



Oregon's Sardine Fishery
2008 Summary

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Fishery Management

Pacific Sardine (*Sardinops sagax*) management has been transformed over the recent decade as a result of biological and industry changes in the directed sardine industry coast wide. Below is a brief overview of the federal and state management plans.

Federal Fishery Management Plan

In the past, sardines were only managed by the individual states of California, Oregon, and Washington. In 1999, the Pacific Fishery Management Council's Amendment 8 [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, an annual coast-wide harvest guideline (HG) for sardines was established beginning in 2000 (Table 1). The HG is based on annual sardine biomass assessments and a maximum sustainable yield control rule defined in the Fishery Management Plan.

From 2000 to 2001, the coast-wide HG was allocated 2/3 to southern California and 1/3 to northern California (north of Morro Bay), Oregon, and Washington. In 2002, the Council adopted an interim allocation system for the 2003-2005 seasons that changed the definition of the sub areas and other rules by the following:

- Moved the geographical boundary between sub area A and B from 35 degrees 40 minutes to 39 degrees latitude (Point Arena California).
- Moved the date for un-harvested allocation from October 1 to September 1.
- Changed the percent reallocated from 50% for both areas to 20% for sub area A and 80% for sub area B.
- Reallocated all un-harvested sardines that remained on December 1, coast wide.

Discussions to design a new long-term allocation system began in 2004 and in June 2005, the Council approved the new allocation formula for Pacific sardine which released allocations of fish coast wide at three set calendar dates rather than to northern and southern areas. The new allocation framework was implemented for the directed Pacific Sardine fishery under Amendment 11 of the Coastal Pelagic Species Fishery Management Plan in 2006:

1. January 1, 35% of the HG to be allocated coastwide;
2. July 1, 40% of the HG, plus any portion not harvested from the initial allocation, to be reallocated coastwide; and
3. September 15, the remaining 25% of the HG, plus any portion not harvested from earlier allocations, to be reallocated coastwide.

The HG was set at 89,093 metric tons (mt) for the January 1 – December 31, 2008 fishing year. The directed sardine fishery was allocated 80,083 mt and the set aside for incidental harvest was established at 8,910 mt (Table 2). The initial allocation for the three periods was as follows: 26,550 mt for January 1 – June 30th; 34,568 mt for July 1 - Sept 14; and 19,065 mt for September 15 – December 31.

Developmental Fishery Transitions to State Limited Entry System

Like Oregon, California and Washington manage their directed sardine fishery programs. All three states are required to be consistent with the Federal Fishery Management Plan. From 1999 to 2005, the Oregon sardine fishery was managed through Oregon Department of Fish and Wildlife (ODFW) Developmental Fisheries Program (DEVO) which limited the number of harvest permits. In December 2005, the Oregon Fish and Wildlife Commission moved the Pacific sardine fishery from a developing fishery into a state run limited entry fishery system. Since 2005, a number of revisions have been made to the limited entry system involving number of permits and renewal requirements; details of changes can be found in previous year's reports. During their January 2008 meeting, the Commission established a new permit renewal deadline. Previously the permit renewal deadline was December 31 of the year the permit was issued. It is now December 31st of the year in which the permit is sought for renewal.

ODFW Fishery Goals and Objectives

The goals for this year's work were to continue to gather information on sardines off Oregon and to continue 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 harvest areas and 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.

Oregon Sardine Fishery for 2008

The 2008 Oregon sardine season was challenging for Oregon's sardine directed fishing industry due to the significant decrease of the HG from prior years. The 2008 HG was the first to fall below 110,000 mt since an annual coastwide HG was set beginning in 2000 (Table 1). The HG in 2008 was 42% less than in 2007. California's efficient ability to catch and process sardines, plus good weather and markets allowed the fishery to catch all of the 35% of the sardines allocated for the first period before the end of May of 2008 (Table 3). Thus, the first of the three allocation periods was unavailable for Oregon and Washington which typically started their sardine fisheries in mid-June during previous years. The second coast wide allocation period commenced on July 1 and closed early on August 8 for all three states harvesting sardines directly. The final allocation period in 2008 was open for only eight days beginning September 15, with landings again in all three states. The harvest of sardines in Oregon was 22,949 mt in 2008. The 46% decrease in harvest for Oregon reflecting the 42% decrease in the overall HG.

Off Oregon, weather events such as storms, heavy fog, or high seas are major factors in the success rate of catching sardines. The gap in landings evident in early July was due to adverse weather (Figure 1). These types of events demonstrate the difficulties in predicting how many pounds of sardines could be

delivered during any given day. Other variables that can affect Oregon based fishermen is the quality of the sardines. Belly thickness, quantity of food in the stomach tissues, average size of the fish, and oil content, can all influence the quality of the fish. All of these factors can effect the ex vessel price paid to the fishermen. Sardines caught in the summer months in the area of Oregon and Washington are feeding in the productive nutrient rich waters. During this time, the fish are increasing their oil content or “fat”. Oil content is important in the palatability for human consumption. If the oil content is high people will enjoy eating the fish. The peak in oil content for sardine off of Oregon and Washington generally occurs in August and September which coincide with the peak months of sardine landings in Oregon the previous three years (Figure 2).

Sardine fishing in Oregon and Washington waters and landing in the Astoria area is a day time fishery. When possible, spotter planes are used to assist fishing vessel captains in locating schools of fish. The spotter plane pilots and the fishing boat captains work as a team in increasing the efficiency in catching sardines. When fishermen are successful at rounding up their catch, distances to processors can be a factor. Tides, currents, and contending with the Columbia River all produce challenges in the cost in fuel and predictably of the Sardine fishery. Most offloads begin in the mid to late afternoon and/or at night. It is rare for a fisherman to make more then one landing in a twenty four hour period.

Landings & Effort

The first directed landing of sardines into Oregon since 1948 occurred in 1999 for a total of 1.7 million pounds (776 mt) by three vessels (Table 1). The highest landings took place in 2005, with over 99 million pounds (45 mt) landed.

August and September have generally been the months with the highest rate of landings. However, because of allocation issues described above, this peak fishing period was not available to Oregon fishermen in 2008 (Figure 1 and 2). The allocation restrictions also effected July whereby fishermen and processors fished earlier and harder. The HG for the second and third periods was exhausted quickly. The average weekly landing for the second allocation period was approximately 5,952,479 lbs, (2,700 mt) per week. The third coast wide allocation period was open for eight days. Oregon’s total landings for the 3rd and final allocation period were 14,934,109 lbs, (6774 mt) of sardines. Individual vessel landings ranged from 1,680 lbs (0.76 mt) to over 251,000 lb (113.8 mt) (Figure 3).

Monthly directed sardine fishery landings of sardines varied between states. Oregon harvested approximately 26.5% of the overall HG. California landed 66% and Washington landed 7.4% of the allocation (Table 3).

A total of 471 landings were made to eight different processors throughout Warrenton and Astoria. A handful of landings were made in Newport, but the fish were transported to the Astoria area where they were processed and frozen.

Occasionally, vessels set on fish that exceed the capacity of the vessel and will often share the fish with another vessel. Rather than releasing the fish, the vessel will hold the fish in the net and allow another vessel to pump from the first fishing vessels' net. According to logbook information approximately 3,798,190 lb (690 mt) were shared between vessels.

Although twenty-five permits were issued, only twenty-two permits were actively utilized in the 2008 fishery (Table 1). The top three vessels targeting sardines and landing into Oregon accounted for 24.6% of the harvest.

Fishery Value

Sardines landed in Oregon were marketed for both human consumption and bait. Sardine value varied from zero value to \$0.145 per pound. Of the 22,949 mt of sardines landed, 96.2 % were valued at \$0.08 or greater per pound. Roughly 607.1 mt of sardines, 2.7% of landings, were valued at less than \$0.02 per pound. The ex-vessel value of the 2008 sardine fishery in Oregon was approximately \$5.66 million dollars, the highest on record (Table 1). It is noteworthy that even though the harvest declined by 63,561 mt (46 %) from 2007, the value of the fishery increased by about \$1.12 million (25%) because of the higher price per pound in 2008.

Non Target Species

Oregon's sardine permit rule stipulates that an at sea observer is required to be allowed on the vessel, when requested by ODFW. Currently ODFW does not have personnel dedicated to observe on sardine vessels whereby documenting bycatch of non-target species. Available staff made attempts to observe trips, however only one of the 471 trips (0.2%) was observed. The observer viewed one Coho salmon, which was released alive which is required by law when ever possible. The state requires the use of a grate over the intake of the hold to sort out larger species of fish, such as salmon or mackerel. The grate size spacing can be no larger then 2-3/8 inches between bars.

Oregon limited entry sardine permit rules require fishermen to report in the logbook incidental catch including salmonids and other species. Logbook data indicate approximately 885 sets were made of which 85% of sets were successful for catching sardines. The estimated total catch of salmon for the fishery, based on log data, was 198 salmon (Table 4). The incidental catch rate was 0.008 salmon per mt of sardines landed. An estimated 62% of all salmon were released alive. Other non-target species caught in the 2008 season included Pacific and jack mackerel, Pacific herring, Northern anchovy, Pacific hake, American shad, and sharks.

Based on Oregon fish tickets, bycatch in the fishery continues to be low, with approximately 116.9 mt of non-target species landed for 22,949 mt of sardine (Table 5). More than half of the non-targeted species landed within the directed sardine fishery was Pacific mackerel (56.8 mt) which had an ex-vessel value of approximately \$7,813. The other coastal pelagic species (CPS) components of incidental catch were 1.6 mt of Jack mackerel and 2.4 mt of Northern anchovy. Pacific herring composed the second largest component of non-target species landed in the 2008 fishery.

Area of Catch

Most of the fishing activity, according to log book data, took place off the coast of Oregon and Washington in waters averaging 58 fathoms. The range of depth was as little as 5 fathoms and as much as 500 fathoms. The average temperature of the water was 56 degrees Fahrenheit. Of the 885 sets made, 526 (59%) where sets at or after twelve noon. The furthest area fished to the north was off of Point

Granville Washington, north of Grays Harbor. The southern range was as far south as Cape Perpetua, just south of Newport. There was a small effort in landing into Newport for a short time (Figure 4).

Biological Collections

Collection of biological data from the directed sardine fishery started in 2000. Data collected from each fish includes: weight in grams (g), standard length in millimeters (mm), sex, and maturity stage. Sex and maturity are determined by using the maturity codes system developed at the aging and maturity workshop in April, 2003 (Table 6). Under the direction of the Pacific Fishery Management Council's Coastal Pelagic Species Management Team, biological sampling was based on a formula proportional to the number of metric tons landed in the ports in Oregon. The goal of four fish samples (25 fish per sample) for every 1000 mt landed is the current guideline. In 2008, the ODFW staff collected 80 biological samples; 60 samples were collected during the second allocation period and 20 during the third period. All of the otoliths collected were sent to the Washington Department of Fish and Wildlife for age reading.

Fish weight, length, maturity and age of sardine

The Oregon sardine fishery typically catches fish between two and five years old with some variation from year to year. Fish selectivity (catch of fish targeted by sizes) varies from year to year and the presence of dominant year classes may be seen. Age data for 2008 fishery samples showed fish ages between two and ten years with a dominant year class of four year old fish (Figure 5 & 6). The age composition reflects the age of fish caught and not necessarily all ages of fish in the population. Fish sampled in 2008 ranged from 54 g to 232 g, with an overall average of 122 g. Standard length ranged from 118 mm to 257 mm, with an overall average of 199 mm (Table 7 & Figure 7). Additional age information is available for years 2001-2008 (Figure 9).

Most of the fish (88.3 %), both male and female, for 2008 were a maturity code 2, not clearly immature (Figure 8). Only a handful of fish showed signs of maturity stage 3. Females within the maturity code guideline have an additional 4th stage. Two females sampled were in the category of stage 4.

Future Management

The 2009 HG coast wide for Pacific sardines was established at 66,932 mt which is 26 % less than the 2008 HG. The fishing year starts January 1, 2009. The Pacific Fishery Management Council recommended set asides of 6,500mt for incidental catch and 1,200 mt for industry sponsored research (Table 8). Therefore, the directed sardine fishery will operate under an adjusted allocation of 59,232 mt.

Incidental catch set aside amounts for each seasonal period were created based on historical landings of sardine catch in other CPS fisheries such as squid and anchovy. The purpose of the incidental catch set aside is to prevent premature closures of other CPS fisheries mainly occurring in California. In addition to the incidental catch set aside, an industry sponsored research project, which started in the summer of 2008 to investigate methods for an additional index of abundance, is expected to be expanded in 2009. National Marine fisheries service will have to issue an exempted fishing permit(s) for this work before fish may be utilized for this study. If the incidental set aside is not fully attained or is exceeded in a

given allocation period, the National Marine Fisheries Service may adjust the directed harvest allocation to account for the discrepancy for the next allocation period as an automatic action. For example, if the directed commercial sardine harvest is attained and other CPS fisheries achieve their incidental set aside, retention of sardines may be prohibited. If a set aside amount is not used it may be rolled into the next seasonal period adjusted allocation.

Acknowledgments

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Table 1. Comparison of Oregon sardine fisheries, 1999-2008										
	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
coast-wide harvest guideline (mt)		186,791	134,737	118,442	110,908	122,747	136,179	118,936	152,654	89,093
initial northern allocation (mt)		62,264	44,912	39,481	36,969	40,917	45,393			
pounds landed in Oregon (mt)	1,709,686	21,005,311	28,214,988	50,068,717	55,683,476	79,610,370	99,449,714	78,590,903	92,927,053	50,592,780
	776	9,528	12,798	22,711	25,258	36,111	45,110	35,648	42,151	22,949
permits issued	15	15	20	20	20	20	20	26	26	25
vessels targeting sardines	3	14	18	17	17	19	20	16	22	22
landings by target vessels	23	349	453	657	712	939	1,090	766	877	471
average landing (lb)	74,306	60,183	62,260	76,208	78,207	84,761	91,216	102,599	105,960	104,171
percent of Oregon landings harvested off Oregon		75%	73%	90%	65%	59%	39%	36%	27%	37%
start date	21-Jun	14-Jun	04-Jun	10-Jun	22-Jun	08-Jun	26-Apr	29-Jun	07-Jun	**01-Jul
end date	15-Sep	12-Oct	05-Oct	*10/14	02-Oct	17-Dec	18-Oct	18-Oct	13-Oct	**22-Sep
buyers	1	3	5	7	7	8	10	7	8	8
average ex-vessel price/lb	\$0.05	\$0.05	\$0.06	\$0.05	\$0.05	\$0.05	\$0.05	\$0.05	\$0.05	\$0.11
Total value of Sardine Fishery (Sardines only)	\$85,889	\$1,108,126	\$1,547,878	\$2,633,988	\$2,718,336	\$4,596,848	\$5,550,238	\$3,714,520	\$4,539,791	\$5,659,963

* Coastwide Sardine Fishery Closure from 9/14/2002 - 9/20/2002

** Coastwide Sardine Fishery Closure from 8/8/2008 & 9/23/2008

Table 2. Coast wide allocation for directed sardine fishery, 2008.

	Jan 1 - June 30	July 1- Sept 14	Sept 15 - Dec 31	Total
Seasonal Allocation (mt)	31,183	35,637	22,273	89,093
Set aside %	5.2%	1.2%	3.6%	10%
Set Aside (mt)	4,633	1,069	3,207	8,909
Adjusted Allocation (mt)	26,550	34,568	19,066	80,184

Table 3. Directed sardine landings (mt) into Oregon, Washington, and California, 2008.

Allocation Periods	Month	OR	WA	CA	Total
*Period 1 <i>Jan 1 - June 30</i>	Jan-Jun	0	0	26,674	26,674
**Period 2 <i>July 1 - Sept 14</i>	Jul	9,691	2,581	14,001	26,273
	Aug	6,474	1,613	6,405	14,492
***Period 3 <i>Sept 15-Dec 31</i>	Sep	6,774	2,106	9,484	18,364
	Oct	0	0	0	0
	Nov	0	0	0	0
	Dec	0	0	0	0
	Total	22,939	6,300	57,291	86,530
	Percent landed	26.5%	7.4%	66.1%	

* Period 1 closed, May 29, 2008

**Period 2 closed, Aug. 8th, 2008.

***Period 3 closed, Sept 23, 2008.

Table 4. Estimated number of salmon caught in directed sardine fishery based on log book data and at sea observers, 2000-2008.

	2000	2001	2002	2003	2004	2005	2006	2007	2008
salmon recorded	206	472	274	460	823	541	257	519	198
salmon/trip	0.6	1.1	0.4	0.7	0.9	0.5	0.03	0.6	0.4
salmon/mt	0.02	0.04	0.013	0.02	0.023	0.013	0.007	0.012	0.008
% of logs turned in to ODFW	94%	93%	95%	88%	95%	92%	97%	99.9%	100%

Table 5. Recorded incidental catch in metric tons from fish tickets, 2001-2008.

	2001	2002	2003	2004	2005	2006	2007	2008
Pacific mackerel	52.8	126.3	158.3	161.5	316.1	665	699.7	56.8
Jack mackerel	1.2	0.3	3.2	24.1	3.6	1.4	8	1.6
Pacific herring	-	3.3	-	10.3	0.1	1.2	-	55.8
Northern anchovy	-	0.2	-	1	68.4	8.6	-	2.4
American shad	-	0.3	-	1.2	-	0.44	-	0.3
Pacific hake	-	-	0.1	-	-	-	-	-
thresher shark	-	-	0.3	0.3	0.4	0.16	0.14	-
squid	-	-	-	13.9	-	-	-	-
jellyfish	-	-	-	5.5	-	-	-	-

Table 6. Maturity stages of Pacific sardine (abbreviated) for males and females

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 7. Weight and length data for directed sardine fishery, 2000-2008.

Year		2000	2001	2002	2003	2004	2005	2006	2007	2008
Weight (gm)	avg.	153.4	153.8	183.1	174.6	154.4	87.2	117.9	109.6	121.8
	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	67.3 - 270.2	53.9 - 232.2
Length (mm)	avg.	209	212	222	217	206	174	194	196	199
	range	118 - 257	145 - 256	116 - 260	70 - 300	76 - 259	120 - 287	174.0 - 254.0	170 - 271	118-257
Number of fish sampled		940	1000	1549	968	1024	399	300	2075	2000

Table 8. The Federal sardine harvest guideline, seasonal allocation, set aside totals, and adjusted allocation, 2009.

	Jan 1- June 30	July 1- Sept 14	Sept 15 – Dec 31	Total
Total Harvest Guideline	66,932			66,932
Set Aside (mt)	1,000	1,000	4,500	6,500
Research set aside	0	*1,200	0	1,200
Adjusted Allocation (mt)	22,006	25,293	11,933	59,232

* If research set aside not use in the 2nd allocation it will be added to the 3rd allocation period.

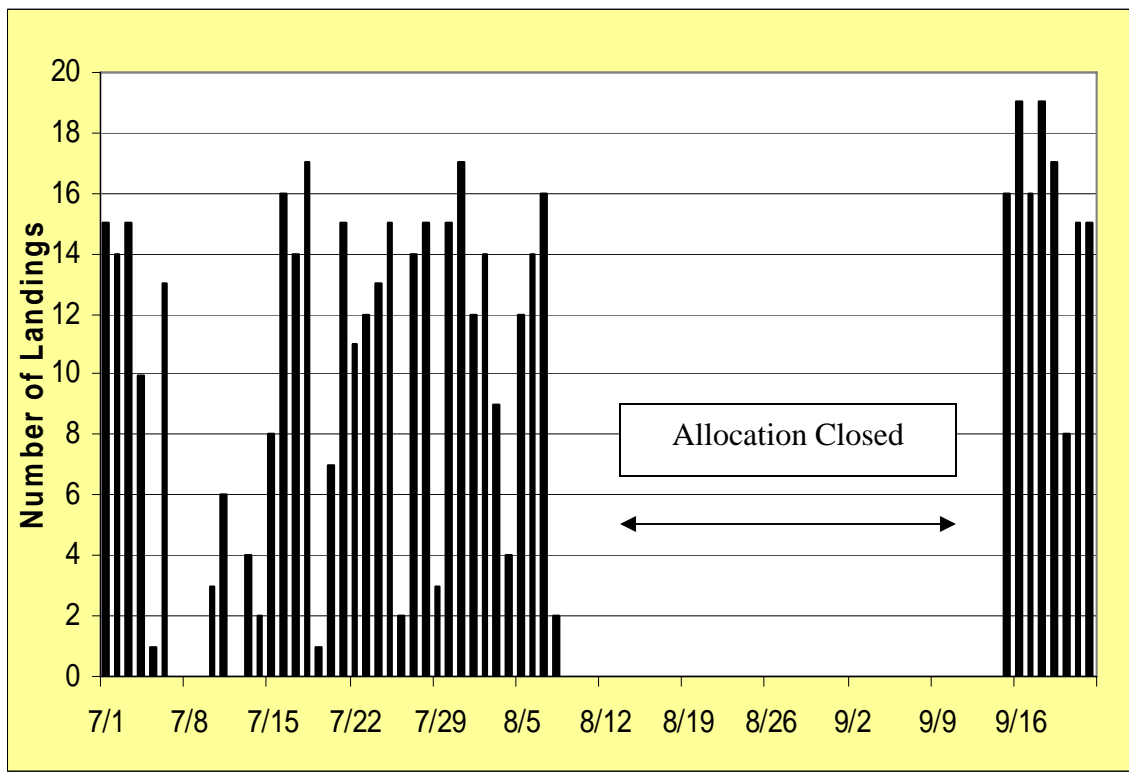


Figure 1. Daily landings by vessel during the second and third allocation period for Oregon 2008 season.

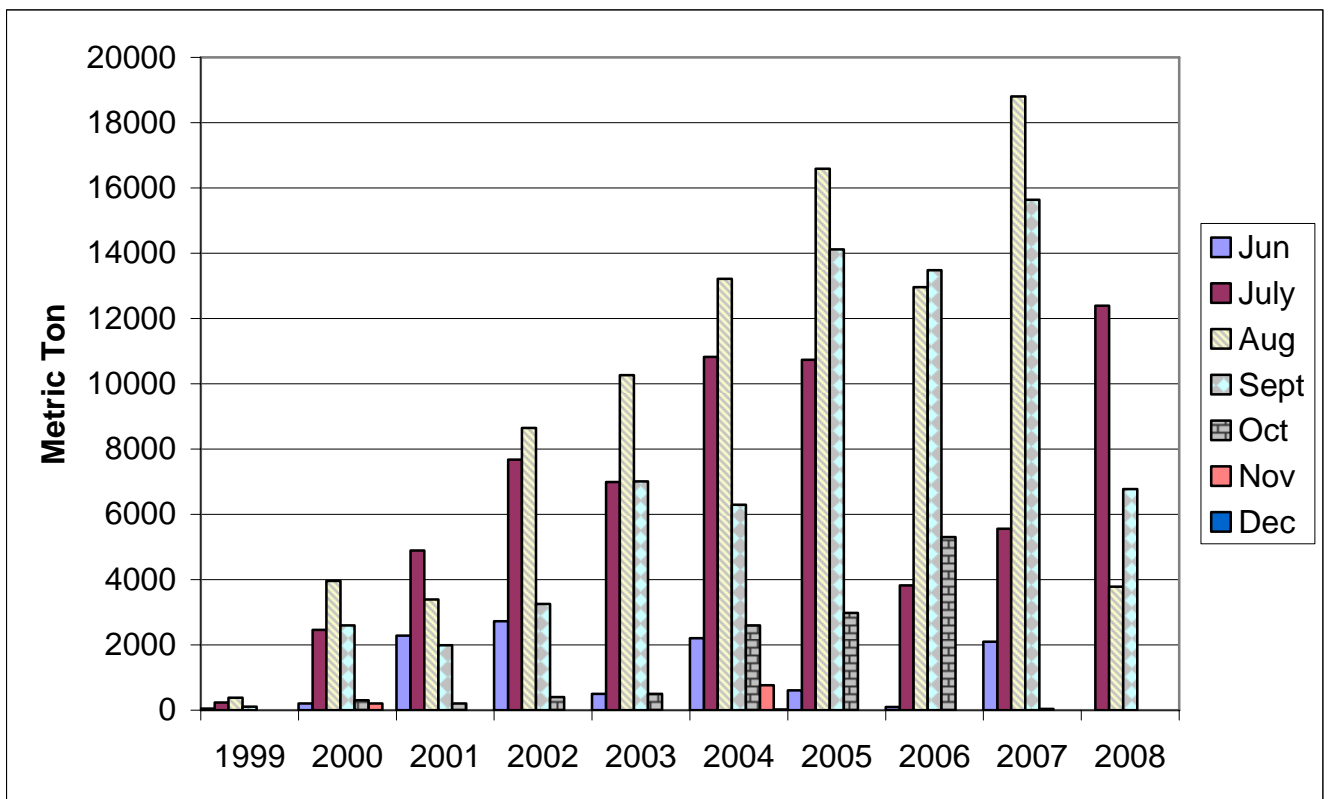


Figure 2. Annual landings (mt) of sardines into Oregon, by month, 1999-2008.

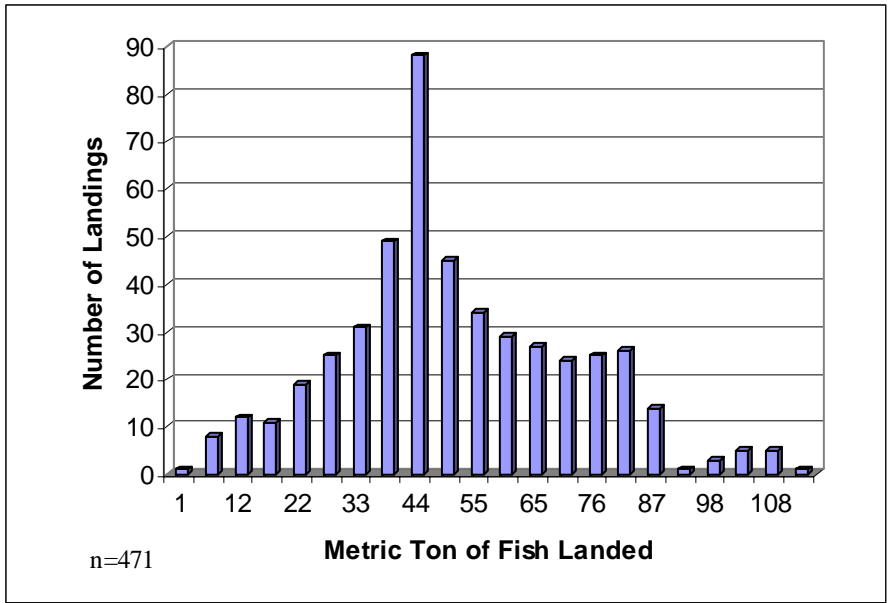


Figure 3. Weight of sardines (mt) per landing, 2008.

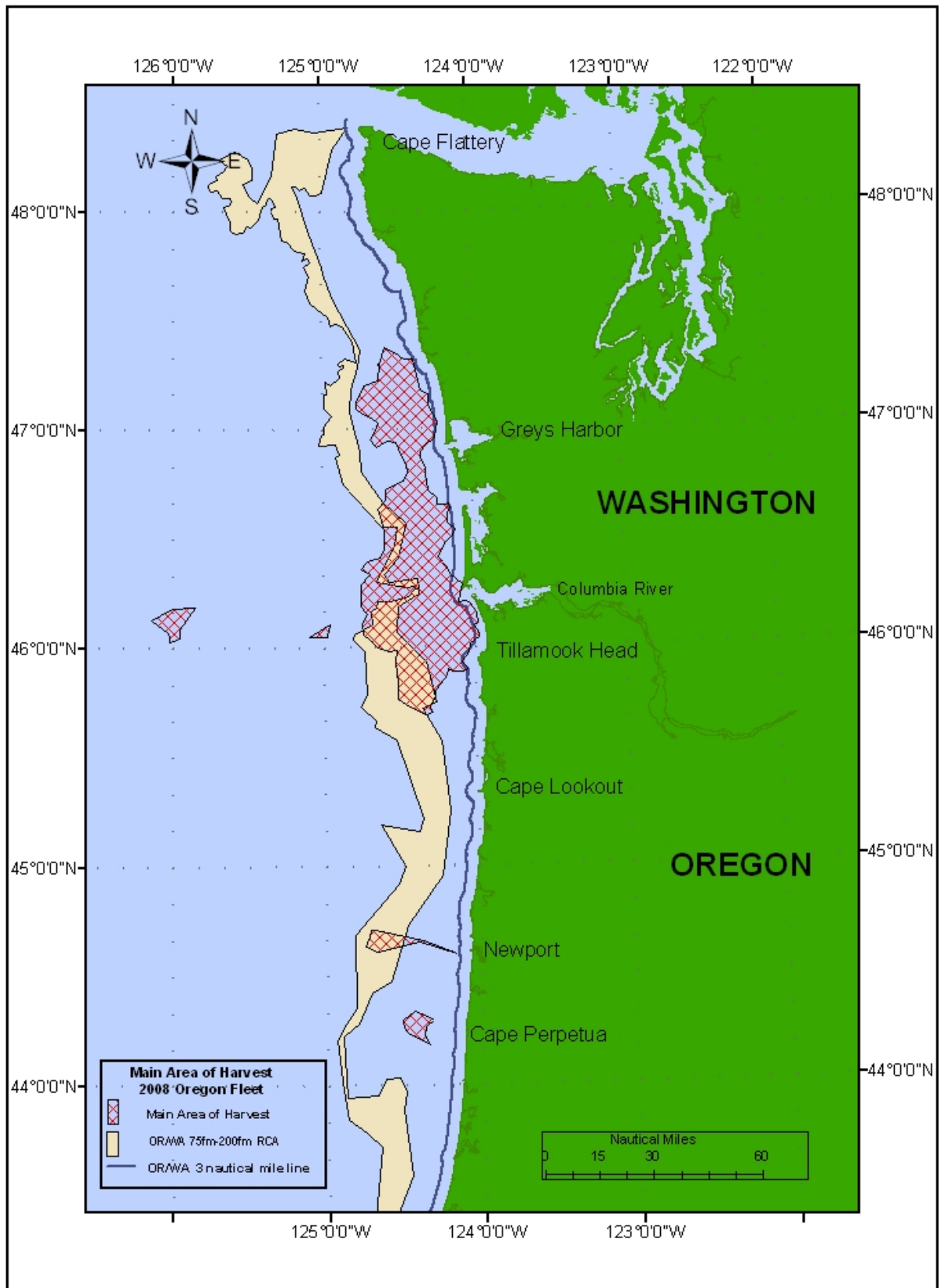


Figure 4. Areas of sardine catches from log book data and at sea observer, 2008.

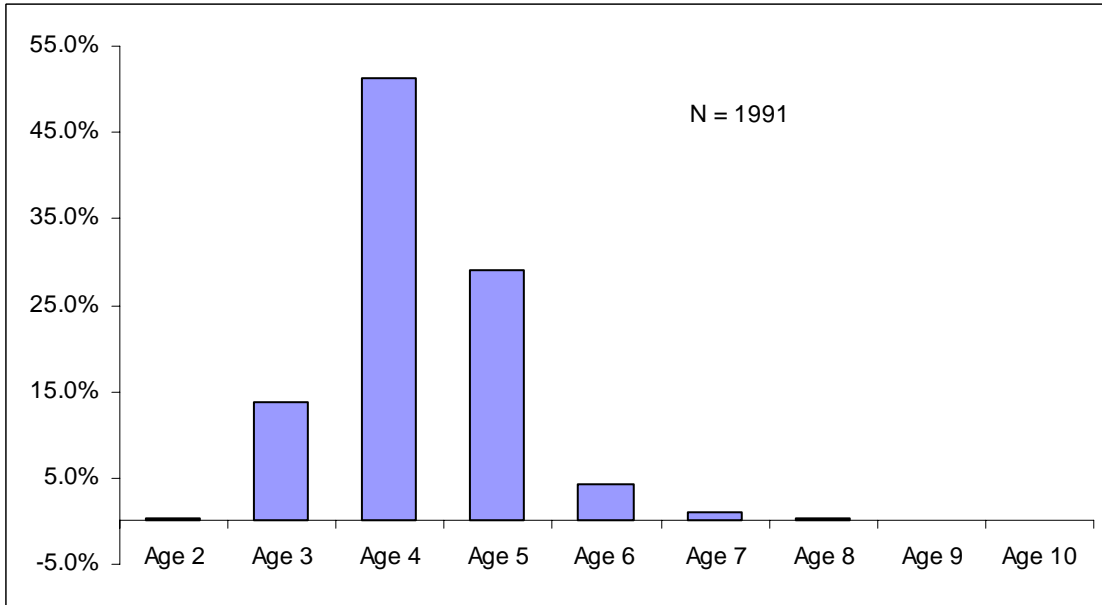


Figure 5 Age frequency (%), of sardines sampled, 2008.

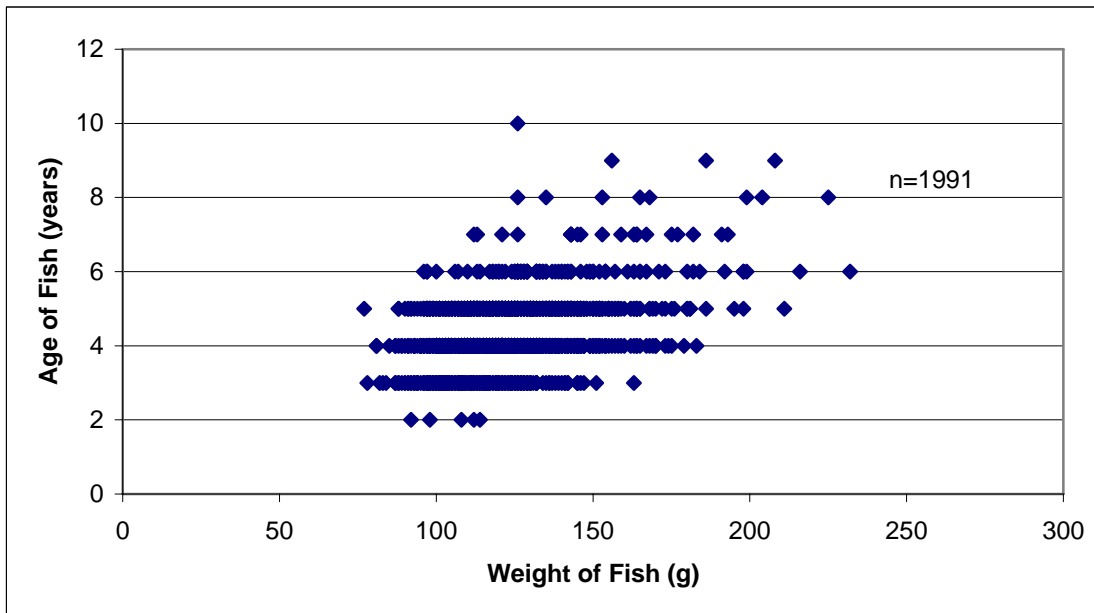


Figure 6. Comparison of age and weight of sardines sampled, 2008.

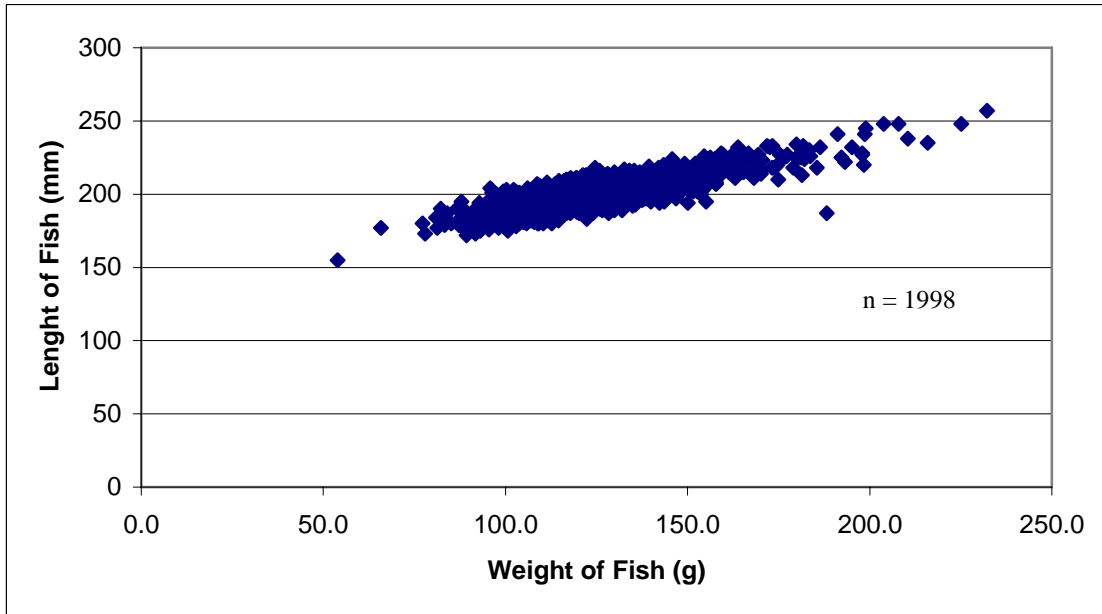


Figure 7. Comparison of weight and length of sardines sampled, 2008

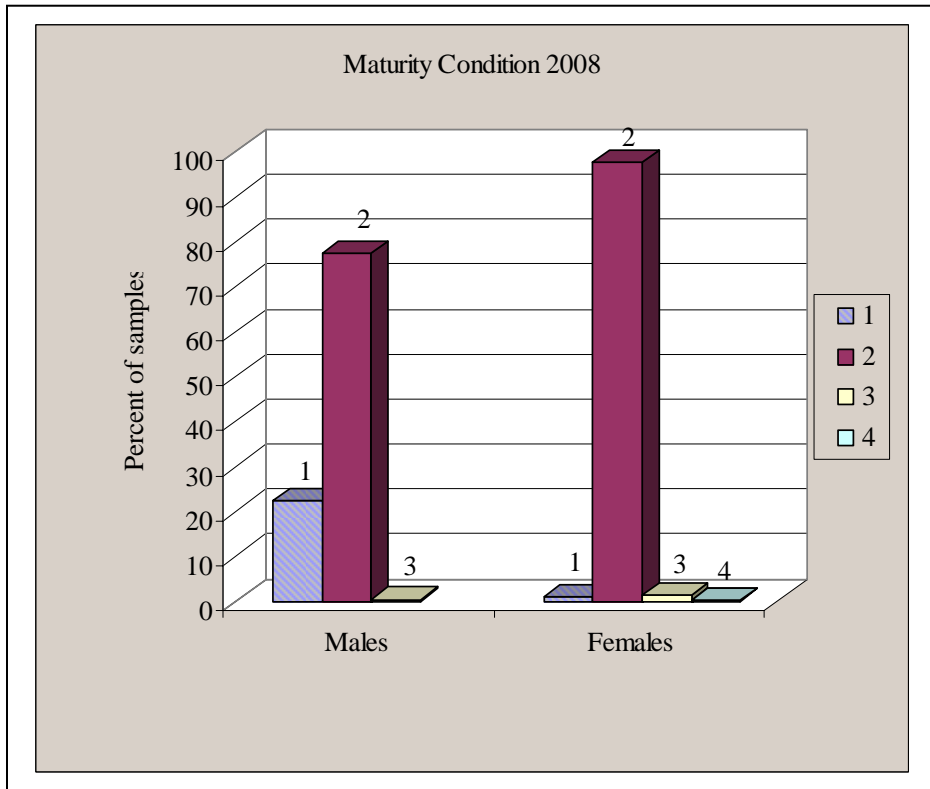


Figure 8. Maturity levels for both male and females of sardines sampled, 2008.
* Maturity level 1 is least mature.

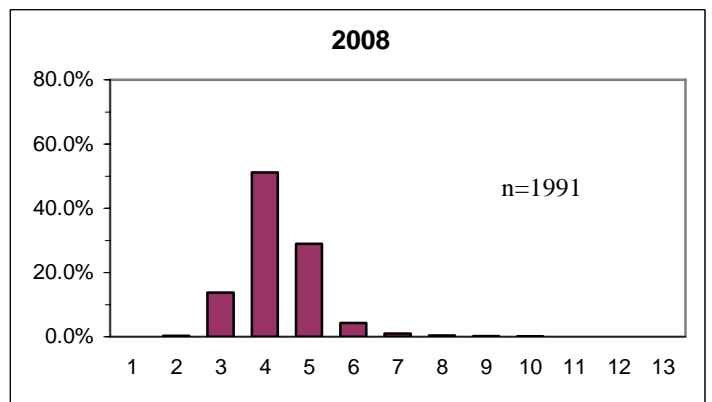
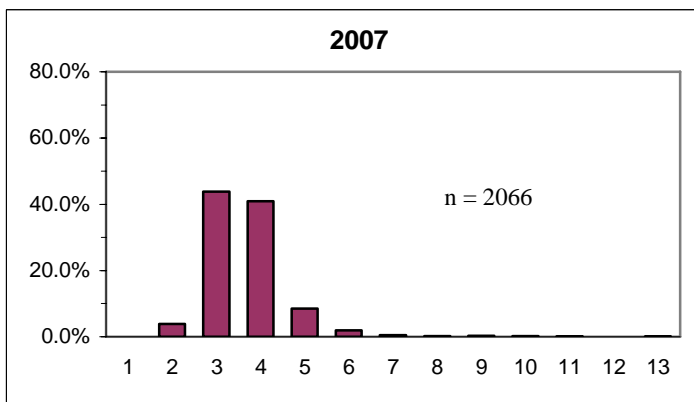
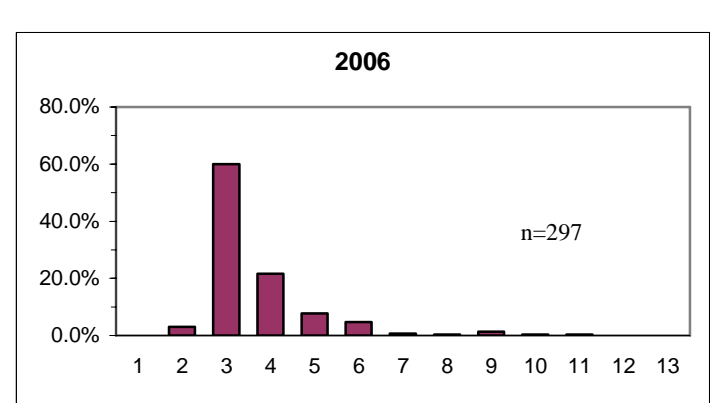
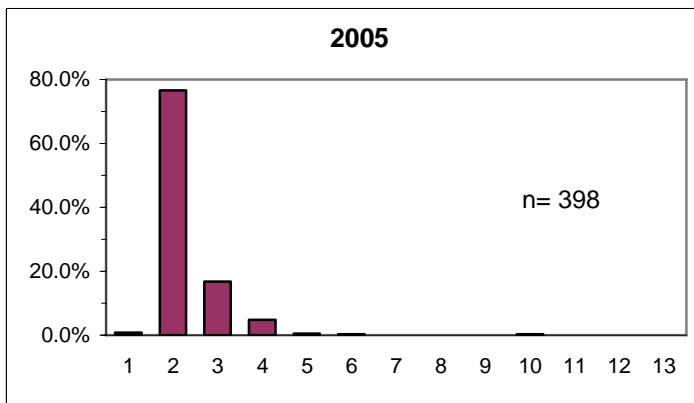
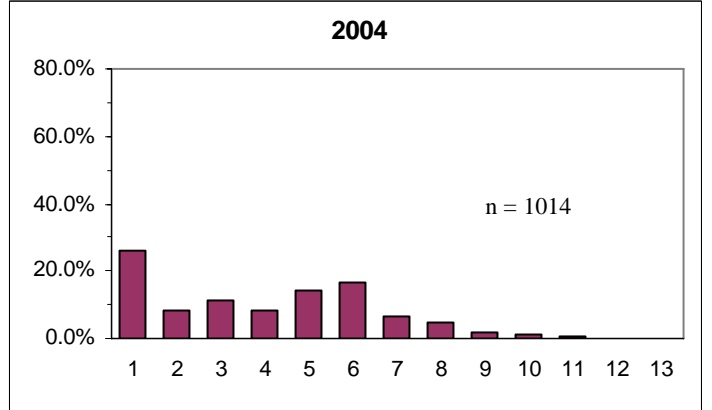
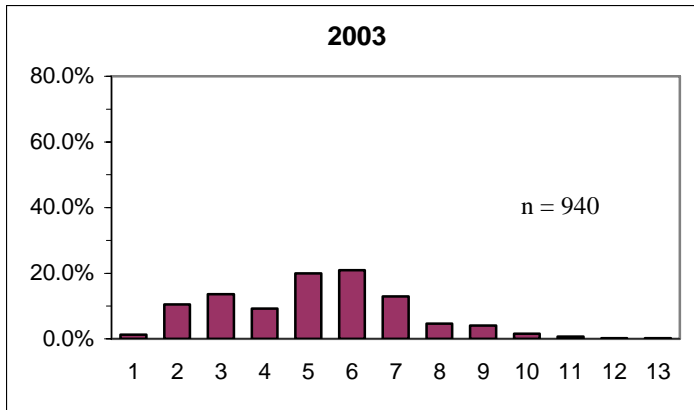
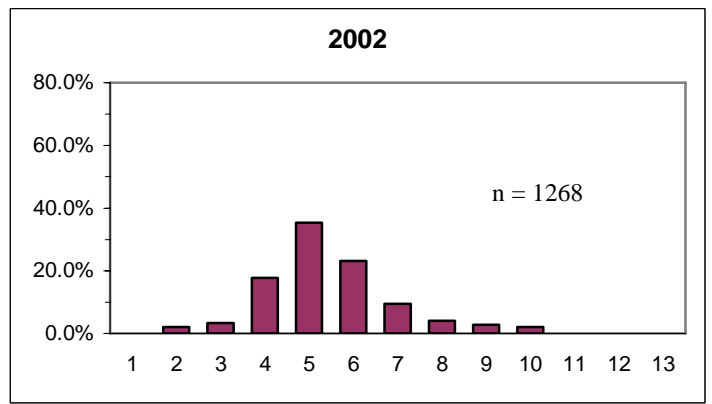
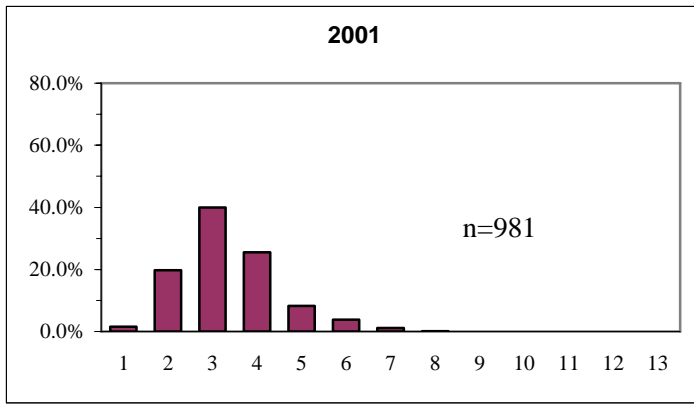


Figure 9. Age composition (%) of sardines sampled 2001-2008