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Salmon Stock Assessment in the North Pacific Ocean, 2002

by

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ABSTRACT

We summarize results of research cruises on salmon stock assessment conducted by Japan in summer of 2002. Five Japanese salmon research vessels (*Oshoro maru*, *Wakatori maru*, *Kaiyo maru*, *Kaiun maru* and *Wakatake maru*) conducted oceanographic observations, 63 gillnet (3,116 tans), 31 longline (830 hachi), 2 hook-and-line, and 24 trawl fishing operations in the western, the central, the eastern North Pacific, and the Bering Sea from May to July. Mean sea surface temperature, abundance and body size of Pacific salmon in 2002 are compared to those from 1992 to 2001. Mean sea surface temperature at salmon research stations in 2002 was lower than the mean of 1992-2001 in the Bering Sea but higher in three regions of North Pacific. A total of 13,570 salmonids was caught using drift gillnets, longlines, trawls, and hook-and-lines, including 10,278 chum (75.7%), 1,347 pink (9.9%), 1,215 sockeye (9.0%), 363 coho (2.7%), and 291 chinook salmon (2.1%), and 76 steelhead trout (0.6%) in 2002. CPUE of sockeye salmon was in a low level in 1992-2002. CPUE of chum salmon recovered from the lowest level in 2000 among even years of 1992-2002. CPUE of pink salmon in 2002 was the lowest in the Bering Sea but in a high level in the western North Pacific among even years of 1992-2002. No common trend in annual changes of mean fork lengths of salmonids was observed.

INTRODUCTION

According to the 2002 Work Plan of the North Pacific Anadromous Fish Commission (NPAFC), the Committee on Scientific Research and Statistics (CSRS) should review results of salmon stock assessment research and the condition of salmon stocks (NPAFC 2001). This report summarizes the oceanographic conditions, abundance, and body size of salmon in the North Pacific Ocean and Bering Sea in 2002 from the salmon research conducted by Japan in the North Pacific Ocean from May to July. In this report, we compared results in 2002 with those in the previous ten years from 1992 to 2001.

MATERIALS AND METHODS

Five Japanese salmon research vessels (*Oshoro maru*, *Wakatori maru*, *Kaiyo maru*, *Kaiun maru*, and *Wakatake maru*) conducted 63 gillnet (3,116 tans), 31 longline (830

hachi), 24 trawl and 2 hook-and-line fishing operations in the North Pacific Ocean and Bering Sea from May to July 2002 (Table 1, Fig. 1). We divided the research area to 4 regions: the western North Pacific (38-51° N, 150-170° E), the central North Pacific (38-52° N, 170° E-170° W), the Bering Sea (52-59° N, 170° E-170° W), and the eastern North Pacific (38-56° N, 170-140° W). To examine abundance of salmon, mean numbers of fish caught by 30 tans of non-selective research gillnets (CPUEs) were calculated (Takagi 1975). For body size of salmon, mean fork length (MFL) of fish caught by non-selective research gillnets was calculated.

RESULTS AND DISCUSSION

Sea Surface Temperature

Mean sea surface temperature at gillnet stations of Japanese salmon researches was 11.2°C in the western North Pacific, 13.4°C in the central North Pacific, 7.2°C in the Bering Sea, and 12.0°C in the eastern North Pacific in the summer of 2002 (Table 1). That was lower than the mean of 1992-2000 in the Bering Sea. In three regions of the North Pacific, and the, mean sea surface temperature in 2002 was higher than mean in 1992-2001. Ocean condition of the North Pacific in 2002 was described by Kusaka and Azumaya (2002).

Salmonid and Non-Salmonid Catches

A total of 13,570 salmonids was caught using drift gillnets, longlines, trawls, and hook-and-lines, including 10,278 chum (75.7%), 1,347 pink (9.9%), 1,215 sockeye (9.0%), 363 coho (2.7%), and 291 chinook salmon (2.1%), and 76 steelhead trout (0.6%) in 2002 (Table 2). No Dolly Varden was caught. Dominant non-salmonid catches included 47,768 Atka mackerel (*Pleurogrammus monopterygus*), 3,078 Pacific pomfret (*Brama japonica*), 3,045 Pacific saury (*Cololabis saira*), and 961 neon flying squid (*Ommastrephes bartrami*).

Salmon Abundance

CPUE of sockeye salmon in the summer of 2002 was in a low level in 1992-2002 (Fig. 2). Sockeye salmon are mainly distributed in the Bering Sea and the eastern North Pacific in summer. In 2002, CPUE of sockeye salmon in the Bering Sea ($28.5 \pm \text{SD } 13.6$) was 67.5% of the mean in 1992-2002 ($42.2 \pm \text{SD } 37.5$). Sockeye CPUE in the eastern North Pacific ($30.5 \pm \text{SD } 20.6$) was 75.5% of the mean in 1992-2002 ($40.4 \pm \text{SD } 38.7$).

CPUE of chum salmon in 2002 recovered from the lowest level in 2000 in the Bering Sea (Fig. 3). Chum salmon are mainly distributed in the Bering Sea in summer. In this region, chum CPUE is lower in odd years than in even years. CPUE of chum salmon in the Bering Sea ($189 \pm \text{SD } 83.5$) was similar to the mean in even-years of 1992-2002 ($204 \pm \text{SD } 86.7$).

CPUE of pink salmon in 2002 was the lowest in the Bering Sea but in a high level in the western North Pacific among even years of 1992-2002 (Fig. 4). Pink salmon are mainly distributed in the Bering Sea and the western North Pacific. In the Bering Sea, CPUEs in odd years are higher than in even years. CPUE in this region of 2002 ($2.2 \pm \text{SD } 1.6$) was the lowest in even-years of 1992-2002. In the western North Pacific, CPUEs in odd years are

lower than in even years. In this region, pink salmon CPUE in 2002 ($130 \pm \text{SD } 98.9$) was higher than the mean in even-years of 1992-2002 ($118 \pm \text{SD } 168$).

CPUE of coho salmon in 2002 was in the lowest level in 1992-2002 (Fig. 5). Coho salmon are distributed in the western, central, and eastern North Pacific. Coho salmon CPUEs in these regions of 2002 were the lowest in 1992-2002. Chinook salmon are distributed in the Bering Sea and their CPUE in 2002 was in a high level in 1992-2002 (Fig. 6). Steelhead trout are mainly distributed in the eastern North Pacific and their CPUE in 2002 was in a high level in 1992-2002 (Fig. 7).

Fish Size

MFL of sockeye salmon in summer of 2002 recovered from the smallest level in 2000 in the eastern North Pacific and the Bering Sea (Fig. 8). MFL of chum salmon in summer of 2002 was in the similar level in 1992-2002 in the western, eastern North Pacific and the Bering Sea, but that was relatively lower in the western North Pacific (Fig. 9). In these species, it was not possible to compare MFL by age groups, because age determination has not yet been finished.

MFL of pink salmon in summer of 2002 in the eastern North Pacific and the Bering Sea was relatively larger in 1992-2002 (Fig. 10). In the central North Pacific, MFL of pink salmon in 2002 was relatively smaller in 1992-2002. MFL of coho salmon in summer of 2002 was relatively larger than in 1992-2002 in the western, central North Pacific, and the Bering Sea (Fig. 11).

No clear change in MFL was observed for chinook salmon and steelhead trout due to small number of samples (Fig. 12 and Fig. 13).

ACKNOWLEDGMENTS

We thank captains, officers and crew of all Japanese salmon research vessels for their careful collection of data and samples.

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Table 1. Mean sea surface temperature (°C), standard deviation, and number of observations (in parentheses) of gillnet stations of Japanese salmon researches by regions in the North Pacific Ocean in the summer of 1992-2002.

Year	Western North Pacific			Central North Pacific			Bering Sea			Eastern North Pacific		
1992	9.0	± 4.13	(38)	10.6	± 3.46	(38)	6.6	± 0.53	(11)	9.6	± 0.68	(9)
1993	11.0	± 3.50	(27)	12.0	± 2.94	(32)	7.5	± 0.56	(11)	9.4	± 1.30	(8)
1994	12.9	± 4.99	(29)	12.3	± 4.72	(32)	7.1	± 0.59	(11)	10.4	± 1.10	(10)
1995	11.6	± 4.14	(30)	11.6	± 2.81	(32)	7.8	± 0.70	(11)	9.8	± 1.62	(7)
1996	10.0	± 2.71	(25)	12.4	± 3.18	(33)	7.9	± 0.56	(9)	9.6	± 0.99	(9)
1997	9.2	± 1.79	(20)	11.6	± 3.55	(31)	8.4	± 0.64	(10)	12.2	± 0.43	(9)
1998	10.8	± 4.39	(23)	11.2	± 3.84	(22)	7.5	± 1.14	(11)	10.0	± 1.11	(12)
1999	9.6	± 3.63	(18)	10.7	± 4.22	(19)	6.7	± 0.60	(11)	9.7	± 2.82	(13)
2000	12.6	± 7.14	(21)	9.0	± 2.77	(10)	7.9	± 0.89	(11)	10.0	± 1.77	(14)
2001	12.7	± 4.99	(15)	12.5	± 4.11	(34)	6.0	± 0.69	(13)	8.4	± 1.11	(9)
92-01	10.9	± 4.54	(246)	11.6	± 3.73	(283)	7.3	± 1.01	(109)	9.9	± 1.76	(100)
2002	11.2	± 2.65	(7)	13.4	± 4.15	(37)	7.2	± 0.25	(13)	12.0	± 0.47	(6)

Table 2. Numbers of salmonids and other organisms caught by the Japanese salmon research vessels in summer of 2002.

Region	Research Vessel	Gear	Date	No. operation	Tan/h achi	Pacific										Atka mackere e	Walley pollock	Other r fishes	Othe r birds	Mam mals		
						Sockeye	Chum	Pink	Coho	Chinook	Steel	Flying squid	Other squid	Pacific pomfret	saury						Lance t fish	Sharks l
Western North Pacific	<i>Oshoro maru</i>	Research	May 26-Jun 16	7	210	0	165	911	8	0	0	0	0	0	0	0	0	0	0	0	0	
		Commercial	May 26-Jun 16	7	84	0	188	180	11	1	0	0	0	0	0	0	0	0	0	0	0	
		Small-mesh	May 26-Jun 16	7	49	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	
		Total	May 26-Jun 16	7	343	0	353	1092	19	1	0	0	0	0	0	0	0	0	0	0	0	
Central North Pacific	<i>Wakatake maru</i>	Research	Jun 15-Jun 24	8	240	13	198	5	48	2	9	1	112	269	1	0	0	0	0	2	1	0
		Commercial	Jun 15-Jun 24	8	136	7	20	5	80	1	14	2	1	170	0	1	1	0	0	1	0	0
		Small-mesh	Jun 15-Jun 24	8	16	0	0	0	0	0	0	0	0	0	144	0	0	0	0	0	0	0
		Longline	Jun 15-Jun 26	11	330	5	81	4	20	0	2	0	5	771	0	1	1	1	0	3	0	0
	<i>Kaiun maru</i>	Research	Jul 1-Jul 31	16	480	15	107	30	58	4	2	413	186	745	372	0	46	0	0	56	9	1
		Commercial	Jul 1-Jul 31	16	256	11	76	44	66	6	3	127	0	389	0	0	51	0	0	22	10	0
		Small-mesh	Jul 1-Jul 31	16	64	0	0	0	0	0	0	87	58	1	1700	0	0	0	0	170	1	0
	<i>Wakatori maru</i>	Research	May 11-May 25 May 11-May	13	390	0	35	14	23	0	1	127	20	549	8	0	48	0	0	76	0	1
		Commercial	25	13	208	0	13	0	29	0	0	203	0	182	0	0	31	0	0	11	1	0
		Small-mesh	May 11-May 25	13	52	0	0	0	0	0	0	1	18	2	818	0	0	0	0	15	0	0
		Total	May 11-Jul 31	48	2172	51	530	102	324	13	31	961	400	3078	3043	2	178	1	0	356	22	2
Bering Sea	<i>Kaiyo maru</i>	Trawl	Jun 29-Jul 14	24	24	92	2382	11	0	107	0	0	3000	0	0	0	0	47391	15	59	0	0
	<i>Wakatake maru</i>	Research	Jul 2-Jul 14	13	390	370	2463	28	2	90	0	0	17	0	0	0	1	348	0	2	14	0
		Commercial	Jul 2-Jul 14	13	247	288	2155	17	3	55	0	0	0	0	0	0	1	1	0	2	20	1
		Small-mesh	Jun 27-Jul 11	13	450	34	1886	1	0	25	0	0	1	0	0	1	0	27	0	0	1	0
		Total	Jun 27-Jul 14	37	1111	784	8886	57	5	277	0	0	3018	0	0	1	2	47767	15	63	35	1
Eastern North Pacific	<i>Oshoro maru</i>	Research	Jul 19-Jul 24	6	180	183	377	32	8	0	30	0	0	0	0	0	0	0	0	0	0	0
		Commercial	Jul 19-Jul 24	6	114	197	130	63	7	0	15	0	0	0	0	0	0	0	0	0	0	0
		Longline	Jul 18-Jul 24	5	50	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Hook & line	Jul 22-Jul 23	2	2	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Total	Jul 18-Jul 24	13	346	380	509	96	15	0	45	0	0	0	0	0	0	0	0	0	0	0
Total			May 11-Jul 31	105	3972	1215	10278	1347	363	291	76	961	3418	3078	3043	3	180	47768	15	419	57	3

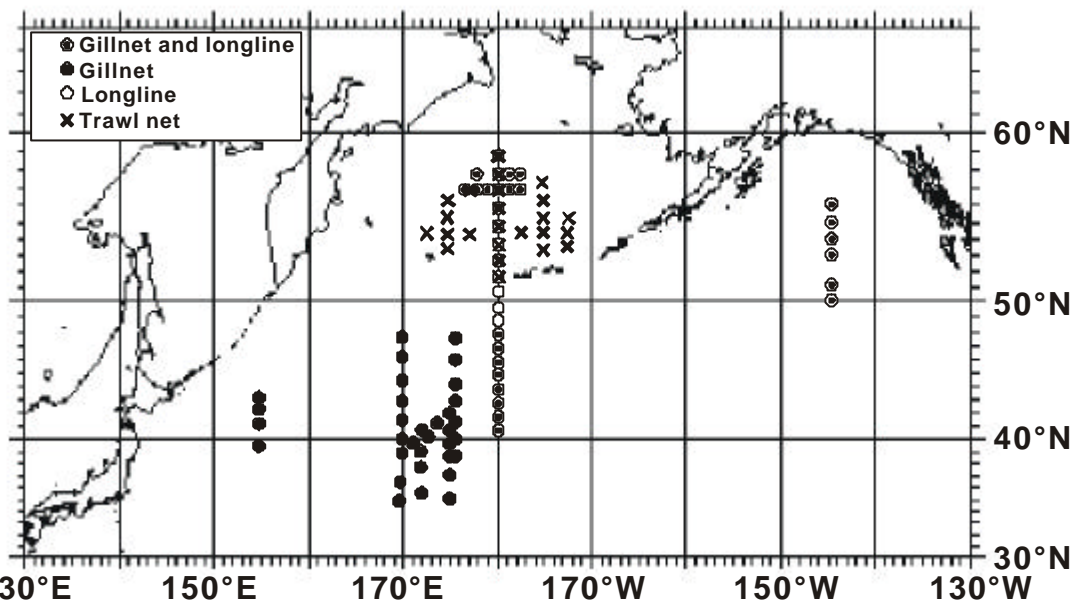


Fig. 1. Sampling locations for Japanese salmon research vessels in the North Pacific Ocean from May to July of 2002.

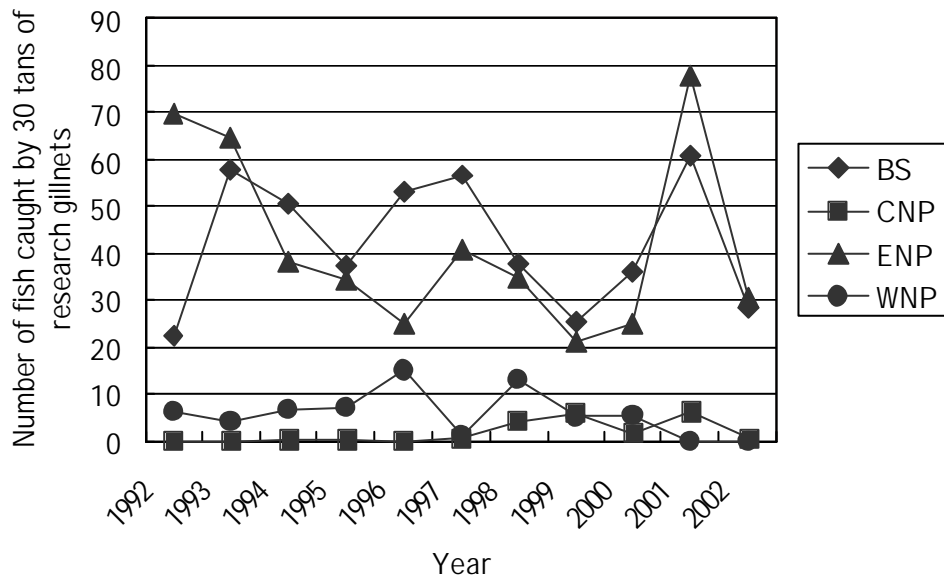


Fig. 2. Number of sockeye salmon caught by 30 tans of research gillnets in summer of 1992-2002 in the North Pacific Ocean.

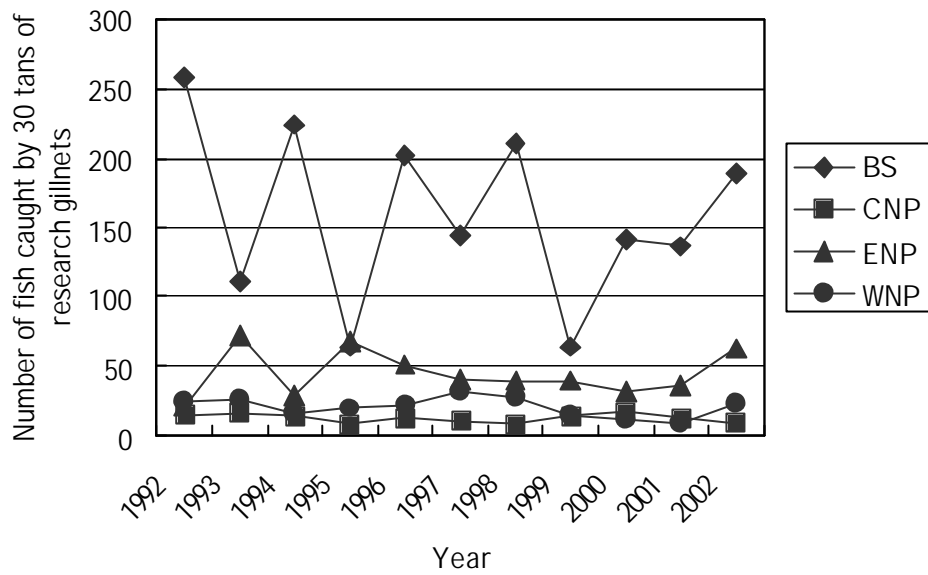


Fig. 3. Number of chum salmon caught by 30 tans of research gillnets in summer of 1992-2002 in the North Pacific Ocean.

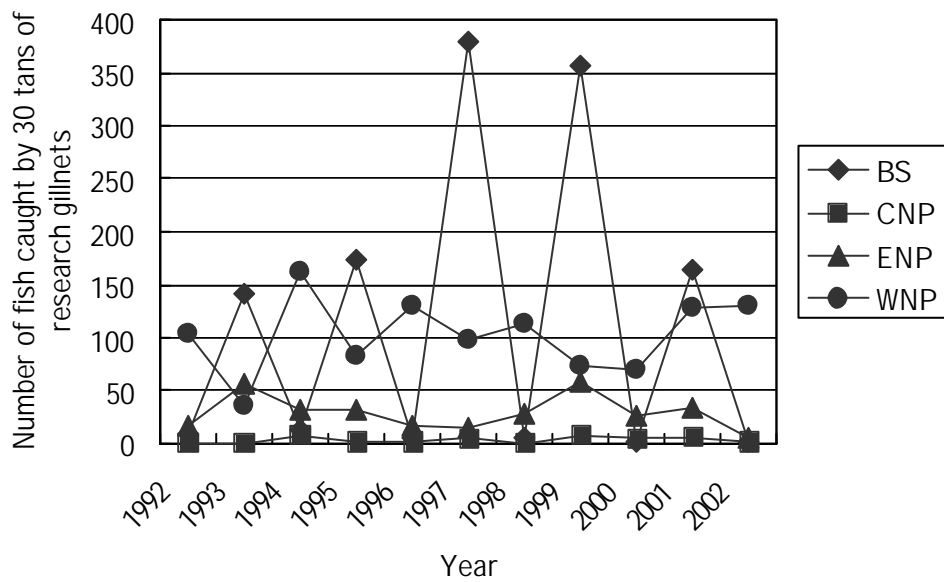


Fig. 4. Number of pink salmon caught by 30 tans of research gillnets in summer of 1992-2002 in the North Pacific Ocean.

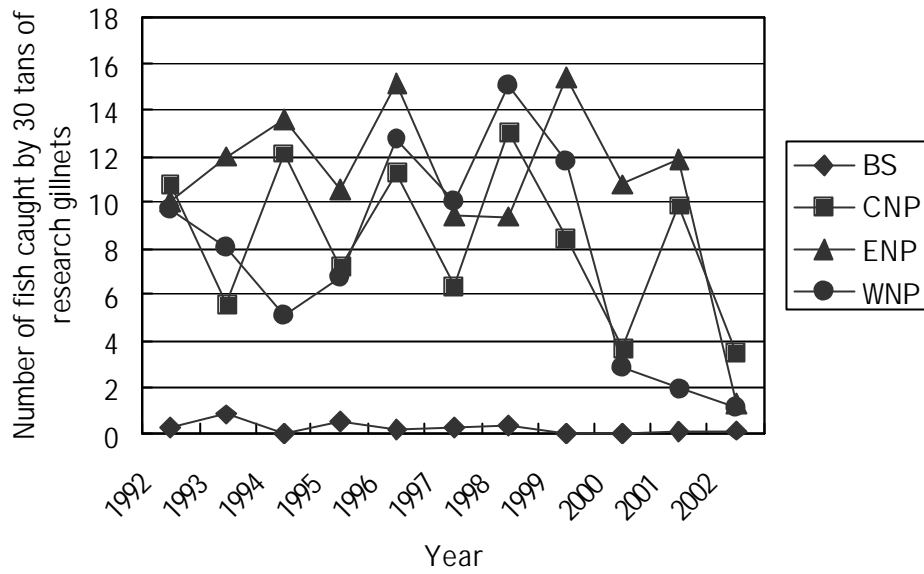


Fig. 5. Number of coho salmon caught by 30 tans of research gillnets in summer of 1992-2002 in the North Pacific Ocean.

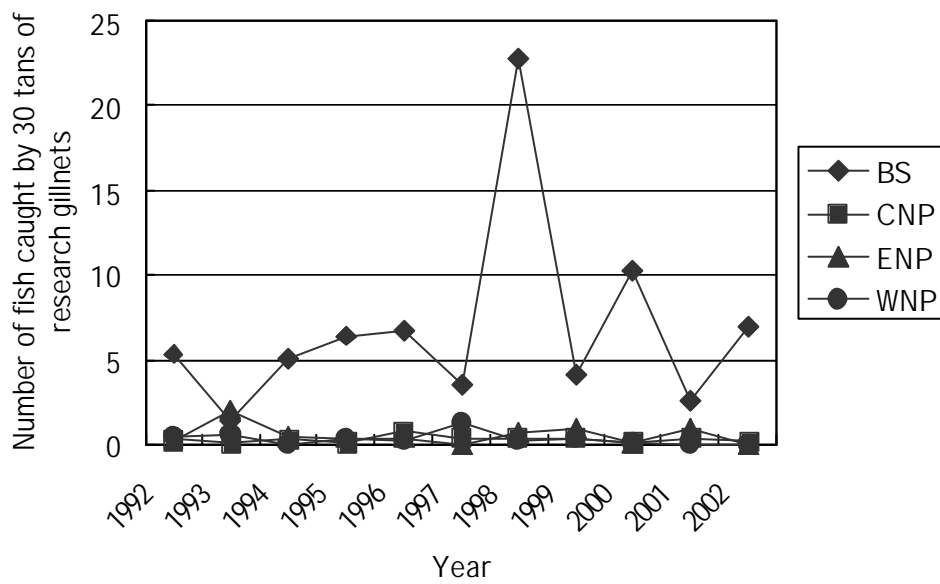


Fig. 6. Number of chinook salmon caught by 30 tans of research gillnets in summer of 1992-2002 in the North Pacific Ocean.

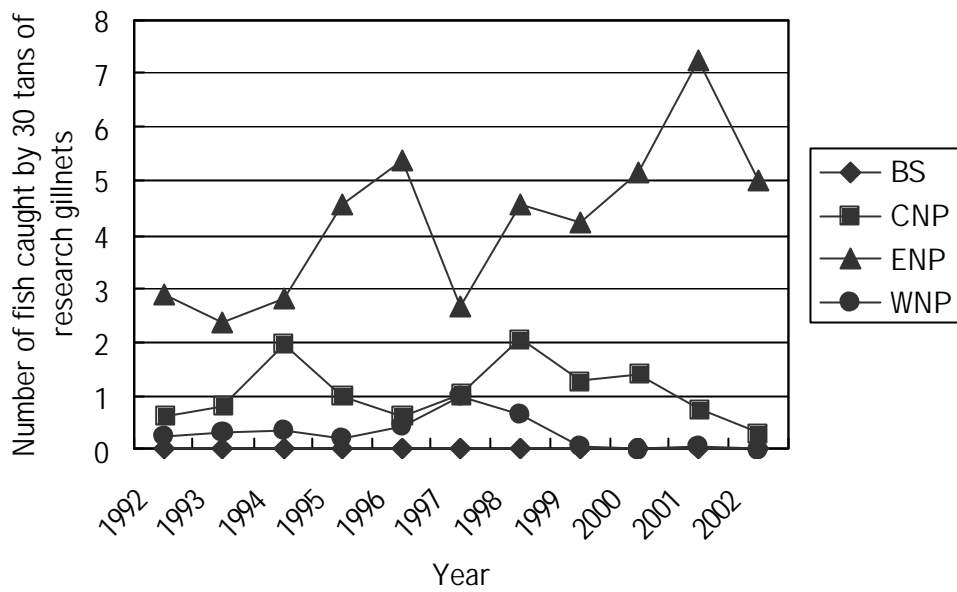


Fig. 7. Number of steelhead trout caught by 30 tans of research gillnets in summer of 1992-2002 in the North Pacific Ocean.

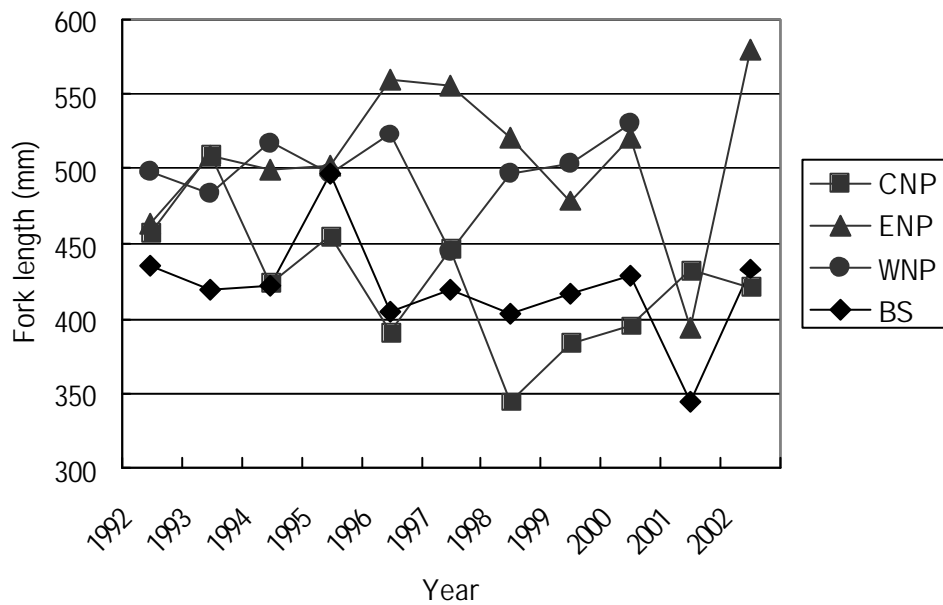


Fig. 8. Mean fork length of sockeye salmon caught by research gillnets in summer of 1992-2002 in the North Pacific Ocean.

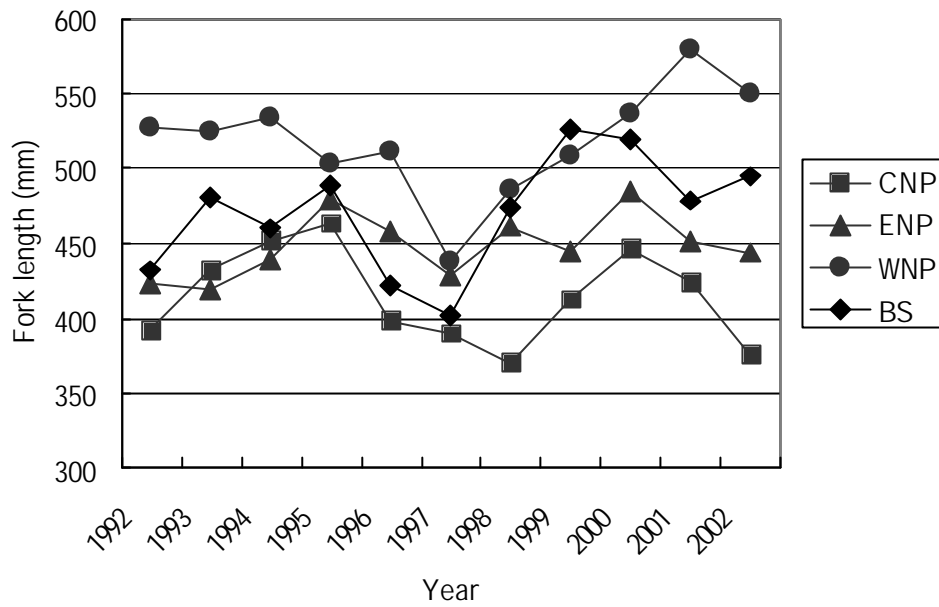


Fig. 9. Mean fork length of chum salmon caught by research gillnets in summer of 1992-2001 in the North Pacific Ocean.

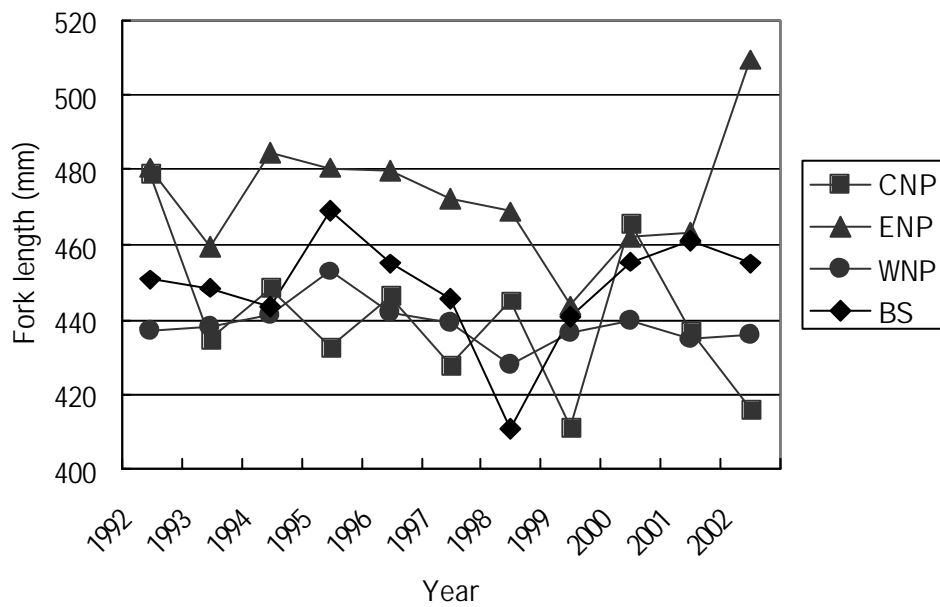


Fig. 10. Mean fork length of pink salmon caught by research gillnets in summer of 1992-2002 in the North Pacific Ocean.

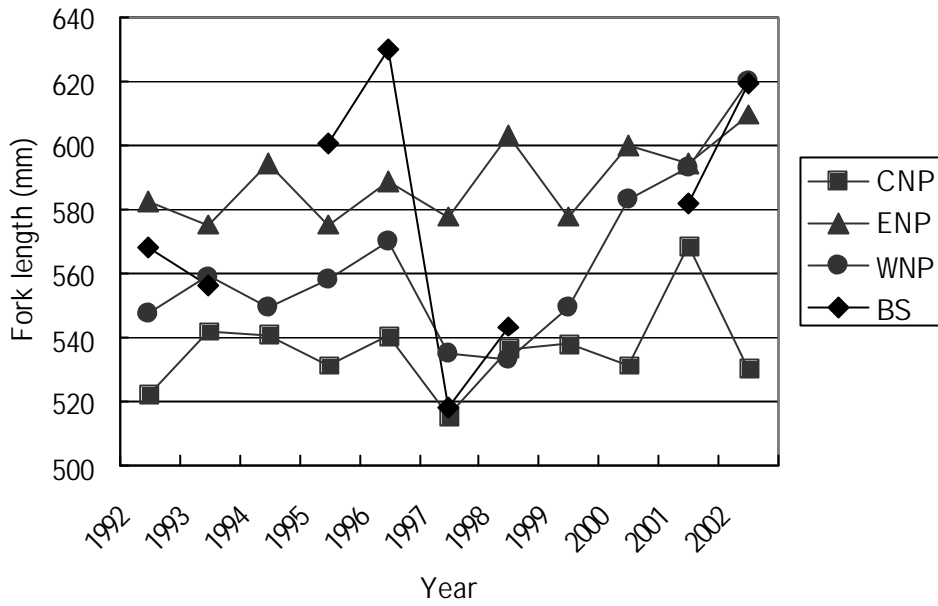


Fig. 11. Mean fork length of coho salmon caught by research gillnets in summer of 1992-2002 in the North Pacific Ocean.

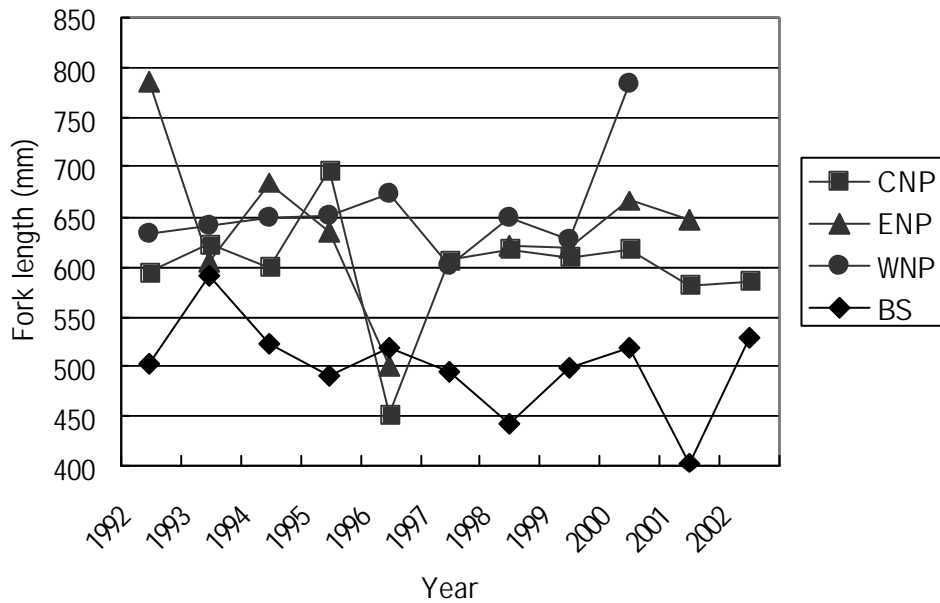


Fig. 12. Mean fork length of chinook salmon caught by research gillnets in summer of 1992-2002 in the North Pacific Ocean.

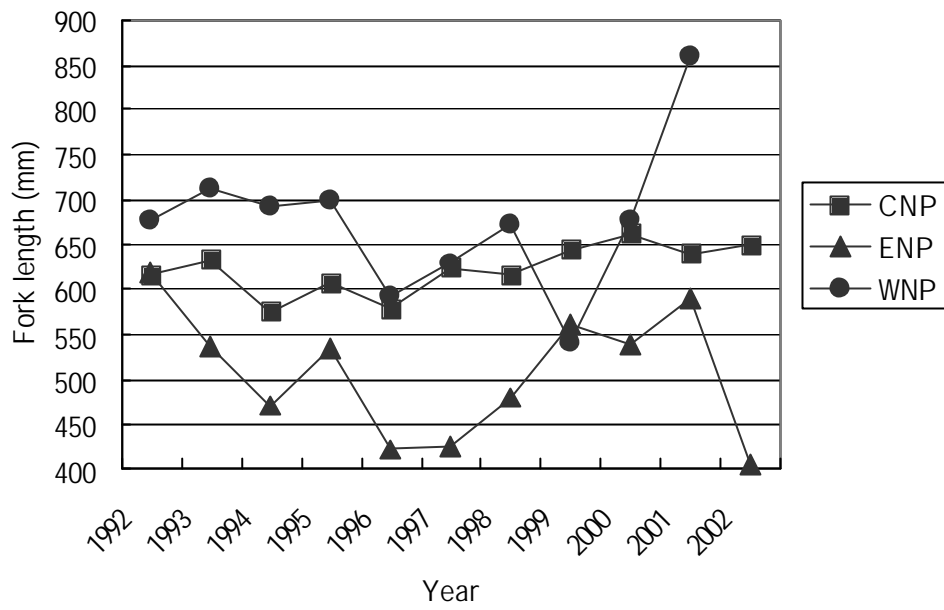


Fig. 13. Mean fork length of steelhead trout caught by research gillnets in summer of 1992-2002 in the North Pacific Ocean.