



Oregon's Sardine Fishery
2006 Summary

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Fishery Management

Prior to 2000, sardines were managed by individual states of California, Oregon and Washington. In 1999, Amendment 8 to the Pacific Fishery Management Council's [Coastal Pelagic Species Fishery Management Plan](#) (formerly the Northern Anchovy Fishery Management Plan) placed Pacific sardine (*Sardinops sagax*), Pacific mackerel (*Scomber japonicus*), jack mackerel (*Trachurus symmetricus*), and market squid (*Loligo opalescens*) in a management unit with northern anchovy (*Engraulis mordax*). Under the plan, a biomass estimate of sardines and coast-wide harvest guideline is established annually (Table 1).

From 1999 to 2001 the coast-wide harvest guideline was allocated 2/3 to the southern California fishery and 1/3 to the northern California (approximately Point Arena, CA), Oregon, and Washington fishery. Then in 2002, the Council adopted an interim allocation system for the 2003-2005 seasons. Discussions to design a new allocation system began in 2004 and in June 2005 the Council approved a new long-term allocation formula for Pacific sardine. The new allocation framework, which releases allocations of fish coast wide at three set dates rather northern and southern areas, was implemented for the 2006 Pacific sardine fishery under Amendment 11 to the Coastal Pelagic Species Fishery Management Plan.

2006 Sardine Fishery Allocation

The 2006 harvest guideline (HG) for Pacific sardines was established at 118,936 metric tons (mt) and on January 1st 41,628 mt (35% of the HG) was allocated coast-wide (Table 1). On July 1st 70,049 mt was reallocated coast wide (40% of the HG or 47,574 mt plus the remaining 22,475 mt from the initial allocation); and on September 15th 60,000 mt was reallocated coast wide (the remaining 25% or 29,734 mt of the HG plus the remaining 30,266 mt from initial allocations).

Developmental Fishery to State Limited Entry

Except for the coast-wide harvest guideline, management of sardines north of 39° N (approximately Point Arena, CA) continues under state management and must be consistent with the Federal Fishery Management Plan. From 1999 to 2005 the Oregon sardine fishery was managed under the Developmental Fishery Program which limits the number of harvest permits. Prior to 2001, fifteen permits were allowed and all were issued in 1999 and 2000. In 2001, five additional permits were added (for a total of 20) to encourage an increase in processing capabilities. In 2004, the sardine industry asked the Department of Fish and Wildlife to remove Pacific sardines from the developmental fisheries species list and create a limited entry system for the fishery. The Department began work with the Developmental Fisheries Board and the industry to develop alternatives for a limited entry fishery. In December 2005, the Oregon Fish and Wildlife Commission (Commission) moved the Pacific sardine fishery from a developing fishery into a state run limited entry fishery system. Twenty Oregon permits were established and made available to qualifying participants for the 2006 fishery. At that point, the Commission directed the Department

to create minimum landing requirements for permit renewal. In April, the Commission established permit renewal requirements that included annual minimum landing requirements of at least 10 landings of at least 5 metric tons (mt) each, or landings totaling at least \$40,000, based on ex-vessel price, of sardines into Oregon. The industry expressed concern over the current lack of markets and the possibility of not being able to meet the minimum landing requirements. Therefore, rules allow a waiver of landing requirements due to illness, injury, or circumstances beyond the control of the permit holder and also authorize the Commission to waive the landing requirements for the industry as a whole for any particular year due to unusual market conditions. Then, in May and August of 2006, the Commission heard public petitions to amend limited entry permit eligibility rules to include all 2005 developmental fishery permit holders who did not meet eligibility requirements chosen by the Commission in December. The Commission amended a rule which resulted in an immediate addition of 6 permits for a total of 26 limited entry permits in 2006.

Although 26 permits were issued, only 18 permits were actively utilized in the 2006 fishery (Table 1). Two of those 18 permits were transferred to vessels with the intention of qualify them under the new renewal requirements. A total of eight (of 26) permit holders did not meet the minimum landing requirements for renewal of their limited entry permit. In September, the Commission received letters from eight processors and one fisherman requesting an industry-wide waiver of the minimum landing requirements due to unusual market conditions. The Commission granted a waiver for all 2006 limited entry permit holders in January 2007 for the fishing year 2007.

Future Management

During the winter of 2007, ODFW hosted discussions with Washington and the Pacific Northwest (PNW) sardine industry to focus on current state rules that prevent a directed reduction fishery. Attendees discussed difficulties of minimizing reduction of fish and finding alternative markets for small and unwanted sardines. The two states will continue to work together with the coastwide sardine industry to consider the resource, economics and harvesting capabilities to conserve the resource, yet uphold the value of the fishery.

During the January Oregon Fish and Wildlife Commission meeting, the Commission directed ODFW staff to work with the Oregon sardine industry to establish a minimum number of permits for the fishery and create a regulatory system to reissue permits that are not renewed. ODFW staff will begin this work in summer of 2007.

In January 2007, the National Marine Fisheries Service (a division of National Oceanic and Atmospheric Administration) established the PNW sardine fishery as a category three fishery. This enables NMFS to fund the West Coast Observer Program as needed to observe fishing activity for marine mammal interactions.

Goals and Objectives

The goals for this year's work were to continue to gather information on sardines off Oregon to improve the coast-wide stock assessment of sardines and document the extent of by-catch in the fishery.

Objectives include:

- Collect size, age, and distribution data of adult sardines off Oregon, from both the harvest areas and outside harvest areas to support stock assessments and fishery resource monitoring.

- Document bycatch, in terms of species, amount, and condition. Recommend management measures to reduce by-catch if necessary.
- Document harvest methods, distribution of harvest, and catch per unit of effort.
- Continue efforts to observe vessel fishing activity at sea.

2006 Fishery

Landings & Effort

The Oregon sardine fishery is open all year and landings are made by the directed limited entry fishery, small bait fisheries and as bycatch in other fisheries. The first directed landings of sardines into Oregon since 1948 occurred in 1999 for a total of 1.7 million pounds (775.7 mt) by three vessels (Table 1).

Oregon's 2006 directed fishery started approximately a month later (August) than past years due to the late arrival of fish into northern Oregon waters. As in the past spotter planes hired by the industry were used to locate fish and the first limited entry permitted landing into Oregon was made at the end of June. However, because of the small fish size and low oil content, major harvest activities did not start in earnest until early August. Approximately 3,000 mt per week were landed during the peak of the fishery from August to September, with a fishery average of 46.5 mt (102,599 lbs) of sardine per landing (Table 2, Figure 1). Individual landings ranged from 5,498 lbs (2.5 mt) to over 223,616 lb (101 mt) and the last directed landing occurred on October 18th. Eighteen of the twenty-six permitted vessels landed a total of 35,648 mt (78,590,903 lbs) of sardines. This a 21% decrease from the 45,110 mt landed in 2005. A total of 766 landings were made at seven different processors throughout Warrenton and Astoria. The 2006 Oregon sardine fishery saw the second highest harvest on record since the current Oregon fishery began in 1999 (Table 1).

Monthly landings of sardine varied between states (Table 3 and Figure 2). Oregon had the largest monthly landings while California landings were spread throughout the year.

Fishery Value

Sardine value varied from \$0.02 to \$0.09 per pound. Roughly 4,938 mt of sardines (14% of landings) were valued at less than \$0.02/lb. The exvessel value of sardine in the 2006 sardine fishery is roughly \$3.54 million with an average price per pound of \$0.047 or \$104/mt (figures exclude those fish valued at less than \$0.02/lb).

Non Target species

Oregon's permit stipulations include at sea observers when requested by the Department or the Federal Government, requirement of a grate over the hold opening to sort out larger species of fish (such as salmon or mackerel), and seine gear logbooks. Oregon did not have personnel dedicated to ride along on sardine vessels and observe bycatch of non-target species. Available staff was able to observe 14 of 766 trips (1.8%). Vessel skippers were also required to record all species caught in a logbook. We received 97% of the logbooks for trips in 2006 which accounted for 98% of the

landings. A total of 1041 sets were made with 88% (913) of them successful for sardines. According to logbooks positive sets averaged 55 mt.

Based on Oregon fish tickets, observer, and logbook data bycatch continues to be low. Various bycatch include mackerel, northern anchovy, sharks and salmon (Tables 4 & 5). The estimated total catch of salmon for the fishery, based on log data, is 257 salmon and is the second lowest salmon incidental rate since 2000. An estimated 55% of all salmon were released alive. Based on log data, the incidental catch rates are 0.13 salmon caught per trip and 0.007 salmon per mt of sardine landed. The incidental catches of salmon during 14 observed trips with a total catch of 6 salmon in 2006 is 0.43 salmon per observed trip (two of the 14 trips did not catch fish). This does not reflect the logbook estimates of 0.13 salmon per trip but the observed rate may be high due to a low number observational trips. The observed salmon per mt of sardine caught during the observed trips (0.010) is similar to the salmon per mt rate calculated from logbooks (0.007).

Incidental catch recorded on fish tickets consisted of 665 mt of Pacific mackerel, 1.4 mt of jack mackerel, 8.6 mt of northern anchovy, 1.2 mt of Pacific herring, 0.44 mt of American shad, 0.16 mt of thresher shark and 0.01 mt of sablefish for a total of 2% of the total catch (Table 5). The 2006 Pacific mackerel exvessel value in the sardine fishery was roughly \$35,000.

Area of Catch

Most of the 2006 fishing activity took place outside of state waters (3 nautical mile line) and shoreward of the 75 fathom line of the non-trawl Rockfish Conservation Area (Figure 3). The major area of catch was approximately 24 nautical miles (nm) north and 27 nm south of the Columbia River and out to approximately 16 nm off shore. Due to large amounts of small fish in the area and the high cost of fuel, most of the 2006 fishing activity took place off Washington rather than Oregon. Based on logbook data, 36% of sardine pounds landed were taken off Oregon and 64% off Washington. In past years, 60-90% of pounds landed were taken off Oregon.

Biological Collections

Sardine biological collections were done each year (Table 6). Data collected from each fish include weight (gm), standard length (mm), sex, and maturity. Other data included on the data sheets were vessel, date, and location and depth of catch. Sex and maturity were determined using the maturity codes developed at the aging and maturing workshop in April, 2003 (Table 7).

Since vessels that land in Oregon and Washington fish in the same general areas, both states agreed to a combined sampling program to increase efficiency and random sampling of vessels. Each state collected samples on alternate weeks; two samples per week in July and August and one sample per week the rest of the season. ODFW staff collected 12 biological samples of 25 sardines each; 6 of these samples were taken in August during the peak of the fishery. Otoliths were extracted and sent to Washington Department of Fish and Wildlife (WDFW) for age-reading.

Weight, length and age of sardine

Fish selectivity (catch of fish a certain size or age) varies from year to year and the presence of dominant year classes may be seen (Figure 4). The Oregon sardine fishery typically catches fish between two and five years old. The 2006 fishery samples showed fish ages between two and eleven years with a dominant year class of three year old fish (Table 8 & Figure 4). The age

composition reflects the age of fish caught and not necessarily the age of fish in the population. The lack of one and two year olds in the catch may be due to fishers avoiding small fish.

In general as a fish increases in length it increases in weight (Figure 5). Fish sampled in 2006 ranged from 77 g to 241 g, with an overall average of 117 g (Table 6, Figure 6). Standard length ranged from 174 mm to 254 mm, with an overall average of 194 mm and a mode (most often) of 191 mm (Figure 9, Table 8). Fish length and weight can vary within age classes (Figures 7 & 8) and fish weight can vary based on the presence of food in the fish's stomach at time of sampling.

With exception to 2005, the average weight and length of sardines harvested in 2006 were smaller than previous years (Table 6, Figure 9).

Market Conditions

The abundance of small fish caused problems for harvesters and processors as established markets were geared toward larger sized fish. Markets were slow to accept fish in 2006 since many of the small fish from 2005 still remained in cold storages. Also, Japanese harvesters fished domestically to supply market needs thereby hindering sales of U.S. caught fish. Markets are continuing to be developed in 2007 and a canning market may assist in processing smaller fish for export to foreign countries.

Acknowledgements

Many big thanks go to Zac Forster, and Ryan Easton for their at-sea observations, collections and working up biological samples and logs; Washington Department of Fish and Wildlife for aging otoliths and Carol Henry of WDFW; and all the vessel skippers, crew members, and processors for their cooperation.

Table 1. Comparison of Oregon sardine fisheries, 1999-2006.

	1999	2000	2001	2002	2003	2004	2005	2006
coast-wide harvest guideline (mt)		186,791	134,737	118,442	110,908	122,747	136,179	118,936
initial northern allocation (mt)		62,264	44,912	39,481	36,969	40,917	45,393	
*initial coast-wide allocation (Jan 1 st mt)								41,628
pounds landed (metric tons)	1,709,686 (776)	21,005,311 (9,528)	28,214,988 (12,798)	50,068,717 (22,711)	55,683,476 (25,258)	79,610,370 (36,111)	99,449,714 (45,110)	78,590,903 (35,648)
permits issued	15	15	20	20	20	20	20	26
vessels targeting sardines	3	14	18	17	17	19	20	16
landings by target vessels	23	349	453	657	712	939	1,090	766
average landing (lb)	74,306	60,183	62,260	76,208	78,207	84,761	91,216	102,599
percent of OR landings harvested off OR		75%	73%	90%	65%	59%	39%	36%
start date	6/21	6/14	6/4	6/10	6/22	6/8	4/26	6/29
end date	9/15	10/12	10/5	**10/14	10/2	12/17	10/18	10/18
buyers	1	3	5	7	7	8	10	7
average ex-vessel price/lb	\$0.05	\$0.05	\$0.06	\$0.05	\$0.05	\$0.05	\$0.05	\$0.05

*New allocation system established

**Coastwide fishery closure from 9/14/2002 - 9/20/2002

Table 2. Landings (mt) of sardines into Oregon, by month 1999-2006.

Month	1999	2000	2001	2002	2003	2004	2005	2006
April - June	50	205	2,288	2,724	503	2,203	692	102
July	238	2,457	4,898	7,677	6,991	10,825	10,735	3,819
August	383	3,960	3,393	8,650	10,263	13,214	16,585	12,960
September	104	2,599	1,993	3,258	7,006	6,291	14,114	13,462
October		303	208	402	495	2,603	2,984	5,305
November		3				762		
December		2				213		

Table 3. Landings (mt) of sardines into Oregon and Washington by month and allocation period, 2006.

Initial coastwide allocation (Jan-June) is (35% of coastwide allocation): 41,628 mt					
Second coastwide allocation (July-Aug) is (40% of coastwide allocation) + (remainder of 1 st allocation): 47,574 mt + 22,186 = 69,760					
Third coastwide allocation (Sept 15-Dec) is (25% of coastwide allocation) + (remainder of 2 nd allocation): 29,734 mt + 48,342 = 78,076					
Total coastwide allocation: (Jan-Dec): 118,936 mt					
Month	OR	WA*	CA	Total	Total landed for allocation period
Jan-Jun	102		19,340	19,442	19,442
Jul	3,819	414	349	4,582	21,418
Aug	12,960	1,762	2,114	16,836	
Sep	13,462	3,347	2,583	19,392	**53,761
Oct	5,305	4099	10,049	19,453	
Nov			8,879	8,879	
Dec			6,037	6,037	
Total	35,648	9,622	49,351	94,621	94,621

*WA landing data from WDFW website

**Landing data for third period includes entire month of September.

Table 4. Reported logbook and observed catches of non-target species caught in Oregon sardine fishery, 2006.

Species	Logbook data (97% coverage); number caught	Observer data (1.8% coverage); number caught
Blue shark	3	0
Thresher shark	2	0
unknown shark	1	0
	257	6
Salmonids	(55% alive; 45% dead)	(55% alive; 45% dead)
Mackerel	292,150 lb	Approx. 30,000 lbs
Anchovy	1000 lb	½ lb
Squid	150	0
Jelly fish	<100 lb	250 lbs

Table 5. Recorded incidental catch (mt) in Oregon sardine fishery, 2001-2006 (from fish ticket data).

Species	2001		2002		2003		2004		2005		2006	
	mt landed	% of catch	mt landed	% of catch	mt landed	% of catch	mt landed	% of catch	mt landed	% of catch	mt landed	% of catch
Pacific mackerel	52.8	0.4	126.3	0.6	158.3	0.6	161.5	0.5	316.1	0.7	665	1.8
Jack mackerel	1.2	<0.1	0.3	<0.1	3.2	<0.1	24.1	0.1	3.6	<0.1	1.4	<0.1
Pacific herring	-	-	3.3	<0.1	-	-	10.3	<0.1	0.1	<0.1	1.2	<0.1
Northern anchovy	-	-	0.2	<0.1	-	-	1.0	<0.1	68.4	0.2	8.6	<0.1
American shad	-	-	0.3	<0.1	-	-	1.2	<0.1	-	-	0.44	<0.1
Pacific hake	-	-	-	-	0.1	<0.1	-	-	-	-	-	-
thresher shark	-	-	-	-	0.3	<0.1	0.3	<0.1	0.4	<0.1	0.16	<0.1
squid	-	-	-	-	-	-	13.9	<0.1	-	-	-	-
jellyfish	-	-	-	-	-	-	5.5	<0.1	-	-	-	-

Table 6. Average and range of weight (gm) and length (mm) of sardines sampled from Oregon sardine fishery, 2000-2006.

Year		2000	2001	2002	2003	2004	2005	2006
Weight (gm)	average	153.4	153.8	183.1	174.6	154.4	87.2	117.9
	range	79.9 - 273.3	46.4 - 241.0	83.2 - 301.6	29.0 - 279.0	31.3 - 293.6	29.4 - 222.0	77.2 - 241.1
Length (mm)	average	209	212	222	217	206	174	194
	range	118 - 257	145 - 256	116 - 260	70 - 300	76 - 259	120 - 287	174.0 - 254.0
Number of samples taken		940	1000	1549	968	1024	399	300

Table 7. Sex and maturity stages of Pacific sardine (abbreviated).

Code	Females - Description	Males - Description
1	Clearly immature - ovary is very small	Clearly immature - testis is very small
2	Not clearly immature - individual oocytes not visible	No milt evident and is not a clear immature
3	Yolked oocytes visible	Milt is present
4	Hydrated oocytes present	

Table 8. Fish sampling data from the 2006 Oregon sardine fishery.

Sample date	Julian Day	# of Males	# of females	# of unk.	Ave. wt. (gm)	Ave. length (mm)	% of Maturity Code 1	% of Maturity Code 2	% of Maturity Code 3	% of Maturity Code 4	% of 2 year olds	% of 3 year olds	% of 4 year olds	% of 5 year olds	% of 6 year olds	% of 7 year olds	% of 8 year olds	% of 9 year olds	% of 10 year olds	% of 11 year olds	% age unk.	
7/11/2006	193	14	11	0	120.4	190.2	80	20				79	17	4								1
7/20/2006	202	10	15	0	113.5	194.4	16	84				52	36	4	8							
8/1/2006	214	10	15	0	118.2	192.4	48	52				52	20	20	4	4						
8/3/2006	216	15	10	0	115.7	194.8	64	36				54	33	4	4			4				1
8/9/2006	222	12	13	0	127.2	197.0	40	60				56	24	4	8			4		4		
8/9/2006	222	11	14	0	131.7	201.6	8	92				44	28	16	8		4					
8/30/2006	243	14	11	0	114.5	189.9	80	20				44	28	16	12							
8/30/2006	243	10	15	0	136.2	203.5	36	56	8			52	16	8	8	4		8	4			
9/12/2006	256	11	14	0	111.7	193.0	100					75	21	0	4							
9/26/2006	270	7	18	0	105.1	188.6	28	72				96	4	0								
10/13/2006	287	10	15	0	108.3	190.0	68	32			36	52	8	4								
10/23/2006	297	12	13	0	111.7	194.3	36	64				64	24	12								
Total		136	164	0	117.9	194.1	50.4	49.0	0.6	0.0	3.0	60.0	21.6	7.8	4.6	0.7	0.3	1.3	0.3	0.3	0.3	0.2

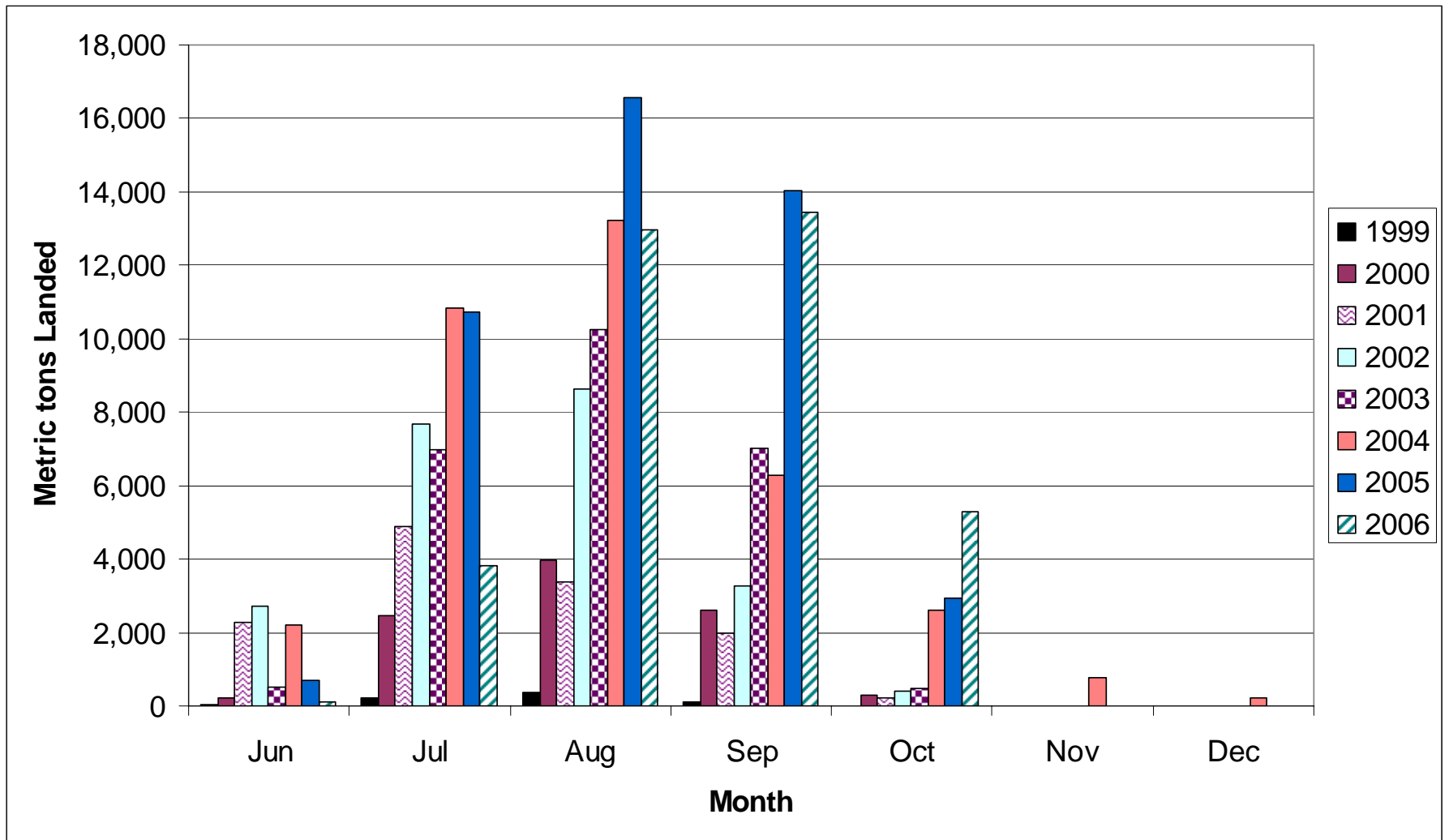


Figure 1. Monthly landings (mt) of sardines into Oregon, 1999-2006.

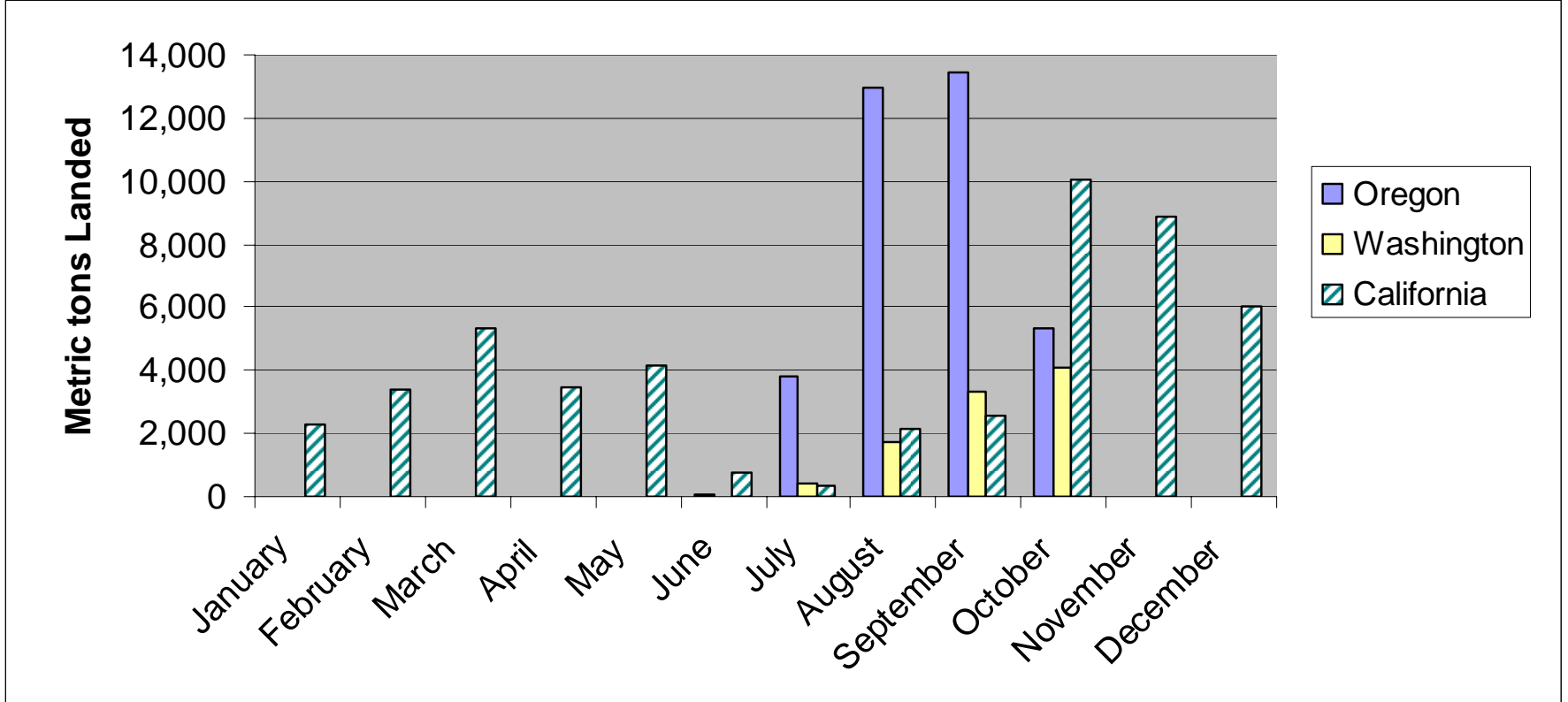


Figure 2. 2006 sardine landings by state.

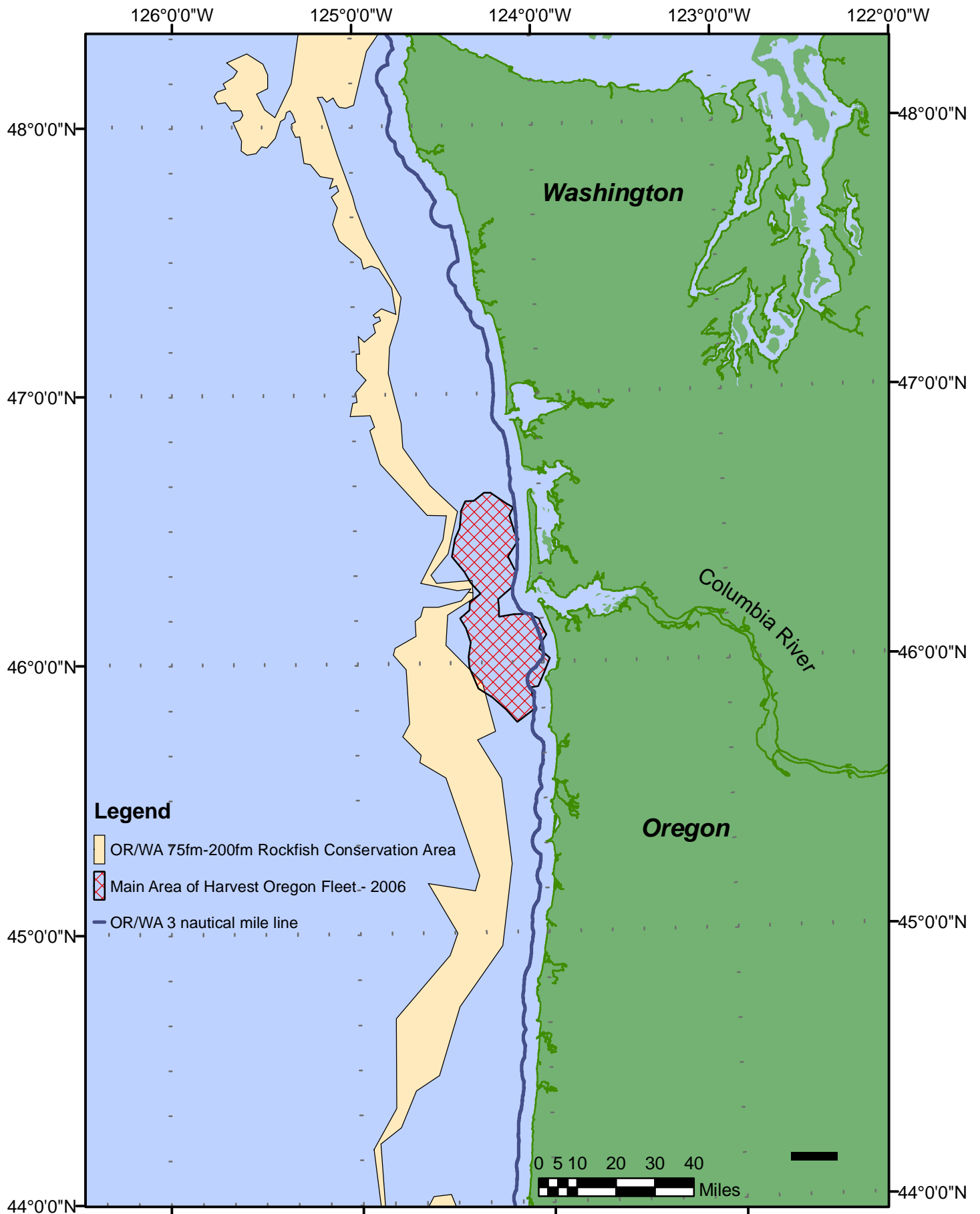


Figure 3. Major area of harvest during the 2006 Oregon sardine fishery.

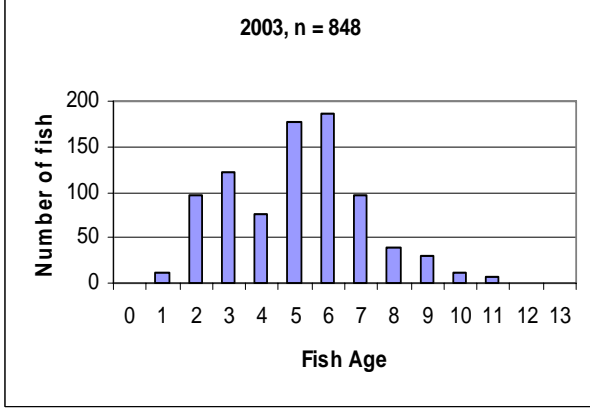
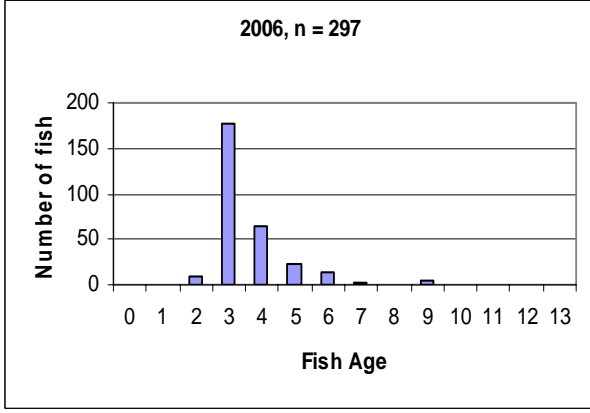
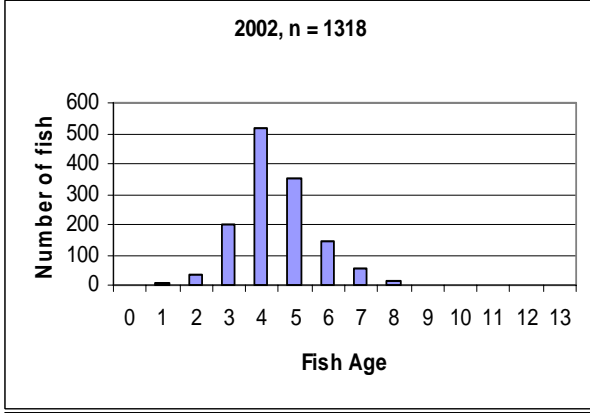
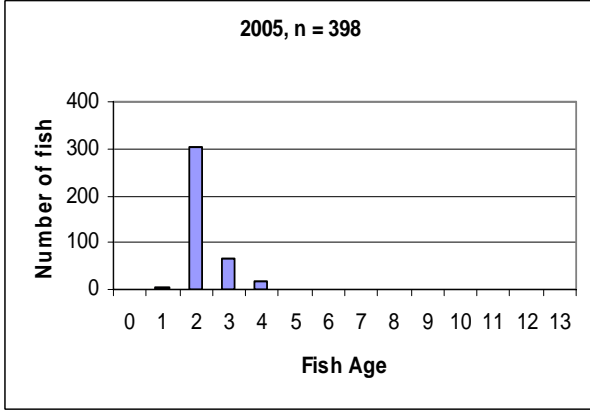
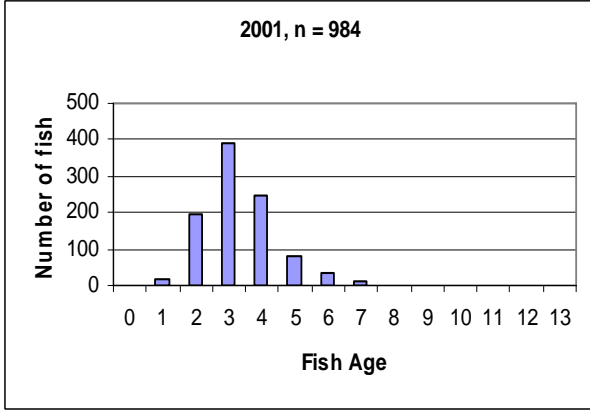
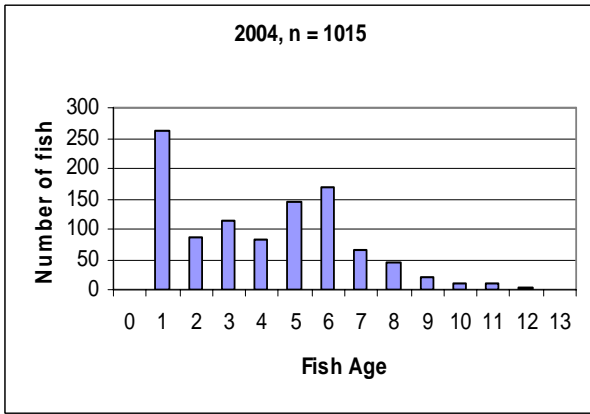
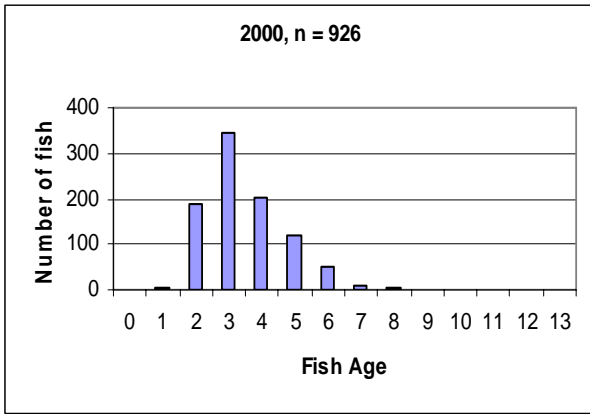


Figure 4. Fish age classes sampled in the Oregon sardine fishery 2000-2006 (n = number of fish).

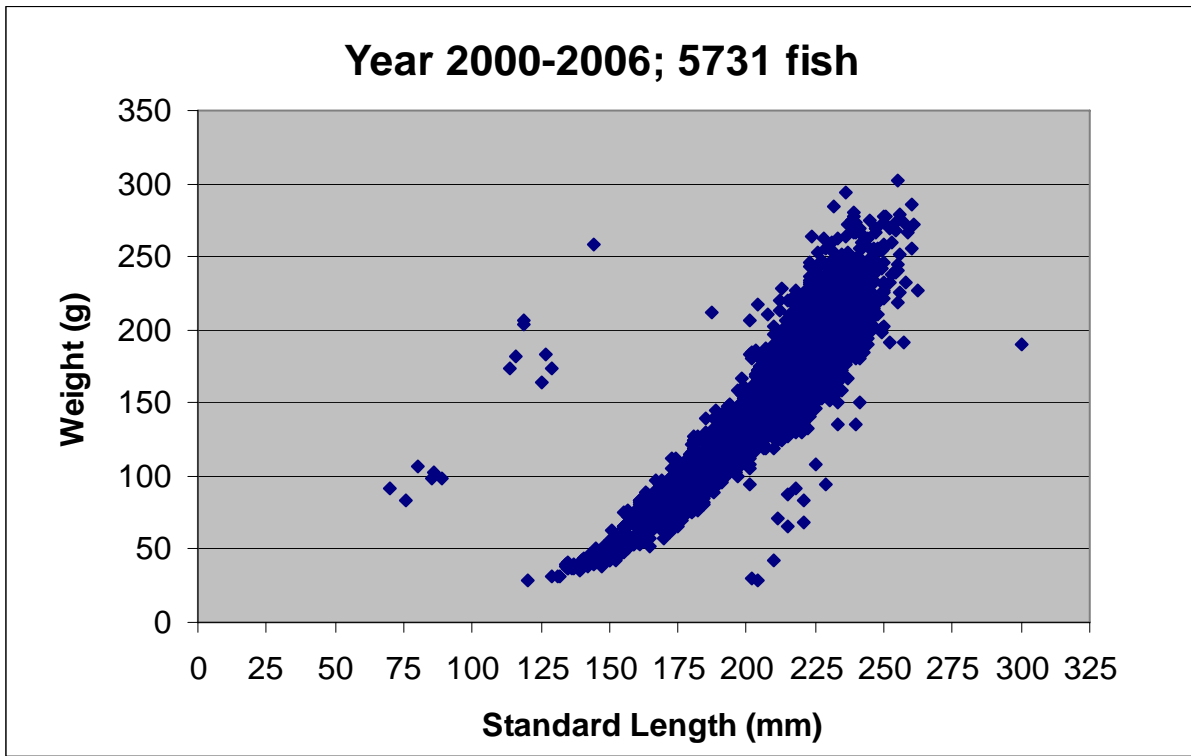


Figure 5. Fish length and weight relationship for Oregon sardine samples 2000-2006.

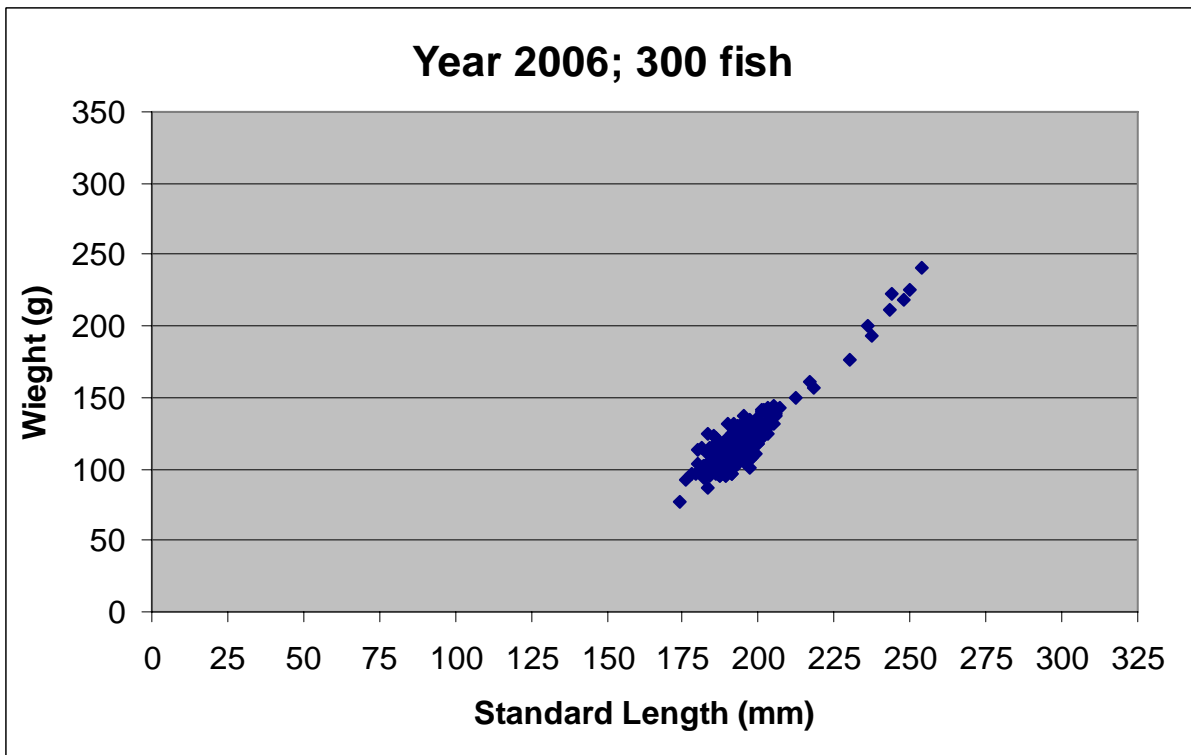


Figure 6. Fish length and weight relationship for Oregon sardine samples 2006.

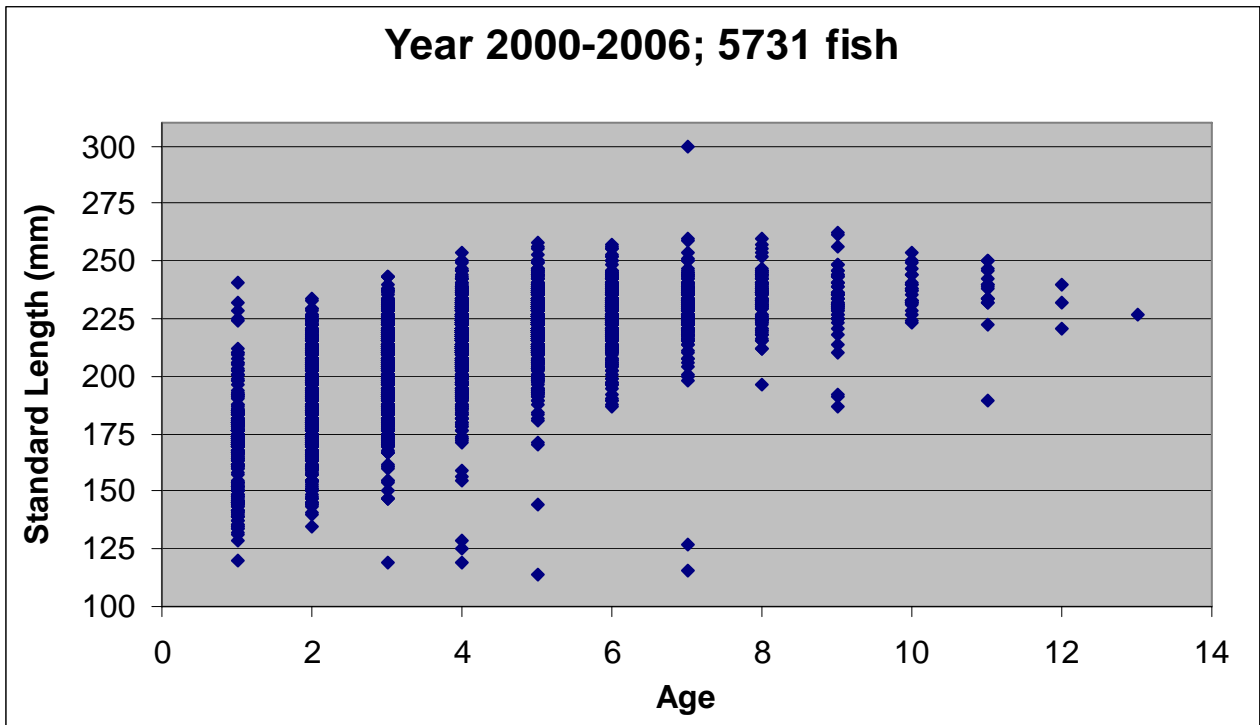


Figure 7. Fish age and length relationship for Oregon sardine samples.

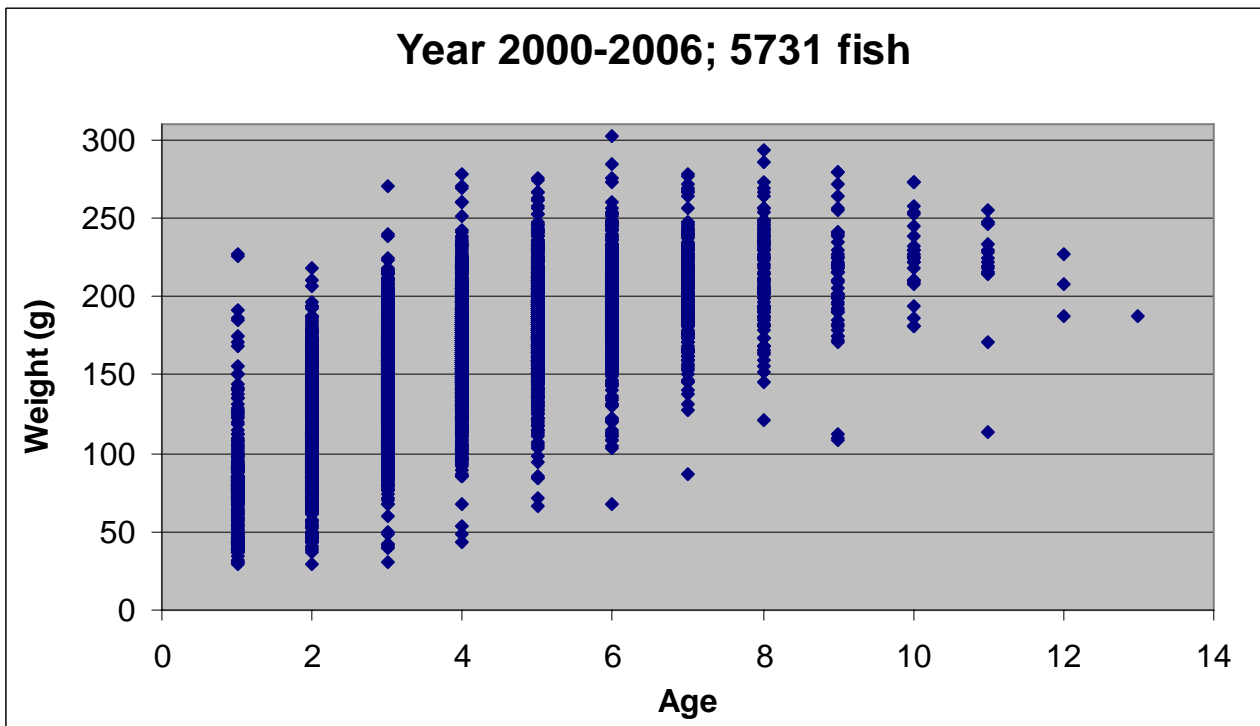


Figure 8. Fish age and weight relationship for Oregon sardine samples.

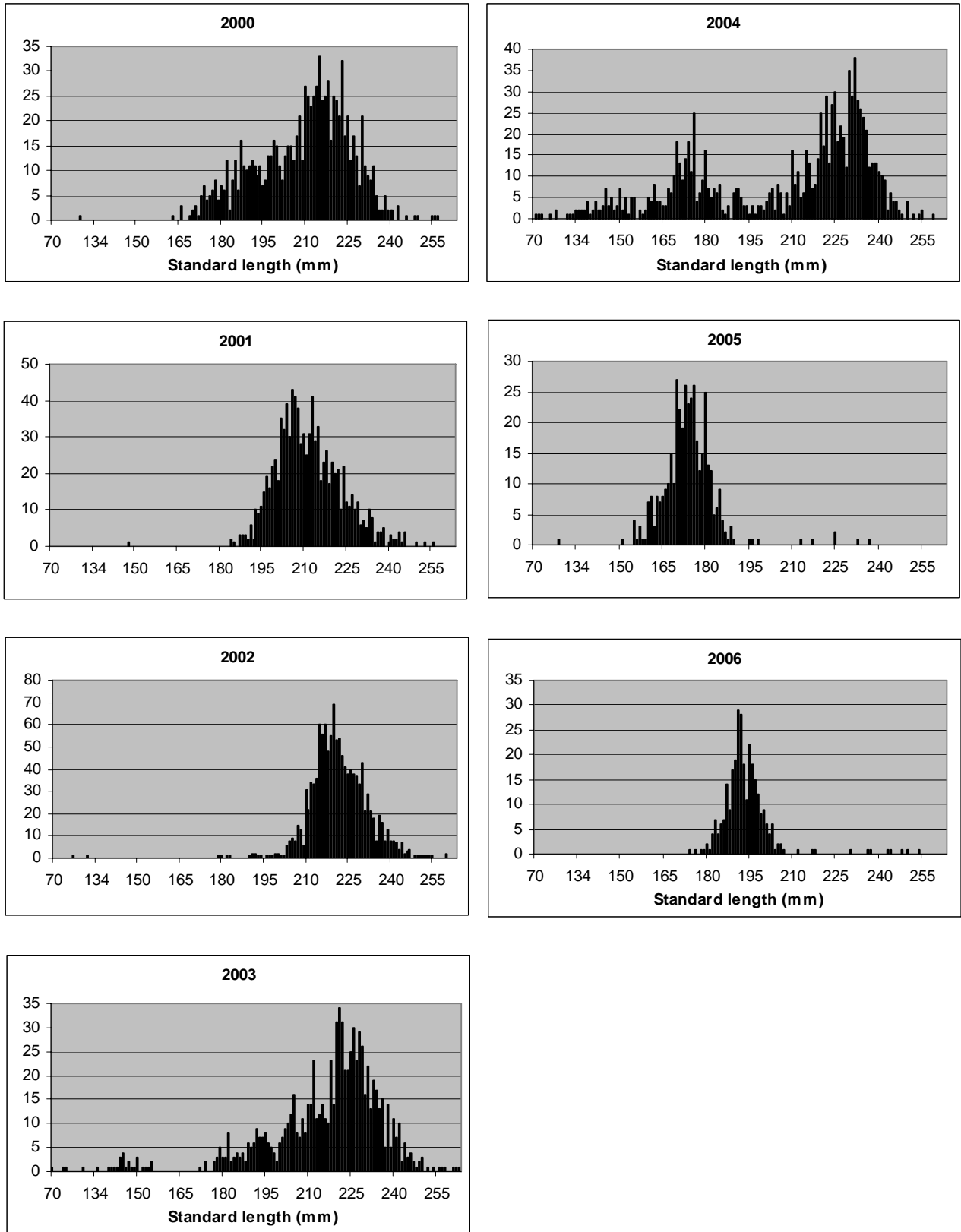


Figure 9. Sardine size frequencies in the Oregon sardine fishery 2000-2006. Y-axis is number of fish.