

4K94-42

THE 1993 BLACK ROCKFISH FISHERY AND CATCH SAMPLING PROGRAM
KODIAK ISLAND WATERS

By

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Regional Information Report¹ No. 4K94-42

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Commercial Fisheries Management and Development Division
211 Mission Road
Kodiak, Alaska 99615

November 1994

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ACKNOWLEDGMENTS

The following Alaska Department of Fish and Game personnel provided valuable assistance in the preparation of this report: Scott Meyer provided reference materials and information on the sport catch of black rockfish, Doug Pengilly assisted in statistical analysis, Joan Brodie read the otolith samples from the commercial catch, and Gail Smith provided fish ticket information. Doug Pengilly, Dave Jackson, and Jim Blackburn provided a review of the report although all errors remain the responsibility of the authors.

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INTRODUCTION

Black rockfish *Sebastes melanops* are a slow-growing, long-lived pelagically schooling fish which occur mainly in rocky nearshore areas (Haldorson and Love, 1991). They are distributed along the Pacific coast from the south side of the Alaska Peninsula to southern California (Kessler, 1985; Eschmeyer, 1983). Tagging studies off the Washington and Oregon coast indicate that while the great majority of tag recoveries showed no movement, straying over a considerable distance can occur (Mathews and Barker, 1983; Culver, 1986; Ayres, 1988).

The 1991 Kodiak area commercial black rockfish fishery saw a dramatic increase in both catch and effort levels. Fifty-nine vessels landed over 791,000 pounds of black rockfish in the Kodiak area, compared to an annual average of 8,675 pounds for the years 1986-1990. The areas nearest the city of Kodiak saw the greatest increase in commercial effort with Chiniak/Marmot Bays and Ugak Bay contributing 58.7% of the total 1991 harvest. The sportfishing effort on black rockfish was also concentrated in this area.

Concern over this increased fishing mortality led the Alaska Department of Fish and Game (ADF&G) to propose measures to protect the rockfish resources of the Kodiak area nearest the city of Kodiak and to insure the long-term sustained-yield of these stocks. In 1992, the Alaska Board of Fisheries acting on a proposal from ADF&G Sport Fish Division set the sportfish bag limit at ten fish per day per person. The ADF&G Division of Commercial Fisheries set a guideline harvest level at 100,000 pounds (round weight) during each calendar year for the Chiniak and Marmot Bay waters shoreward of the 3 mile state territorial line from Pillar Cape to Cape Chiniak. A 50,000 pound guideline harvest level was set for the Ugak waters 3 miles shoreward of the territorial line from Cape Chiniak to Dangerous Cape (Figure 1).

The Division of Commercial Fisheries and the Sport Fisheries Division of ADF&G both conduct dockside sampling programs to document the catch of black rockfish. Data collected provides information on location, size, and age composition of the harvest. This report details the 1993 sampling effort of the Division of Commercial Fisheries and also provides a brief comparison of sport and commercial sampling data.

SAMPLING OBJECTIVES

The objectives of the dockside rockfish sampling program for commercially caught fish were established as:

1. Document the area used by the fishery.
2. Document the species composition of the fishery.
3. Document the size composition of the catch for each primary area fished.
4. Sample the catch for age composition of black rockfish.
5. Demonstrate size and age difference between male and female black rockfish.

METHODS

The 1993 Kodiak area rockfish fishery was conducted using mechanical jigging machines or hand jigs. Any number of power driven machines are attached to the bulkhead at various locations around the deck. Hooks are set out on a line from each jigging machine which automatically reel the line in when it is weighted with a fish. Individual hand jigs were also used. This is simply a hook and line set up, which is operated by hand.

The catch was delivered to a Kodiak processing plant up to three days after the fish were caught. The ADF&G dockside sampler took an average weight from the catch as it was unloaded from the boat and weighed by the processor unloading crew. The sampler conducted an interview with the skipper to gather information on catch location, gear use, and catch per unit effort.

The dockside sampler collected up to 300 length measurements from rockfish of each species delivered. The sample size depended on the size of the catch and the rate of processing. The lengths were taken from fish which were randomly selected from totes before the catch was processed.

Otoliths were collected from the black rockfish for age identification. The otoliths were extracted from the ear cavity by slicing through the upper gill and into the saccule. The sex and length of each fish from which otoliths were taken was also recorded. The sex was determined using external sex characteristics on each fish. At least 25 or more sets of otoliths were collected from each delivery. The number of fish sampled for otolith collection varied, and was influenced by the time allowed prior to the catch being processed.

The otoliths were aged by a trained ADF&G fisheries biologist using the break and burn method under protocols established by the Committee of Age Reading Experts (C.A.R.E.).

RESULTS

Areas Commercially Fished

In 1993, a total of 107,746 pounds (round weight) of black rockfish were harvested by 17 vessels from 20 statistical areas in the Kodiak area. Of this total, 96% was landed with hand or power jig gear. There were 8 hand jig vessels and 6 power jig vessels (Table 1, Figure 1).

Species Composition of the Fishery

While the fishery targeted on black rockfish, dusky rockfish *Sebastes ciliatus* were also retained for commercial use, amounting to 2.4% of the harvest. Other species of rockfish were incidentally caught and had no commercial value. These were retained for personal use by the fishermen or cannery workers and were measured and documented when possible. Species

sampled included yellowtail *Sebastes flavidus*, yelloweye *S. ruberrimus*, quillback *S. maliger*, Canary *S. pinniger*. Lingcod *Ophiodon elongatus* were also sampled.

Size Composition of the Catch for Each Primary Area Fished

Table 2 gives the size measurements of the various incidentally-caught rockfish. Size measurements for black and dusky rockfish are given in Tables 3 and 4. For black rockfish, size distribution by the statistical areas in Ugak and Chiniak/Marmot are shown graphically in figure 2. Three lingcod were measured with lengths of 84, 89, and 91 cms.

The size distributions of fish sampled from 4 statistical areas of Chiniak and Marmot Bay show significant variation (Kruskal-Wallis statistic = 316, $p < 0.0001$). In addition, the 2 statistical areas in Ugak Bay also show significant variation (Mann-Whitney U statistic = 326254, $p < 0.0001$). Figure 3 summarizes the black rockfish length measurements by statistical area.

Age Composition of Black Rockfish

A total of 304 black rockfish were sampled for age composition from sixteen landings and nine statistical areas. The sampling periods were spread from April until September, 1993. Sixty-two females and 215 males that were sampled had an overall average age of 14. The sex could not be determined from 27 of the fish sampled, so they were not included in any analyses by sex. The age composition of male and female fish is shown in Figure 4 for all the sampled areas.

Fourteen year old fish were by far the most frequent year class found, and represent 35% of all black rockfish sampled. Chiniak and Marmot Bays, Ugak Bay, and the combination of the other areas each had 14 year olds as the most common age class. All areas showed strong cohort at 17 years.

Size and Age Difference Between Male and Female Black Rockfish

Up to age 13, there are similar numbers of male and female fish in the fishery. From age 13 and older, many fewer females than males were caught, although the range of ages sampled was the same (figure 5). Females sampled reached a greater size, ranging from 38 to 56 cms in length (figure 6). The males ranged from 34 to 52 cms in length.

Comparison of Sport and Commercial Sampling Programs

Otolith sampling of sport and commercially caught black rockfish both showed a strong cohort of 14 year old fish. Both sampling programs also identified many more males than females. Combining length measurements from males and females, it can be seen that the sport sampled fish were larger (Figure 7; Student's $t = 2.58$, $df = 4240$, $p < 0.0001$).

DISCUSSION

Several facts stand out from the 1993 sampling data. More males than females are being caught by both the sport and commercial fisheries. This is true of nearly all age and size classes. It is thought that ripe females move into deeper waters for parturition (O'Connell, 1987) which may explain why they are unavailable to the nearshore fishery during the season when the catch is sampled.

Black rockfish seem to have irregular, sporadic recruitment into the population. The strong year class of 14 year olds is followed by a much weaker class of 16 year olds, and then a stronger class of 18 year olds. Even a spike of 31-32 year old fish is still apparent even after being diminished by years of natural mortality. Widely separated areas around the island showed strong recruitment in the same year (figure 4), indicating that a favorable recruitment event can be island-wide.

In addition, despite showing similar year class strengths, fish sampled from adjacent statistical areas can have significantly different size distributions. This may be the result of discrete stocks of fish, different fishing or natural mortality rates, or may be simply an artifact of the sampling program. The fact that the sampled sport caught fish are significantly larger than sampled commercially caught fish may indicate that under the constraints of a 10 fish limit, sport fishermen are releasing small fish and only retaining their larger catch. Sport fishing catch records from 1993 reveal that only 49% of rockfish caught by Kodiak area fishermen were retained (Mills, 1994).

Continued dockside sampling can help track size, age, growth, and fishery effort differences between areas over time. Of special interest would be early evidence of the presence of a strong year class entering the fishery or of the depletion of a cohort that previously had been strong. It has been suggested that black rockfish may have depth related subpopulations (Field, 1984). The effort should be made to gather more depth information by the dockside samplers.

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Table 1. Statistical areas, numbers of vessels and landings, and poundage taken during the 1993 Kodiak Island commercial black rockfish fishery.

Statistical Area	vessels	landings	poundage
525701	3	7	23422
525702	3	5	21873
525731	3	5	4350
525733	7	9	5569
525803	3	5	8298
525805	5	7	9979
525806	4	6	3807
-- ^a	17	25	30448
TOTALS	17	69	107746

^aCombination of 13 confidential statistical areas (less than 3 vessels per area).

Table 2. Incidental rockfish lengths (cm) sampled from Kodiak Island waters, April to September, 1993.

length (cm)	quillback	yellowtail	yelloweye	canary
37	0	1	0	1
38	0	0	0	0
39	0	1	0	0
40	0	2	1	0
41	1	1	1	1
42	0	2	0	1
43	1	3	0	1
44	0	4	0	1
45	0	1	0	2
46	0	1	0	0
47	0	0	0	0
48	0	0	0	0
49	0	0	0	0
50	0	0	0	0
51	0	1	0	0
52	0	0	0	0
53	0	0	0	0
54	0	0	0	0
55	0	0	0	0
56	0	0	0	0
57	0	0	0	0
58	0	0	0	0
59	0	0	0	0
60	0	0	1	0
61	0	0	0	0
62	0	0	1	0
63	0	0	1	0
64	0	0	1	0
65	0	0	0	0
66	0	0	0	0
67	0	0	0	0
68	0	0	0	0
69	0	0	1	0
70	0	0	0	0
71	0	0	0	0
72	0	0	0	0
73	0	0	1	0
TOTALS	2	17	8	7

Table 3. Dusky rockfish lengths (cm) by statistical area sampled from Kodiak Island waters, April to September, 1993.

Length	525701	525702	525703	525731	525732	525733	525805	535631
30	0	0	0	0	0	0	1	0
31	0	0	0	0	0	0	1	0
32	0	0	0	0	1	0	1	0
33	0	0	0	0	3	0	3	0
34	0	0	0	0	8	3	0	0
35	2	1	0	0	6	1	5	3
36	2	0	0	0	5	2	7	2
37	4	2	0	2	14	12	7	3
38	6	2	0	0	16	8	13	4
39	4	5	0	0	16	8	13	5
40	8	6	0	1	14	10	14	3
41	6	10	3	0	21	9	16	12
42	15	9	1	3	17	10	12	1
43	7	12	1	1	12	12	6	3
44	5	7	1	0	14	6	9	4
45	1	10	3	0	8	0	7	4
46	6	6	0	0	2	1	6	4
47	4	3	0	0	0	0	3	2
48	1	0	0	0	1	3	2	0
49	0	1	0	0	0	0	0	0
50	0	0	0	0	0	0	0	2
Totals	71	74	9	7	158	85	126	52

Table 4. Black Rockfish lengths (cm) by statistical area sampled from Kodiak Island waters, 1993.

Length	525701	525702	525703	525731	525732	525733	525803	525805	535631
28	0	0	0	2	0	0	0	0	0
29	0	0	0	1	0	0	0	0	0
30	0	0	0	2	1	0	0	0	0
31	0	0	0	9	2	0	0	0	0
32	0	0	0	7	4	0	0	0	0
33	0	0	0	4	0	1	0	0	0
34	0	0	0	10	4	0	0	1	0
35	2	0	0	11	4	5	0	0	0
36	3	1	0	21	10	0	0	4	1
37	8	3	3	18	7	2	1	8	2
38	16	7	4	37	9	7	1	18	6
39	19	21	3	40	8	6	2	13	10
40	29	21	11	35	28	0	1	29	7
41	14	9	11	32	14	6	1	38	5
42	31	25	10	39	22	10	6	38	4
43	41	41	18	47	22	16	11	53	8
44	57	70	36	57	46	25	12	85	12
45	97	100	32	69	61	48	15	73	23
46	124	99	45	53	49	48	18	113	33
47	146	84	46	23	39	40	25	76	35
48	109	38	40	20	12	27	15	66	27
49	88	42	25	11	10	17	0	64	20
50	53	20	13	3	3	13	0	53	19
51	29	6	15	4	6	9	0	49	9
52	17	4	8	3	3	2	0	28	3
53	20	2	0	1	1	2	0	21	4
54	4	1	4	0	0	2	0	15	1
55	5	1	0	1	0	0	0	1	3
56	0	2	1	0	0	0	0	5	0
57	0	0	0	0	0	0	0	2	0
58	0	0	0	0	0	0	0	1	1
59	0	0	0	0	0	0	0	0	0
60	0	0	0	0	0	0	0	0	0
61	0	0	0	0	0	0	0	1	0
62	0	0	0	0	0	0	0	1	0
Totals	912	597	325	560	365	286	108	856	7

Table 5. Summary of statistics of black rockfish length measurements (cms) taken during the 1993 commercial and sport fisheries.

Geographic Area	Statistical Area	length range (cm)		Number Measured	Number Aged				Mean Length	Std. Deviation	Mode
		minimum	maximum		??	female	male	# samples			
Inner Ugak Bay	525701	35	55	912	4	13	32	2	46.2	3.46	47
Outer Ugak Bay	525702	36	56	597	5	10	41	2	45.3	3.00	45
Kiliuda Bay	525703	37	56	325	3	4	14	1	46.1	3.27	47
Marmot Bay	525731	28	51	560	3	5	20	3	42.0	4.47	45
Outer Chiniak/Marmot	525732	30	53	365	3	9	33	2	43.6	3.96	45
Chiniak Bay	525733	33	54	286	1	5	28	1	45.6	3.38	46
N. Afognak Island	525803	37	48	108	0	0	0	0	45.2	2.33	47
Inner Marmot Bay	525805	34	62	856	7	11	34	4	46.2	4.03	46
Two-Headed Island	535631	36	58	233	1	5	13	1	46.3	3.78	47
COMMERCIAL TOTALS		28	62	4242	27	62	215	16	45.2	3.96	46
SPORT TOTALS		29	57	812	52	172	260		46.5	4.15	48

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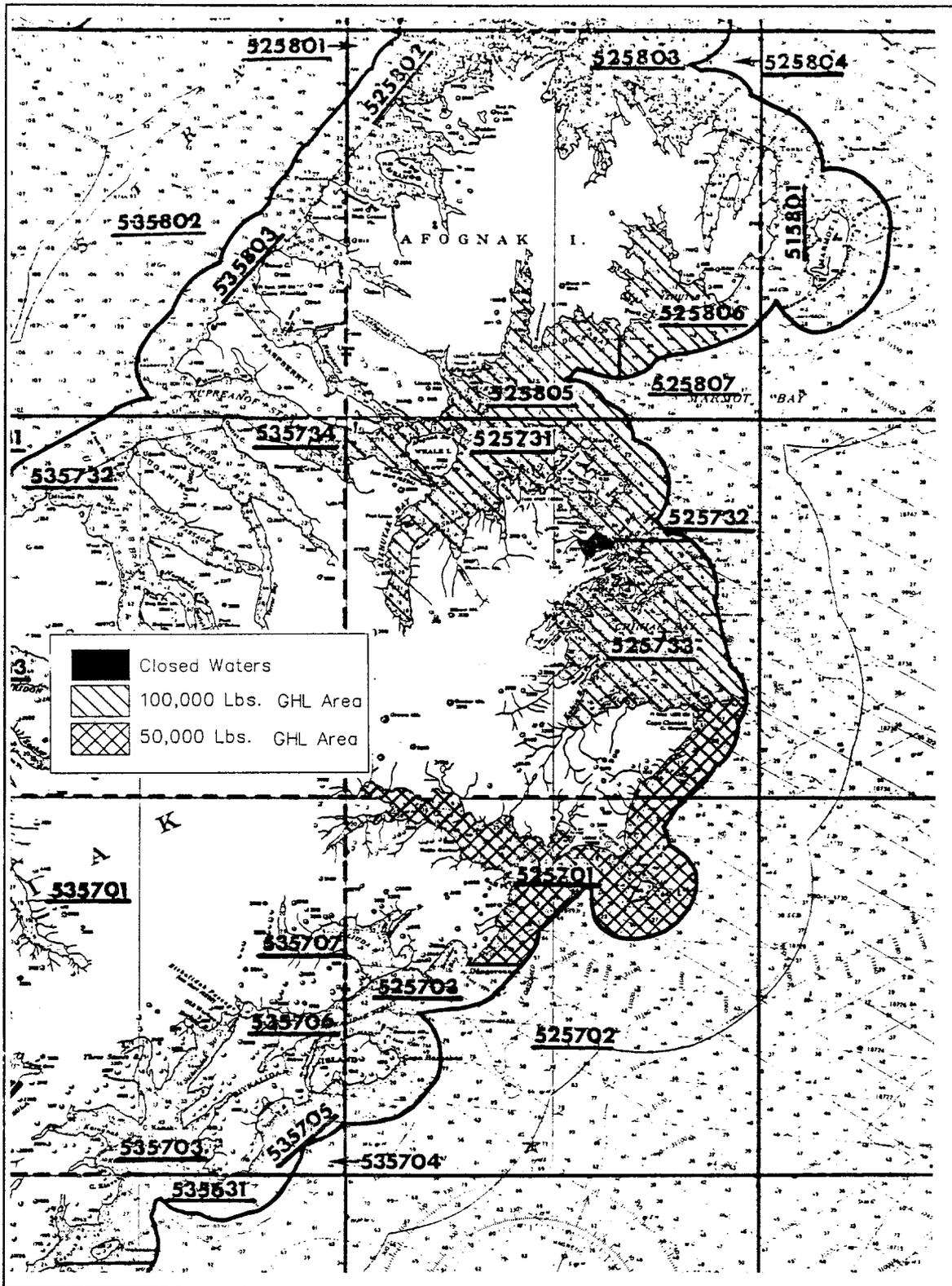


Figure 1. Guideline harvest areas, statistical areas, and closed waters for the Kodiak Island Black Rockfish fishery.

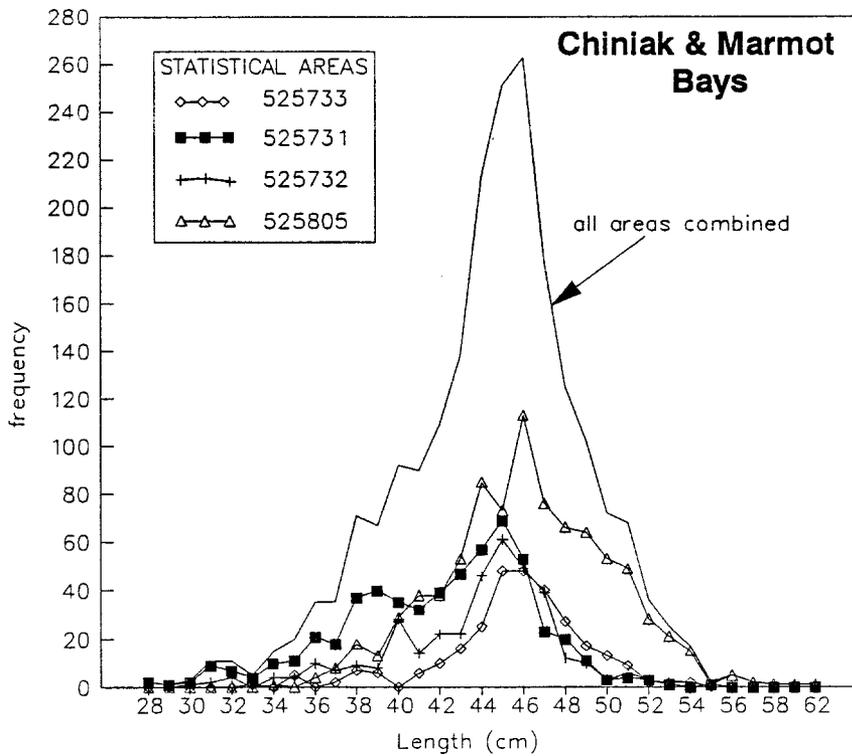
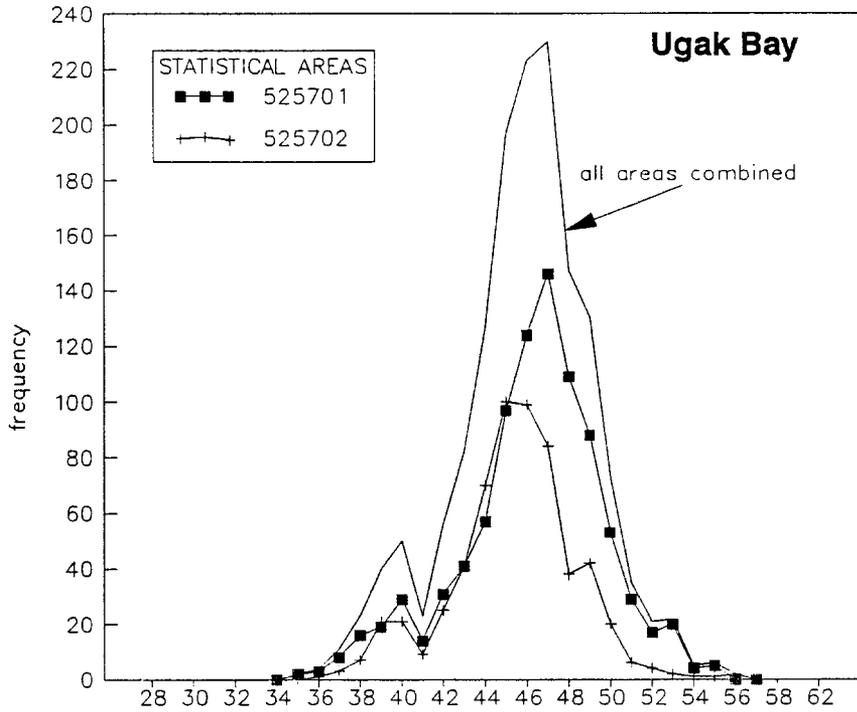


Figure 2. Length distribution of black rockfish from Ugak Bay, and Chiniak/Marmot Bays from the 1993 Kodiak commercial catch, shown by statistical area.

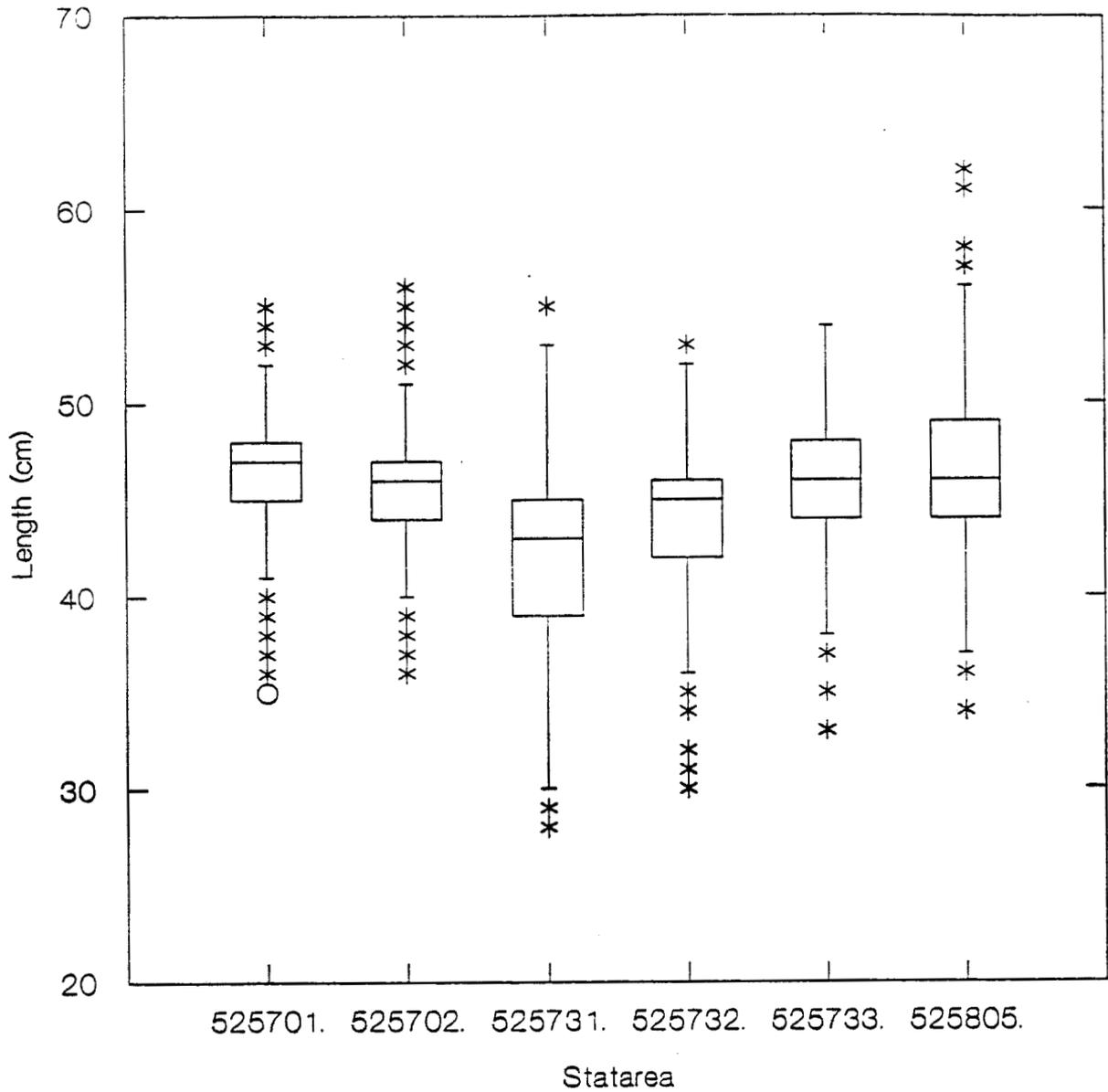


Figure 3.

"Box plots" of fish length measurements by statistical area of black rockfish taken in the 1993 Kodiak Island commercial fishery. Horizontal line in each "box" is the sample median. Bottom and top "box" gives the 25th and 75th percentile in each sample. The range of measurements is represented by the T-bar, with outlying measurements shown as a "*" or "o".

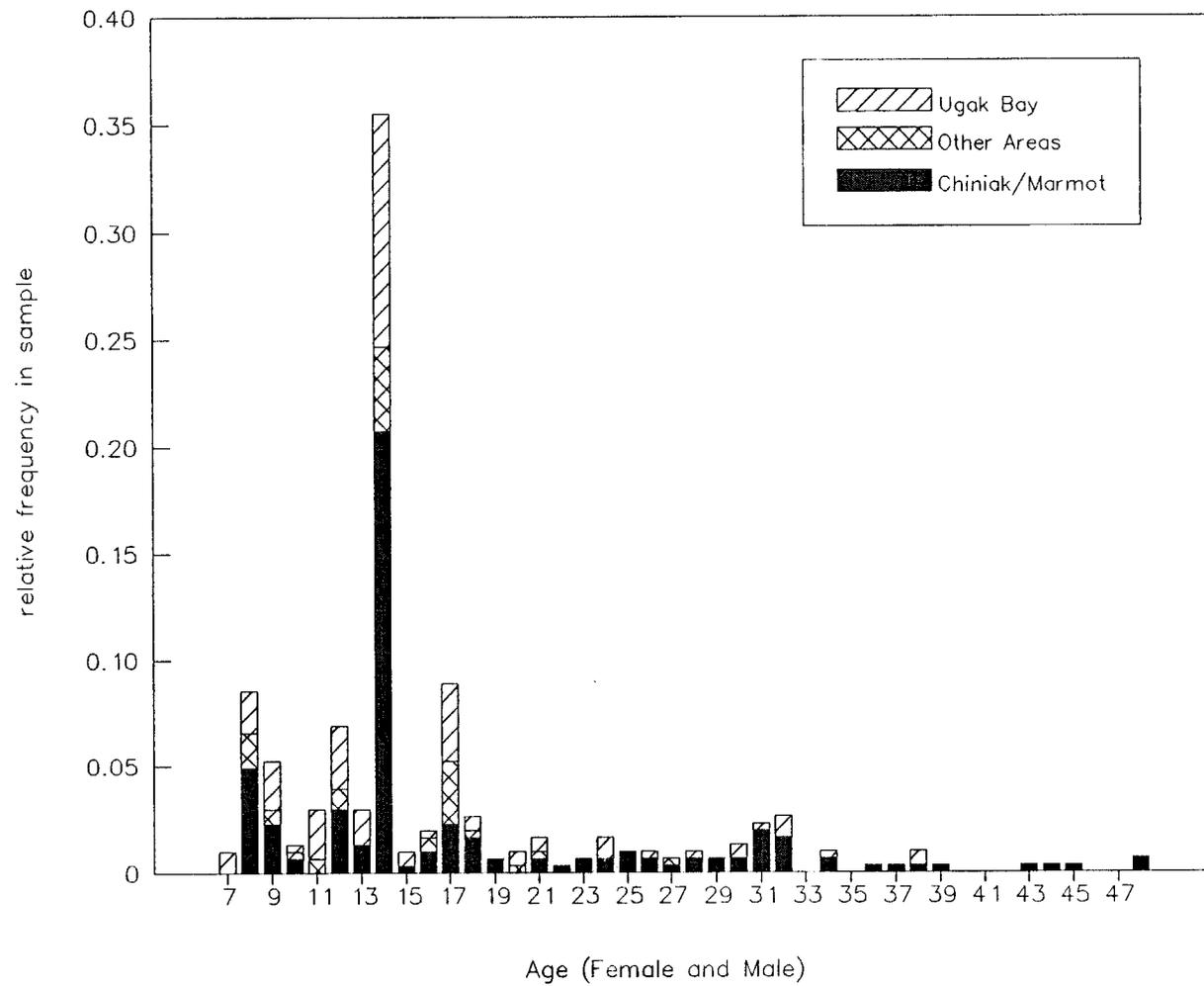


Figure 4. Age frequency by sample area of male and female black rockfish from the 1993 Kodiak Island commercial fishery.

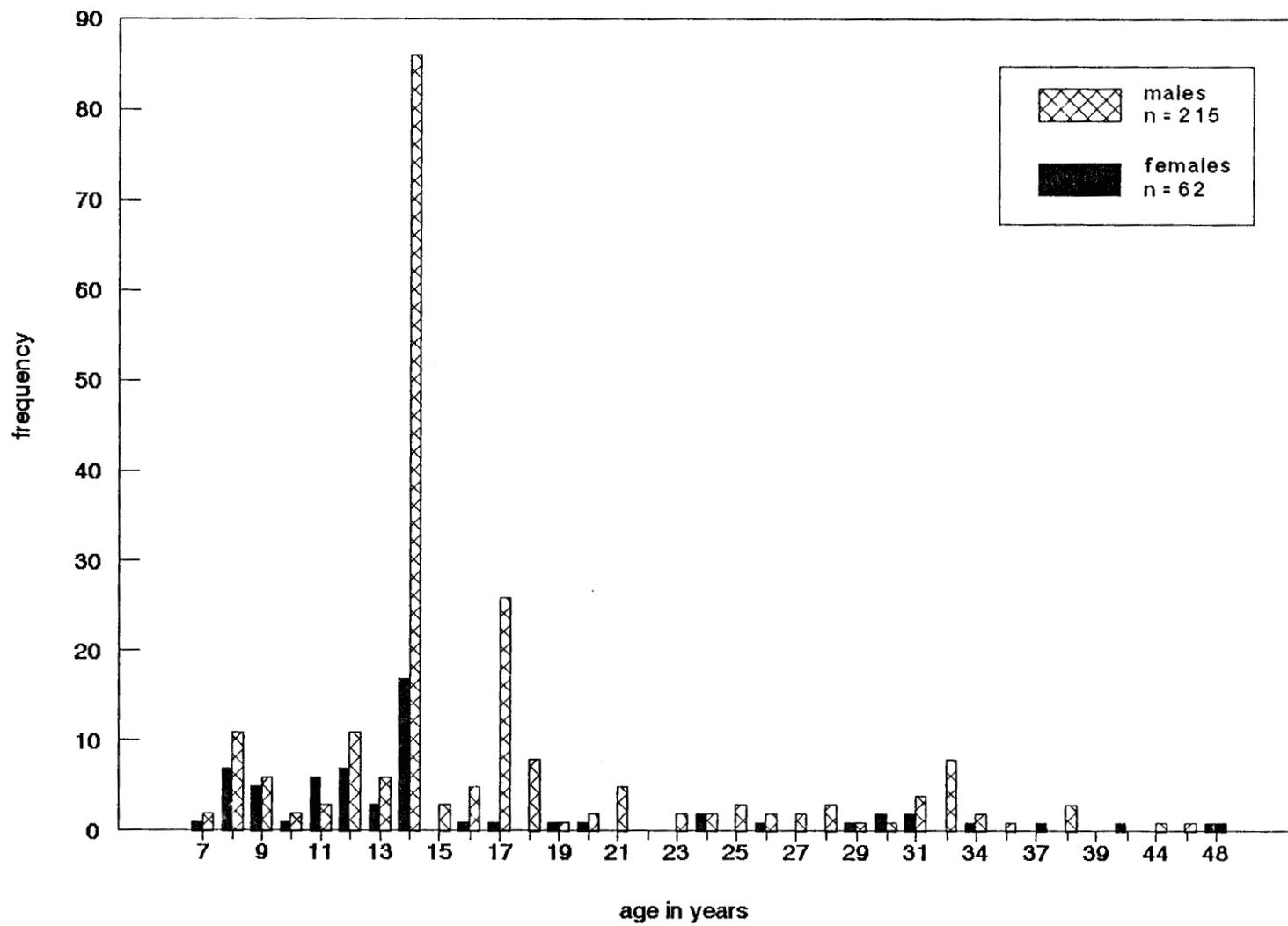


Figure 5. Ages of male and female black rockfish sampled from the 1993 Kodiak Island commercial fishery.

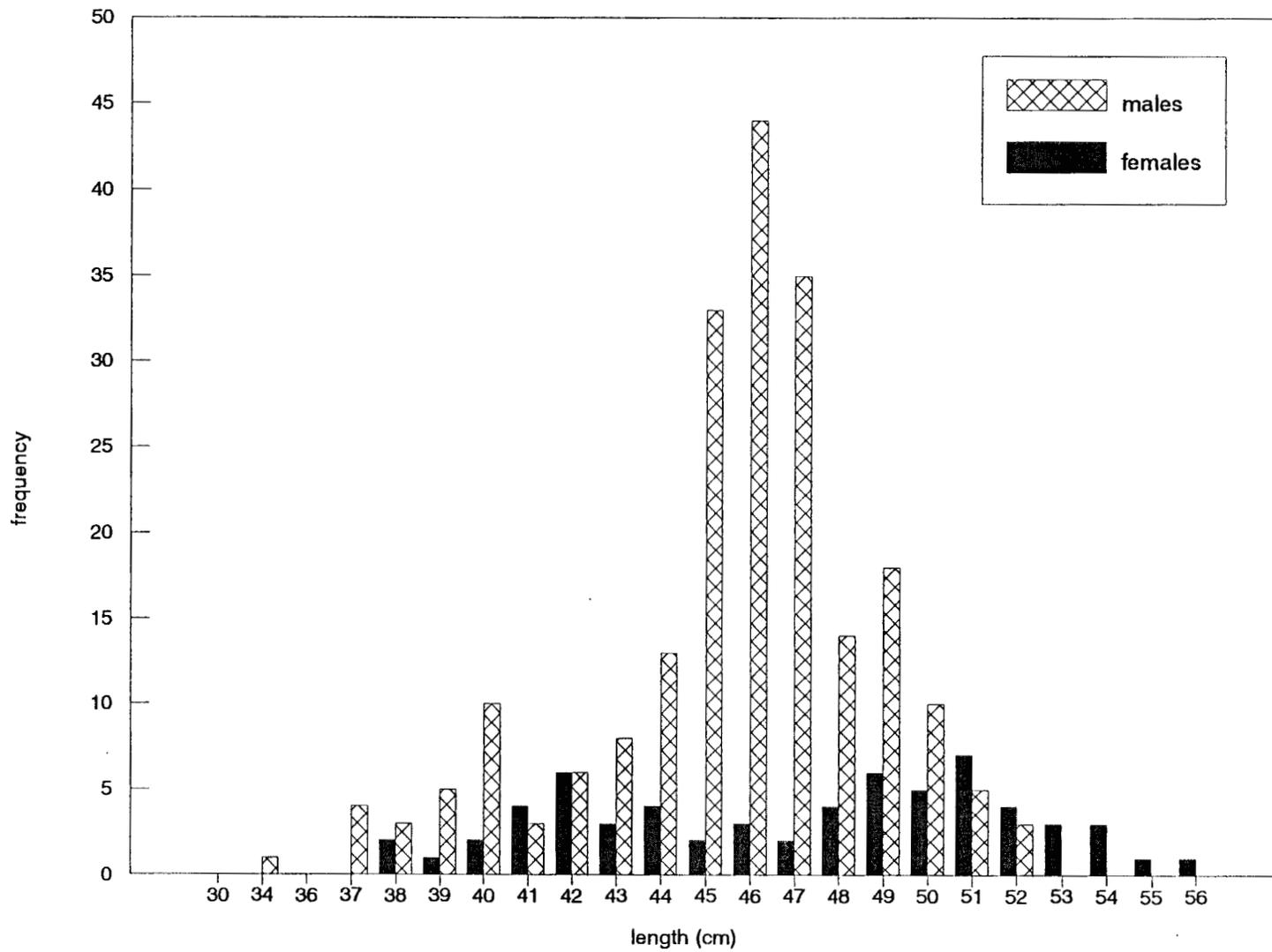


Figure 6. Lengths of male and female black rockfish sampled from the 1993 Kodiak Island commercial fishery.

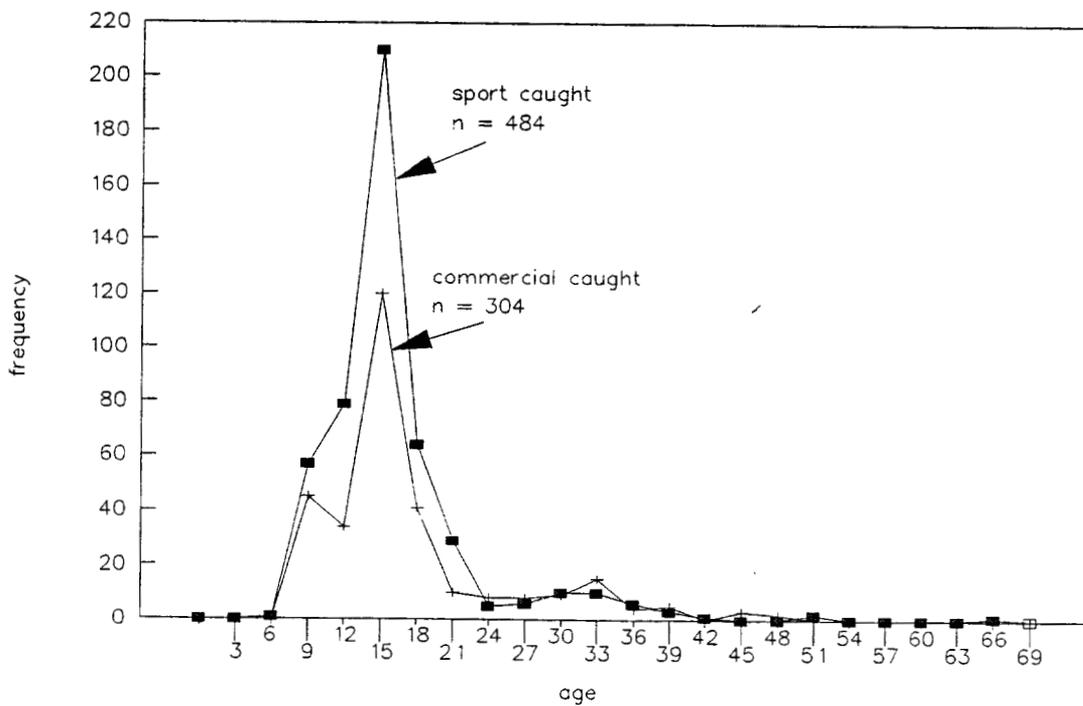
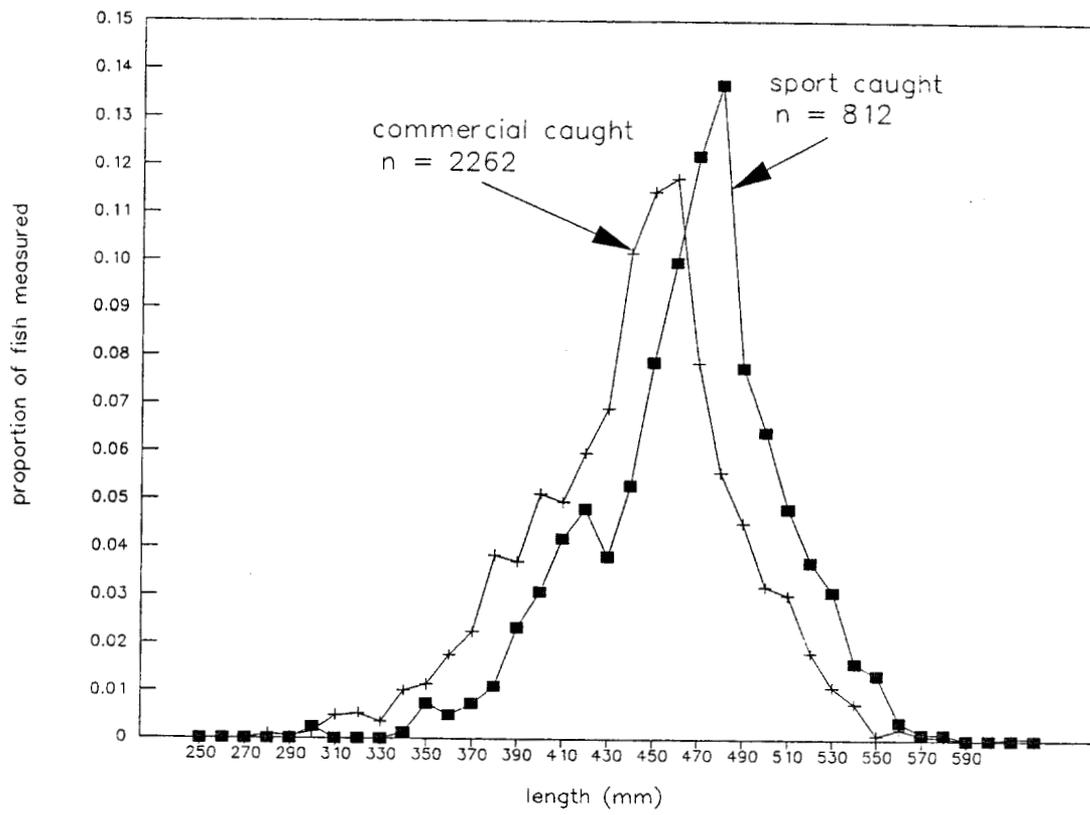


Figure 7. Length and age of black rockfish sampled from the 1993 sport and commercial fisheries.

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