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COASTAL RIVERS INVESTIGATION
INFORMATION REPORT 74-7

TAGGING OF STRIPED BASS IN THE
UMPQUA RIVER, 1971-73

by

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Fish Commission of Oregon
Management and Research Division

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Tagging of Striped Bass in the Umpqua River, 1971-73

INTRODUCTION

Striped bass (*Morone saxatilis*) were tagged on the Umpqua and Smith rivers (Figure 1) to estimate the numbers of bass recruited to the commercial fishery and to gather information on migration habits of bass in these rivers. Small numbers of striped bass were tagged in the summers of 1971 and 1972, but most were tagged in the springs of 1972 and 1973. Tagged striped bass were recaptured by the commercial and sport fisheries.

White sturgeon (*Acipenser transmontanus*) and green sturgeon (*A. medirostris*) captured incidental to striped bass were also tagged.

THE COMMERCIAL FISHERY

The first recorded commercial landings of striped bass from the Smith and Umpqua rivers were in 1934 when 62 lbs were landed incidental to the intensive American shad (*Alosa sapidissima*) fishery. The striped bass landings increased since 1934 to a peak of 56,321 lbs in 1971. Striped bass landings were low, rarely exceeding 10,000 lbs/year prior to the 1960's. Since 1960, the combined annual landings for the Smith and Umpqua rivers averaged 24,800 lbs/year (Mullen, 1973).

The Umpqua River commercial fishery was limited to gill nets (drift nets). Both gill nets and set nets were legal on the Smith River, but for practical reasons, only set nets were fished. The upstream commercial fishery deadline was at the confluence of the North Fork on the Smith River and at the confluence of Mill Creek on the Umpqua River. There was no regulatory downstream closure although most commercial fishing was conducted upstream from Reedsport and probably none was downstream from the Big Bend (Figure 1).

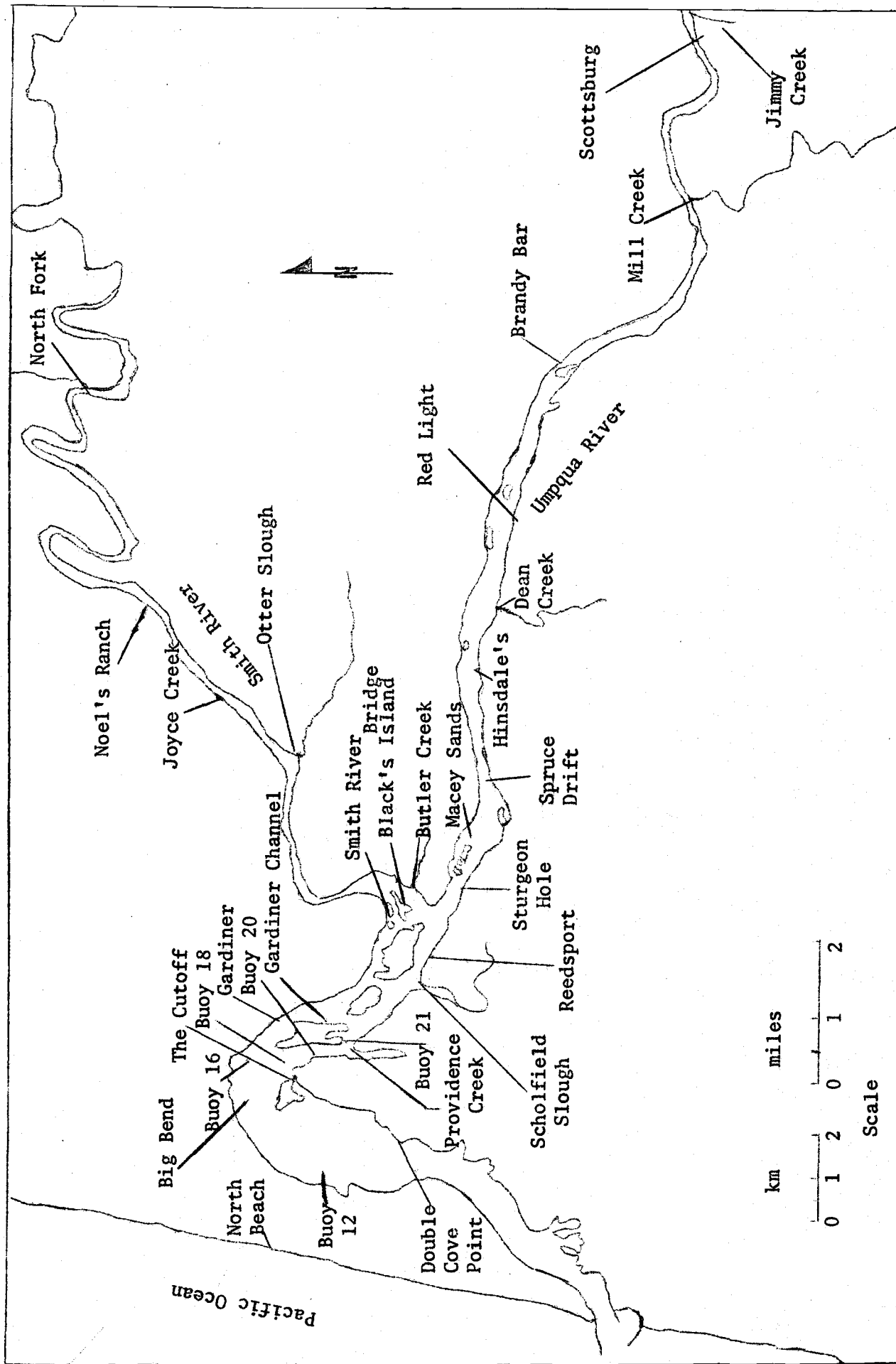


Figure 1. Map of Smith and Umpqua Rivers Showing Tagging and Recovery Sites Referred to in the Text

Commercially caught striped bass were landed from May 11 through July 1. No size or bag limit existed on commercially landed bass. Net mesh size restrictions were not less than 6" nor more than 6-3/4" for both rivers.

THE SPORT FISHERY

The sport fishery on the Smith and Umpqua rivers caught an estimated 6,036 striped bass in 1972, expending an estimated 31,507 angler days during the period February 21 through October 31 (Aney, 1973). This represented a sizeable increase in sport fishing pressure and success since 1946 when it was estimated that no more than 50 fish were caught by 25 anglers (Fish Comm. of Oregon, 1946).

There was no closed season or fishing area for striped bass taken on sport gear. The bag limit was five fish per day, 16" and over in length. No significant amount of sport fishing effort was expended upstream from the town of Scottsburg or downstream from Double Cove Point (Figure 1).

CAPTURE AND TAGGING PROCEDURES

All bass tagged prior to the opening of the commercial fishery, and used to estimate the number of recruited fish, were captured using a 6" (15.2 cm) stretch mesh, 42-mesh deep, no. 33 (First Washington Net Factory, Inc.) cable lay gill net, hung on a one-half basis. The net was 100 fathoms (182.9 m) long although the entire net was not always fished. A few bass captured in 1971 were caught by hook and line. During the summer of 1972 bass were captured with a 125' (38.1 m), 1/2" (1.3 cm) mesh bag seine.

Most bass were tagged at night. A few were tagged in late afternoon when water and tide conditions were suitable. Most tagging trips spanned 2 calendar days with the date of the 1st day used as the reference date.

Thus, fish tagged on the evening of April 17 and the morning of April 18 were both recorded as April 17.

Tagging location varied. Fishing was continued at a given location until the catch rate dropped to an unacceptable level. Most fish were tagged within the physical boundaries of the commercial fishery although a few were tagged approximately 0.5 km up river from Mill Creek.

Fishing techniques varied with the net sometimes anchored or tied to shore and at other times allowed to drift free with the tide. Fishing was usually restricted to an hour or two before and after slack tidal current, but this varied greatly with tidal height and river flow. No attempt was made to standardize the number of hours fished or the length of drifts.

Once captured, fish were removed from the gill net as quickly and gently as possible. Each fish was measured to the nearest centimeter (fork length) and sex determined, when possible, by exerting pressure on the fish's abdomen and forcing the discharge of gametes. Very few female bass were identified using this technique.

Bass were tagged with bright orange or yellow vinyl "spaghetti" tags placed below the insertion of the second dorsal fin. Each tag was secured with a numbered stainless steel clamp and tied with a single loop knot. All tags were numbered and stamped with a return address. No rewards were offered for returning tags.

Once tagged, fish were held by hand over the side of the boat. Fish were not released until they could swim freely. Fish that were badly injured were either released untagged or destroyed.

In 1973 all bass were given a left ventral fin clip in addition to the spaghetti tag.

Green and white sturgeon were tagged with numbered Petersen disc tags inserted through the caudal peduncle. The total length of each tagged sturgeon was recorded.

TECHNIQUES FOR RECOVERING TAGGED FISH

Prior to the 1972 commercial fishing season, a letter was sent to all licensed commercial fishermen on the Umpqua and Smith rivers. Fishermen were requested to leave the tags in bass they caught and to leave the tagged fish with unmarked fish they sold to either of the two buying stations located at Reedsport. The letter also explained the purpose of the tagging program.

Fish Commission personnel regularly visited both buying stations throughout the season; at least twice a week in 1972 and 5 days a week in 1973. Workers at buying stations were alerted and asked to watch for and return tags. In 1973, Fish Commission employees examined striped bass at the buying stations, counting fin-clipped fish.

Signs were posted at boat ramps and marinas to alert sport fishermen. These signs showed a picture of a tagged bass, briefly outlined the reasons for the tagging program, and asked that tags be returned to the Fish Commission. A return address was listed on the sign as well as a note that a letter telling each angler when and where their fish was tagged would be returned to each person who mailed in a tag.

A news release was carried by local radio, television, and newspapers describing our program and asking anglers to watch for tagged fish. One newspaper ran periodic summaries of how many striped bass had been tagged and returned to date.

The Oregon State Wildlife Commission conducted creel censuses in both 1972 and 1973 and collected tags when encountered in the sport catch.

SUMMARY OF TAGGED AND RECAPTURED FISH

1971

Fourteen striped bass were tagged on 6 nights in July and August of 1971. Two white sturgeon and six green sturgeon were also tagged. The sturgeon were all tagged at the "sturgeon hole." The bass were tagged at three locations (Table 1).

Table 1. Location and Number of Fish Tagged in Smith and Umpqua Rivers, 1971

Location	Number	
	Striped Bass	Sturgeon
Gardiner Channel	3	0
Lower Clark's	2	0
Butler Creek	9	0
Sturgeon Hole	<u>0</u>	<u>8</u>
Total	14	8

Four striped bass tags were returned by sport fishermen; one in 1971, two in 1972, and one in 1973. One striped bass was recaptured and released by the tagging crew in 1973 (Table 2). None of the tagged sturgeon were recaptured.

Table 2. Tag Recoveries of Striped Bass Tagged in the Smith and Umpqua Rivers, 1971

Tag No.	Length	Sex	Date Tagged	Date Recovered	Days at Large	Area Tagged	Area Recovered	Type ^{1/}
2723	47	--	8/25/71	5/09/73	623	Lower Clark's	Providence Creek	R
2736	57	--	8/26/71	7/27/72	336	Butler Creek	Smith River Bridge	S
2737	58	--	8/26/71	4/07/73	590	Butler Creek	Smith River at North Fork	S
2738	66	--	8/30/71	9/26/71	27	Butler Creek	Butler Creek	S
2741	62	--	8/31/71	7/07/72	311	Butler Creek	Smith River	S

^{1/} Symbols: R = Recapture by tagging crew, S = Sport.

1972 (Spring)

Between March 9 and May 9, 1972, 435 striped bass were captured and measured, 430 of which were tagged and released. One white sturgeon and three green sturgeon were also tagged (Table 3).

Table 3. Location and Number of Fish Tagged in the Smith and Umpqua Rivers, March-May, 1972

Location	Number	
	Striped Bass	Sturgeon
Lower Clark's	5	0
Otter Slough	69	0
Noel's Ranch	6	0
Macey Sands	121	2
Spruce Drift	115	1
Hinsdale's	84	1
Brandy Bar	1	0
Mill Creek	<u>29</u>	<u>0</u>
Total	430	4

In 1972, 18 tags were returned by commercial fishermen and 40 tags were returned by sport fishermen. Nine tags and 20 tags were returned in 1973 by each group, respectively. Three tagged bass were found dead; 12, 26, and 33 days after being tagged. One fish was recaptured in 1973 by the tagging crew, given a left ventral fin clip, released and counted as a 1973 release (Table 4).

No tagged sturgeon were recaptured.

1972 (Summer)

From June through September 1972, 19 striped bass were tagged after being captured in a bag seine (Table 5). Three of these fish were recaptured by the 1973 commercial fishery. One fish was recaptured in 1973 by the tagging crew, given a left ventral fin clip, released, and counted as a 1973 release (Table 6).

Table 4. Tag Recoveries of Striped Bass Tagged in the Smith and Umpqua Rivers, March-May, 1972

Tag No.	Length	Sex	Date Tagged	Date Recovered	Days	Area Tagged	Area Recovered	Type
					At Large			
2749	51	--	3/09/72	6/05/72	88	Spruce Drift	Big Bend	S
2750	51	--	3/09/72	5/13/72	65	Spruce Drift	Umpqua River	C
2755	61	--	3/10/72	7/01/73	478	Spruce Drift	Reedsport	S
2757	60	--	3/10/72	7/15/73	492	Spruce Drift	Gardiner	S
2758	56	--	3/10/72	5/15/72	66	Spruce Drift	Umpqua River	C
2768	65	--	3/10/72	6/27/72	109	Spruce Drift	Buoy 21	S
2773	65	--	3/11/72	3/25/73	379	Spruce Drift	Mill Creek	S
2774	57	--	3/11/72	6/11/72	92	Spruce Drift	Mouth of Smith River	S
2782	110	--	3/11/72	7/31/72	142	Spruce Drift	Big Bend	S
2785	59	--	3/11/72	5/29/72	79	Spruce Drift	Umpqua River	C
2786	66	--	3/11/72	8/12/72	154	Spruce Drift	Buoy 20	S
2790	46	M	3/11/72	5/16/73	431	Hinsdale's	Umpqua River	C
2795	60	--	3/14/72	6/17/72	95	Spruce Drift	Mouth of Smith River	S
2796	62	--	3/14/72	4/09/72	26	Spruce Drift	North Beach	M
2798	62	--	3/14/72	7/13/72	121	Spruce Drift	Big Bend	S
2800	59	--	3/14/72	6/29/72	107	Spruce Drift	Scholfield Slough	S
2805	68	--	3/14/72	5/06/72	53	Spruce Drift	Big Bend	S
2811	55	--	3/14/72	5/30/72	77	Spruce Drift	--	C
2820	97	--	3/14/72	4/16/72	33	Spruce Drift	Big Bend	M
2823	65	--	3/15/72	3/28/73	378	Spruce Drift	Mill Creek	S
2830	55	M	3/15/72	7/13/73	485	Spruce Drift	Buoy 20	S
2825	66	--	3/15/72	5/20/72	66	Hinsdale's	Big Bend	S
2831	49	M	3/15/72	5/13/72	59	Hinsdale's	Umpqua River	C
2834	57	--	3/15/72	6/27/72	104	Hinsdale's	Gardiner Channel	S
2835	49	M	3/15/72	5/03/73	414	Hinsdale's	Macey Sands	S
2837	63	--	3/15/72	5/29/72	75	Hinsdale's	Big Bend	S
2844	50	M	3/15/72	6/16/72	93	Hinsdale's	Umpqua	S
2845	49	--	3/15/72	6/02/73	458	Hinsdale's	Umpqua River	C
2850	62	--	3/15/72	5/29/72	75	Hinsdale's	Red Light	C
2852	60	--	3/15/72	7/15/73	487	Hinsdale's	Gardiner	S
2853	60	--	3/15/72	9/03/73	537	Hinsdale's	Reedsport	S
2855	63	--	3/16/72	5/20/72	65	Spruce Drift	Big Bend	S
2856	59	M	3/16/72	5/14/72	59	Spruce Drift	Umpqua River	C
2861	61	--	3/16/72	3/28/73	377	Hinsdale's	Mill Creek	S
2869	49	M	3/16/72	5/13/72	58	Hinsdale's	Umpqua River	C
2884	65	--	3/18/72	5/16/72	59	Hinsdale's	Umpqua River	C
3372	102	--	3/18/72	9/12/72	178	Spruce Drift	Scholfield Slough	S
3375	58	--	3/18/72	6/28/72	102	Hinsdale's	Gardiner Channel	S
3384	53	M	3/18/72	5/15/72	58	Hinsdale's	Umpqua River	C
3388	67	--	3/19/72	6/06/72	79	Spruce Drift	Big Bend	S
3389	62	M	3/19/72	9/05/72	170	Spruce Drift	Buoy 20	S
3390	92	M	3/19/72	8/02/72	136	Spruce Drift	Smith River	S
3402	57	M	3/19/72	5/16/72	58	Macey Sands	Umpqua River	C
3409	63	--	3/20/72	6/09/72	81	Spruce Drift	Dean Creek	C
3429	51	--	3/20/72	5/31/72	72	Hinsdale's	Umpqua River	C
2896	53	M	3/23/72	5/30/72	68	Lower Clark's	Umpqua River	C

Table 4. Continued

Tag No.	Length	Sex	Date Tagged	Date Recovered	Days At Large	Area Tagged	Area Recovered	Type 1/
3413	68	M	3/26/72	5/15/72	50	Hinsdale's	Umpqua River	C
3358	63	--	3/26/72	7/30/72	126	Spruce Drift	Gardiner Channel	S
3416	59	--	3/30/72	6/01/72	63	Mill Creek	Butler Creek	S
2886	61	M	3/19/72	6/04/72	77	Macey Sands	Red Light	C
2888	69	--	3/19/72	5/09/72	51	Macey Sands	Smith River	S
2889	104	--	3/19/72	9/24/72	189	Macey Sands	Noel's Ranch	S
2891	67	--	3/19/72	5/03/73	410	Macey Sands	Buoy 21	S
2892	50	--	3/19/72	7/--/72		Macey Sands	Big Bend	S
3417	95	--	4/03/72	5/31/73	423	Otter Slough	Smith River	C
3431	56	--	4/03/72	7/25/73	478	Otter Slough	Buoy 20	S
3457	60	--	4/06/72	6/25/72	80	Otter Slough	Gardiner	S
3460	64	--	4/06/72	5/06/72	30	Otter Slough	--	S
3462	61	--	4/06/72	8/15/72	131	Otter Slough	--	S
3464	55	M	4/06/72	7/13/72	98	Otter Slough	Reedsport	S
3468	55	M	4/06/72	6/27/72	82	Otter Slough	Buoy 21	S
3471	60	--	4/06/72	6/14/72	69	Otter Slough	Gardiner	S
3489	51	--	4/10/72	6/15/72	66	Otter Slough	Smith River	S
3501	101	--	4/11/72	8/10/73	486	Noel's Ranch	Buoy 20	S
3508	67	--	4/14/72	5/21/73	402	Spruce Drift	Buoy 20	S
3604	59	--	4/17/72	6/20/73	429	Hinsdale's	Buoy 20	S
3514	67	--	4/18/72	5/14/72	26	Hinsdale's	Gardiner Channel	S
3528	52	F	4/25/72	5/28/72	33	Mill Creek	Big Bend	S
3533	57	--	4/26/72	1972		Mill Creek	--	S
3537	57	--	4/26/72	7/01/72	66	Mill Creek	Smith River	S
3539	42	--	4/26/72	3/13/73	321	Mill Creek	Mill Creek	S
3547	59	--	4/27/72	8/11/73	471	Mill Creek	Gardiner	S
3548	49	M	4/27/72	5/16/73	384	Mill Creek	Umpqua River	C
3550	43	--	4/28/72	6/04/72	37	Hinsdale's	Providence Creek	S
3554	46	--	5/01/72	6/04/73	399	Macey Sands	Umpqua River	C
3566	98	M	5/01/72	5/15/72	14	Macey Sands	Umpqua River	C
3570	57	M	5/01/72	1973		Macey Sands	--	S
3575	103	--	5/01/72	7/09/73	434	Macey Sands	Buoy 20	S
3602	49	--	5/02/72	5/18/73	377	Macey Sands	Umpqua River	C
3606	57	M	5/02/72	5/14/72	12	Macey Sands	Smith River	M
3584	59	M	5/02/72	7/02/72	61	Macey Sands	Smith River	S
3597	59	--	5/02/72	7/01/72	60	Macey Sands	--	S
3621	63	--	5/02/72	8/19/72	109	Macey Sands	--	S
3622	57	--	5/02/72	6/08/73	402	Macey Sands	Umpqua River	C
3628	62	--	5/02/72	5/31/73	394	Macey Sands	Umpqua River	C
3633	67	--	5/03/72	3/11/73	312	Macey Sands	Mill Creek	S
3634	98	--	5/03/72	4/06/73	338	Macey Sands	Noel's Ranch	S
3643	57	M	5/03/72	5/19/73	381	Macey Sands	Umpqua River	C
3640	69	--	5/05/72	5/01/73	361	Mill Creek	Providence Creek	R
3654	81	M	5/08/72	5/19/72	11	Macey Sands	Smith River	S
3659	59	--	5/09/72	5/29/72	20	Macey Sands	Umpqua River	C

1/ Symbols: C = Commercial, M = Mortality, R = Recapture by tagging crew, S = Sport.

Table 5. Location and Number of Striped Bass Tagged in the Smith and Umpqua Rivers, June-September, 1972

Location	Number
North Fork	3
Noel's Ranch	1
Otter Slough	3
Black's Island	1
Scholfield Slough	1
Spruce Drift	<u>10</u>
Total	19

Table 6. Tag Recoveries of Striped Bass Tagged in the Smith and Umpqua Rivers, June-September, 1972

Tag No.	Length	Sex	Date Tagged	Date Recovered	Days At Large	Area Tagged	Area Recovered	Type
3669	56	--	6/24/72	3/20/73	269	Spruce Beach	Mill Creek	R
3684	49	--	8/02/72	6/04/73	306	Otter Slough	Smith River	C
3674	40	--	8/09/72	5/19/73	283	Black's Island	Smith River	C
3673	57	--	8/30/72	6/11/73	285	Scholfield Slough	Umpqua River	C

1/ Symbols: R = Recapture by tagging crew, C = Commercial.

1973

From March 5 to May 9, 1973, 420 striped bass were tagged, given a left ventral fin clip, and released, including two fish tagged in previous years that were recaptured, given a left ventral fin clip, and released. Two white sturgeon and one green sturgeon were also tagged (Table 7).

Table 7. Location and Number of Fish Tagged in the Smith and Umpqua Rivers, 1973

Location	Number	
	Striped Bass	Sturgeon
Spruce Drift	1	1
Hinsdale's	7	1
Macey Sands	54	0
Mill Creek	9	0
Otter Slough	1	0
Luder Creek	272	1
Providence Creek	56	0
The Cutoff	3	0
Red Light	<u>17</u>	<u>0</u>
Total	420	3

The 1973 commercial fishery returned 33 tags plus one tag that was found tangled in a gill net. The sport fishery returned 29 tags, including one which was removed from the fish and the fish released. Three fish were recaptured by the tagging crew (excluding those fish recaptured on the same night they were tagged) (Table 8).

VALIDITY OF PETERSEN ESTIMATES

A Petersen population estimate may be made when either the marked fish become randomly distributed in the population before the second sample is taken, or, the second sample is selected at random from the population. Ricker (1958) listed six conditions, that if met, should assure that these criteria are met. Each condition, as related to the present study, is discussed below.

1) *Marked fish suffer the same natural mortality as the unmarked fish.* There was little evidence to either support or contradict this assumption. Three dead tagged fish were reported in 1972 and one in 1973. The dead fish in 1973 reportedly showed signs of infection around the insertion of the tag and had severe abrasions where the stub of the clipped ventral fin rubbed against the abdomen.

Table 8. Tag Recoveries of Striped Bass Tagged in the Smith and Umpqua Rivers, 1973

Tag No.	Length	Sex	Date Tagged	Date Recovered	Days At Large	Area Tagged	Area Recovered	Type 1/
3703	60	--	3/08/73	8/23/73	168	Luder Creek	Reedsport	S
3704	76	--	3/08/73	1973		Luder Creek	--	S
3705	69	--	3/08/73	4/05/73	28	Luder Creek	Gardiner	M
3708	57	--	3/08/73	5/18/73	71	Luder Creek	Red Light	C
3727	63	--	3/09/73	5/03/73	55	Luder Creek	--	S
3690	55	--	3/13/73	1973		Luder Creek	--	S
3695	69	--	3/13/73	7/14/73	123	Luder Creek	Buoy 18	S
3699	73	--	3/13/73	5/19/73	67	Luder Creek	Umpqua River	C
3744	58	M	3/13/73	5/18/73	66	Luder Creek	Umpqua River	C
3746	59	--	3/13/73	5/21/73	69	Luder Creek	Buoy 20	S
3754	57	--	3/14/73	7/16/73	124	Luder Creek	Buoy 18	S
3757	56	M	3/14/73	5/15/73	62	Luder Creek	Umpqua River	C
3769	58	--	3/15/73	6/02/73	79	Luder Creek	Umpqua River	C
3776	61	--	3/16/73	6/17/73	93	Luder Creek	Buoy 21	S
3782	68	--	3/16/73	6/18/73	94	Luder Creek	Umpqua River	C
3787	58	--	3/16/73	8/25/73	162	Luder Creek	Macey Sands	S
3788	56	M	3/16/73	5/18/73	63	Luder Creek	Umpqua River	C
3793	65	--	3/19/73	4/19/73	31	Luder Creek	Gardiner Slough	R
3795	62	--	3/19/73	5/27/73	69	Luder Creek	Umpqua River	C
3797	70	--	3/19/73	5/03/73	45	Luder Creek	Buoy 21	S
3807	57	--	3/19/73	5/18/73	60	Luder Creek	Umpqua River	C
3809	57	--	3/19/73	7/27/73	130	Luder Creek	Buoy 21	S
3810	65	M	3/19/73	5/16/73	58	Luder Creek	Umpqua River	C
3814	58	--	3/20/73	9/05/73	169	Luder Creek	Noel's Ranch	S
3820	75	--	3/20/73	1973		Luder Creek	--	S
3824	59	--	3/20/73	5/18/73	59	Luder Creek	Umpqua River	C
3839	60	--	3/20/73	9/28/73	192	Luder Creek	Reedsport	S
3841	59	M	3/20/73	5/17/73	58	Luder Creek	Umpqua River	C
3842	59	--	3/20/73	4/23/73	34	Luder Creek	Providence Creek	R
3863	66	M	3/21/73	4/16/73	26	Luder Creek	Otter Slough	R
3865	53	M	3/21/73	5/19/73	59	Luder Creek	Umpqua River	C
3866	67	--	3/21/73	4/05/73	15	Luder Creek	Jimmy Creek	S
3867	62	--	3/21/73	6/18/73	89	Luder Creek	Umpqua River	C
3853	58	--	3/22/73	6/22/73	92	Luder Creek	Umpqua River	C
3872	78	--	3/22/73	8/11/73	142	Luder Creek	Buoy 12	S
3883	54	M	3/26/73	5/18/73	53	Luder Creek	Smith River	C
3893	59	--	3/27/73	5/22/73	56	Luder Creek	Umpqua River	C
3894	60	--	3/27/73	9/23/73	180	Luder Creek	Reedsport	S
3895	58	--	3/27/73	6/30/73	95	Luder Creek	Umpqua River	C
3911	67	M	4/02/73	6/02/73	61	Hinsdale's	Umpqua River	C
3916	78	F	4/03/73	5/21/73	48	Luder Creek	Buoy 20	S
3927	64	M	4/05/73	6/04/73	60	Luder Creek	Brandy Bar	S
3934	61	--	4/05/73	5/25/73	50	Luder Creek	Smith River	C
3944	63	--	4/05/73	6/08/73	64	Luder Creek	Umpqua River	C
3960	62	--	4/06/73	4/08/73	2	Luder Creek	Smith River	S
3969	60	M	4/10/73	7/20/73	101	Macey Sands	Joyce Creek	S

Table 8. Continued

Tag No.	Length	Sex	Date Tagged	Date Recovered	Days At Large	Area Tagged	Area Recovered	Type 1/
3977	59	M	4/10/73	1973		Macey Sands	Macey Sands	S
3985	66	--	4/17/73	6/13/73	57	Macey Sands	Umpqua River	C
3998	55	M	4/18/73	5/17/73	29	Luder Creek	Umpqua River	C
3999	68	M	4/18/73	7/11/73	84	Luder Creek	Buoy 20	S
3987	59	--	4/19/73	7/20/73	92	Providence Creek	Buoy 16	S
2904	73	--	4/20/73	6/29/73	70	Macey Sands	Umpqua River	C
2917	53	--	4/26/73	6/02/73	37	The Cutoff	Umpqua River	C
2934	93	M	4/27/73	6/06/73	40	Macey Sands	Scholfield Slough	S
2942	62	--	4/27/73	6/20/73	54	Providence Creek	Umpqua River	C
2944	95	--	4/27/73	5/23/73	26	Macey Sands	Scholfield Slough	S
2946	58	M	4/29/73	5/23/73	24	Macey Sands	Smith River	C
2952	61	M	4/29/73	6/01/73	33	Mill Creek	Umpqua River	C
2953	61	--	4/29/73	6/02/73	34	Mill Creek	Umpqua River	C
2970	77	--	5/01/73	6/19/73	49	Providence Creek	Buoy 20	S
2971	67	--	5/01/73	5/22/73	21	Providence Creek	Umpqua River	C ^{2/}
2974	75	--	5/01/73	5/22/73	21	Providence Creek	Scholfield Slough	S ^{3/}
2975	71	--	5/01/73	6/16/73	46	Providence Creek	Reedsport	S
2992	62	--	5/07/73	5/24/73	17	Macey Sands	Umpqua River	C
2996	72	--	5/07/73	6/17/73	41	Macey Sands	Umpqua River	C
2998	43	M	5/07/73	5/30/73	23	Hinsdale's	Smith River	C
0808	97	M	5/08/73	9/08/73	123	Macey Sands	Buoy 21	S
0810	58	--	5/08/73	5/23/73	15	Red Light	Macey Sands	C

1/ Symbols: C = Commercial, M = Mortality, R = Recapture by tagging crew, S = Sport.

2/ Tag was tangled in gill net with no fish.

3/ Tag was removed and the fish was released.

Fish Commission samplers inspected many of the recaptured fish at commercial buying stations in 1972 and 1973. Fish that were inspected showed no abnormal external signs of infection at the tag insertion. In fact, once a tag was removed from a fish, it was often difficult to detect a tagged fish without close inspection. Chadwick (1963) reported doughnut-shaped proliferations of connective tissue and considerable necrosis around the insertions of spaghetti tags made of Temflex tubing, after 6 months. Such severe conditions were not observed during the present study, even on fish at large for over 1 year.

Immediate tagging mortality was minimized by holding fish until they were able to swim. On a few occasions when several fish were captured within a short time, fish had to be released without this precaution. Immediate tagging mortality was 37 fish in the spring of 1972, 35 of which were captured in a single school and exceeded the crew's capacity to get fish out of the gill net before they died, and three fish in 1973.

2) *Marked fish are as vulnerable to the fishing being carried on as the unmarked fish.* Tagging ceased when the commercial fishery began. Thus, differential capture rate of tagged fish that had not fully recovered from the stress of tagging was probably minimal. There was no evidence that fish tagged immediately prior to the opening of the commercial fishery were caught at a different rate than fish tagged in early spring.

There is danger that tagged fish had a greater chance of becoming entangled in gill nets. Lewis (1961) and Davis (1959) showed that Petersen disc tag returns of striped bass were significantly greater in selective gear (gill nets) than were streamer and jaw ring tags. Petersen disc tags were purposely avoided in the present study for this reason.

One tag was found entangled in a commercial gill net in 1973, apparently having been torn loose from the fish. Whether the fish tore away from the tag or the fisherman inadvertently ripped the tag loose while removing the fish from his net was not known. If the former was the case, then the fish had to be reasonably free of the net and became tangled only because the tag became snagged.

3) *Marked fish do not lose their mark.* To date, tagged striped bass have been recovered up to 3 years after being tagged with spaghetti tags. Alperin (1966) recovered striped bass tagged with spaghetti-dangler tags up to 4 years after tagging. The tags from these fish were still securely attached.

To compute Petersen population estimates it was only necessary that the fish retained the tags for 3 to 4 months, until the end of the commercial fishing season. It was unlikely the tag loss was significant in that short a time.

Samplers examined 1,980 commercially landed fish in 1973 (62% of the total catch) and counted 25 fish with a left ventral fin clip. Three of these fish lacked tags. There was no measure of whether these were real tag losses as they could have resulted from uncooperative fishermen maliciously removing tags, sport fishermen removing the tags and releasing the fish (this happened on at least one occasion), or fishermen pulling the tags and returning them to us at a later date. When the latter occurred, the fisherman was questioned as to when the fish was caught; and, if a fin-clipped untagged fish had been noted in the catch for that day, it was corrected and counted as a tagged fish. Only one such correction was made.

Three untagged fish out of 25 fin-clipped fish represented an estimated tag loss of 12%. The total number of tag returns in 1973 was corrected by this amount to correct for tag loss.

4) *Marked fish become randomly mixed with the unmarked; or, the distribution of fishing effort (in subsequent sampling) is proportional to the number of fish present in different geographical areas.* I tested for random mixing of tagged fish by comparing size ranges of tagged fish with fish captured in the commercial fishery. Random mixing was not assured if the fish from these two groups were of equal size, but if the two groups were of unequal size, random mixing was less likely to have occurred. In 1972, the mean length of fish in the commercial fishery was 0.96 cm greater than the mean length of the tagged fish (Figure 2). This difference was tested by the "t-test" with unequal sample sizes (Snedecor, 1956), with a resulting t value of 1.20 ($p = 0.236$). In 1973 the mean length of fish in the commercial landings was 1.54 cm less than the mean length of tagged fish (Figure 3) with a t value of 2.54 ($p = 0.012$). Thus, no difference in mean lengths was apparent in 1972; whereas, in 1973 the mean lengths were different. The difference in 1973 was apparently due to a number of smaller fish (less than 50 cm) in the commercial fishery which were not tagged.

The striped bass in the commercial catch in Coos River in April are predominantly males (unreported Fish Commission data). If the same condition occurred on the Umpqua River, a disproportionate number of males may have been tagged. Determination of sex was impossible for most of the fish that were tagged. If mostly males were tagged, Petersen estimates were still valid if these fish randomly mixed with females and were equally recruited to the commercial fishery.

5) *Marks are recognized and reported on recovery.* The bright orange or yellow spaghetti tags were highly visible and marked fish were easily recognized by both sport anglers and commercial fishermen. Once commercially

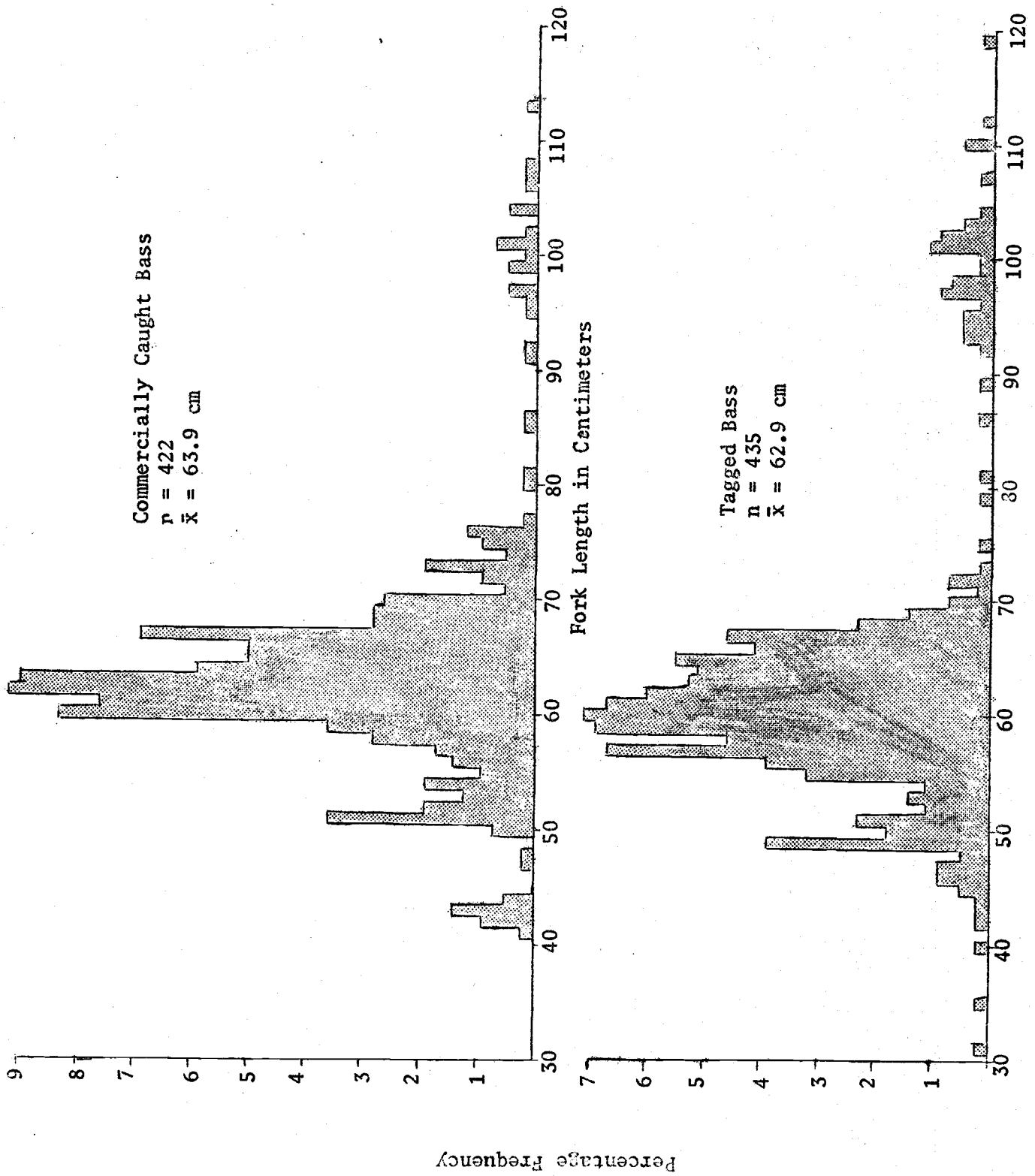


Figure 2. Length Frequency of Striped Bass Tagged and Sampled from the Commercial Catch, Umpqua and Smith Rivers, 1972

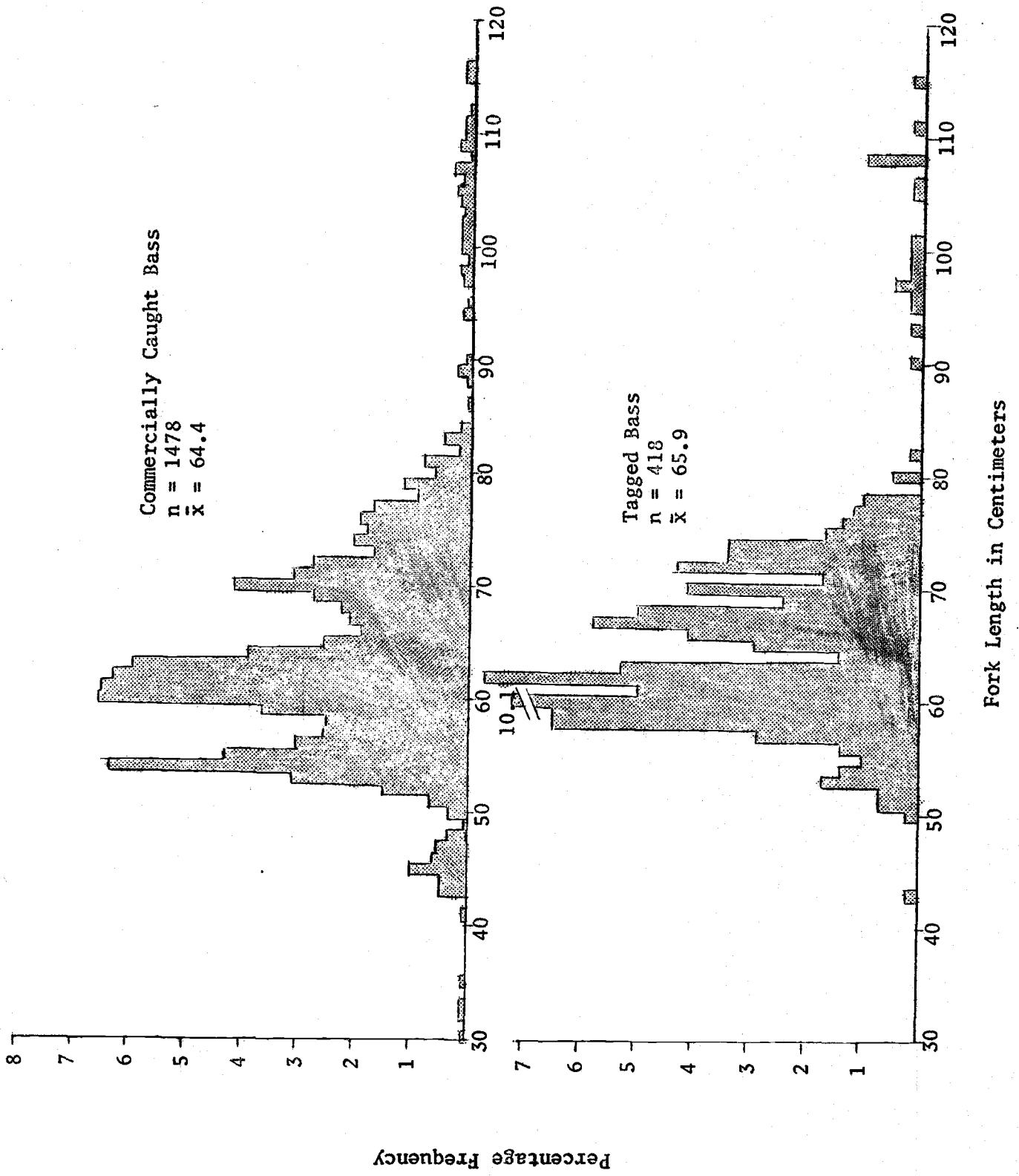


Figure 3. Length Frequency of Striped Bass Tagged and Sampled from the Commercial Catch, Umpqua and Smith Rivers, 1973

caught bass reached the buying station they were repacked and iced down, the dealer would easily notice tagged fish as the catch was packed.

The number of reported tag returns at the two main buying stations was checked against the number of fish landed at each station in 1972 and 1973. Striped bass landings were reported in pounds so the numbers landed were estimated by using an average weight of 8.4 lbs in 1972 ($n = 370$) and 9.1 lbs in 1973 ($n = 1,705$). The ratio of each company's landings to the total landings, multiplied by the total number of tag returns for both companies combined, gave an "expected" number of tag returns for each company if tagged fish were randomly distributed within the catch and both companies reported all tags processed through their plants. These expected returns were compared with the actual returns by a chi-square test of goodness of fit, adjusted for continuity (Snedecor, 1956) (Table 9).

The computed chi-square value in 1972 was 4.64 ($p = 0.033$) and in 1973 was 0.28 ($p = 0.621$). Thus in 1972, tagged fish were not reported equally by both companies. This could have been due to a nonrandom distribution of marks in the catch, but as a practical matter I believe that not all commercially caught tags were recovered in 1972. The low chi-square value in 1973 suggested that both companies reported tagged bass at the same rate. This low chi-square value and the fact that only three fin-clipped fish were examined that did not have tags, indicated the tag return rate in the 1973 commercial fishery was probably very good.

6) *Only a negligible amount of recruitment to the catchable population occurs during the time the recoveries are being made.* Growth of striped bass between the time of tagging (March-May) and the time of recovery from the commercial fishery (May-June) is negligible (based on unreported Fish Commission growth data). Therefore, it is unlikely that any significant

Table 9. Striped Bass Landings, Tag Returns, and Computation of Chi-Square Values Comparing the Rates of Tag Returns of the Two Major Commercial Buying Stations on the Umpqua River, 1972 and 1973

	1972			1973		
	Company A	Company B	Total	Company A	Company B	Total
Pounds Landed	16,461	25,627	42,088	10,420	18,268	28,688
Number Landed	1,969	3,066	5,035	1,145	2,007	3,152
Percentage of Total Landings	39.1	60.9		36.3	63.7	
Number of Tags Reported	12	6	18	10	23	33
Expected Number of Tags	7.04	10.96	18	11.98	21.02	33
Chi-Square	2.83	1.81	4.64	0.18	0.10	0.28

number of small fish, unrecruited to the tagging gill net, became recruited during the commercial fishing season. There was probably a small amount of recruitment in 1973 (from Figure 3) but not enough to significantly affect the results.

RECRUITED POPULATION ESTIMATES

Population estimates were computed using Bailey's (1951) modification of the basic Petersen equation. Confidence limits were estimated by the methods described by Chapman (1948). I assumed that all fish landed by the commercial fishery were checked for tags even though Fish Commission personnel did not physically examine each fish for a tag. This assumption was probably false in 1972, based on the unequal return of tags from the two buying stations.

In 1972, 430 bass were tagged, and an estimated 5,035 were landed in the commercial fishery, including 18 tag recoveries. Based on these data, the estimated recruited population was 113,973 fish, with $\underline{N} = 69,996$ and $\bar{N} = 190,524$. The estimated rate of exploitation was 0.042.

In 1973, 420 bass were tagged, an estimated 3,206 were landed by the commercial fishery, and 33 tags were recovered from the commercial fishery. The total tag recovery was corrected for tag loss with a resulting estimate of 38 tags recovered. The estimated recruited population was 34,537 fish, with $\underline{N} = 24,816$ and $\bar{N} = 48,475$. The estimated rate of exploitation was 0.090.

The 1972 estimate was recomputed using only the landings from Company A (Table 9). I believe that Company A returned tags at a reliable rate. The 12 tags returned by Company A were corrected to 14 tags based on the 1973 estimate of 12% tag loss. The corrected estimate of the recruited

population was 56,473 with $\underline{N} = 32,343$ and $\bar{N} = 102,447$. The corrected estimated rate of exploitation, assuming that Company B should have returned tags at the same rate as Company A was 0.084.

The corrected 1972 exploitation rate of 0.084, and the estimated 1973 exploitation rate of 0.090 are comparable. The recruited population decreased from 56,473 fish in 1972 to 34,537 fish in 1973. This decrease is not alarming and is no doubt due to the dominant 1966 brood year of striped bass being removed from the population through natural and fishing mortality along with reduced recruitment of brood years following 1966. 1/

Aney (1973) estimated the population of striped bass in the Umpqua River in 1972, based on tagged fish released in the spring and summer of 1972, and 15 tags put out by the Oregon Wildlife Commission during the summer. He used the estimated sport harvest of 6,036 fish and 41 tagged fish recovered in the sport catch to compute a recruited population of 66,661. As Aney noted, however, this estimate was complicated by releasing tagged fish into the population throughout much of the sport fishing season. Recruitment of new fish into the catchable size range during the sport fishing season could have overestimated the real population size at the time of tagging, while the capture and subsequent release of fish beyond the bag limit could have underestimated the real population (I am assuming that an angler would selectively keep a tagged fish under the latter condition).

My population estimates were restricted to fish recruited to the commercial fishery while Aney's were for fish recruited to the sport fishery. Both small and large members of the population are not fully recruited to

1/ The dominance of the 1966 brood year was based on scale analysis of the age distribution of the commercial catch.

the commercial gear. The size frequency histogram of fish in the sport fishery (Figure 4) shows relatively high percentages of small and large fish which contribute more heavily to the sport fishery than to the commercial fishery.

Considering the differences in recruited populations to each fishery, Aney's estimate of 66,661 bass recruited to the sport fishery, and my estimate of 56,473 bass recruited to the commercial fishery, were of comparable magnitude.

MIGRATION PATTERNS

The small number of striped bass that were tagged, coupled with the lack of specific recovery area data for most of the commercial tag returns, made any critical analysis of migration patterns impossible. There were several returns from Smith River of fish tagged in the Umpqua, and vice versa, which suggested that striped bass in the two rivers are not discrete populations. However, no tags were returned from any areas outside of the Smith and Umpqua rivers, indicating the population is confined to the basin.

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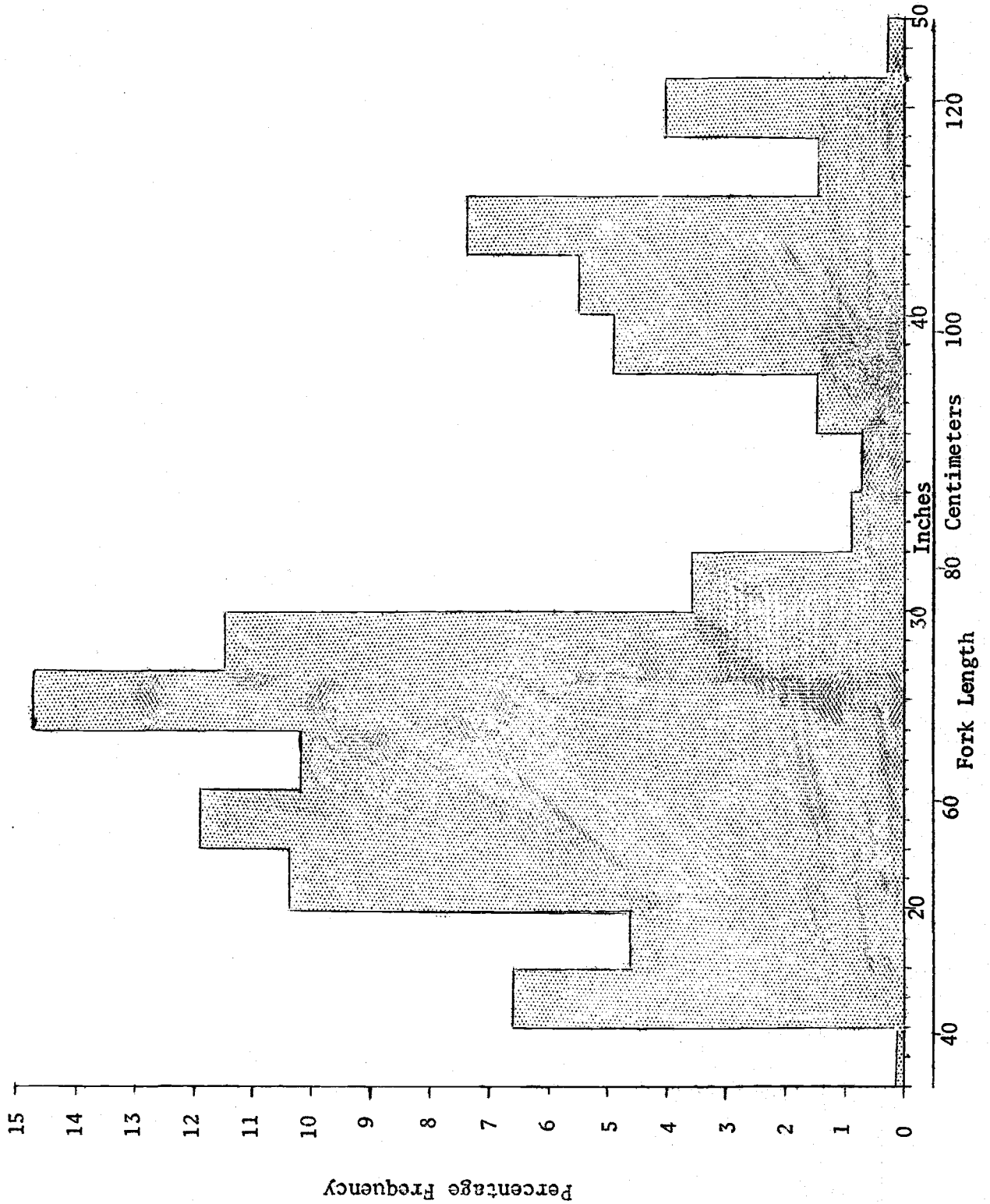


Figure 4. Length Frequency of Striped Bass from the Sport Catch, Umpqua and Smith Rivers, 1972 (based on data from Aney, 1973)

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