Brookings

RESOURCE SURVEYS ON THE CONTINENTAL SHELF OF OREGON

ANNUAL REPORT
July 1, 1974 to June 30, 1975

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Fish Commission of Oregon

National Marine Fisheries Service
National Oceanic and Atmospheric Administration
U.S. Department of Commerce
Commercial Fisheries Research and Development Act
Project No. 1-78-D-3
Contract No. 04-4-208-6

June 1975

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1974 Annual Report of Fish Commission of Oregon

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by

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PL88-309

The following is a correction to be inserted on the above report.

Page 3, paragraph 2, section on Estimates of Biomass.

The appropriate change is: (3) the strata area divided by the average swept area of a tow equals the expansion factor.

RESOURCE SURVEYS ON THE CONTINENTAL SHELF OFF OREGON

Introduction

This report summarizes project progress in FY 1974. Activities were directed entirely at completing the fourth and final phase of work started in 1971, i.e., to survey groundfish resources on the continental shelf off Oregon between the Columbia River and Cape Blanco.

Objectives of the survey were to obtain estimates of biomass of fishes occupying the continental shelf with particular emphasis on flatfishes and to develop techniques of indexing year class strength of flatfishes important to the commercial fishery prior to their recruitment to the fishery.

A comprehensive report of the surveys covering such subjects as sampling methods and survey design is underway and will supplement this report before the end of FY 1976.

Methods

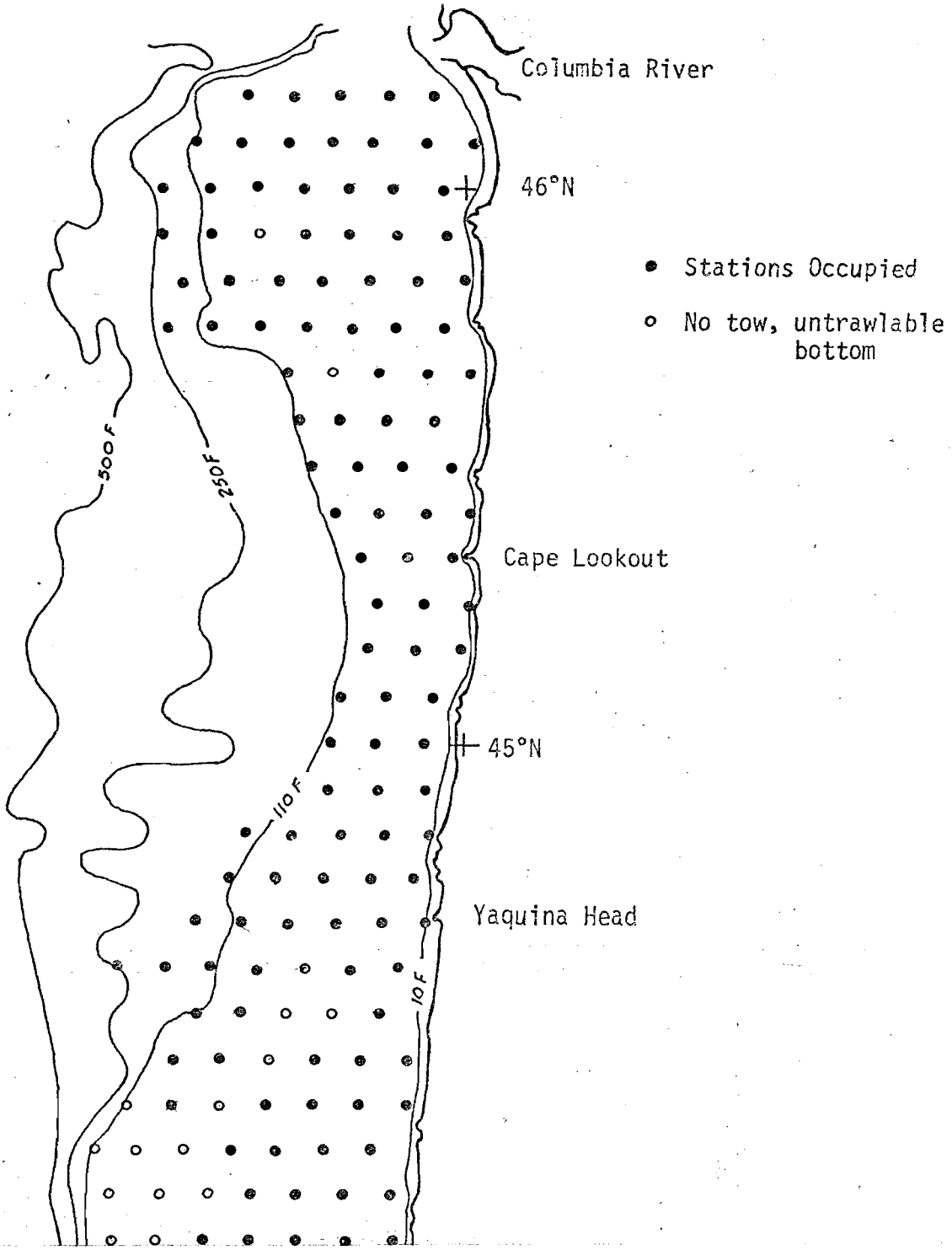
Fishing Methods

Methods developed during the 1971 survey were followed in 1974 except that tow length was increased to 1.0 nautical mile (Demory and Robinson, 1972). Also the offshore survey limit was increased to 250 fathoms, however the offshore limit was 400 fathoms between 43° N latitude and 44° N latitude. Trawl stations are shown in Figure 1.

Catch Processing

Techniques developed during the 1971 survey for sorting and sampling the catch were followed in 1974 (op. cit.). Sampling intensity was different, however, than in surveys conducted in 1971-72. In 1973-74 the proportion of the catch sampled was held constand for most catches at the following rates:

Species	Proportion Sampled
Petrale sole	0.50
Arrowtooth flounder	0.50
Dover sole	0.25
English sole	0.20
Rex sole	0.20
Pacific sanddab	0.20


Columbia River
46°N
Stations Occupied
No tow, untrawlable bottom
500 F
250F
Cape Lookout
45°N
110 F
Yaquina Head
10 F

Exceptionally large catches of any of the species were sampled at a lesser rate, usually 0.10.

Estimates of Biomass

Estimates of biomass from the 1974 survey were combined with estimates from the 1973 survey and apply to the entire continental shelf (4,240 sq. mi.) as do estimates of usable biomass and potential yield.

Calculations of biomass were made as follows: (1) the shelf was stratified into 10 fathom strata between depth limits of 10 and 110 fathoms. Depth strata greater than 110 fathoms were as follows: 110-199, 200-299, and 300-399; (2) average catch per tow by species was determined for each strata; (3) the number of tows possible within any strata divided by the average swept area of a tow equals the expansion factor; (4) the average catch per tow within strata times the appropriate expansion factor gives the biomass within the strata.

Usable Biomass and Potential Yield

Estimates of usable biomass were determined for Dover, English, petrale and rex sole and Pacific sanddab. This was accomplished by converting biomass weight to biomass numbers via age-weight key. Age specific utilization rates were then applied to biomass numbers and summed over the range in age groups. Average weight was used to convert numbers back to pounds. The result of these manipulations equals the usable biomass or that part of the biomass that would be landed under present fishery conditions. This biomass is less than the trawlable or exploitable biomass because discard of small fish is considered.

Estimates of potential yield were determined by letting fishing mortality rate F, equal the natural mortality rate of M (Tiurin, 1965). Estimates of M are: Dover sole, 0.20; English sole, 0.20; petrale sole males, 0.25 and females, 0.20; rex sole, 0.20; and sanddab, 0.25. Estimates of M for Dover and English sole are from Fish Commission data. Estimates for rex and sanddabs are arbitrary and estimates for petrale sole are from Ketchen and Forrester (1966).

Estimates of yield determined in this manner are underestimated because the usable biomass is less than the biomass susceptible to capture by commercial trawl. Trawlable or exploited biomass includes small fish that are discarded, usable biomass does not. Also, because there is a discard factor the fishing mortality is underestimated.

Year Class Strength

Relative year class strength is expressed in percent frequency.

Results

Estimates of Biomass

The biomass estimate for 1973-74 over the shelf survey area was 516 million pounds, a reduction of 16% from the estimate of 1971-72 (Table 1). Pacific hake was the most abundant species at nearly 150 million pounds, about one-half the 1971-72 estimate. The rockfish group showed an increase of 81% over 1971-72, but this difference can largely be attributed to one tow of canary rockfish that accounted for 90% of the total canary rockfish catch and 46% of the total rockfish catch on the continental shelf. Flatfish amounted to about 174 million pounds, a reduction of 5% from 1971-72. The major species, Dover sole, dropped 15% from 58 million pounds in 1971-72 to 49 million pounds in 1973-74. English sole increased 12% in biomass in 1973-74 to 45 million pounds. Sanddabs increased 12% also or 2.7 million pounds. Important flatfish showing a decrease from 1971-72 were petrale sole which declined by 24% to 8.7 million pounds and rex sole which dropped 12% to about 23.4 million pounds.

The survey in 1974 also took place on the upper continental slope between about 43°N and 44°N latitude. This area supports a major off-shelf fishery primarily on Dover sole. Biomass estimates for this area were slightly greater than 76 million pounds. Of the total, Dover sole amounted to 41.2 million pounds or 54% of the total biomass.

Table 1. Estimates of Biomass on The Continental Shelf Between The Columbia River and Cape Blanco and a Portion of The Upper Continental Slope.

Species	Catch in 1000's of pounds Continental shelf 1971-72	Continental shelf 1973-74	Continental slope 1974 [1/]	% Change from 1971-72, shelf only
Spiny dogfish	8,025	28,377		+465
Skate	37,577	37,647	1,869	+<1
Ratfish	27,194	27,657	2,177	+2
Pacific cod	1,642	1,731		+5
Pacific hake	287,164	149,822	1,008	-48
Rockfish				
Bocaccio	2,586	1,931		-25
Widow rockfish	392	689		+76
Black rockfish	661	957		+45
Yellowtail rockfish	4,911	4,535		-8
Canary rockfish	6,101	37,187		+510
Blackmouth rockfish	1,301	1,933	1,937	+49
Redstripe rockfish		256		-
Pacific ocean perch	875	1,642	1,462	+88
Stripetail rockfish	1,017	1,653		+63
Splitnose rockfish	250	340	2,558	+36
Flag rockfish	1,861	374	206	-80
Sharpchin rockfish	732	155	21	-79
Greenstripe rockfish	11,566	7,357	21	-36
Rosethorn rockfish	70	812		+1,060
Yellowmouth rockfish	272	30		-89
Longjaw rockfish	110	173		+57
Rougheye rockfish	5	259	276	+5,080
Aurora rockfish	782	57	175	-93
Thorny head rockfish	2,861	5,600	4,062	+96
Sablefish	24,653	21,996	11,197	-11
Lingcod	8,734	8,956	72	+3
Flatfish				
Pacific sanddab	23,298	26,013		+12
Arrowtooth flounder	17,060	15,337	1,492	-10
Slender sole	1,069	1,203	1,269	+13
Petrale sole	12,266	8,703	830	-29
Flathead sole	774	586		-24
Sand sole	2,589	1,182		-54
Butter sole	945	1,721		+82
English sole	40,160	44,785	365	+12
Rock sole	483	762		+58
Dover sole	57,702	49,088	41,248	-15
Rex sole	26,442	23,380	3,857	-12
Starry flounder	923	900		-2
Curlfin sole	270	237		-12
Total	615,323	516,023	76,102	-16
Rockfish	36,353	65,940	10,718	+81
Flatfish	183,981	173,897	49,061	-5

1/ Limits of survey: 43°10'N - 43°55'N.

Usable Biomass and Potential Yield

In 1971-72 estimates of usable biomass ranged from 42.1 million pounds for Dover sole to 4.8 million pounds for sanddabs. Estimates for English sole and rex sole were similar at 15.1 and 13.4 million pounds respectively. The estimate for petrale sole was nearly 6 million pounds (Table 2). Estimates of usable biomass were less in 1973-74 for all species other than sanddab which was nearly double the 1971-72 estimate. The range in 1973-74 was from 35 million pounds of Dover sole to 4 million pounds of petrale sole.

Table 2. Estimates of Usable Biomass and Potential Yield From the 1971-72 and 1973-74 Surveys Compared to Survey Area Landings. Numbers in Parentheses Are Landings From >110 Fathoms Between 43°10'N and 43°55' N Latitude and Are in Addition to Other Values. All Values in Millions of Pounds.

	Usable Biomass		Potential Yield		Average Commercial Landings, Survey Area	
	1971-72	1973-74	1971-72	1973-74	1971-72	1973-74
Dover sole	42.1	35.1	8.4	7.0	4.3	2.4(1.5)
English sole	15.1	13.4	3.0	2.7	1.4	1.4(0.06)
Petrale sole	5.8	4.1	1.3	0.9	1.2	1.6(0.3)
Rex sole	13.4	9.6	2.7	1.9	0.6	0.8(0.07)
Pacific sanddab	4.8	8.7	1.2	2.2	0.6	0.2(0)

Estimates of potential yield ranged from less than a million pounds for petrale sole in 1973-74 to 8.4 million pounds for Dover sole in 1971-72. Except for sanddabs, estimates of potential yield were less in 1973-74 than in 1971-72.

Also shown in Table 2 are the average landings from the survey area for each of the two survey periods. All species showed a potential for increased production with the possible exception of petrale sole.

Year Class Strength

A relative measure of year class strength is indicated by following a year class for the six dominant flatfish species from the 1971 through the 1974 surveys (Figure 2). A strong 1966 year class was common for four of the six species. The 1968 year class showed well for English, petrale, and rex sole. For English and petrale sole the 1970 year class also appeared strong. The 1961 year class still was abundant in Dover, English, petrale, and rex sole. This particular year class was the strongest for Dover sole since the 1942 year class. For arrowtooth flounder the 1967 and 1969 year classes appeared to be strong.

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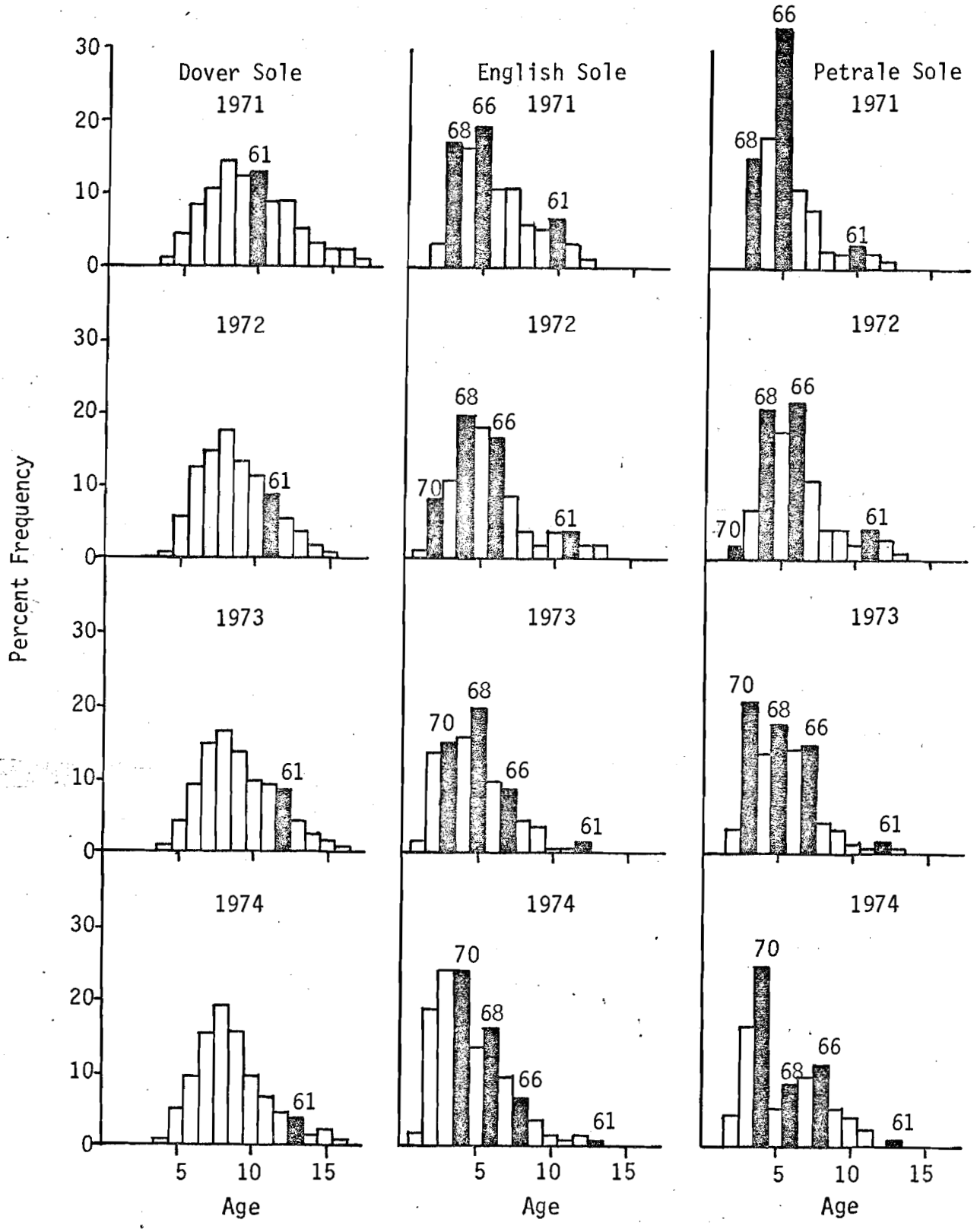

Figure 2. Year Class Strength as Indicated by Relative Frequency of Six Flatfish Species, 1971-1974. Age Frequencies of <1 Percent are not Shown.

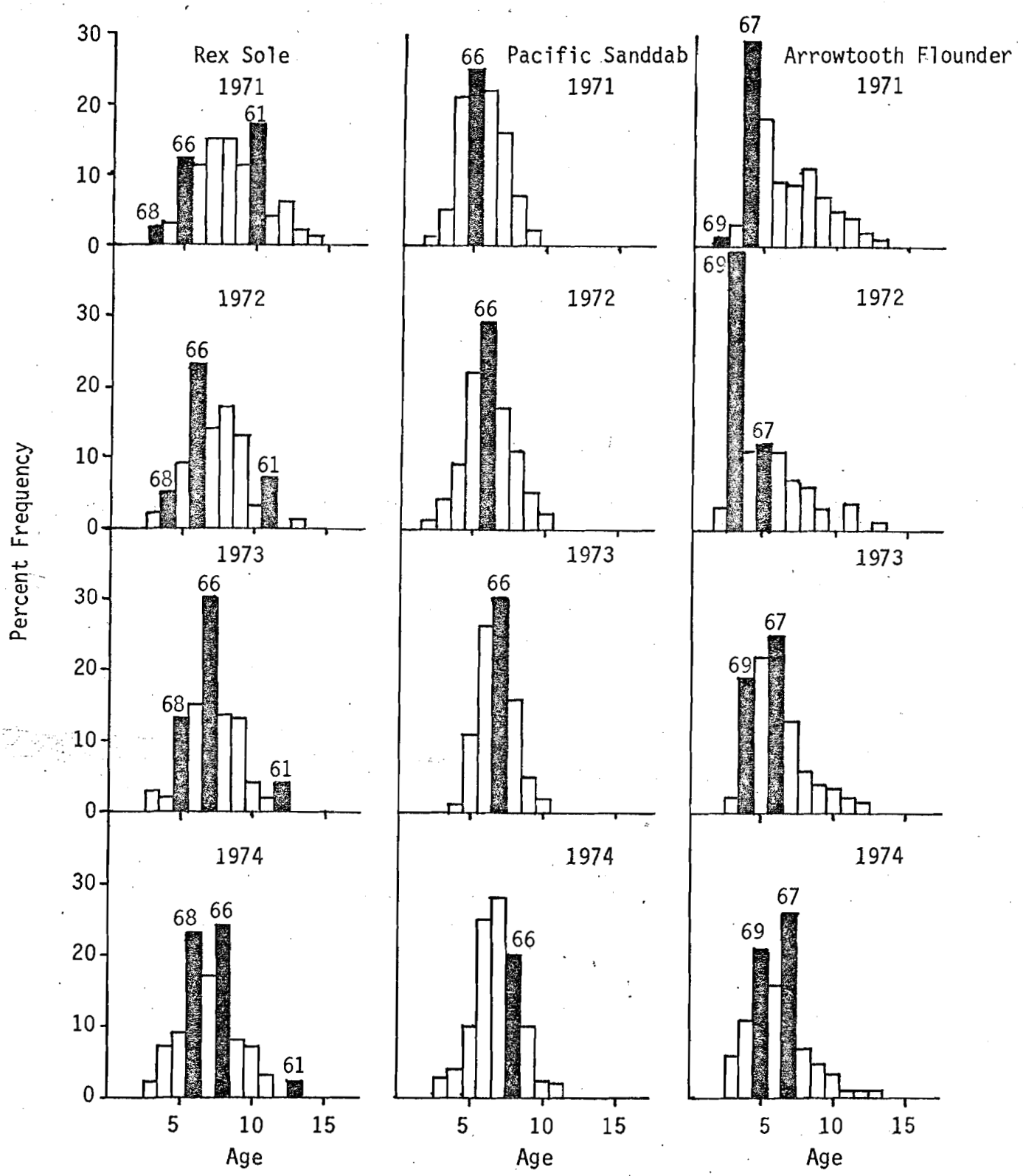

Figure 2 (Continued). Year Class Strength as Indicated by Relative Frequency of Six Flatfish Species, 1971-1974. Age Frequencies of <1 Percent are not Shown.