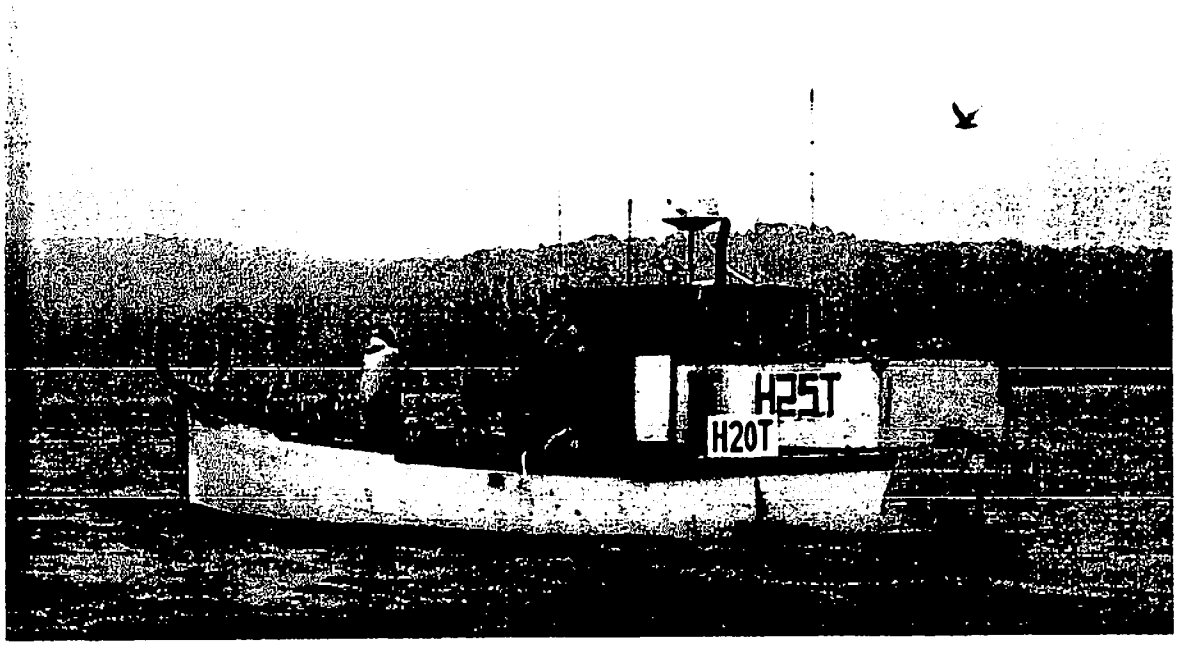
ATTACHMENT (4)(b): INFORMATIONAL HANDOUT PACKET FOR HERRING FISHERIES IN TOMALES BAY

Summary of 2001-02 Spawning-Ground Surveys and Commercial Catch in Tomales Bay



Prepared for:
Director's Herring Advisory Committee
March 27, 2002
and
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April 4, 2002

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Review of the 2001-02 Tomales Bay Pacific Herring Fishery Season by Month

November

We began our seasonal Pacific herring research surveys, by measuring eelgrass bed areas, and taking bed density samples. We attempted to implement a new method of capturing herring in the bay, a mid-water trawl system, to supplement our gill netting effort. However, we were unsuccessful at both, in trying to obtain research samples. We observed herring moving around mid-bay, occasionally holding in John's hole, and the hole near Laird's landing throughout the month. The first spawning event was a trace spawn at the southern tip of bed 27, on November 11. Herring that remained in the bay continued to move fast, up and down the bay with the tides. On Thanksgiving weekend, we had a large spawn event in Marconi and bed 28A. Gracilaria was the primary substrate and accounted for 92 % of the escapement. Both of these spawns occurred during rain events, and seemed to be focused around freshwater inflows. The total spawning escapement for November was 577.1 tons, and accounted for 8.4 % of the season total. There were still herring in the bay through the end of November.

December

December started were November left off, with herring still cruising the bay. We had a hard time picking up a school of herring with our fathometer because they were moving around fast, but their presence was revealed by the mass of harbor seals, cormorants, and gulls in hot pursuit. Early in December we discovered a spawn on the eastern shoreline in beds 25 and 26. We estimated that the spawn date was December 4. The area of the spawn was near a small creek and outfall pipes, which probably drew the herring to this spot. Escapement form this spawn totaled 46.2 tons. On December 18, there was a spawning event that covered the southern eelgrass beds on the western shoreline (1A, 1B, 1C). This section of Tomales Bay has numerous freshwater inflows during rain events, and may be a possible factor in herring selecting the site.

The Tomales Bay Herring Fishery opened December 26, at 17:00 hrs. The fishery started with a bang. Herring had been amassing in the bay and held off spawning till the opener. On December 27, 147 tons of herring were landed, with an average roe count of 15.7 %. Fishermen wrapped up fishing at noon on December 28, and landed an additional 33.8 tons, with an average roe count of 15 %. Escapement estimates for this spawning event was an eye popping 4350 tons. This spawning event alone would represent 63 % of the season's total escapement. At the time, preliminary estimates on spawning escapement showed that season escapement totals topped the 3000 ton mark and warranted a 100 ton quota increase to 400 tons.

January

The first week of January, Joe Mantua allowed us to fish our mid-water trawl off of his boat, since we were having trouble fishing it off our vessel. Even with Joe's help our efforts were unsuccessful. We came to the conclusion that the mid-water trawl wasn't going to work, until we reconfigured our vessel. January was a strange month. There was little rain and was actually the nicest period of the season, sunny and no wind. After several storms in November and December the freshwater input was high and the salinity may have been reduced to less than optimal levels. This is a possible reason why the herring held off spawning for 3-4 weeks. Early in January, herring were fairly easy for us to catch because the water was still muddied from December storms. As we progressed further into January it became increasingly more difficult to capture herring as the water clarity increased. By mid month, there was a large algal bloom, which reduced the water clarity. This made catching herring more difficult to catch because as the algal bloom increased the bioluminescence also increased. At night nets were lit up and allowed herring to avoid capture. On January 21, fishermen were landing fish. Most of the fishing was concentrated near Indian Beach (Bed 1). However, after extensive searching we could not find any spawning. The fishermen ended that day by landing 77.5 tons with a roe count of 15 %. The next day, we found sufficient spawning to increase the quota another 100 tons to the maximum of 500 tons. By the January 23, the fishermen landed a total of 169 tons, with a roe count averaging slightly over 15 %. It took a few days to determine the extent of the spawns and calculate the escapement. We were able to locate 19 spawning areas that

ranged from the southern most eelgrass bed, bed 30, up to bed22 near Hog Island. The spawn at bed 30 is the second time we recorded spawning at that bed; the first time was last season. Spawning at beds 22 and 24 near Hog Island marked the first time spawning has taken place around the island since the 1986-87 season. The estimated escapement from this spawning event was 1,598 tons.

February

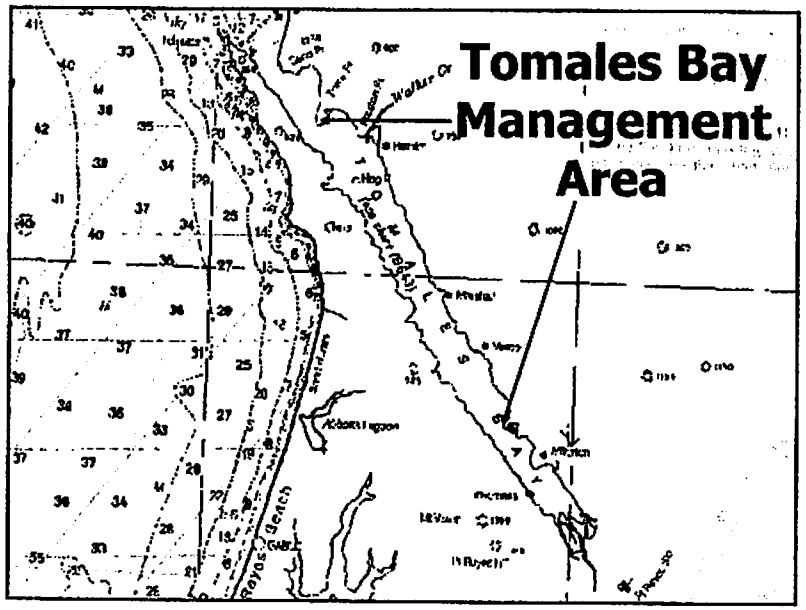
February was a slow month, and herring were very difficult to catch. The school that was in the bay didn't seem to be very large. It would typically move in and out with the tide. Bioluminescence associated with the algal bloom remained a hindrance to fishermen. On February 11, some fishermen were able to capture fish. Fishing continued till the following day, but landings were much less than they hoped. Combined landing for the days they fished were 4.4 tons, or one percent of the total landings for the season. Average roe counts from these landings were the highest of the season at over 16%. Despite fishermen catching herring, there was no spawn event during this period. A week later on February 17-18, we found that herring had spawned on five separate areas (HD, 1C, 1B, 28A, 1A). The total escapement from this spawning event was 148.7 tons. Most of the spawns were trace spawns. Ninety percent of the spawning took place at bed 28A, almost exclusively on Gracilaria (133.1 tons).

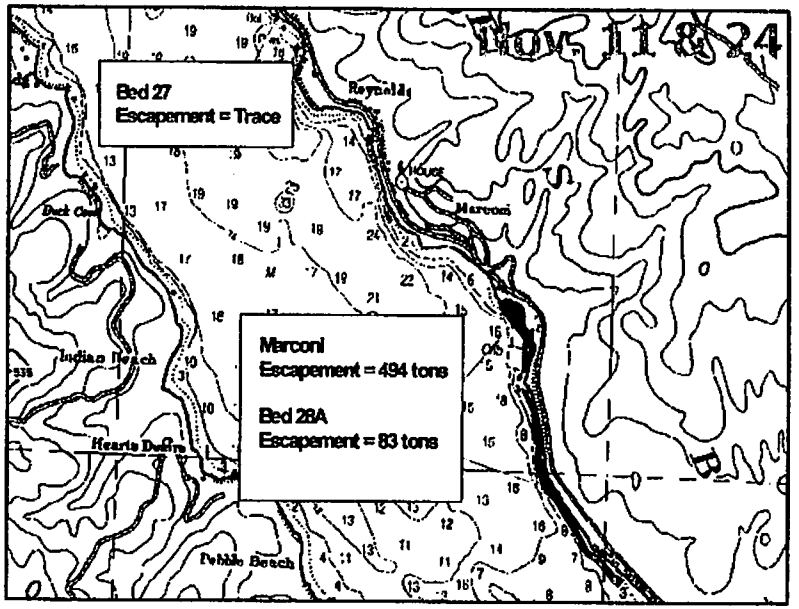
March

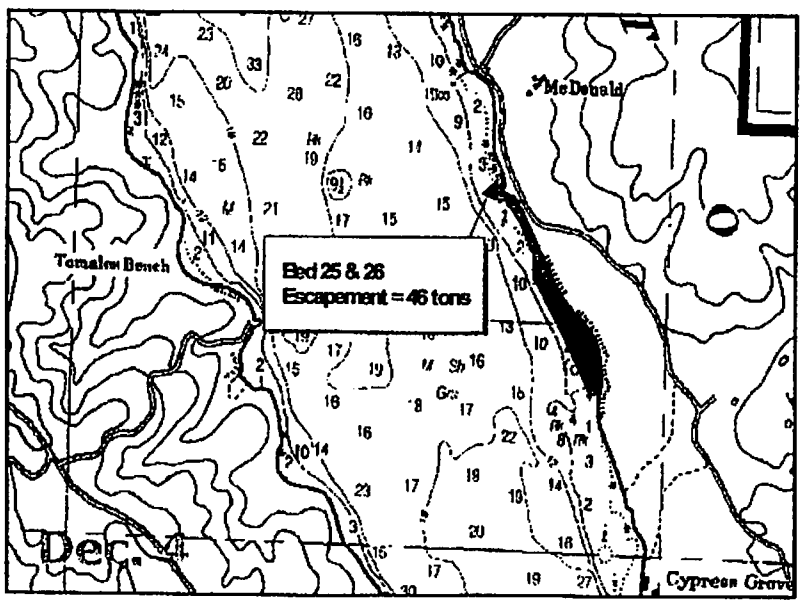
The herring fishery closed on March 8, with no commercial landings for the month. We did discover a trace spawn over the northern half of bed 1A. The spawning date was estimated to be March 22. This spawning event corresponds to a storm that came through at the same time.

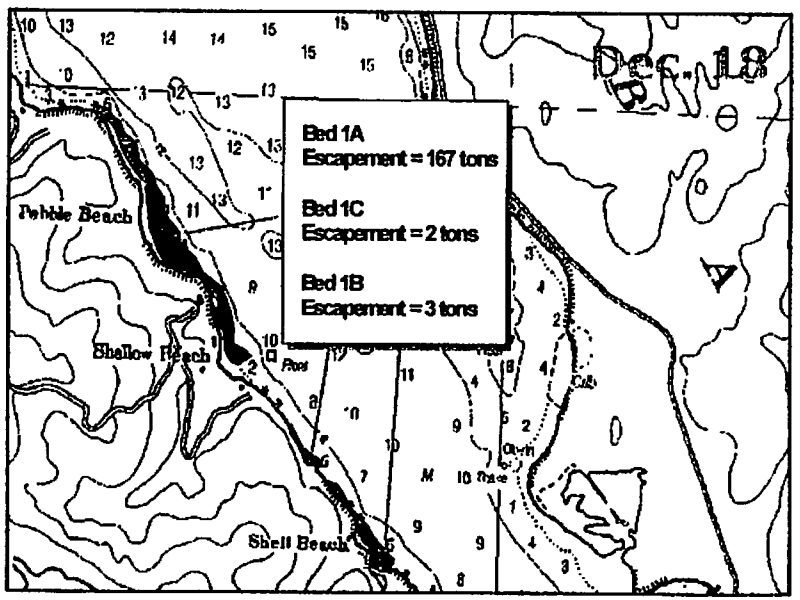
Highlights of the 2001-02 Tomales Bay Pacific Herring Fishery Season

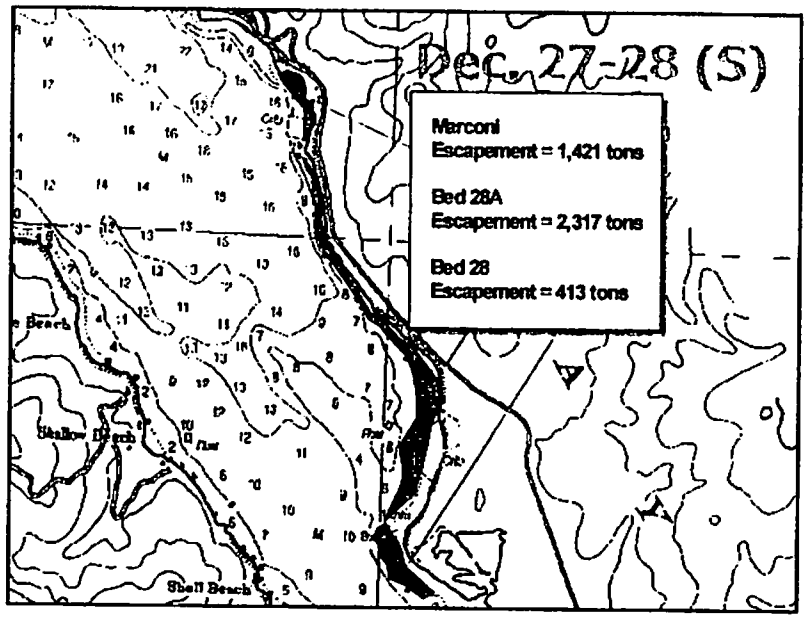
- There were eight spawning events during the season. Most of these spawning events corresponded to significant rain events.
- November spawning events were the largest ever recorded.
- December had the largest monthly spawning escapement and commercial landings of the season.
- January had the most widespread spawning event, covering nineteen separate areas. Spawn discovered around Hog Island marked the first time since the 1986-87 season that herring have used the beds around the island.
- February commercial landings and spawning event period did not overlap.
- March had only a trace spawning event.
- This season's spawning escapement was the largest since 1982-83, and the spawning biomass is the largest since the fishery was limited to Tomales Bay.
- ***Gracilaria*** dominated as the preferred spawning substrate; it accounted for 70% of the spawning escapement.
- The commercial catch was the second highest total since the fishery was limited to Tomales Bay. The catch had the highest season roe count average (15.4%) recorded.
- A sample of Tomales Bay commercial caught herring were used for DNA samples, in a cooperative effort by Canada Department of Fisheries and Oceans to study the genetics of Pacific herring populations.
- A sample of research caught herring from Tomales Bay, were used to provide gonads for a study on the effects of salinity on herring egg development by the U.C. Davis Bodega Bay Marine Lab.

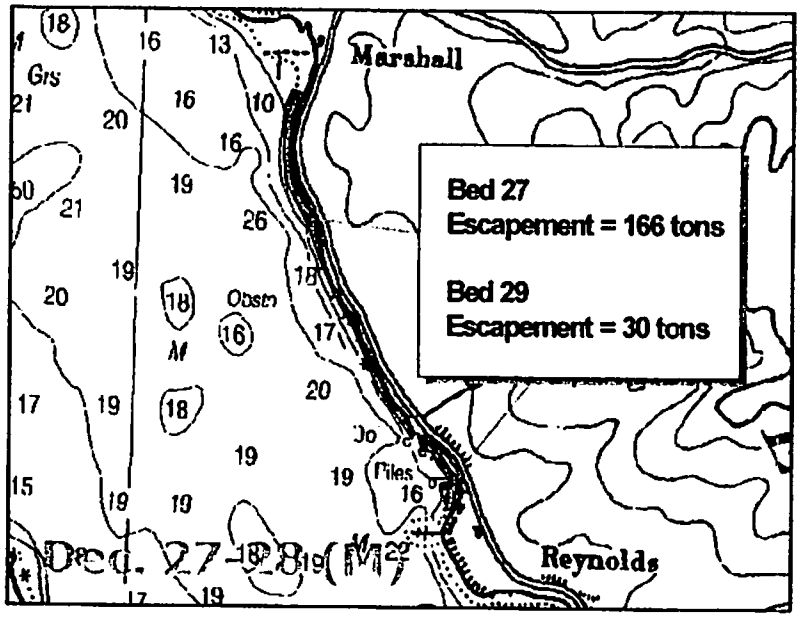

Tomales Bay
Management
Area

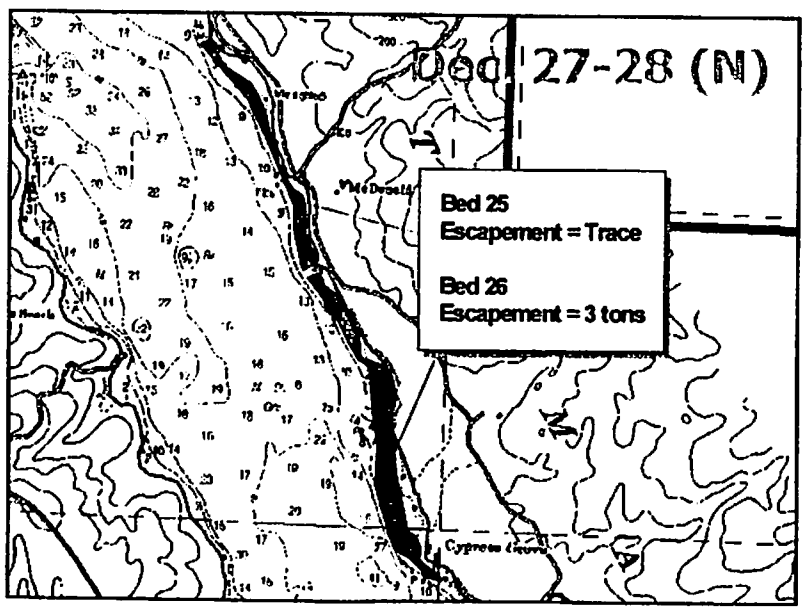

Bed 27
Escapement = Trace
Marconi
Escapement = 494 tons
Bed 28A
Escapement = 83 tons
Indian Beach
Hearts Delight
Pebble Beach

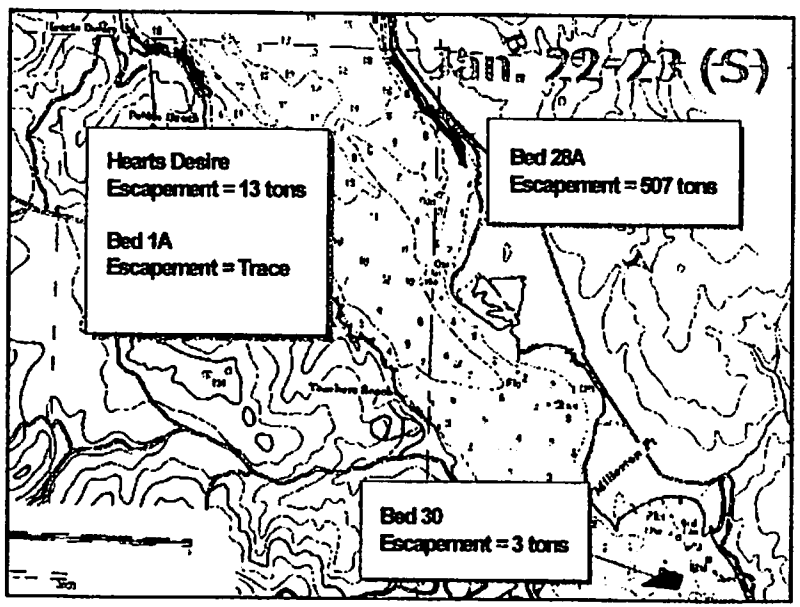

McDonald
Tomales Beach
Bed 25 & 26
Escapement = 46 tons
Cypress Grove

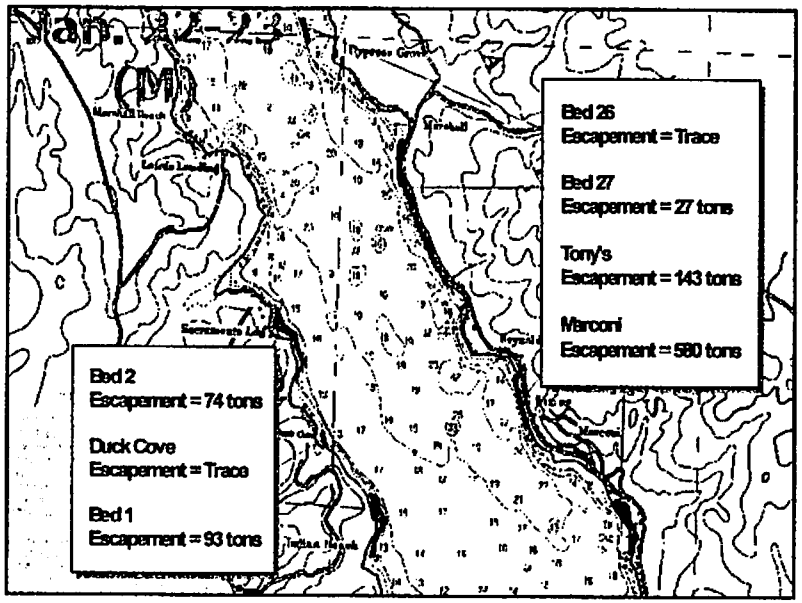

Bed 1A
Escapement = 167 tons
Bed 1C
Escapement = 2 tons
Bed 1B
Escapement = 3 tons
Pebble Beach
Shallow Beach
Shell Beach

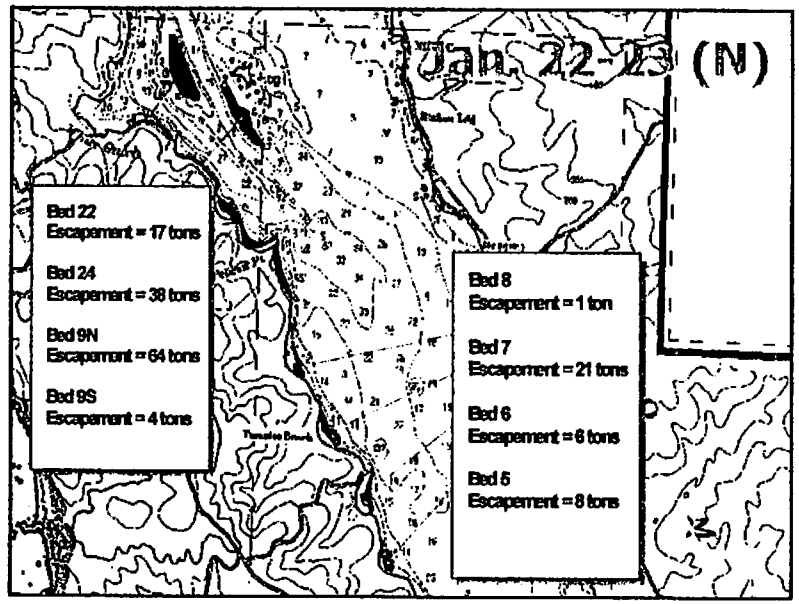

Dec. 27-28 (S)
Marconi
Escapement = 1,421 tons
Bed 28A
Escapement = 2,317 tons
Bed 28
Escapement = 413 tons

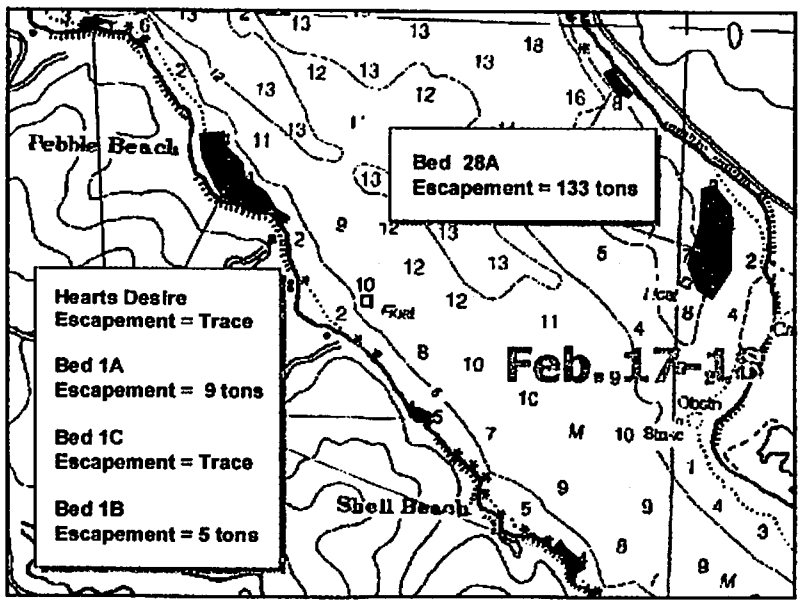

Marshall
Bed 27
Escapement = 166 tons
Bed 29
Escapement = 30 tons
Dec. 27-28 (M)
Reynolds


Dec. 27-28 (N)
Bed 25
Escapement = Trace
Bed 26
Escapement = 3 tons


Jan. 22-23 (S)
Hearts Desire
Escapement = 13 tons
Bed 1A
Escapement = Trace
Bed 28A
Escapement = 507 tons
Bed 30
Escapement = 3 tons


Jan. 22-23
(M)
Bed 2
Escapement = 74 tons
Duck Cove
Escapement = Trace
Bed 1
Escapement = 93 tons
Bed 26
Escapement = Trace
Bed 27
Escapement = 27 tons
Tony's
Escapement = 143 tons
Marconi
Escapement = 580 tons


Jan. 22-23 (N)
Bed 22
Escapement = 17 tons
Bed 24
Escapement = 38 tons
Bed 9N
Escapement = 64 tons
Bed 9S
Escapement = 4 tons
Bed 8
Escapement = 1 ton
Bed 7
Escapement = 21 tons
Bed 6
Escapement = 6 tons
Bed 5
Escapement = 8 tons


Pebble Beach
Bed 28A
Escapement = 133 tons
Hearts Desire
Escapement = Trace
Bed 1A
Escapement = 9 tons
Bed 1C
Escapement = Trace
Bed 1B
Escapement = 5 tons
Feb. 17-1
Shell Beach

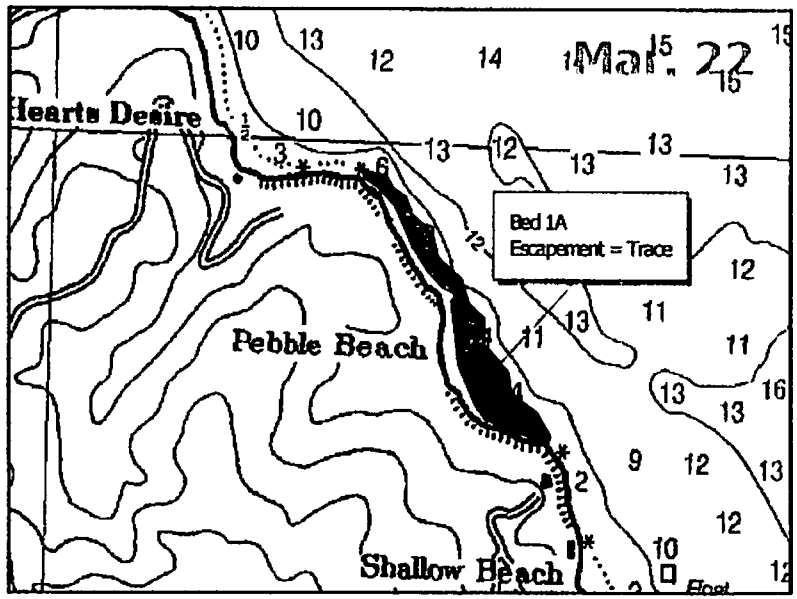

Mar. 22
Hearts Desire
Bed 1A
Escapement = Trace
Pebble Beach
Shallow Beach

TABLE 1. Tomales Bay Herring Spawn Data, 2001-02

Date	Location	Area m2	Eggs/m2	Millions of Eggs X 106	Conversion Factor X 10-8	Tons	Subtotal (Tons)
11-Nov-01	27	75			1.38	Trace	
24-Nov-01	Marconi*	19,545	1,830,996	35,786,812,629	1.38	494.4	
24-Nov-01	28A	33,175	102,607	3,404,000,351	1.38	47.0	
24-Nov-01	28A*	33,175	112,935	3,746,628,579	1.38	35.8	
				November			**577.1**
4-Dec-01	25-26	64,884	51,685	3,353,541,582	1.38	46.3	
18-Dec-01	1A	79,360	116,830	9,271,657,217	1.38	127.9	
18-Dec-01	1A*	4,000	707,503	2,830,010,590	1.38	39.1	
18-Dec-01	1B	15,686	12,886	202,126,558	1.38	2.8	
18-Dec-01	1C	4,056	35,414	143,640,114	1.38	2.0	
27-28-Dec-01	27	17,503	611,624	10,705,261,766	1.07	114.5	
27-28-Dec-01	27*	5,001	946,981	4,735,710,022	1.07	50.7	
27-28-Dec-01	Marconi*	19,545	6,768,094	132,282,403,307	1.07	1415.4	
27-28-Dec-01	Marconi	1,000	595,434	595,433,744	1.07	6.4	
27-28-Dec-01	28A	124,887	868,022	108,404,632,469	1.07	1159.9	
27-28-Dec-01	28A*	49,595	2,180,265	108,130,237,238	1.07	1157.0	
27-28-Dec-01	28	41,403	399,972	16,560,034,184	1.07	145.4	
27-28-Dec-01	28*	41,403	605,389	25,064,902,757	1.07	268.2	
27-28-Dec-01	29*	2,769	1,005,383	2,783,904,350	1.07	29.8	
27-28-Dec-01	29	2,769			1.07	Trace	
27-28-Dec-01	25	71,450	334	23,839,065	1.07	Trace	
27-28-Dec-01	26	182,976	1,289	235,875,523	1.07	2.5	
				December			**4567.9**
22-23-Jan-02	Tony's*	7,694	2,108,547	16,223,163,386	0.88	142.8	
22-23-Jan-02	Tony's	7,694			0.88	Trace	
22-23-Jan-02	Marconi*	19,545	3,370,322	65,872,940,536	0.88	579.7	
22-23-Jan-02	1	15,986	657,997	10,518,733,728	0.88	92.6	
22-23-Jan-02	1*	15,986	1,492,195	23,854,225,552	0.88	Trace	
22-23-Jan-02	Duck Cove	2,081			0.88	Trace	
22-23-Jan-02	Duck Cove*	2,081			0.88	Trace	
22-23-Jan-02	Heart's Desire	8,640	173,904	1,502,534,742	0.88	13.2	
22-23-Jan-02	Heart's Desire*	8,640			0.88	Trace	
22-23-Jan-02	2	16,936	495,499	8,391,768,680	0.88	73.8	
22-23-Jan-02	28A	33,507	23,439	785,360,950	0.88	6.9	
22-23-Jan-02	28A*	33,507	1,694,502	56,777,675,297	0.88	499.6	
22-23-Jan-02	1A	17,118	2,718	46,521,521	0.88	Trace	
22-23-Jan-02	5	7,859	110,506	868,465,887	0.88	7.6	
22-23-Jan-02	6	8,931	74,175	662,460,769	0.88	5.8	
22-23-Jan-02	7	10,578	222,214	2,350,580,857	0.88	20.7	
22-23-Jan-02	8	6,258	19,476	121,882,723	0.88	1.1	
22-23-Jan-02	9N	19,105	383,530	7,327,341,881	0.88	64.5	
22-23-Jan-02	22	46,724	40,201	1,878,366,496	0.88	16.5	
22-23-Jan-02	24	32,190	134,478	4,328,831,951	0.88	38.1	
22-23-Jan-02	9S	11,562	39,845	460,692,052	0.88	4.1	
22-23-Jan-02	26*	3,982			0.88	Trace	
22-23-Jan-02	26	3,982			0.88	Trace	
22-23-Jan-02	27	17,503	176,270	3,085,249,544	0.88	27.2	
22-23-Jan-02	30	23,058	13,752	317,088,717	0.88	2.8	
				January			**1597.0**
17-18-Feb-02	Heart's Desire	2,253	1,600	3,605,219	1.21	Trace	
17-18-Feb-02	1C	2,372	9,519	22,578,855	1.21	Trace	
17-18-Feb-02	1B*	4,979	86,969	433,017,406	1.21	5.2	
17-18-Feb-02	1B	4,979	4,555	22,681,099	1.21	Trace	
17-18-Feb-02	28A*	43,513	252,879	11,003,509,849	1.21	133.1	
17-18-Feb-02	28A	43,513	3,974	16,967,112	1.21	Trace	
17-18-Feb-02	1A	4,000	20,460	715,384,795	1.21	8.7	
17-18-Feb-02	1A*	34,965	17,670	70,678,022	1.21	Trace	
				February			**147.0**
22-Mar-02	1A	56454			1.21	Trace	
				March			**Trace**
				Season Total			**6889.0**

** indicates spawn on Gracilaria*

Trace spawn is less than 1 ton

TABLE 2. Daily Landings by Tomales Bay Gill Net Fleet for 2001-02 Season.*

Date	Pounds	Tons	Tickets	Pounds/Ticket	Tons/Ticket	Roe Count
12/27/2001	293977	146.99	42	6999.45	3.50	15.71
12/28/2001	67621	33.81	22	3073.68	1.54	15.1
1/21/2002	154964	77.48	30	5165.47	2.58	15.12
1/22/2002	129671	64.84	26	4987.35	2.49	15.19
1/23/2002	53343	26.67	26	2051.65	1.03	15.46
2/11/2002	5584	2.79	10	558.40	0.28	15.98
2/12/2002	3214	1.61	7	459.14	0.23	16.5
Totals	**708,374**	**354.19**	**163**	---	---	---
Average	**101,196**	**50.60**	**23**	**3,328.00**	**1.66**	**15.41**

* Two inch mesh gill nets with one shackle of net per permittee.

Table 3. Annual Landings from Tomales/Bodega Bay Gill Net Fleet.

Year	Pounds	Tons	Trips	Lbs/Trip	Roe Count
2-inch Mesh Gill Net Fishery in Both Tomales Bay and Outer Bodega Bay					
84-85	844,472	422.2	215	3,928	12.8
85-86	1,542,676	771.3	512	3,013	12.5
86-87	1,732,428	866.2	429	4,038	12.5
87-88	1,499,402	749.5	484	3,097	12.4
88-89	426,163	213	291	1,464	12.7
Tomales Bay Closed - 2-inch Mesh Gill Net Fishery in Outer Bodega Bay					
89-90	190,409	95.2	61	3,121	13.5
90-91	173,103	86.5	72	2,404	13.6
91-92	47,125	23.5	30	1,571	14.6
Tomales Bay Re-Opened with 2 1/8-inch Mesh and Outer Bodega Bay Closed					
92-93	444,312	222.3	66	6,732	11.0
93-94	437,867	218.9	164	2,670	12.3
94-95	550,262	275.1	84	6,551	12.0
95-96	710,573	355.3	134	5,303	13.8
96-97	443,128	222	126	3,517	11.6
97-98*	0	0	0	0	--
98-99	104,722	54	52	2,014	15.0
99-00	83,258	42	24	3,469	15.2
Tomales Bay Gill Net Mesh Study - 2-inch Mesh					
00-01	596,987	298.5	73	8,178	12.4
01-02	708,374	354.2	82	8,639	15.4
Average	**619,721**	**310**	**171**	**4,101**	**13**

* El Nino year, no commercial landings.

TABLE 4. Tomales Bay Herring Biomass Estimates 1972-73 through 2001-02 Season.

Season	Spawn Escapement (tons)	Catch (tons)	Percent Catch (Exploitation Rate)	Spawning Biomass (tons)
Gillnet and Lampara Fisheries in Tomales Bay and Outer Bodega Bay				
1972-73	2,265	598	26.4	2,863
1973-74	6,041	521	7.9	6,562
1974-75	4,210	518	11	4,728
1975-76	7,769	144	1.8	7,913
1976-77	4,739	344	6.8	5,083
Gillnet Only Fishery - Tomales Bay and Outer Bodega Bay				
1977-78	21,513	646	2.9	22,159
1978-79	—	448	--	-- *
1979-80	5,420	603	10	6,023
1980-81	5,128	448	8	5,576
1981-82	6,298	851	11.9	7,149
1982-83	10,218	822	7.4	11,040
1983-84	1,170	110	8.6	1,280
1984-85	6,156	430	6.5	6,586
1985-86	435	771	12.8	6,000**
1986-87	4,931	867	15	5,798
1987-88	1,311	750	36.4	2,061
1988-89	167	213	56	380
Tomales Bay Gillnet Fishery Closed - Fishing in Outer Bodega Bay Only				
1989-90	345	0	0	345
1990-91	779	0	0	779
1991-92	1,214	0	0	1,214
Tomales Bay Gillnet Fishery Opened - Fishing in Outer Bodega Bay Closed				
1992-93	3,856	222	5.4	4,078
1993-94	2,244	219	8.9	2,463
1994-95	3,704	275	6.9	3,979
1995-96	1,704	355	17.2	2,059
1996-97	1,288	222	14.7	1,510
1997-98	586	0	0	586
1998-99	4,015	54	1.3	4,069
1999-00	1,969	42	2.1	2,011
2000-01	3,898	298	7.1	4,196
2001-02	6,889	354	5.1	7,243
AVERAGE	**4,147**	**371**	**10.3**	**4,633**

* No herring fieldwork this season.

**Biomass estimated by cohort analysis; for all other years, biomass was estimated from spawning-ground surveys.

Fig. 1

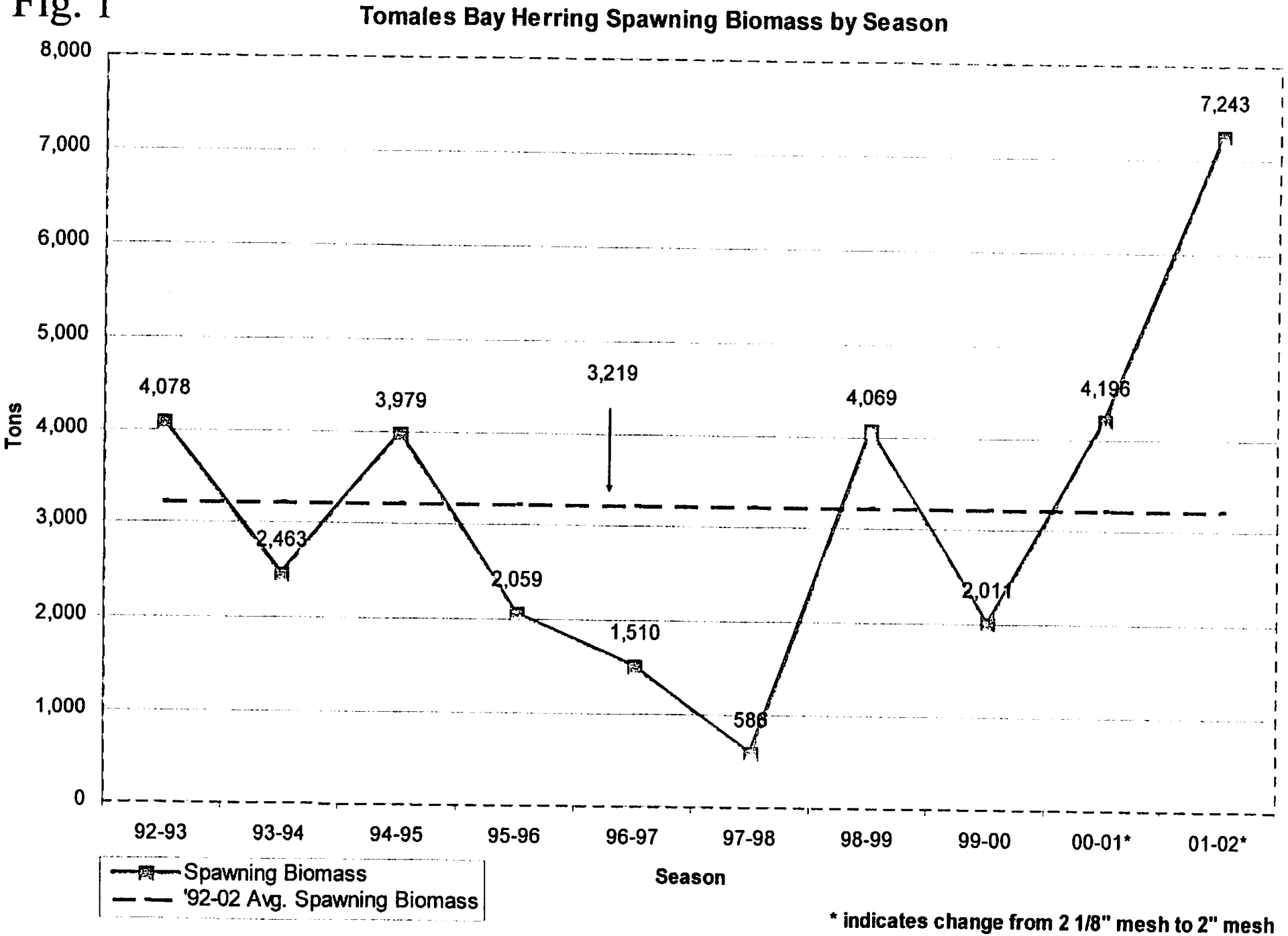

Tomales Bay Herring Spawning Biomass by Season
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
Tons
4,078
2,463
3,979
2,059
1,510
586
4,069
2,011
4,196
7,243
3,219
92-93
93-94
94-95
95-96
96-97
97-98
98-99
99-00
00-01*
01-02*
Season
Spawning Biomass
'92-02 Avg. Spawning Biomass
* indicates change from 2 1/8" mesh to 2" mesh

Table 5. Mean Length and Sex Ratio of Commercial Gill Net Catch and Research Catch in Tomales Bay, 2001-02

	Commercial Gill Net (2-inch mesh)		Research Multi-Panel Gill Net	
Month	Mean Body Length (mm)	Sex Ratio % M/F	Mean Body Length (mm)	Sex Ratio % M/F
December	187.4	41.3/58.7	175	54.9/45.1
January	187.6	44.4/55.6	177.5	47/53
February	189.2	40.6/59.4	179.3	66.7/30.8
Average	**187.7**	**42.7/57.3**	**176.6**	**52.2/47.8**

Table 6. Historical Lengths of Tomales Bay Commercial Gill Net Catches, 1992-93 to 2001-02.

Year	Commercial Gill Net Mesh Size	Average Length
Tomales Bay Gill Net Fishery Re-Opens with 2 1/8-in Mesh		
1992-93	2.125 inches	196.4
1993-94	2.125 inches	197.3
1994-95	2.125 inches	195.5
1995-96	2.125 inches	189.2
1996-97	2.125 inches	194.8
1997-98	2.125 inches	196 *
1998-99	2.125 inches	186.3
1999-00	2.125 inches	187.6
Tomales Bay Mesh Study- Mesh Size Reduced to 2.0-in		
2000-01	2.0 inches	188
2001-02	2.0 inches	187.7
Average	—	**191.8**

* Small samples from commercial gill nets, no commercial landings.

Fig .2

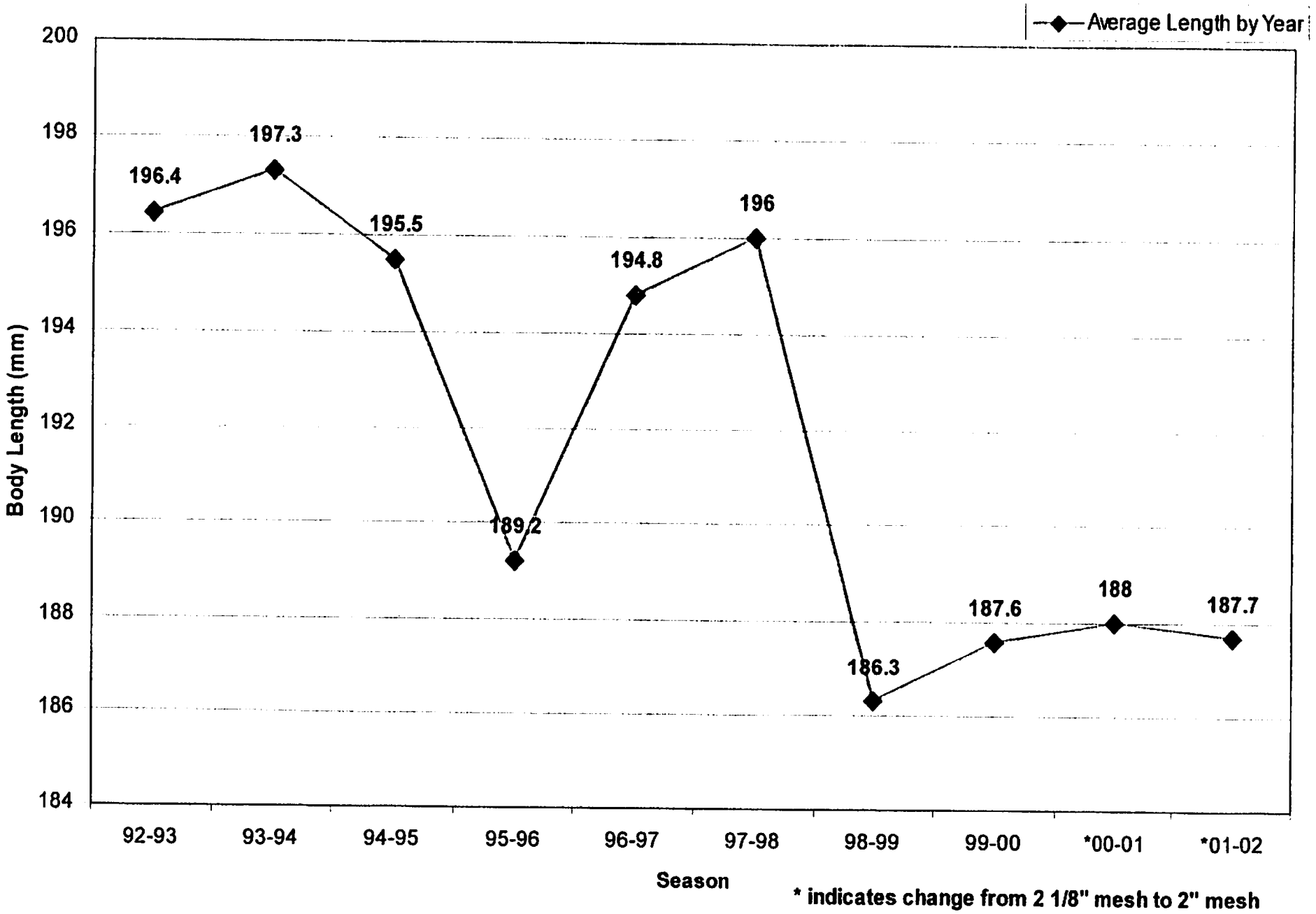
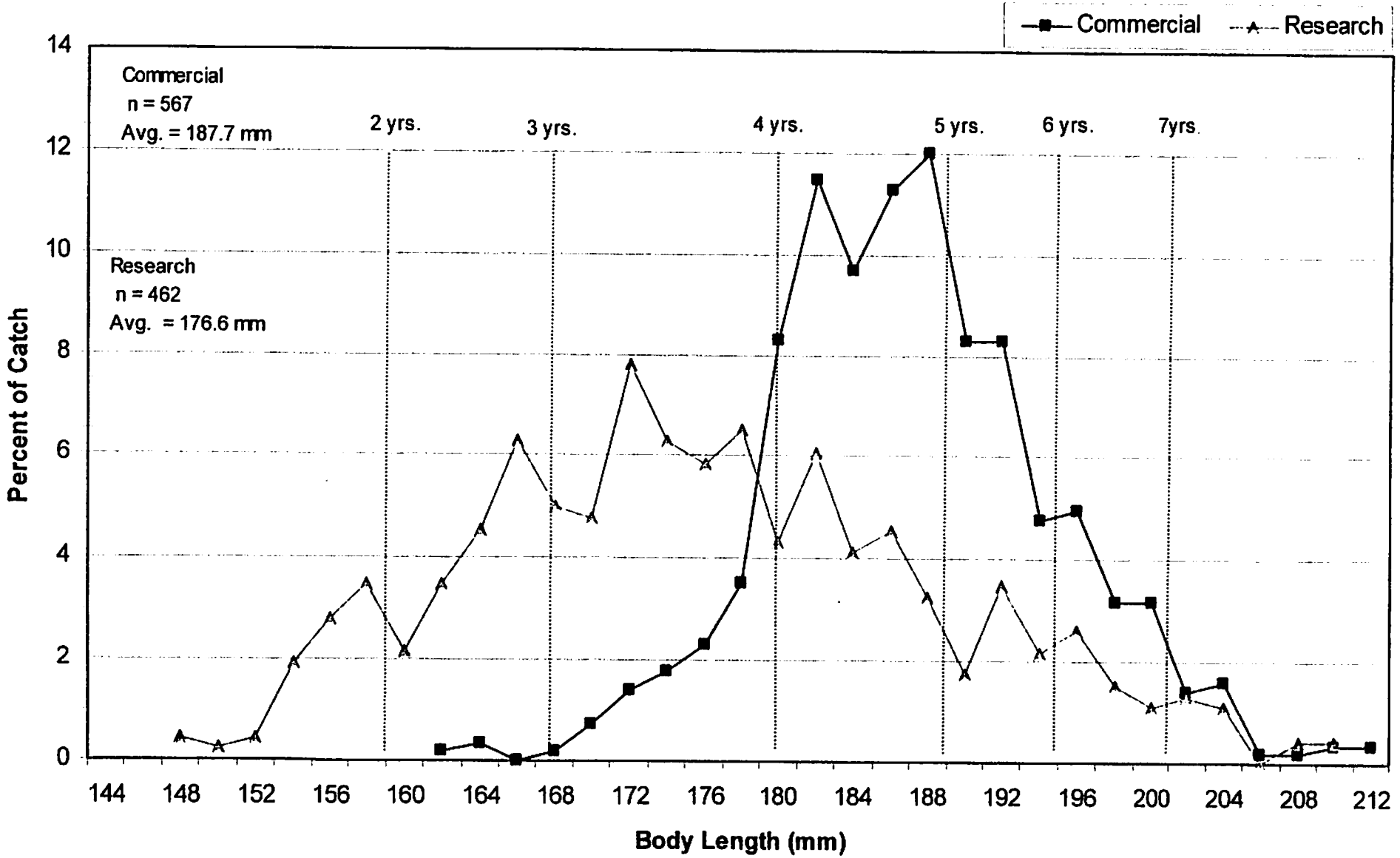

Average Length of Tomales Bay Commercially Caught Herring by Season
Average Length by Year
Body Length (mm)
200
198
196
194
192
190
188
186
184
196.4
197.3
195.5
189.2
194.8
196
186.3
187.6
188
187.7
92-93
93-94
94-95
95-96
96-97
97-98
98-99
99-00
*00-01
*01-02
Season
* indicates change from 2 1/8" mesh to 2" mesh

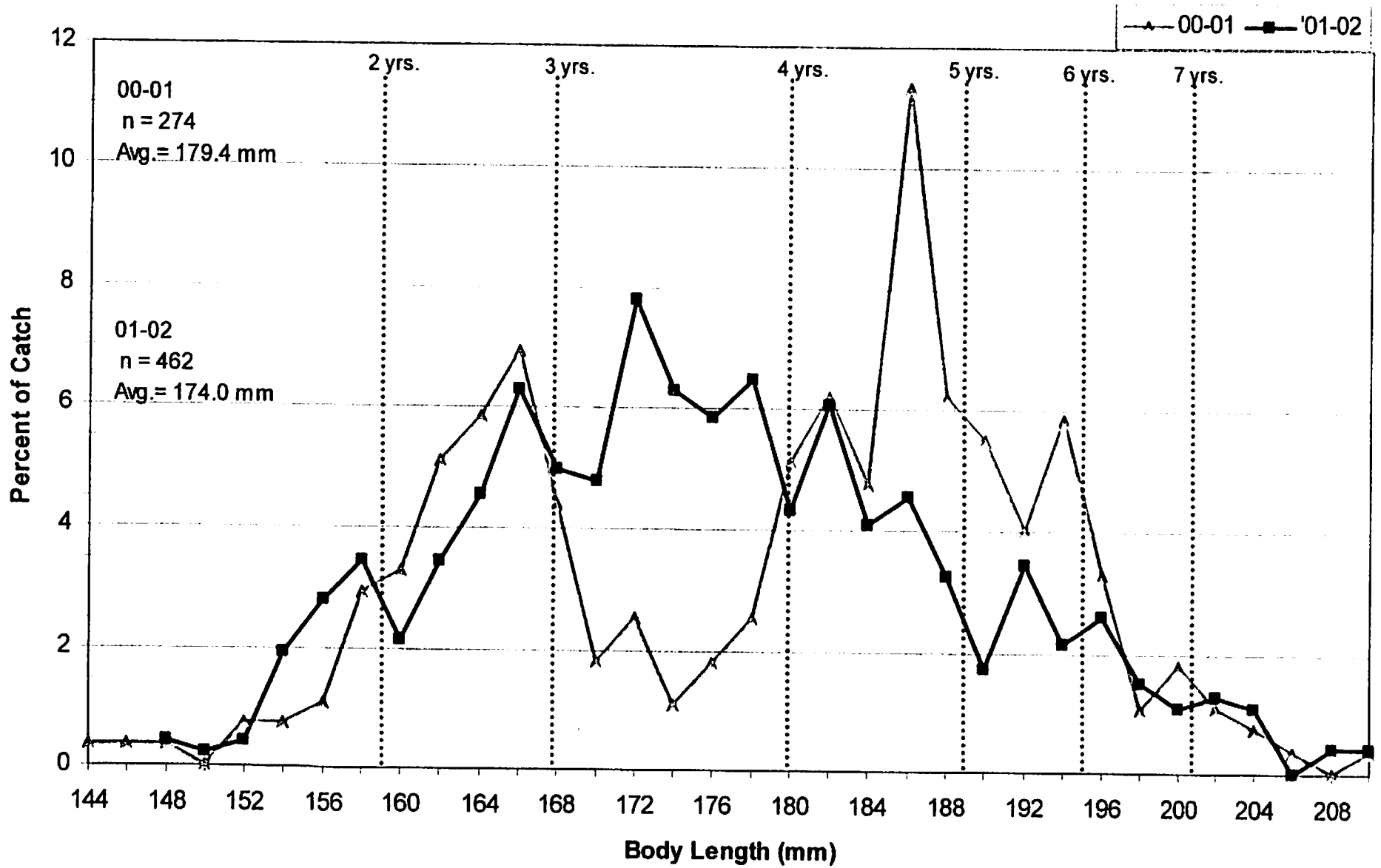
Fig. 3 **2001-2002 Tomales Bay Commercial Gill Net Catch (2" mesh) vs. Research Multi-Panel Gill Net Catch**



Dashed lines are estimated mean lengths at age, which are based on research catch data from 1999-00 season.

Fig. 4

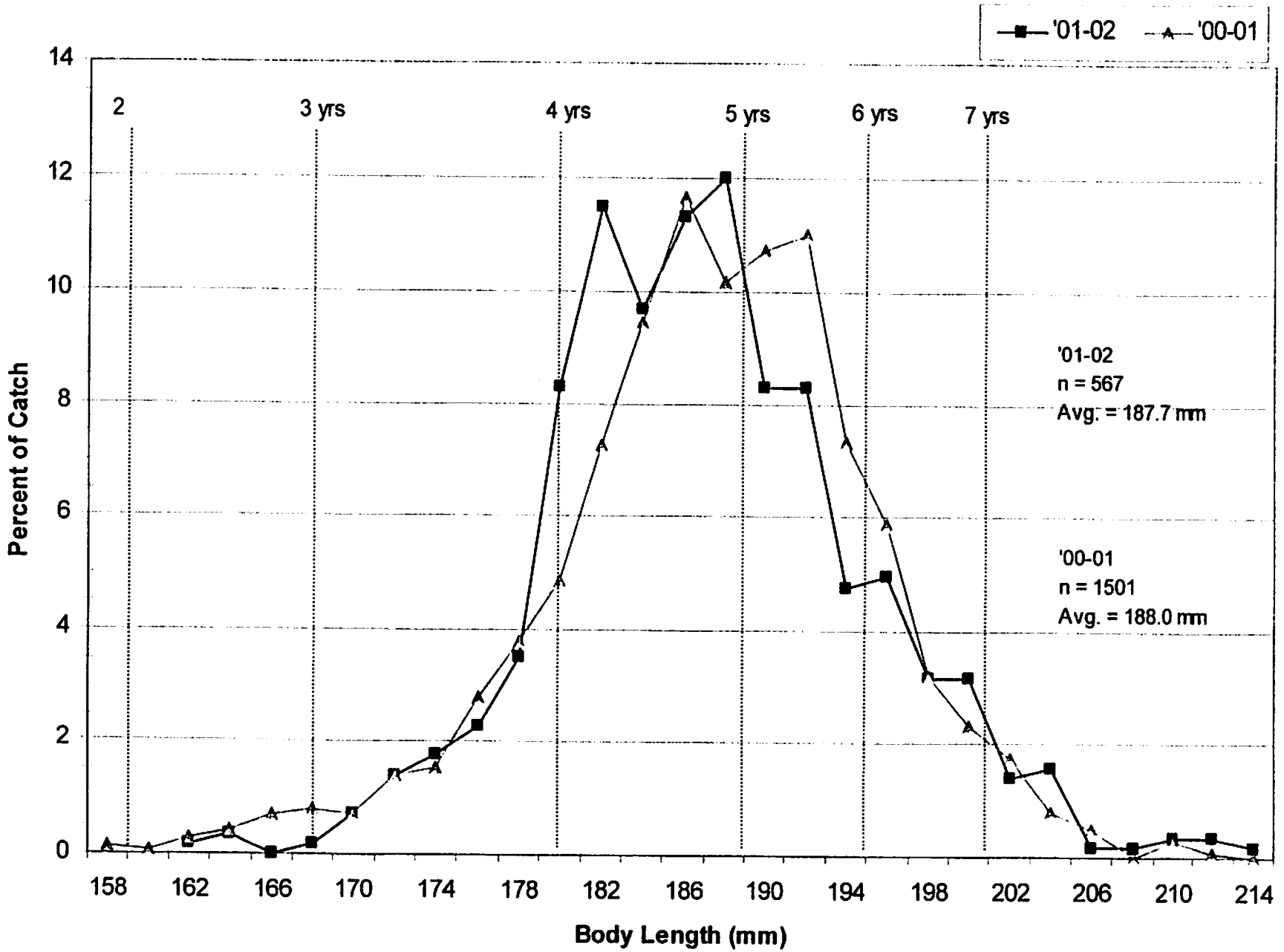
2001-02 vs. 2000-01 Tomales Bay Research Multi-Panel Gill Net Catch



Dashed lines are estimated mean lengths at age, which are based on research catch data from 1999-00 season.

Fig. 5

2001-02 vs. 2000-01 Tomales Bay Commercial Gill Net Catch



Dashed lines are estimated mean lengths at age, which are based on research catch data from 1999-00 season.

Proposals for the 2002-2003 Herring Fishery in Tomales Bay

SUMMARY: The preliminary 2001-02 spawning biomass estimate of 7,243 tons represents a 72 percent increase from last season's 4,200 ton biomass estimate. This is the largest spawning biomass estimate since the 11,040 ton 1982-83 El Nino season 19 years ago, and is 54 percent higher than the 4,699 ton long-term biomass average.

Approximately 75 percent of the total season spawning escapement occurred in the months of November and December with 63 percent in the last week of December after the commercial fishery began on December 26. This was similar to the previous season when 72 percent of the total season spawning escapement occurred in December with 60 percent in the last week after the season opening.

The 354.2 ton catch was 145.9 tons short of the 500 ton season quota and was just about a ton short of the previous high catch of 355.3 tons in the 1995-96 season. This season's catch is equivalent to a 4.9 percent exploitation rate, about one-half of the long-term average exploitation rate.

The mean length of commercially caught herring in the 2001-02 season was not significantly different than the previous two seasons although the experimental gillnet fishery in Tomales Bay has allowed the use of smaller 2 inch mesh gillnets for both the 2000-01 and 2001-02 seasons.

PROPOSALS FOR THE SEASON:

Season Dates: Tomales Bay herring gill net fishery would begin on Sunday, December 29, at 1700 hrs and would close Tuesday, December 31, at 1200 hrs. The fishery would re-open in 2003 at 1700 hrs on Sunday, January 5, 2003. The Tomales Bay herring gillnet fishery would end on Friday, March 7, 2003, at 1200 hrs.

Quota: 300 tons (4.1% of the 2001-02 spawning biomass). However, if the spawning escapement reaches or exceeds 3,000 tons prior to February 15, the quota shall be increased as follows: 1) If the spawning escapement is more than 3,000 tons, the total take of herring shall not exceed 400 tons for the season; 2) If the spawning escapement is more than 4,000 tons, the total take of herring shall not exceed 500 tons.

RATIONALE: Large Tomales Bay herring initial catch quotas (>300 tons) in seasons following high biomass years have resulted in high exploitation rates (>15%) in some years (e.g. 1986-87 and 1994-95). A 300 ton initial catch quota should allow fishers sufficient initial quota since no catches have exceeded 355 tons since the 1987-88 season. Since the implementation of one net per permittee, only in this season and in the 1995-96 season did the Tomales Bay commercial

catch exceed 300 tons.

PERMITS: Two permits per vessel.

RATIONALE: Most fishers like this option since it reduces the number of vessels on the bay.

NETS: Continuation of the Tomales Bay experimental gillnet test fishery using one shackle of 2 inch mesh per permittee.

RATIONALE: The Department proposes that the experimental gillnet test fishery in Tomales Bay using 2 inch mesh gillnets continue for at least an additional three seasons to assess changes in recruitment and mortality on the current stock structure and resultant commercial catch in the 2002-03 season.