



**Northwest and  
Alaska Fisheries  
Center**

National Marine  
Fisheries Service

U.S. DEPARTMENT OF COMMERCE

**NWAFRC PROCESSED REPORT 88-25**

Report on the Port Moller  
Pacific Cod Trawl Fishery,  
Summer 1988

October 1988



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**REPORT ON THE PORT MOLLER PACIFIC COD  
TRAWL FISHERY, SUMMER 1988**

**October 1988**

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## INTRODUCTION

Concern over the bycatch rate of prohibited species prompted the adoption of emergency regulations (see 50 CFR Part 675), in 1986, closing an area of the Bering Sea Fishery Conservation Zone to all commercial trawling. The closed area, referred to as Area 512, lies north of the Alaska Peninsula, encompassing the area west of 160°00' W. longitude, east of 162°00' W. longitude and south of 58°00' N. latitude. These regulations, with minor changes, were implemented as part of Amendment 10 to the Fishery Management Plan for the Groundfish Fishery in the Bering Sea and Aleutian Islands. Regulations affecting Area 512 became effective March 16, 1987 and will expire December 31, 1988.

An exception was made, both under the emergency and final regulations, allowing domestic trawling for Pacific cod (Gadus macrocephalus) in the area generally south of the 25 fathom contour line. Vessels wishing to participate in the "Port Moller Pacific cod fishery", however, were required to:

"...[Fish] in accordance with a data-gathering program, approved by the Regional Director after consultation with the Council, designed to provide data useful in the management of the trawl fishery, the Pacific halibut, Tanner crab and king crab fisheries, and which will be monitored to prevent overfishing of the Pacific halibut, Tanner and king crab stocks in the area (50 CFR §675.22).

The Regional Director develops an Agreement, which must be signed before a vessel may participate in the fishery. The regulations also established a prohibited species catch (PSC) limit of 12,000 red king crabs (Paralithodes camtschatica) in the Port Moller cod fishery, formally defined as the area south of a line connecting the coordinates 56°43' N. latitude, 160°00' W longitude and 56°00' N, 162°00' W. The PSC limit of 12,000 red king crab originated from multiplying two figures: a projected groundfish catch of 6,000 metric tons (MT), with a maximum



allowable incidence rate of 2 red king crab per MT of groundfish catch. When the PSC limit is reached, the Regional Director will immediately close the area to all trawling.

In 1986, the first year under the new regulations, observers (data-gatherers) were placed on 100% of the vessels trawling for cod in the Port Moller region during the summer fishery. Five observers made seven "cruises" in 1986. A similar data-gathering program was operated during the 1987 summer fishery, although observer coverage was lower. The 1987 Agreement between the NMFS Alaska Regional Director and vessel operators stipulated a 20% level of coverage, or a minimum of two observers. Since no more than six vessels at any given time participated in the 1987 fishery, only two observers, who made a total of four cruises, were required.

The 1988 Agreement required a minimum of three observers if any vessel participated in the fishery that had not previously done so under the guise of a data-gathering program. In fact, one new vessel did operate for at least one week during late June and early July, however no observer was assigned to that vessel. The two observers this year made a total of three cruises.

The program objectives, which provide the authorization and guidance for this report, are stated as follows in the Agreement:

1. To prevent overfishing of any species of fish or shellfish.
2. For participating vessels,
  - a. To estimate the total catch of each groundfish species and the total bycatch of each species of fish and shellfish.
  - b. To estimate rates of bycatch, rates of bycatch mortality, of each species.
  - c. To determine the size, sex and age composition of bycatch species.

Also, the target species for each participating vessel, for all fishing within Area 512, was to be Pacific cod.

This report is based on data collected by observers during the Summer 1988 Port Moller cod fishery.

## **DESCRIPTION OF THE FISHERY**

The 1988 Port Moller Summer Pacific Cod Fishery commenced on May 28th, when the first observer boarded a vessel on its way to the fishing grounds. On July 7th, the last remaining vessel in Area 512 disembarked their observer, ending the fishing season, which lasted 40 days. Observer coverage is difficult to determine because the catcher boats operating with a floating processor are not required to "check-in" and "check-out" of an area (only catcher-processors report vessel movements to the federal fisheries monitoring system). A total of six vessels: two factory trawlers, three catcher boats and a floating processor mothership, participated in the fishery. Of the 41 observer sampling days, 37 were on catcher boats and 4 on factory trawlers, reflecting the distribution of vessel types participating in the 1988 fishery. Observer coverage for the 1988 season is estimated at approximately 33% on catcher boats and 33% on factory trawlers.

Fishing effort in the Port Moller region concentrated around four foci (Figure 1). These foci represent areas not only fished, but also sampled by observers. One of the observers spent nearly two weeks on one vessel that moved between Area 512, where an observer was required, and Areas 511 and 513. When that vessel was outside Area 512, the observer was not permitted to sample. Samples in Areas 511 and 513 were taken by the other observer, who was permitted to continue sampling when her vessel moved outside Area 512.

For all data summaries, hauls were attributed to the area where they were retrieved. For hauls near longitudes dividing two areas, some hauls may have fished 90% in one area, but were retrieved, and credited to another area. In Figure 1, the fishing areas are indicated by shaded regions. For the purposes of this analysis, two sets of summaries have been prepared, one for Area 512, the other for Areas 511 and 513 combined. PSC limits technically apply only to Area 512, although the Port Moller cod fishery often extends out to one degree of longitude both east and west of Area 512.

In describing weekly trends, Sunday to Saturday has been used as the division period. The same weekly division was used in previous years, and it corresponds to the catcher processor reporting period.

<u>(WEEK)</u>	<u>Dates</u>
1	5/29-6/04
2	6/05-6/11
3	6/12-6/18
4	6/19-6/25
5	6/26-7/02
6	7/03-7/09

## FISHERY DATA FOR THE MAJOR SPECIES

During the 1988 Port Moller cod fishery, Pacific cod constituted 64.00% of the total catch (Table 1 and Figure 2). Weekly variation in the portion of the catch composed of Pacific cod was substantial: 29.6% in Week 1 to 77.3% in Week 5. In Weeks 2, 4 and 6, cod made up over 60% of the catch, while in Week 3 less than half the catch (47.7%) was cod (Table 2 and Figure 3). In Areas 511 and 513, Pacific cod constituted 65.51% of the catch this year.

The principal bycatch species to the cod fishery, averaged over the course of the season, were yellowfin sole (Limanda aspera) - 12.9%, rock sole (Lepidopsetta bilineata) - 11.1%, Pacific herring (Clupea harengus pallasii) - 5.7%, and walleye pollock (Theragra chalcogramma) - 2.4%. Each of these species, except for rock sole, fluctuated broadly during the season. Yellowfin sole varied between 9.7% (Week 3) and 25.0% (Week 1) of the catch; rock sole between 9.3% (Week 5) and 15.4% (Week 1); Pacific herring between 0.3% (Week 1) and 24.3% (Week 3)<sup>1</sup>; and walleye pollock between 0.6% (Week 5) and 14.1% (Week 1).

## BIOLOGICAL DATA FOR TARGET SPECIES

Observers collected biological data on the target species, Pacific cod, in all areas fished. A total of 3,180 length frequencies were taken - 2,504 in Area 512, the remainder in Areas 511 and 513. Sex determination could only be performed on 2,251 of the fish however, due to sampling and/or processing constraints. Sex ratios in areas sampled were: Area 512 - 51.8% female to 48.2% male; Areas 511/513 - 53.4% female to 46.6% male. In Area 512, cod averaged

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<sup>1</sup> 54% of the herring occurred in one sampled haul, 90% in five sampled hauls.

2.65 kg, varying between 2.35 kg (Week 3) and 3.16 kg (Week 1). Cod averaged 2.55 kg in Area 511/513. Individual sex weight variation was not recorded.

Overall average length for cod, in Area 512, was 54.5 cm (Figure 4). Males averaged 57.1 cm and females 57.7 cm. Both sexed average lengths are greater than the combined average length due to the inclusion of smaller cod, which could not be accurately sexed, in the combined average length. Males ranged in size from 29 cm to 98 cm, showing a bimodal distribution, centering around peaks at 35 and 55 cm. Females ranged between 28 cm and 109 cm, with a possibly trimodal distribution, centering around 35 cm, 52 cm and 63 cm. The sexes combined plot shows a small mode around 17 cm as well.

In Areas 511 and 513, male cod averaged 56.1 cm compared to an average length of 58.9 cm for females and an overall average length of 57.2 cm. Males ranged from 30 to 95 cm, while females ranged between 32 and 102 cm (Figure 5). Too few data points exist to determine the type of distribution.

Average weight data for other predominant species was also collected. Yellowfin sole averaged 0.32 kg, ranging from 0.27 kg (Week 1) to 0.38 kg (Week 5). Rock sole averaged 0.24 kg, fluctuating between 0.18 kg (Week 6) and 0.27 kg (Weeks 2 and 3). Pacific herring averaged 0.30 kg, varying between 0.15 kg in Week 1 and 0.32 kg in Week 3. Walleye pollock averaged 1.32 kg, fluctuating between 1.63 kg (Week 4) and 1.18 kg (Week 5).

## INCIDENCE OF PROHIBITED SPECIES

Incidence rates of prohibited species, in mean number and weight per ton of groundfish catch, are summarized in Tables 3 and 4. As explained in the Introduction, a figure for the total days on grounds could not be calculated for the 1988 fishery. Therefore, estimates of catch by the fleet could not be made and only incidence rates of prohibited species can be reported here.

Over the course of the fishery, Pacific herring was the most common incidentally taken prohibited species. Incidence averaged 192.88 individuals per metric ton (ind./ton), weighing a total of 57.22 kg, per metric ton (kg/ton) of groundfish catch. The extreme variability of herring catch during this fishery was noted previously. Incidence peaked during Week 3 at 764.86 ind./ton, weighing 242.86 kg/ton. Incidence rates in Week 3, however, were greatly influenced by a small number of hauls that contained substantially higher amounts of herring. Nearly 54% of the herring encountered by the observer during Week 3, came from one haul, and 90% were taken in five hauls.

Pacific halibut was the second most common prohibited species, averaging 5.76 ind./ton of groundfish catch. Halibut averaged 8.07 kg/ton of catch. Halibut incidence also exhibited some variability. The incidence, during Week 5, reached 14.31 ind./ton, weighing 16.71 kg/ton. During Week 2 of the fishery, halibut incidence was relatively low, at 1.35 ind./ton, weighing 2.63 kg/ton of catch. In Areas 511 and 513 halibut incidence averaged 9.28 ind./ton, weighing 13.10 kg/ton.

Incidence of other prohibited species was very low. Red king crab incidence averaged 0.37 ind./ton and 0.56 kg/ton of catch. Red king crab incidence declined during every week of the 1988 fishery. Beginning with the relatively high rate of 3.47 ind./ton (4.77 kg/ton) during Week 1, incidence fell to 0.95 ind./ton and 1.53 kg/ton in Week 2, 0.20 ind./ton and 0.31 kg/ton

in Week 3, 0.18 ind./ton and 0.23 kg/ton in Week 4, 0.03 ind./ton and 0.03 kg/ton in Week 5, and 0.01 ind./ton and 0.01 kg/ton in Week 6.

One species of Tanner crab, Chionoecetes bairdi, and one species of salmon, chum (Onchorhynchus keta), were also taken incidentally in Area 512. C. bairdi Tanner crab incidence averaged 0.01 ind./ton and 0.004 kg/ton, while chum salmon figures were 0.005 ind./ton and 0.016 kg/ton. In Areas 511 and 513, C. opilio Tanner crab were taken in addition to C. bairdi. Incidence rates for the two species of Tanner crab were: C. bairdi - 0.06 ind./ton and 0.03 kg/ton, C. opilio - 0.10 ind./ton and 0.05 kg/ton. Chinook salmon (Onchorhynchus tshawytscha) was the only species of salmon caught in Areas 511 and 513, with incidence averaging 0.01 ind./ton and 0.11 kg/ton.

## BIOLOGICAL AND VIABILITY DATA OF PROHIBITED SPECIES

Biological and viability data were collected from 1017 halibut, 399 red king crab, 7 C. bairdi Tanner crab and 4 chum salmon in Area 512. These data were summarized for the entire period of the fishery, and not analyzed for weekly trends as there were insufficient data for some of the weeks for each of the species. From Areas 511 and 513, data were collected from 359 halibut, 40 red king crab, 19 C. opilio Tanner crab, 12 C. bairdi Tanner crab and 2 chinook salmon. The biological data are presented in Table 5.

### Pacific halibut

The average size of Pacific halibut taken incidentally in Area 512 was 1.40 kg and 52.5 cm. Length range in 1988 was between 25 and 140 cm, showing a bimodal distribution with

peaks at 44 cm and 58 cm (Figure 6). In Areas 511 and 513, halibut averaged 1.17 kg and 52.4 cm. Length distribution was similar to that for Area 512, with a smaller range of lengths: 25cm - 114 cm.

Pacific halibut viabilities for Areas 512 and 511/513 are illustrated in Figure 7. Observers judged 70.4% of halibut to be dead, or to have no chance of survival, when returned to sea. Approximately 15.6% of the halibut were judged to be in excellent condition, and 14.1% in poor condition, when returned to the sea. In Areas 511/513, 42.8% of the halibut were dead, 17.8% excellent and 39.5% were in poor condition.

#### Red king crab

Biological and viability data for red king crab are collected and summarized by sex. During the 1988 Port Moller cod fishery, male red king crab averaged 1.72 kg in weight and 142.8 cm in carapace length, while females averaged 0.89 kg and 119.6 mm. Sex ratio was 74.5% male to 25.5% female. Both males and females showed normal, unimodal distributions (Figure 8). Within Areas 511 and 513, sex ratio was 85.0% male to 15.0% female. Average male weight was 2.33 kg, average female weight was 1.07 kg, while average male carapace length was 150.9 mm and female carapace length was 123.0 mm.

Despite the size difference, male and female red king crab stood an almost equal chance of surviving upon return to the sea (Figure 9). Among males, 70.6% were judged to be in excellent condition, while among females the proportion was 65.5%. Among males, 16.6% were returned to the sea in poor condition, while 20.5% of females were in poor condition. Based on a much smaller sample size, red king crab in Areas 511 and 513 fared as follows: males - 91.2% excellent, 8.8% poor; females - 50.0% excellent, 16.7% poor and 33.3% dead.



### Other prohibited species

In Area 512, 85.7% of C. bairdi Tanner crab were males. Average weight for males was 0.52 kg compared to 0.10 kg for females. Male carapace width averaged 118.0 mm; for females carapace width averaged 63.0 mm. All female C. bairdi and 33.3% of males were returned to the sea in poor condition. The remainder of the males were dead. In Areas 511 and 513, all C. bairdi and C. opilio observed were males. C. bairdi averaged 0.55 kg and 116.3 cm, with a viability breakdown of 74.9% excellent and 25.1% dead. C. opilio averaged 0.53 kg and 113.8 cm in size, with a viability breakdown of 73.8% excellent, 15.8% poor and 10.4% dead.

The chum salmon in Area 512 were all males, weighing an average of 3.40 kg, and measuring 58.7 cm in length. King salmon in Areas 511 and 513 were not sexed, averaging 11.00 kg and 94.0 cm in size.

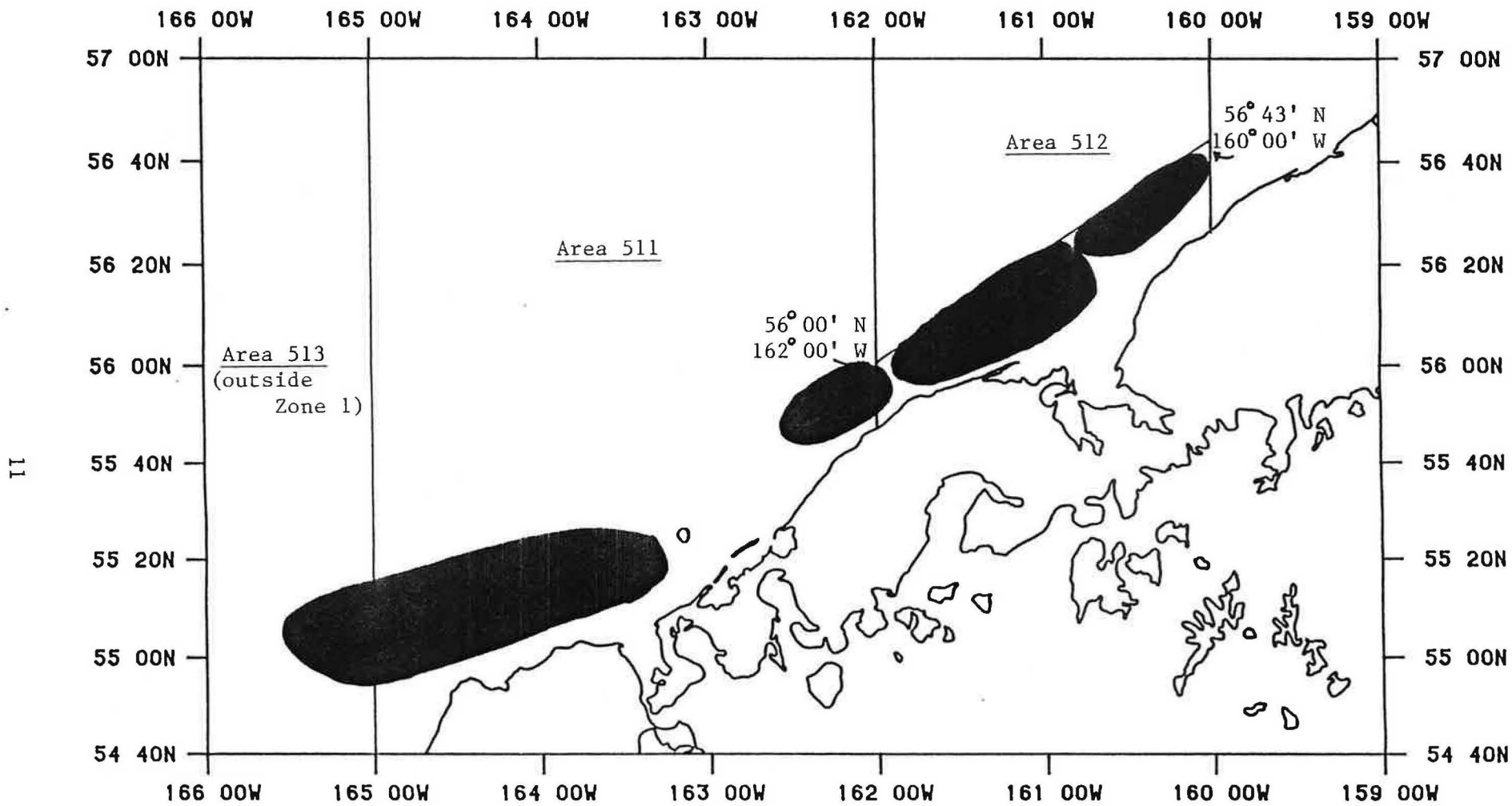


Figure 1. RETRIEVAL POSITIONS PORT MOLLER COD FISHERY, 1988.

Table 1. Species composition of catch in areas fished during Port Moller Pacific cod trawl fishery, Summer 1988.

<u>SPECIES NAME</u>	<u>Area 512</u> (Figures are % of total catch)	<u>Areas 511 &amp; 513</u>
Pacific cod	64.00	65.51
Yellowfin sole	12.89	3.42
Rock sole	11.08	7.12
Pacific herring	5.72	0.28
Walleye pollock	2.35	15.42
Other fish	3.00	7.40
Invertebrates	<u>0.96</u>	<u>1.13</u>
	100.00	100.00

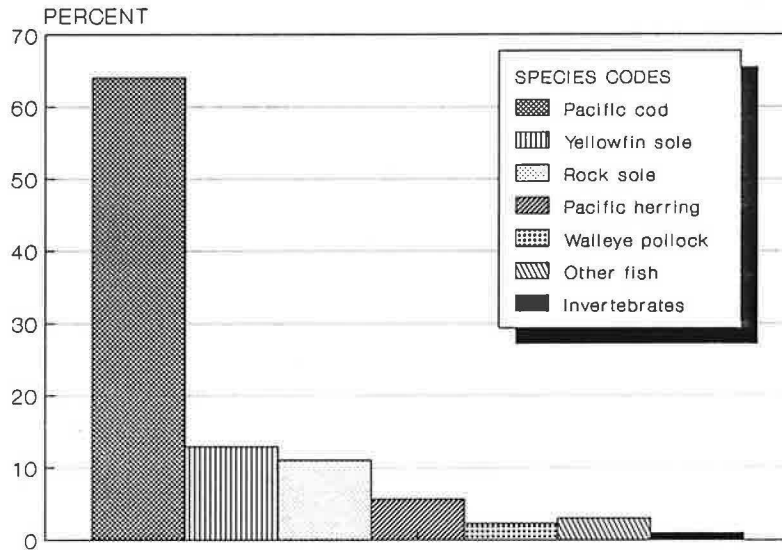
Table 2. Weekly variation in species composition of catch in Area 512 during Port Moller Pacific cod trawl fishery, Summer 1988.

<u>SPECIES NAME</u>	<u>WEEK</u>						<u>TOTAL</u>
	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>	
	(Figures are % of week's total catch)						
Pacific cod	29.63	68.15	47.74	64.83	77.34	62.41	64.00
Yellowfin sole	25.03	9.86	9.66	16.70	7.42	21.93	12.89
Rock sole	15.40	13.31	10.74	12.48	9.27	10.26	11.08
Pacific herring	0.27	0.55	24.29**	1.33	1.61	1.39	5.72
Walleye pollock	14.07	4.76	2.92	0.87	0.59	0.65	2.35
Other fish	12.99	2.76	3.82	2.57	3.12	2.04	3.00
Invertebrates	2.62	0.61	0.83	1.22	0.65	1.32	0.96

\*\* 54% of herring this week occurred in one sampled haul, 90% in five hauls.

# SPECIES COMPOSITION

## AREA 512



## AREAS 511 & 513

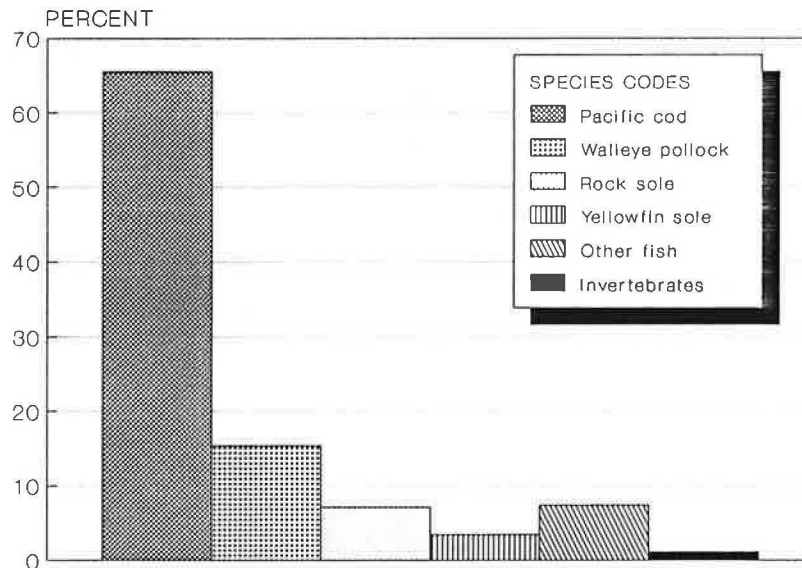


Figure 2. Species composition of the catch in areas fished, Port Moller Pacific cod trawl fishery, Summer 1988.

# AREA 512

## Weekly variation in species composition

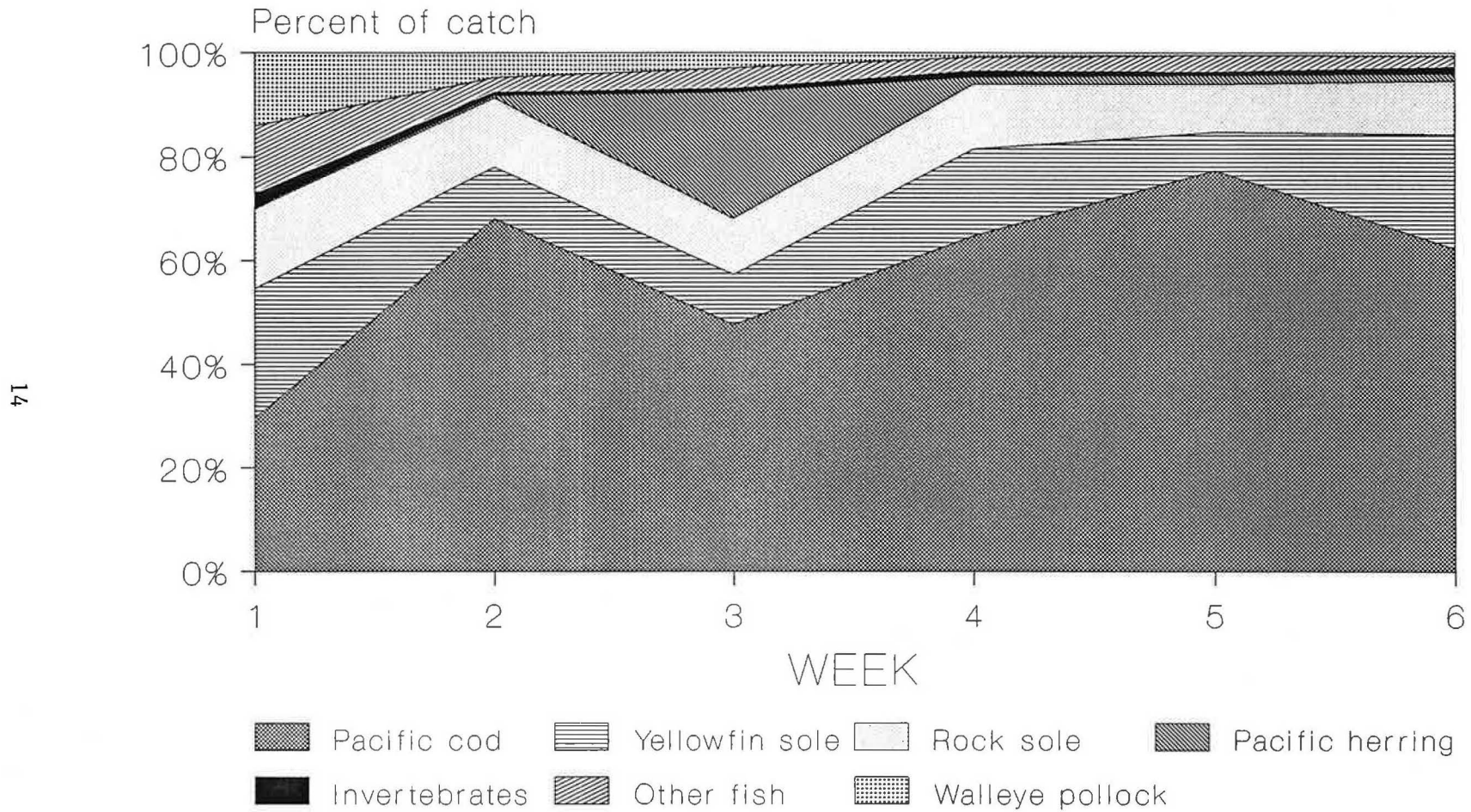
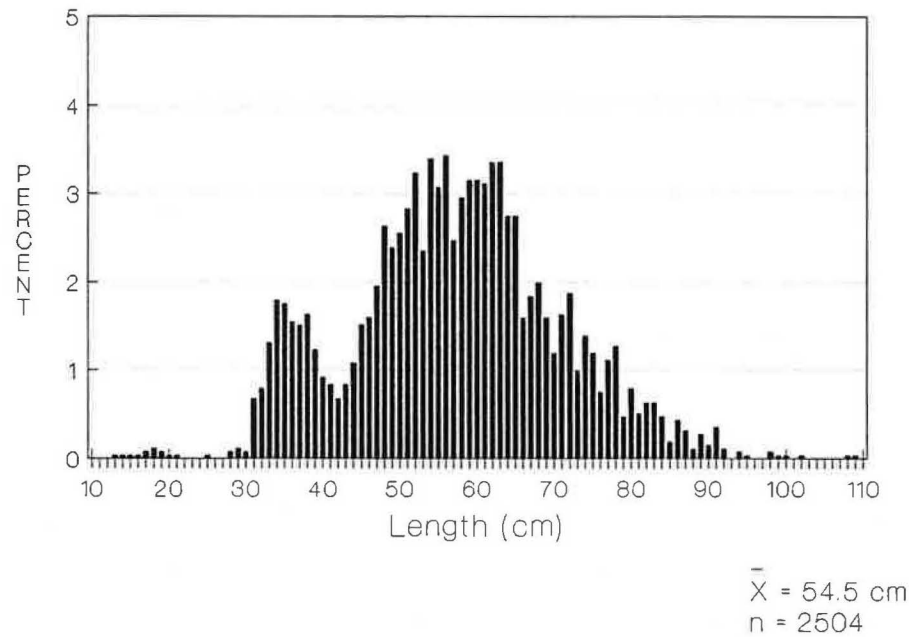


Figure 3. Weekly variation in catch composition in Area 512 during Port Moller Pacific cod fishery, Summer 1988.

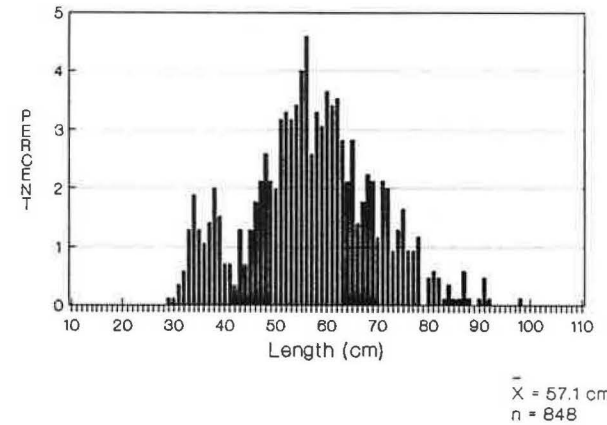
# PACIFIC COD

## Area 512

### SEXES COMBINED



### MALES



### FEMALES

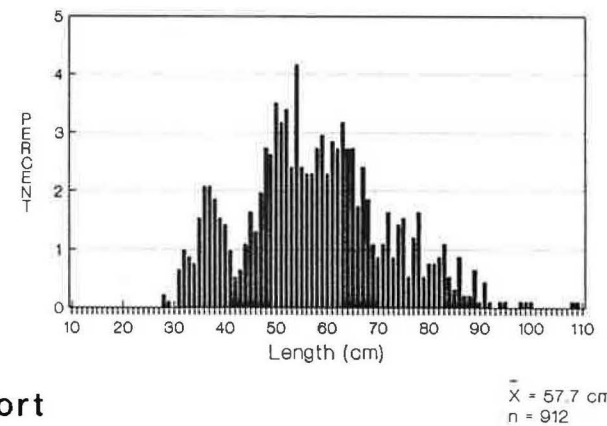
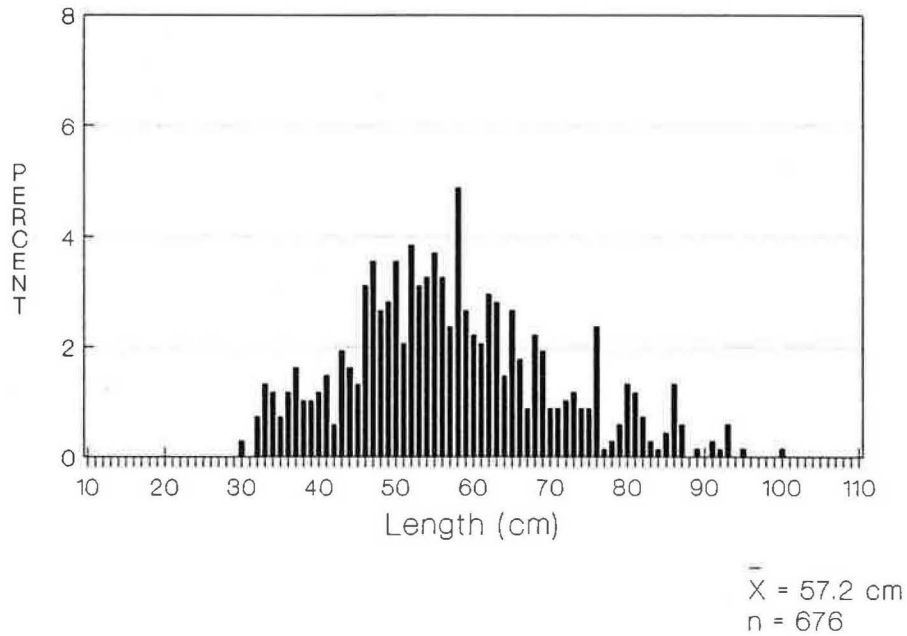


Figure 4. Pacific cod length frequencies from Area 512, Port Moller Pacific cod trawl fishery, Summer 1988.

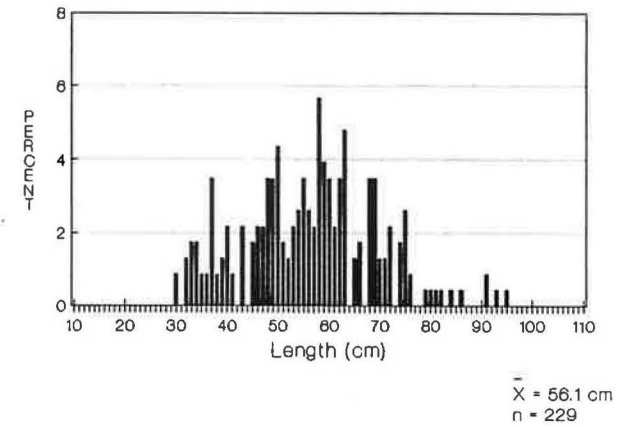
# PACIFIC COD

Areas 511 & 513

## SEXES COMBINED



## MALES



## FEMALES

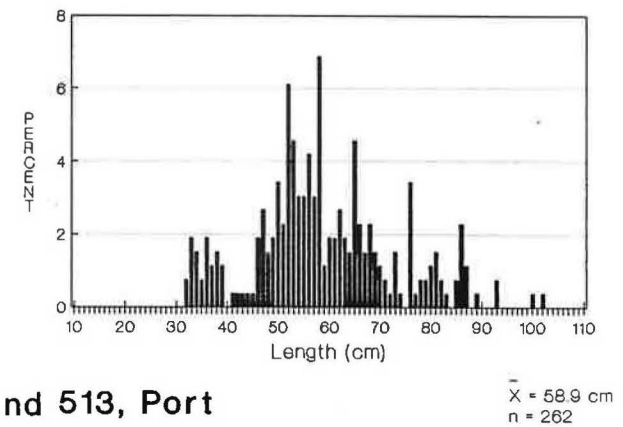


Figure 5. Pacific cod length frequencies from Areas 511 and 513, Port Moller Pacific cod trawl fishery, Summer 1988.

Table 3. Incidence rates for prohibited species in areas fished during Port Moller Pacific cod trawl fishery, Summer 1988.

<u>Species</u>	<u>AREA 512</u>		<u>AREAS 511/513</u>	
	<u>Mean Number/ton</u>	<u>Mean kg/ton</u>	<u>Mean Number/ton</u>	<u>Mean kg/ton</u>
Pacific halibut	5.7614	8.0691	9.2848	13.1010
Pacific herring	192.8840	57.2173	11.3337	2.7929
Red king crab	0.3733	0.5622	0.2034	0.4357
Bairdi Tanner crab	0.0088	0.0042	0.0607	0.0334
Opilio Tanner crab	0.0000	0.0000	0.0965	0.0508
Chum salmon	0.0046	0.0155	0.0000	0.0000
Chinook salmon	0.0000	0.0000	0.0100	0.1104
Sockeye salmon	0.0000	0.0000	0.0000	0.0000
Coho salmon	0.0000	0.0000	0.0000	0.0000
Pink salmon	0.0000	0.0000	0.0000	0.0000

Table 4. Weekly variation in incidence rates and average weight for Pacific halibut and Pacific herring in Area 512 during Port Moller Pacific trawl fishery, Summer 1988.

<u>WEEK</u>	<u>Pacific halibut</u>			<u>Pacific herring<sup>***</sup></u>		
	<u>No./ton</u>	<u>Kg./ton</u>	<u>Av. wt.</u>	<u>No./ton</u>	<u>Kg./ton</u>	<u>Av. wt.</u>
1	6.3259	20.3499	3.22	17.8411	2.7083	0.15
2	1.3460	2.6285	1.95	18.4576	5.5203	0.30
3	1.9682	2.8674	1.46	764.8561	242.8545	0.32
4	4.6919	6.8051	1.30	59.4074	13.3466	0.22
5	14.3061	16.7144	1.17	68.3325	16.0734	0.24
<u>6</u>	<u>9.3702</u>	<u>12.8207</u>	<u>1.37</u>	<u>70.7265</u>	<u>13.8649</u>	<u>0.20</u>
TOTAL	5.7614	8.0691	1.40	192.8840	57.2173	0.30

<sup>\*\*\*</sup> 54% of the herring in Week 3 occurred in one sampled haul, 90% in five hauls.



Table 5. Biological data from prohibited species bycatch collected in Areas 512 and 511/513 during Port Moller Pacific cod trawl fishery, Summer 1988.

AREA 512

<u>SPECIES NAME</u>	Mean weight <sup>a</sup>		Mean length <sup>b</sup>		Sex ratio	
	<u>M</u>	<u>F</u>	<u>M</u>	<u>F</u>	<u>M</u>	<u>F</u>
Pacific halibut	1.40 <sup>c</sup>		52.5			
Red king crab	1.72	0.89	142.8	119.6	72.7	27.3
<u>C. bairdi</u> Tanner crab	0.52	0.10	118.0	63.0	85.7	14.3
Chum salmon	3.40		58.7		100.0	

AREAS 511/513

<u>SPECIES NAME</u>	Mean weight		Mean length		Sex ratio	
	<u>M</u>	<u>F</u>	<u>M</u>	<u>F</u>	<u>M</u>	<u>F</u>
Pacific halibut	1.41		52.4			
Red king crab	2.33	1.07	150.9	123.0	85.0	15.0
<u>C. bairdi</u> Tanner crab	0.55		116.3		100.0	
<u>C. opilio</u> Tanner crab	0.53		113.8		100.0	
Chinook salmon	11.00 <sup>d</sup>		94.0			

<sup>a</sup> All weights are in kg.

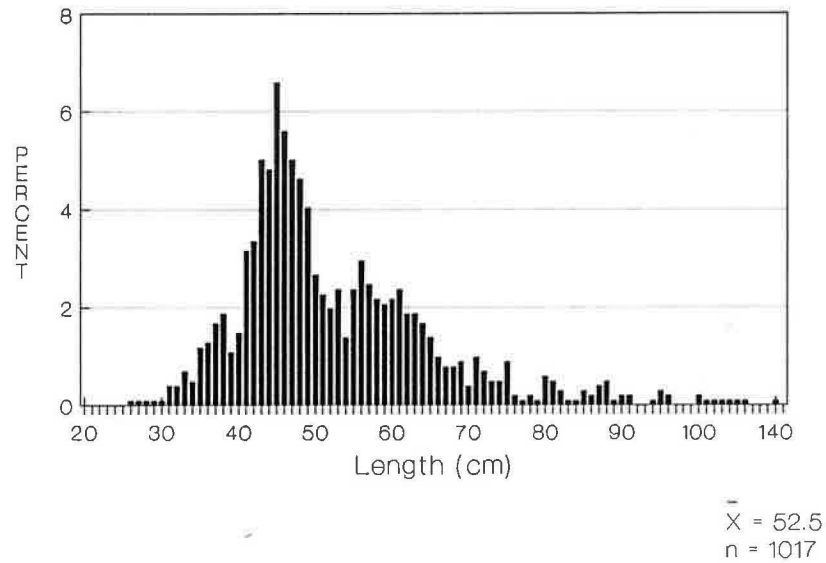
<sup>b</sup> Fish lengths are in cm; carapace lengths for red king crab; carapace widths for Tanner crab are in mm.

<sup>c</sup> Sex determination is not performed on Pacific halibut.

<sup>d</sup> Sex determination not performed due to sampling constraints.

# PACIFIC HALIBUT

## AREA 512



## AREAS 511 & 513

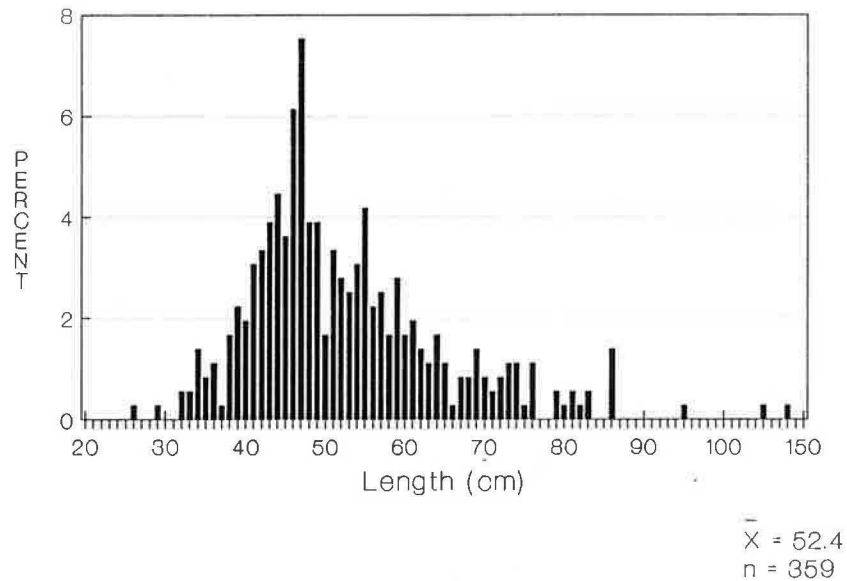


Figure 6. Pacific halibut length frequencies from areas sampled, Port Moller Pacific cod trawl fishery, Summer 1988.

# PACIFIC HALIBUT VIABILITY

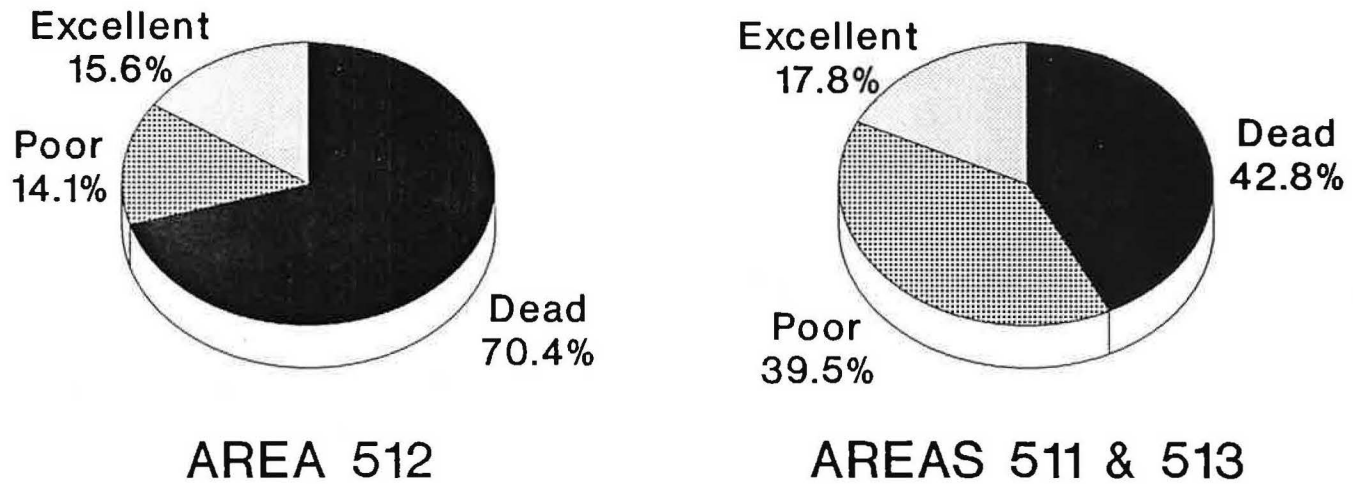
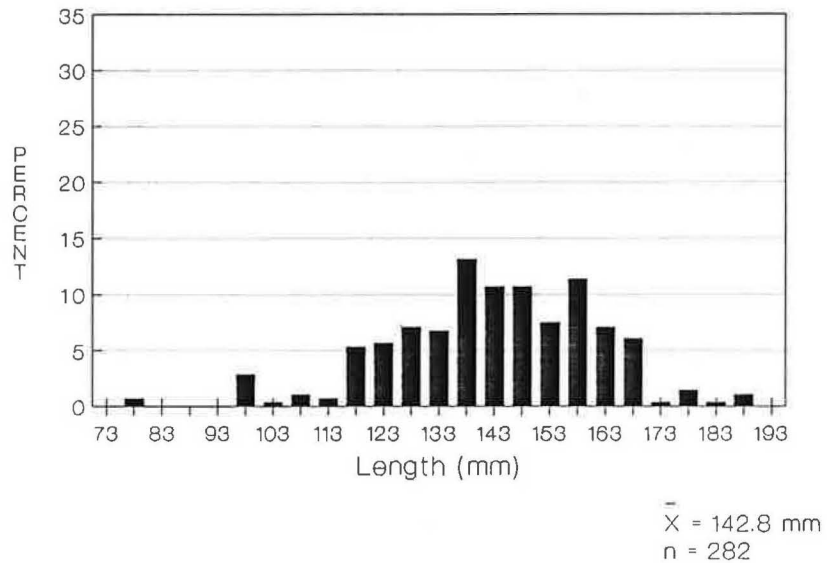


Figure 7. Pacific halibut viabilities in areas fished, Port Moller Pacific cod trawl fishery, Summer 1988.

Sample sizes:  
Area 512 = 969  
Areas 511/513 = 152

# RED KING CRAB

## MALES



## FEMALES

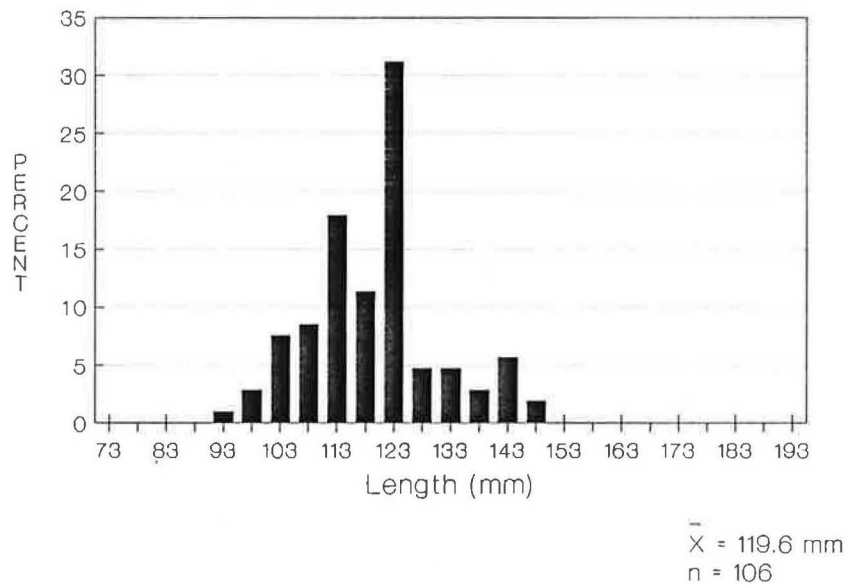


Figure 8. Red king crab length frequencies from Area 512, Port Moller Pacific cod trawl fishery, Summer 1988.

# RED KING CRAB VIABILITY

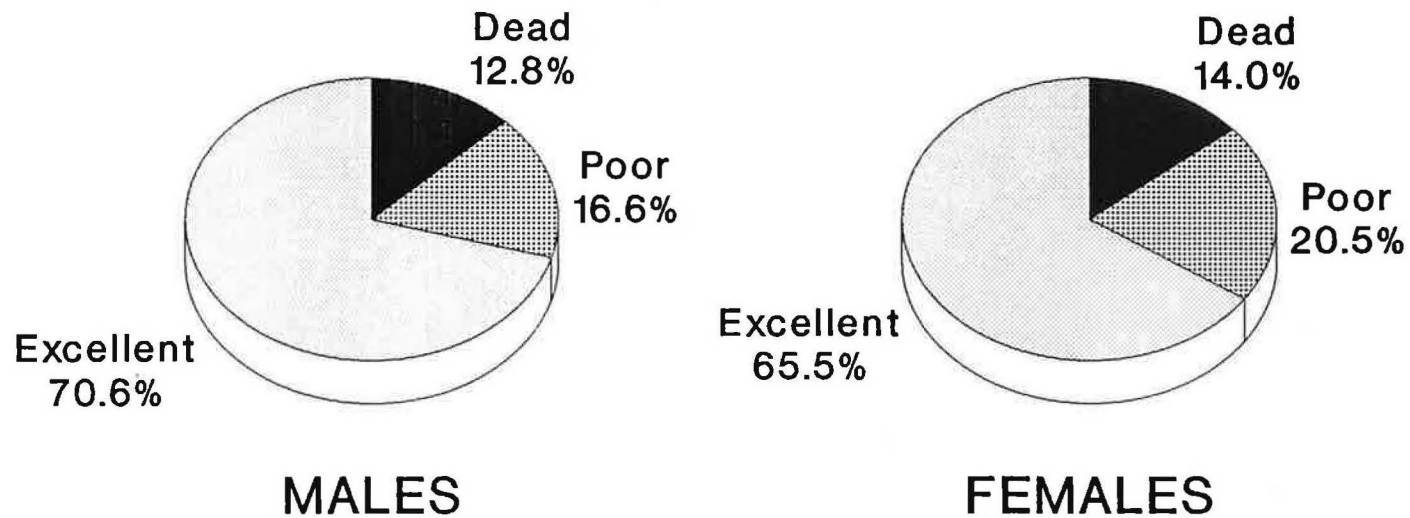


Figure 9. Red king crab viabilities in Area 512 during Port Moller Pacific cod trawl fishery, Summer 1988.

Sample sizes:  
Males = 293  
Females = 106



