                      | 34.0          | Stonington     | Hancock       | 2           | Urchin           | 10              | Bishop          |
| 28              | 12/10/97    | After U2                        | 34.0          | Stonington     | Hancock       | 2           | Urchin           | 8               | Bishop          |
| 29              | 12/12/97    | illy Poo + Alley Too            | 35.0          | Stonington     | Hancock       | 2           | Hybrid           | 7               | Bishop          |
| 30              | 12/16/97    | Echo + Joe                      | 32.0          | Sebasco        | Sagad hoc     | 1           | Hybrid           | 9               | Etwell          |
| 31              | 12/17/97    | Captin Zack                     | 30.0          | Hermit Is.     | Sagad hoc     | 1           | Pipe             | 10              | Etwell          |
| 32              | 12/16/97    | Jericho                         | 32.0          | Winter Harbor  | Hancock       | 2           | Urchin           | 7               | Bishop          |
| 33              | 12/18/97    | Linda + I                       | 40.0          | Lubec          | Wash          | 2           | Urchin           | 10              | Bishop          |
| 34              | 12/19/97    | Caitlin + Krista                | 36.0          | Lubec          | Wash          | 2           | Urchin           | 6               | Bishop          |
| 35              | 1/3/98      | Born Again                      | 35.0          | Port Clyde     | Knox          | 1           | Urchin           | 6               | Etwell          |
| 36              | 1/6/98      | 3 J's                           | 45.0          | Winter Harbor  | Hancock       | 2           | Chain Sweep      | 10              | Bishop          |
| 37              | 1/7/98      | Ester M                         | 25.0          | Millbridge     | Wash          | 2           | Urchin           | 10              | Bishop          |
| 38              | 1/6/98      | Steven + Ashley                 | 32.0          | Spruce Head    | Knox          | 1           | Urchin           | 7               | Etwell          |
| 39              | 1/12/98     | Zoe                             | 30.0          | New Harbor     | Lincoln       | 1           | Pipe             | 3               | Etwell          |
| 40              | 1/21/98     | Island Girl                     | 33.0          | Tenants Harbor | Knox          | 1           | Urchin           | 4               | Etwell          |
| 41              | 1/23/98     | Megan Donielle                  | 35.0          | Port Clyde     | Knox          | 1           | Urchin           | 2               | Etwell          |
| 42              | 1/27/98     | Melanie G                       | 34.0          | Beals          | Wash          | 2           | Runtz            | 9               | Bishop          |
| 43              | 1/28/98     | Odysseus                        | 38.0          | Camden         | Knox          | 1           | Urchin           | 6               | Etwell          |
| 44              | 2/1/98      | Daystar                         | 43.0          | Port Clyde     | Knox          | 1           | Urchin           | 8               | Etwell          |
| 45              | 2/2/98      | Samantha P                      | 39.0          | Jonesport      | Wash          | 2           | Urchin           | 10              | Bishop          |
| 46              | 2/3/97      | Patience                        | 38.0          | Jonesport      | Wash          | 2           | Runtz            | 10              | Bishop          |
| 47              | 2/4/98      | Rebecca Ann                     | 40.0          | Bucks Harbor   | Wash          | 2           | Urchin           | 11              | Bishop          |
| 48              | 2/2/98      | Mistress                        | 36.0          | Port Clyde     | Knox          | 1           | Urchin           | 7               | Etwell          |
| 49              | 2/4/98      | Bad Boyz II                     | 38.0          | Port Clyde     | Knox          | 1           | Urchin           | 4               | Etwell          |
| 50              | 2/10/98     | Miss Priss                      | 36.0          | Whiting River  | Wash          | 2           | Urchin           | 10              | Bishop          |
| 51              | 2/17/98     | Dirty Sally                     | 36.0          | Bremen         | Knox          | 1           | Pipe             | 5               | Etwell          |
| 52              | 2/23/98     | Susan Traci                     | 33.0          | Stonington     | Hancock       | 2           | Urchin           | 10              | Bishop          |
| 53              | 2/27/98     | Patrica Ann                     | 34.0          | Winter Harbor  | Hancock       | 2           | Chain Sweep      | 10              | Bishop          |
| 54              | 3/1/98      | Dirty Sally                     | 36.0          | Bremen         | Lincoln       | 1           | Pipe             | 5               | Bishop          |
| 55              | 3/4/98      | Jolene Marie                    | 32.0          | Bucks Harbor   | Wash          | 2           | Urchin           | 10              | Bishop          |
| 56              | 3/5/98      | Sun Down                        | 37.0          | Cutler         | Wash          | 2           | Urchin           | 10              | Bishop          |
| 57              | 3/17/98     | Lady Lynn II                    | 36.0          | Bucks Harbor   | Wash          | 2           | Urchin           | 10              | Bishop          |
| 58              | 3/18/98     | Mark+Mathew                     | 38.0          | Lubec          | Wash          | 2           | Urchin           | 10              | Bishop          |
| 59              | 3/24/98     | Miss Moriah                     | 30.0          | Stonington     | Hancock       | 2           | Urchin           | 6               | Bishop          |
| 60              | 4/8/98      | Theresa Marie                   | 35.0          | Cutler         | Wash          | 2           | Urchin           | 9               | Etwell          |
| 61              | 4/4/98      | Black Sheep                     | 37.0          | Cutler         | Wash          | 2           | Urchin           | 5               | Wahle           |
| 62A             | 4/13/98     | Black Sheep                     | 37.0          | Cutler         | Wash          | 2           | Pipe             | 5               | Wahle           |
| 62B             | 4/13/98     | Black Sheep                     | 37.0          | Cutler         | Wash          | 2           | Chain Sweep      | 5               | Wahle           |
| 63              | 4/15/98     | Savannah E                      | 33.0          | Hancock        | Hancock       | 2           | Hybrid           | 7               | Etwell          |
| 64              | 4/20/98     | Eastern Winds                   | 39.0          | Lubec          | Wash          | 2           | Urchin           | 7               | Etwell          |



Table 3A

**SEA URCHIN DRAGGER SURVEY FORMS****A. BOAT DATA**Trip No. 5 Observer Name Debrae BishopDate 10/8/97 Port Lubec County Wash. Zone 2Vessel Operator D. Doe Phone Vessel Name BB Length 35' No. Crew 3**TIME**Time of departure 0615Steaming time 25 min.Time of unloading 1530Down time (engine breakdown, repair of gear, etc.) 45 min.**EFFORT**Length of tows 5-10 min. ave. 7Tows per hour 5Total tows per day 38**DEPTH FISHED**Maximum 90 ftMinimum 9 ftAverage 25 ftTowing scope ratio 4:1Wire x or Rope

Table 3B

**B. DREDGE DATA**Trip No. 5 Dredge No. 1 Observer Name Debra Bishop**BAIL****CHAINS**Type of head bailAre fishing chains hung in sweep NScallop \_\_\_\_\_ or square YWhale mouth x No. of sweep chains 10No. of springs \_\_\_\_\_ No. of rock chains 14Other Dana Mitchell Urchin Drag Size of sweep chains 3/8Diameter of bail stoc. 1" Size of rock chains 3/8**DREDGE**Dimension of chain windows 4"x 6"Type urchin **RINGS**Width 5'8" No. of complete tows 2Length 9'2" Diameter 2-1/2"Estimated weight 500 lbs Single or double linked SingleStern or side fished stern Are there ropes between the rings N**ROLLERS****BAG**Any rollers on gear Y Length 4'6"How many 4 Material of construction poly twinsWhere placed all on bail. 2 center,  
1 in each corner Chafing gear type and location rubber hula strips  
at rings, rubber apron covers entire underside of  
bag

What is behind (below) bag \_\_\_\_\_

Codend x Clubfoot \_\_\_\_\_

# C. TOW DATA

Trip No. 5 Dredge No. 1 Observer Name Debra Bishop

|                                     |                             |          |          |
|-------------------------------------|-----------------------------|----------|----------|
| Tow No.                             | 2.0                         | 6.0      | 10.0     |
| Location                            | Leighton Pt<br>Cobscook Bay | same     | same     |
| Depth                               | 40-65 ft                    | 40-65 ft | 50-93 ft |
| Bottom Type                         | Ledge                       | Ledge    | Ledge    |
| Tow Time                            | 7 min                       | 8 min    | 11 min   |
| Wind Speed                          | 10 K                        | 10 K     | 10 K     |
| Wind Direction                      | NW                          | NW       | NW       |
| Sea State                           | calm                        | calm     | calm     |
| Wt. of Viable Legal Urchin          | 8 kg                        | 15.5 kg  | 25.5 kg  |
| Wt. of Critically Damaged Legals    | 2.5                         | 2.5      | 3.5      |
| Wt. of Viable Sublegal Urchin       | 5.5                         | 10.0     | 6.0      |
| Wt. of Critically Damaged Suglegals | 3.5                         | 3.0      | 2.0      |
| Wt. of Other Components             |                             |          |          |
| Shells Wt.                          | 0.0                         | 0.0      | 0.0      |
| Animal Material Wt.                 | 4.5                         | 27.0     | 85.5     |
| Plant Material Wt.                  | 12.0                        | 8.5      | 10.5     |
| Man Made Material Wt.               | 0.0                         | 0.0      | <1.0     |
| Mineral Material Wt. <Fist Size     | 69.5                        | 12.0     | 3.0      |
| Mineral Material Wt. >Fist Size     | 24.0                        | 84.5     | 9.0      |
| Total Weight                        | 129.5 kg                    | 163.0 kg | 176.0 kg |



Figure 1

Scallop type chain sweeps used in the urchin fishery.

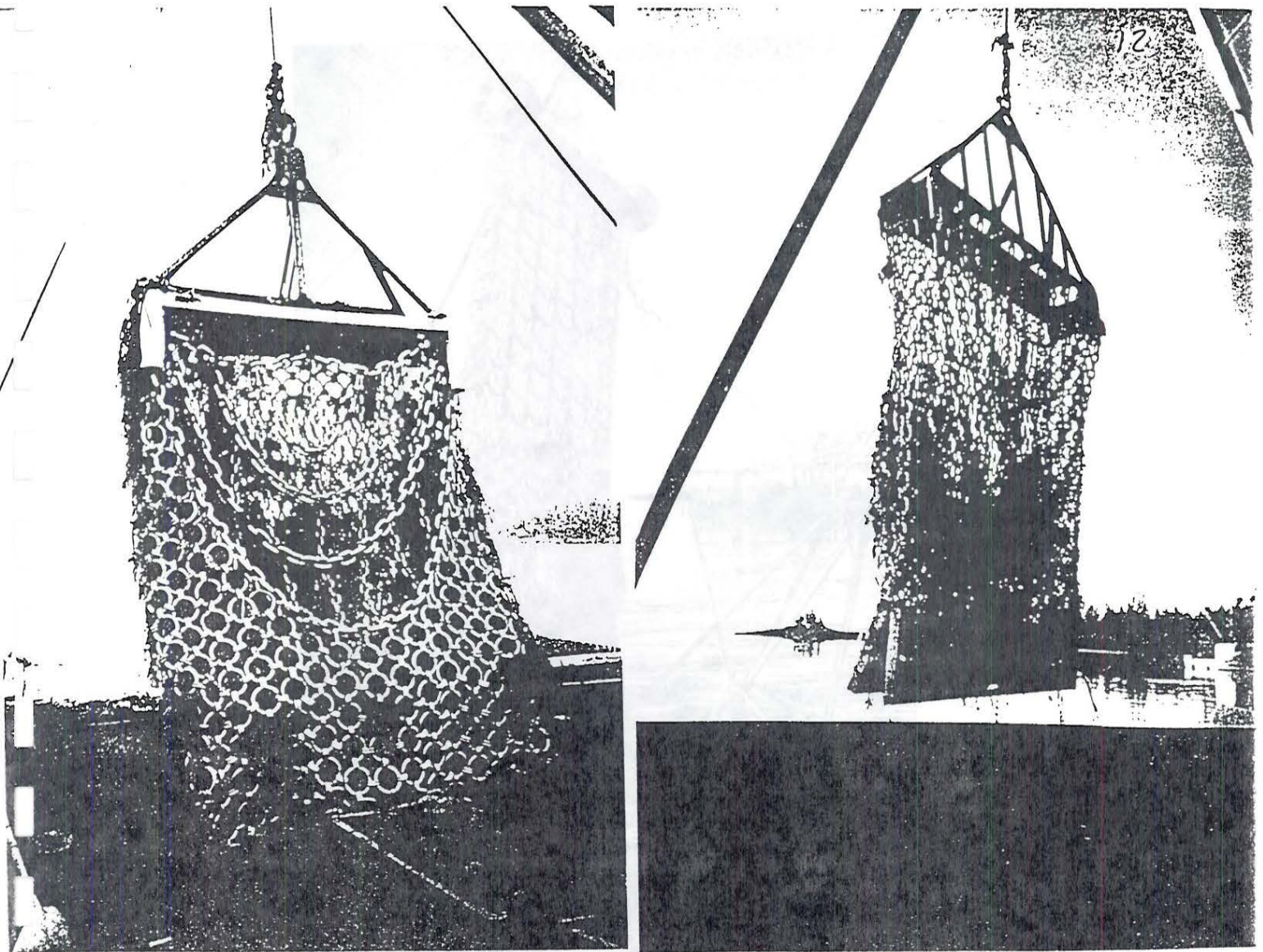




Figure 2

The sea urchin pipe drag.

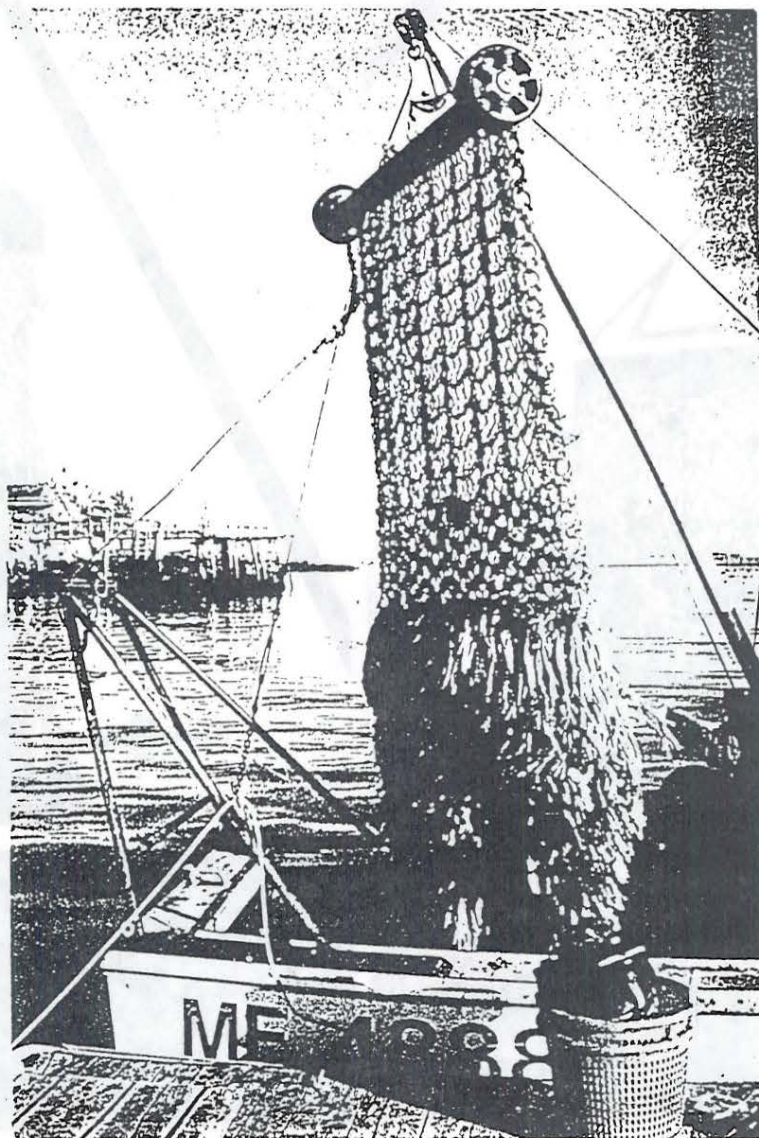


Figure 3

Various modifications of the "urchin" drag.

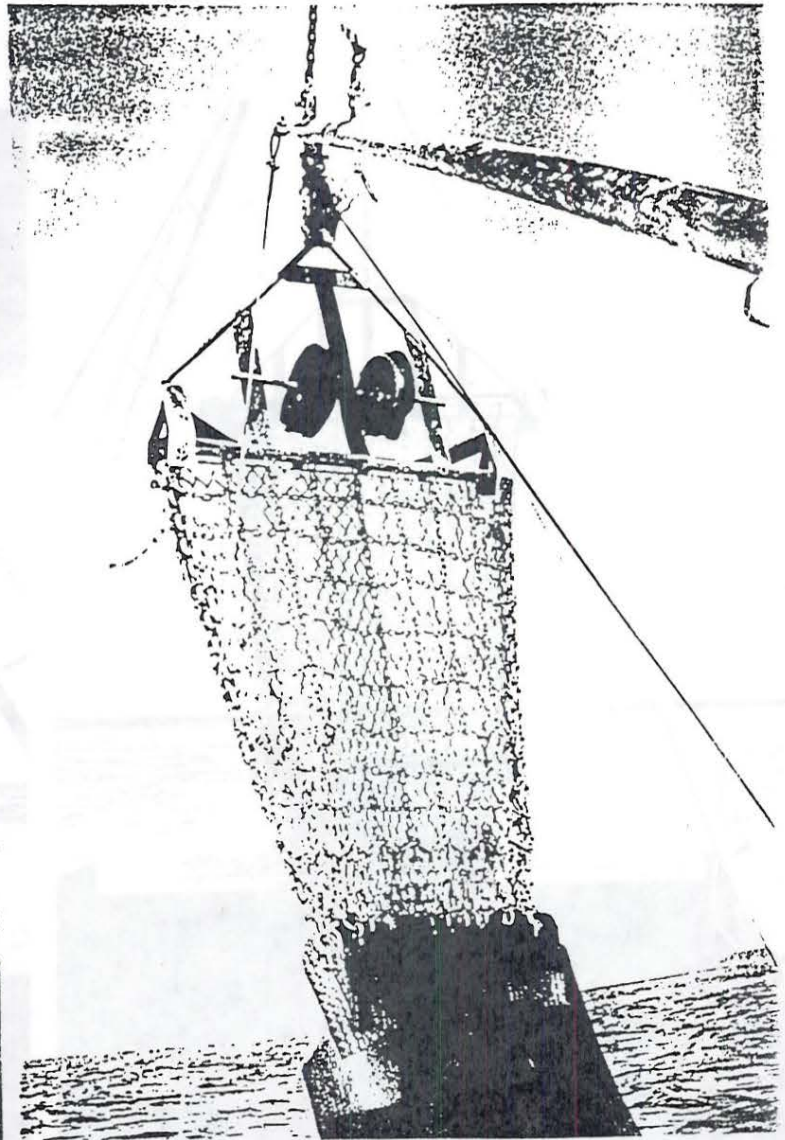
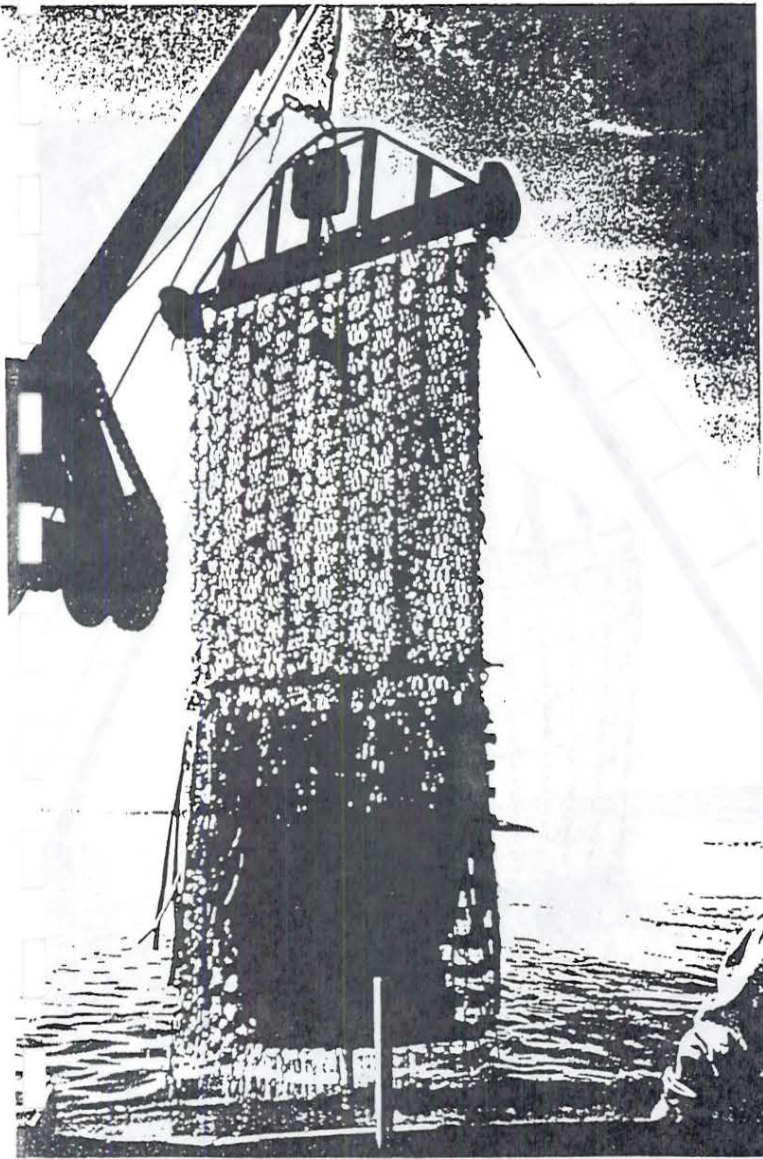




Figure 3 (Continued)

Various modifications of the "urchin" drag.

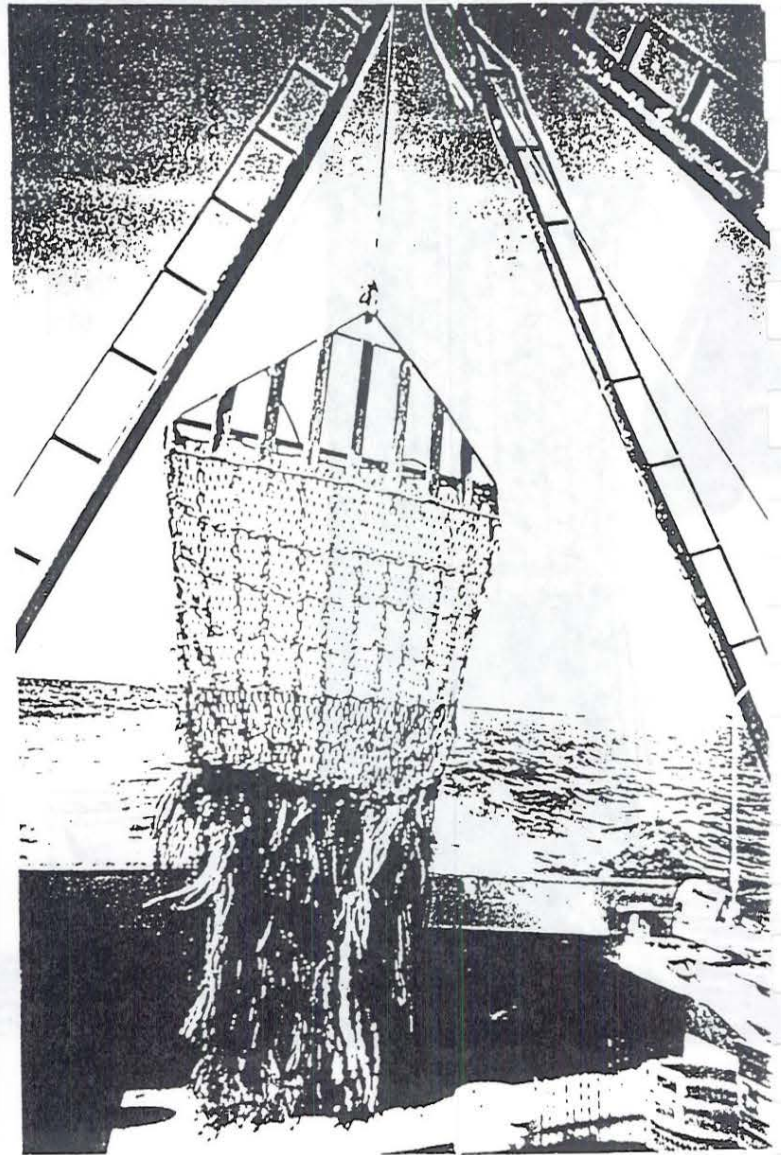
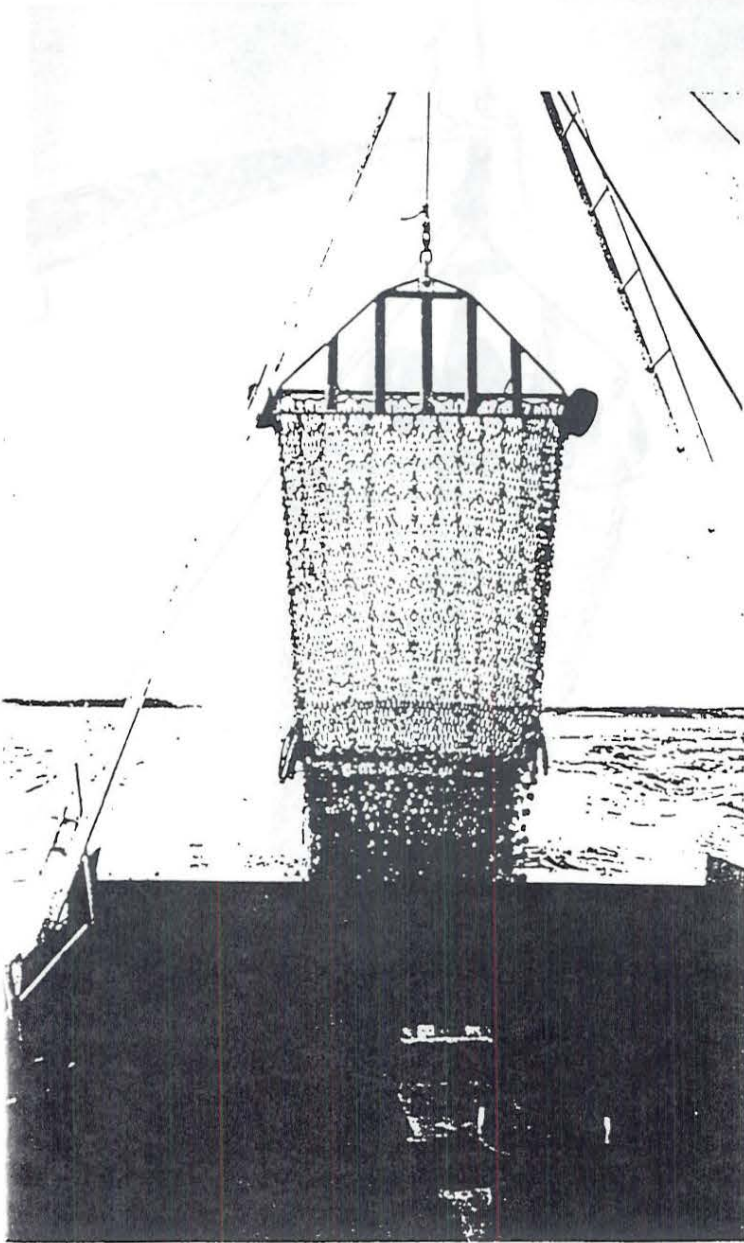




Figure 4

Various modifications  
of the Runtz drag  
(originally designed  
for harvesting peri-  
winkles).

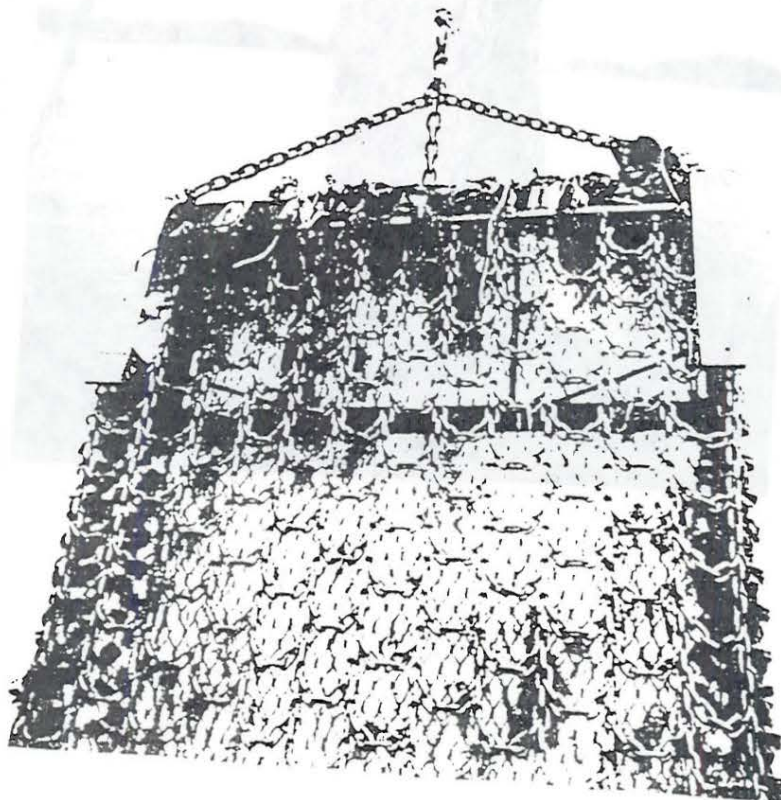
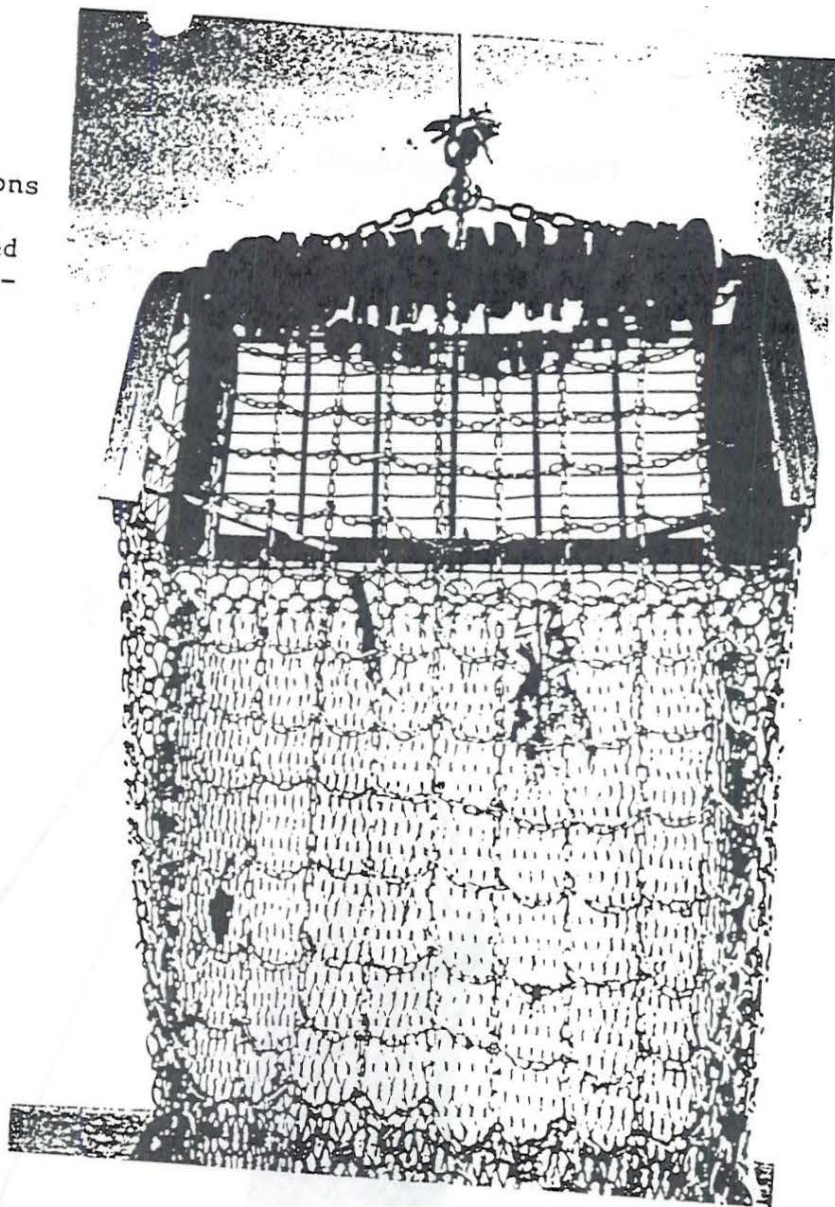
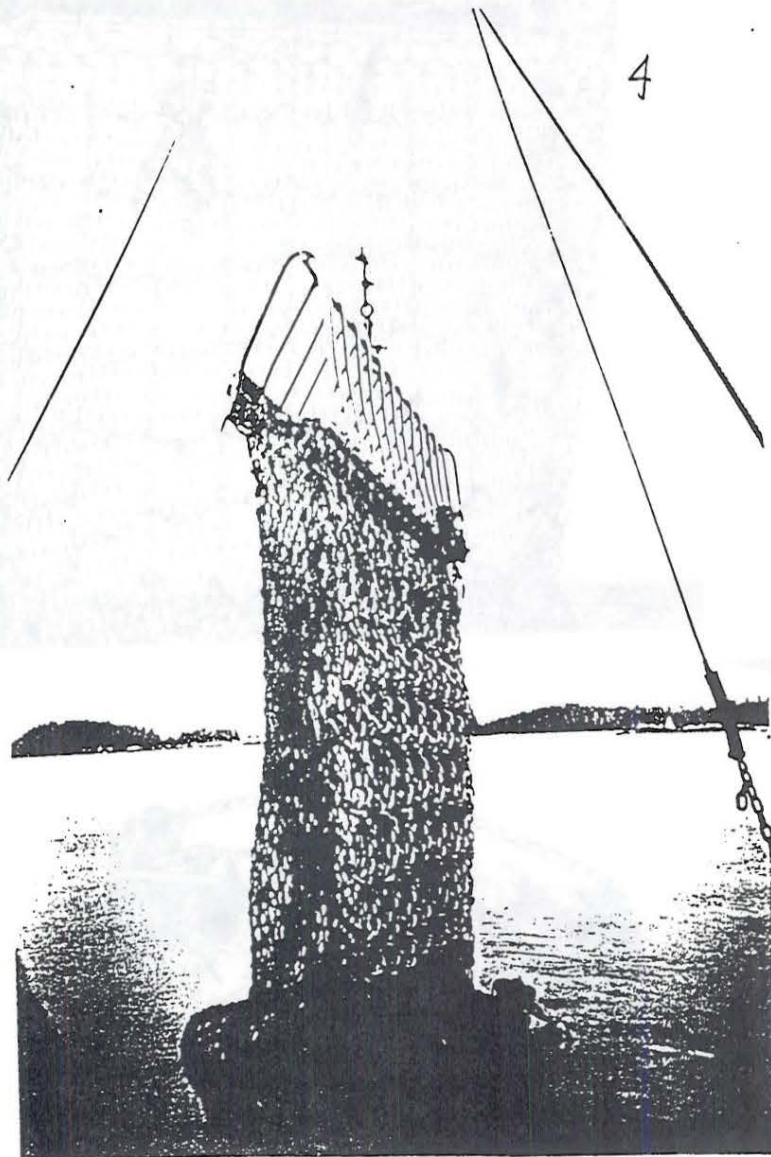


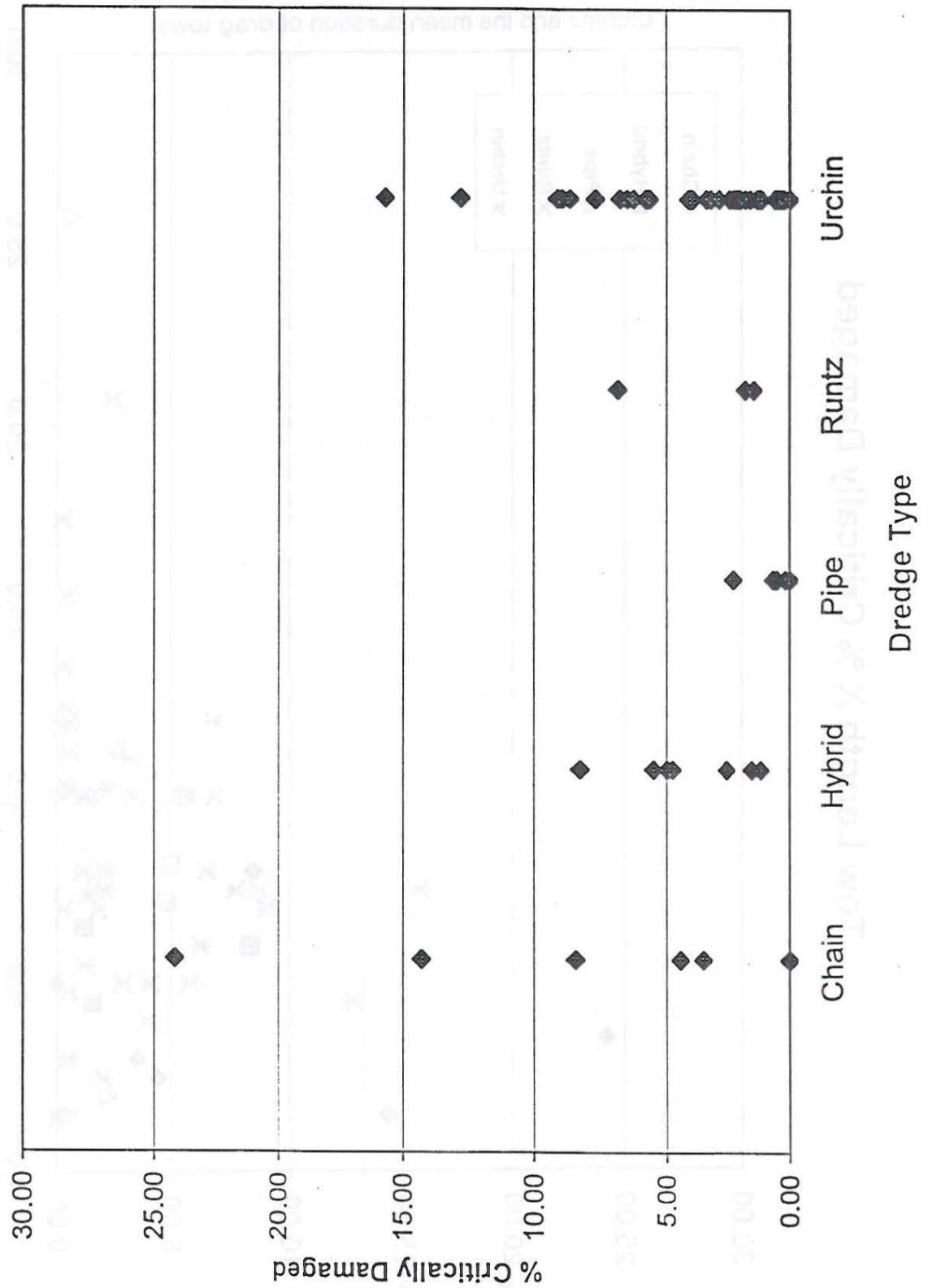


Figure 4 (Continued)

Various modifications of the Runtz drag  
(originally designed for harvesting periwinkles).

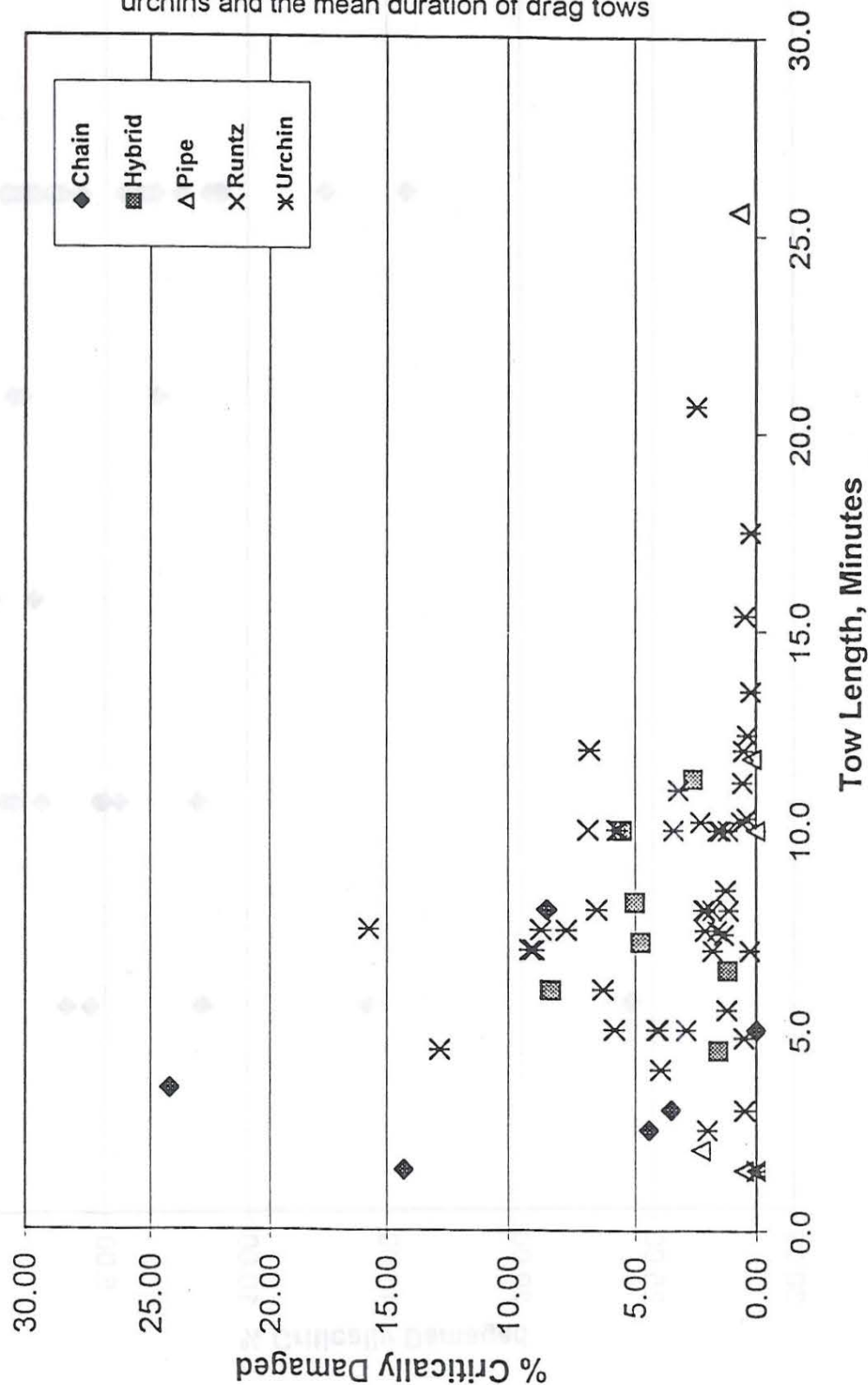


## Dredge Type X % Critically Damaged



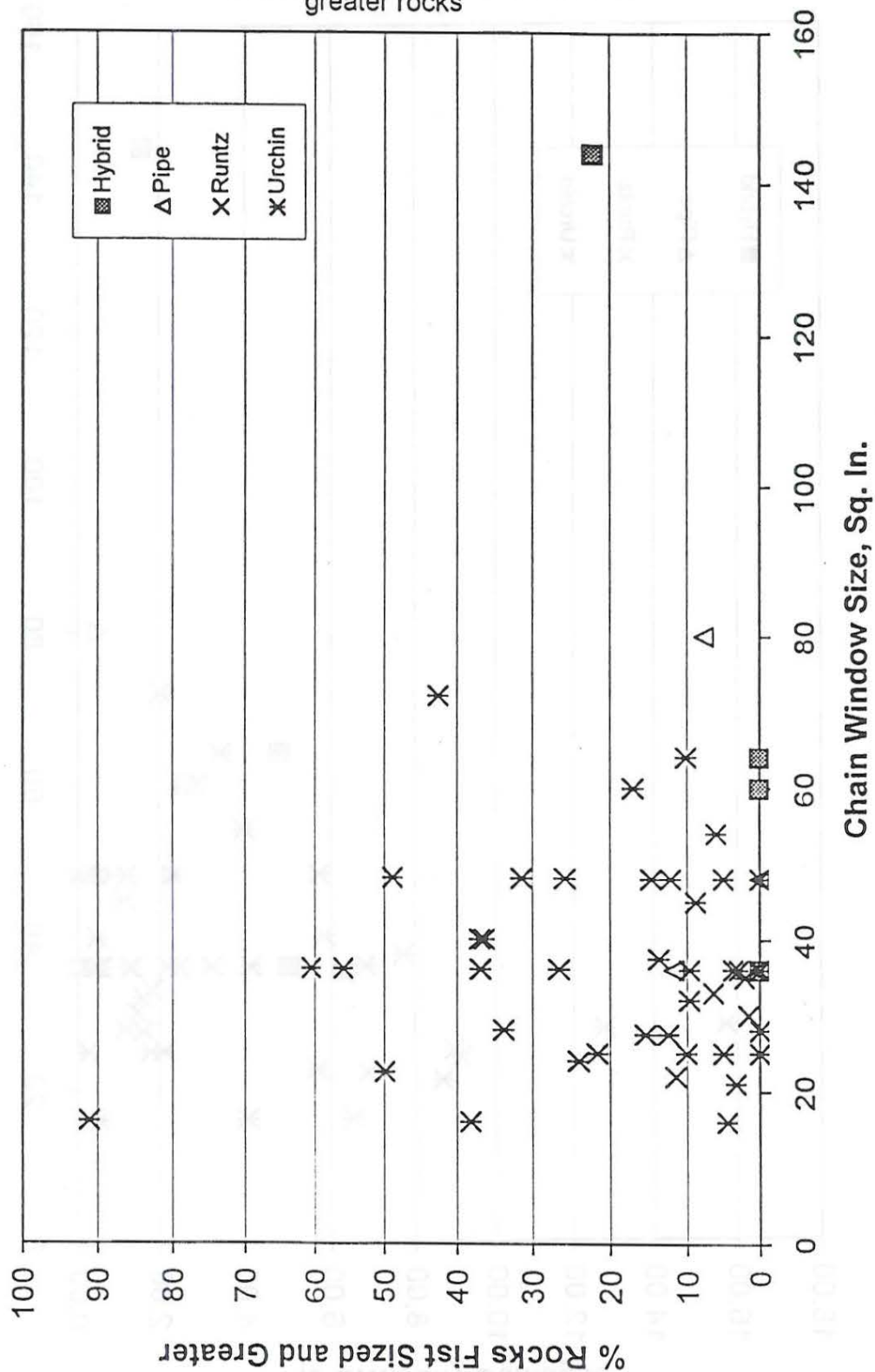
# Tow Length X % Critically Damaged

Figure 6  
The relationship between the % of critically damaged urchins and the mean duration of drag tows



# Chain Window Size X % Rocks Fist Sized and Greater

Figure 7  
The relationship between the size of chain windows and the % of the catch consisting of fist sized and greater rocks





## Chain Window Size X % Critically Damaged

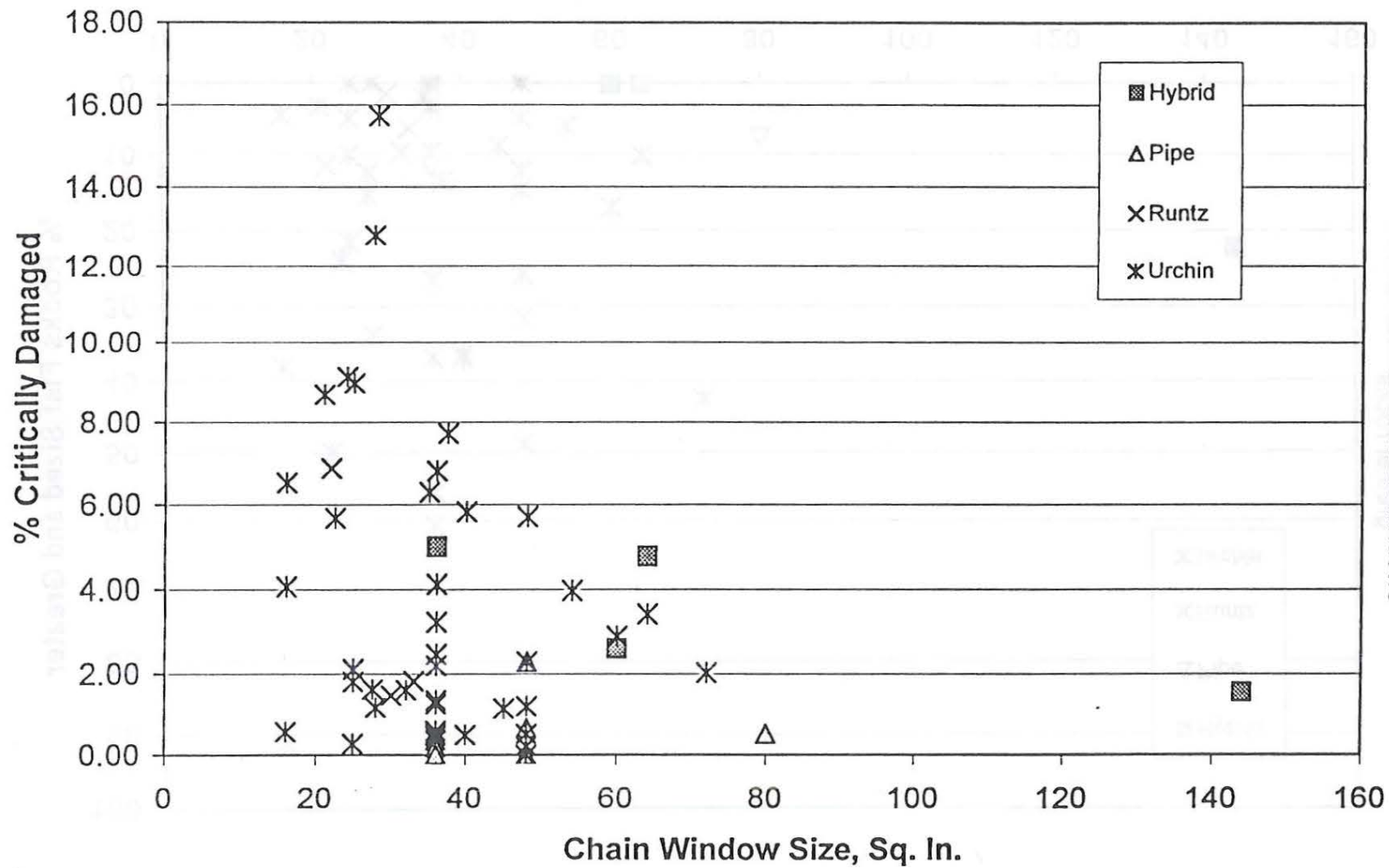
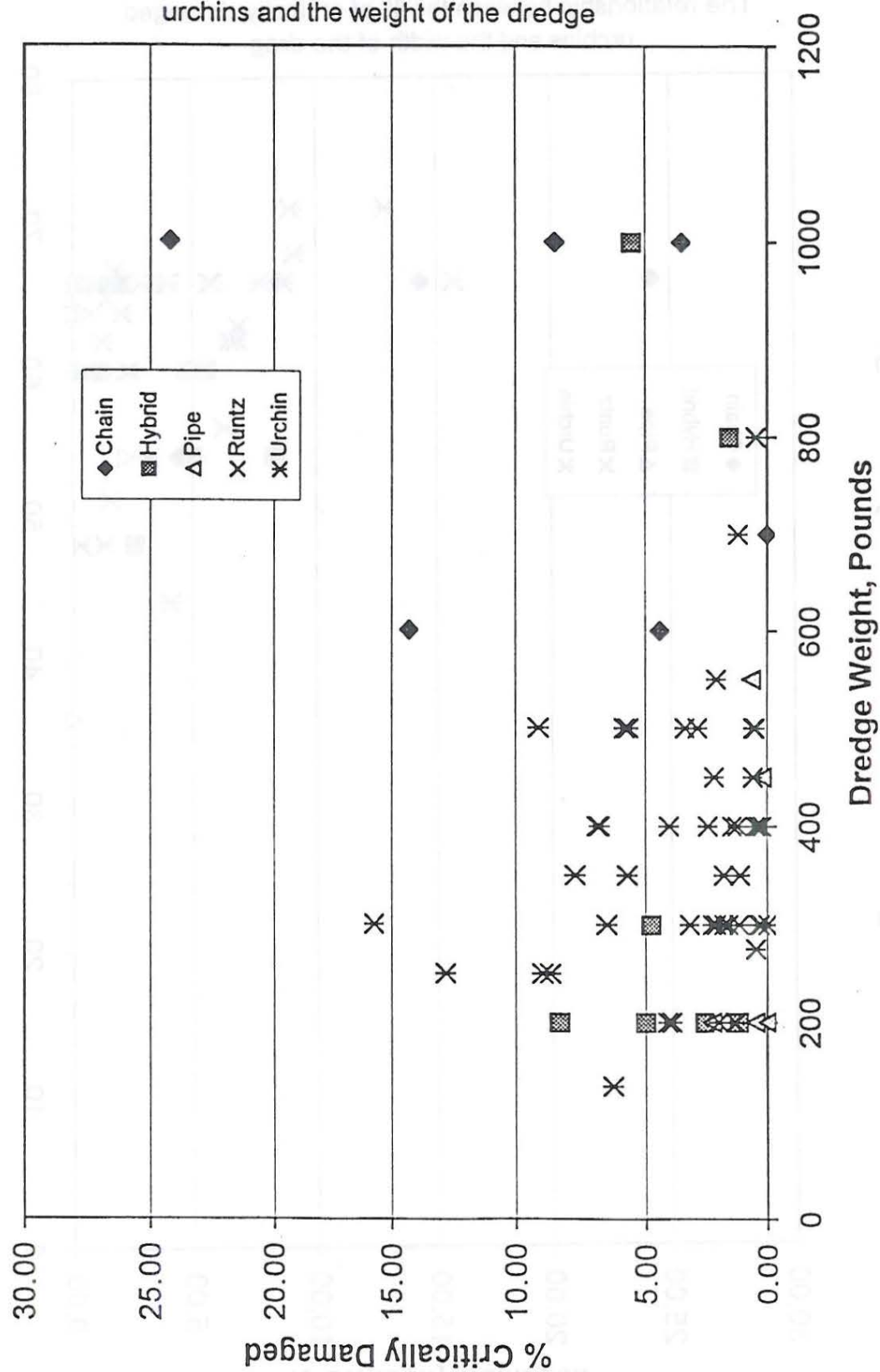


Figure 8  
The relationship between the % of critically damaged urchins and the size of chain windows

## Dredge Weight X % Critically Damaged



# Dredge Width X % Critically Damaged

Figure 10  
The relationship between the % of critically damaged urchins and the width of the drag

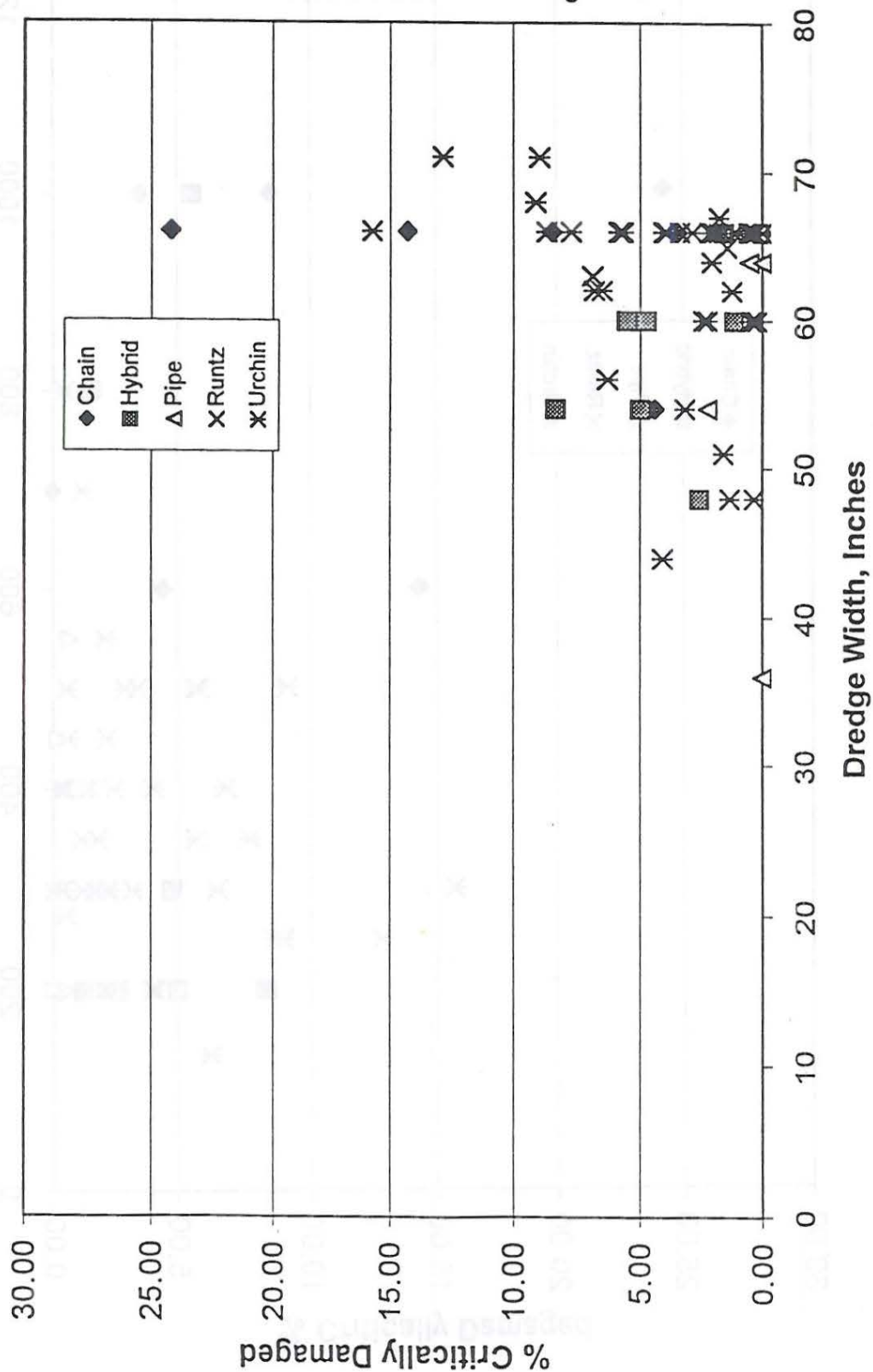
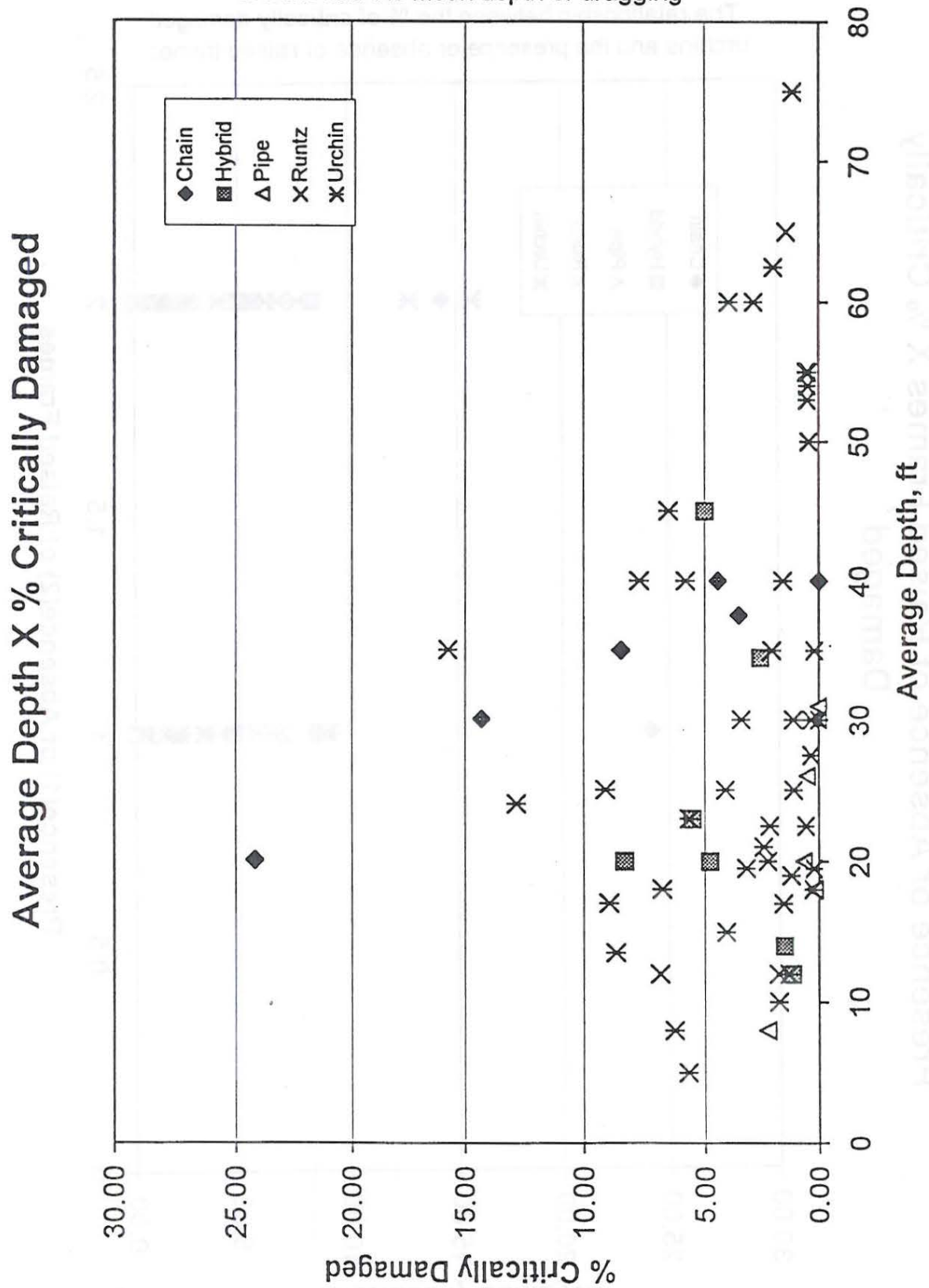


Figure 11  
The relationship between the % of critically damaged urchins and the mean depth of dragging





## Presence or Absence of Raised Frames X % Critically Damaged

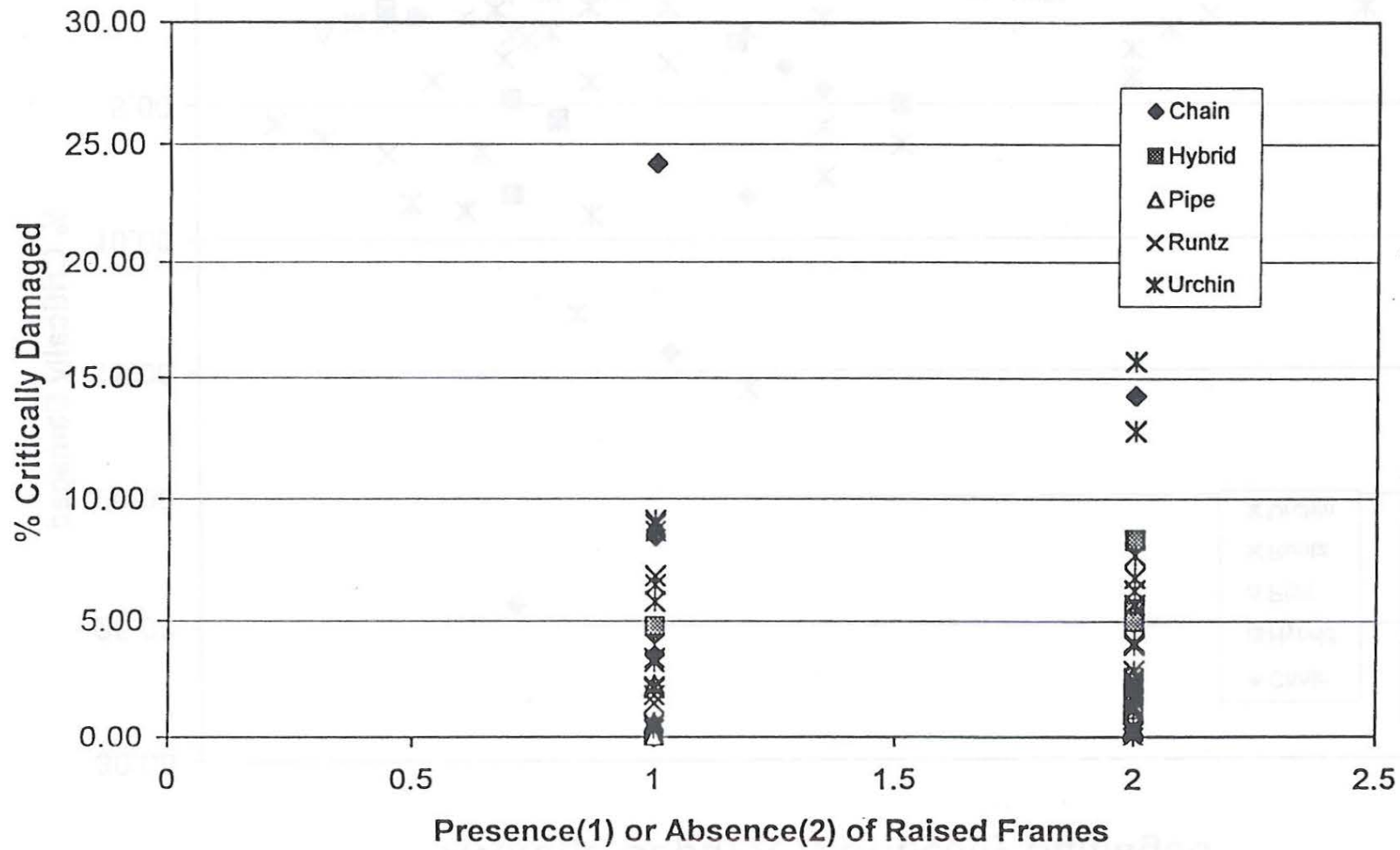


Figure 12  
The relationship between the % of critically damaged urchins and the presence or absence of raised frames