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Salmon Stock Assessment in the North Pacific Ocean, 2003

by

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ABSTRACT

We summarize results of research cruises on salmon stock assessment conducted by Japan in the summer of 2003. Three Japanese salmon research vessels (*Oshoro maru, Kaiun maru* and *Wakatake maru*) conducted oceanographic observations, 57 gillnet (2,801 tans) and 30 longline (900 hachi) fishing operations in the western, central, eastern North Pacific, and the Bering Sea from May to August. Mean sea surface temperature, abundance and body size of Pacific salmon in 2003 are compared to those from 1992 to 2002. Mean sea surface temperature at salmon research stations in 2003 was higher than the mean of 1992-2002. A total of 15,274 salmonids was caught using drift gillnets and longlines, including 10,656 pink (69.8%), 3,182 chum (20.8%), 727 sockeye (4.8%), 505 coho (3.3%), and 176 chinook salmon (1.2%), and 28 steelhead trout (0.2%) in 2003. Mean CPUE of sockeye salmon was in a low level in 1992-2003. Mean CPUE of chum salmon in the Bering Sea was similar to the mean in odd-years of 1993-2003. Mean CPUE of pink salmon in 2003 was similar to the mean for odd-years in 1993-2003 in the Bering Sea and in the western North Pacific. No particular trend in annual changes of mean fork lengths of salmonids was observed.

INTRODUCTION

According to the 2003 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 2002). This report summarizes the oceanographic conditions, abundance, and body size of salmon in the North Pacific Ocean and Bering Sea in the summer of 2003 from the salmon research conducted by Japan in the North Pacific Ocean. In this report, we compared results in 2003 with those from 1992 to 2002.

MATERIALS AND METHODS

Three Japanese salmon research vessels (*Oshoro maru, Kaiun maru,* and *Wakatake maru*) conducted 57 gillnet (2,801 tans) and 30 longline (900 hachi) fishing operations in the North Pacific Ocean and Bering Sea from May to August 2003 (Table1, 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

Sea Surface Temperature

Mean sea surface temperature at gillnet stations of Japanese salmon researches was 13.9°C in the western North Pacific, 13.4°C in the central North Pacific, 8.0°C in the Bering Sea, and 14.7°C in the eastern North Pacific in the summer of 2003 (Table 1). These were higher than means in 1992-2002. Especially in the Bering Sea, mean sea surface temperature (SST) was higher than the long-term mean SST during the summer of 2003 (Japan Meteorological Agency 2003).

Salmonid and Non-Salmonid Catches

A total of 15,274 salmonids was caught using drift gillnets and longlines, including 10,656 pink (69.8%), 3,182 chum (20.8%), 727 sockeye (4.8%), 505 coho (3.3%), and 176 chinook salmon (1.2%), and 28 steelhead trout (0.2%) in 2003 (Table 2). No Dolly Varden was caught. Dominant non-salmonid catches included 8,967 Japanese anchovy (*Engraulis japonicus*), 8,477 Pacific saury (*Cololabis saira*), 1,471 neon flying squid (*Ommastrephes bartrami*), and 1,282 Pacific pomfret (*Brama japonica*).

Salmon Abundance

Mean CPUE of sockeye salmon in the summer of 2003 was in a low level in 1992-2003 (Fig. 2). Sockeye salmon are mainly distributed in the Bering Sea and the eastern North Pacific in summer. In 2003, mean CPUE of sockeye salmon in the Bering Sea (22.4 ± 19.9 SD) was 55.7% of the mean in 1992-2003 (40.2 ± 36.5 SD). Sockeye CPUE in the eastern North Pacific (12.0 ± 20.8 SD) was 30.3% of the mean in 1992-2003 (39.6 ± 38.6 SD).

Mean CPUE of chum salmon in 2003 was in the lowest level during 1992-2003 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. Mean CPUE of chum salmon in the Bering Sea (67.6 ± 27.7 SD) was similar to the mean in odd-years of 1993-2003 (97.1 ± 58.7 SD).

Mean CPUE of pink salmon in 2003 was similar to the mean for odd-years in 1993-2003 in the Bering Sea and in the western North Pacific (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. Mean CPUE in this region of 2003 (228 ± 115 SD) was similar to the mean in odd-years of 1992-2002 (236 ± 140 SD). In the western North Pacific, mean CPUEs in odd years are lower than in even years. In this region, pink salmon CPUE in 2003 (94.1 ± 100.0 SD) was similar to the mean in even-years of 1993-2003 (80.3 ± 116.9 SD).

Mean CPUE of coho salmon in 2003 was in a low level in 1992-2003 (Fig. 5). Coho salmon are distributed in the western, central, and eastern North Pacific. Coho salmon CPUEs in these regions of 2003 were the lowest in 1992-2003. It might be due to high SST at research stations in this year. Chinook salmon are distributed in the Bering Sea and their CPUE in 2003 was similar to the mean in 1992-2003 (Fig. 6). Steelhead trout are mainly distributed in the eastern North Pacific and their CPUE in 2003 was in the lowest in 1992-2003 (Fig. 7).

Fish Size

No common trend in annual changes of mean fork lengths of salmonids was observed. MFL of sockeye salmon in summer of 2003 was smaller than the mean in 1992-2003 in the eastern North Pacific but similar to the mean in the Bering Sea (Fig. 8). MFL of chum salmon in summer of 2003 was similar to the mean in 1992-2002 in the Bering Sea (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 2003 was the largest in the Bering Sea but the smallest in the western North Pacific in 1992-2003 (Fig. 10). MFL of coho salmon in summer of 2003 was similar to the mean in 1992-2003 in the western and eastern North Pacific, but relatively larger than the mean in 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 the *Wakatake maru*, *Oshoro maru*, and *Kaiun maru* 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 1992-2003.

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)
2002	11.2	± 2.65	(7)	13.4	± 4.15	(37)	7.2	± 0.25	(13)	12.0	± 0.47	(6)
92-02	10.9	± 4.50	(253)	11.8	± 3.82	(320)	7.3	± 0.96	(122)	10.0	± 1.78	(106)
2003	13.9	± 5.38	(11)	13.4	± 5.03	(29)	8.0	± 0.35	(14)	14.7	± 0.34	(3)

Table 2. Numbers of salmonids and other organisms caught by the Japanese salmon research vessels in summer of 2003.

Region	Research Vessel	Gear	Date	No. operation	Tan/hachi	Sockeye	Chum	Pink	Coho	Chinook	Steel	Flying squid	Other squid	Pacific pomfret	Pacific saury	Lancet fish	Sharks	Atka mackerel	Walleye pollock	Other fishes	Sea-birds	Mammals
Western	*Oshoro*	Research	May 15-Jul 09	11	330	77	296	1035	28	2	0	109	113	199	56	0	5	0	0	123	6	0
North	*maru*	Commercial	May 15-Jul 09	11	130	44	312	154	31	2	0	1	10	85	0	0	3	0	0	31	4	0
Pacific		Small-mesh	May 15-Jul 09	11	77	2	0	1	0	0	0	60	21	5	1718	1	0	0	0	8035	0	0
		Longline	Jul 07-Jul 09	2	20	0	0	5	6	0	0	0	0	0	0	0	0	0	0	0	0	0
	Total		May 15-Jul 09	11	557	123	608	1195	65	4	0	170	144	289	1774	1	8	0	0	8189	10	0
Central	*Wakatake*	Research	Jun 15-Jun 22	8	240	34	152	248	71	1	6	0	73	128	6	1	0	1	0	0	9	0
North	*maru*	Commercial	Jun 15-Jun 22	8	142	4	86	186	113	5	6	0	2	87	1	0	1	0	0	0	6	1
Pacific		Small-mesh	Jun 15-Jun 19	5	10	0	0	0	0	0	0	0	0	0	1197	0	0	0	0	0	0	0
		Longline	Jun 14-Jun 24	11	360	8	39	104	40	1	4	0	5	62	0	1	1	47	0	0	0	0
	Kaiun	Research	Jul 08-Jul 29	21	666	4	77	19	97	5	2	874	558	521	396	0	59	0	0	85	0	0
	maru	Commercial	Jul 08-Jul 29	21	279	1	75	25	93	6	1	201	1	173	0	0	13	0	0	28	0	0
		Small-mesh	Jul 08-Jul 29	21	94	0	0	0	0	0	0	9	69	13	4265	1	0	0	0	1254	0	0
	Total		Jun 14-Jul 29	32	1791	51	429	582	414	18	19	1084	708	984	5865	3	74	48	0	1367	15	1
Bering	*Wakatake*	Research	Jun 30-Jul 13	14	420	313	946	3186	5	65	0	0	31	0	0	0	0	5	0	1	75	0
Sea	*maru*	Commercial	Jun 30-Jul 13	14	266	161	769	5022	4	50	0	0	0	0	0	0	1	3	2	0	102	0
		Longline	Jun 25-Jul 12	18	510	23	362	671	3	37	0	0	0	0	0	0	0	70	0	0	2	0
	Total		Jun 25-Jul 13	18	1196	497	2077	8879	12	152	0	0	31	0	0	0	1	78	2	1	179	0
Eastern	*Oshoro*	Research	Jul 30-Aug 03	3	90	36	53	0	8	2	6	187	5	4	4	0	2	0	0	12	0	0
North	*maru*	Commercial	Jul 30-Aug 03	3	36	18	12	0	5	0	3	5	0	5	0	0	0	0	0	1	0	0
Pacific		Small-mesh	Jul 30-Aug 03	3	21	0	0	0	0	0	0	25	90	0	834	0	0	0	0	1452	1	0
		Longline	Jul 30-Jul 30	1	10	2	3	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
	Total		Jul 30-Aug 03	3	157	56	68	0	14	2	9	217	95	9	838	0	2	0	0	1465	1	0
Total			May 15-Aug 03	64	3701	727	3182	10656	505	176	28	1471	978	1282	8477	4	85	126	2	11022	205	1

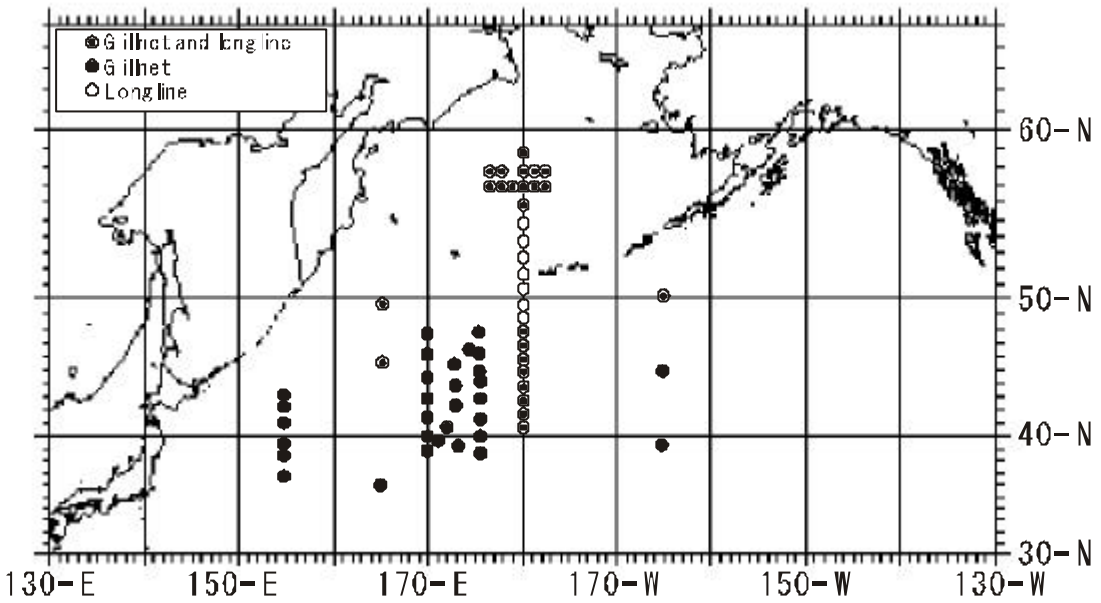

Fig. 1. Sampling locations for Japanese salmon research vessels in the North Pacific Ocean from May to August of 2003.

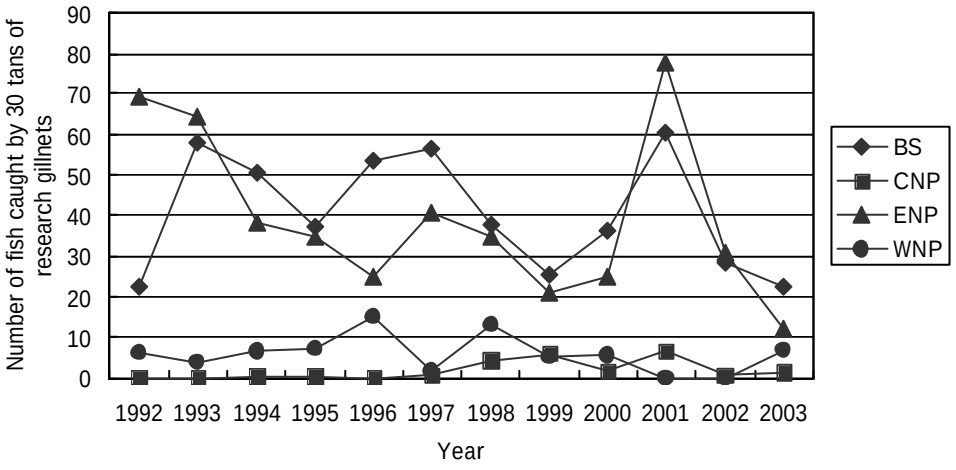

Fig. 2. Number of sockeye salmon caught by 30 tans of research gillnets in summer of 1992-2003 in the North Pacific Ocean.

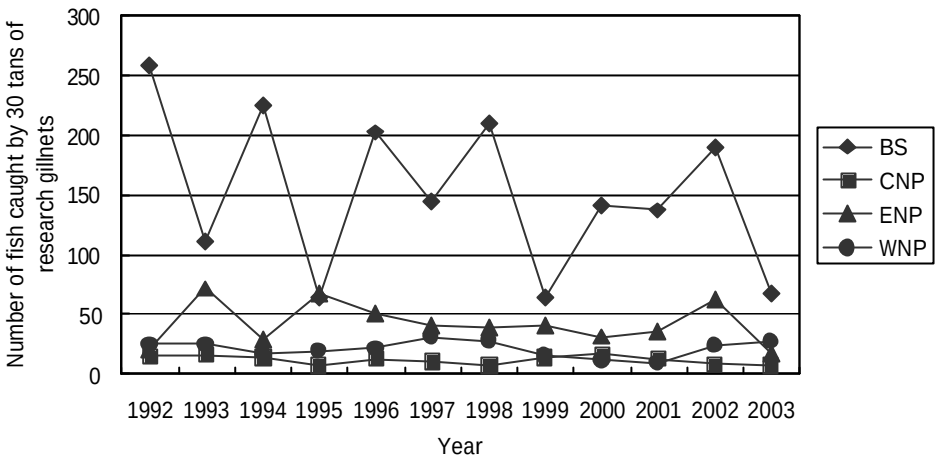

Fig. 3. Number of chum salmon caught by 30 tans of research gillnets in summer of 1992-2003 in the North Pacific Ocean.

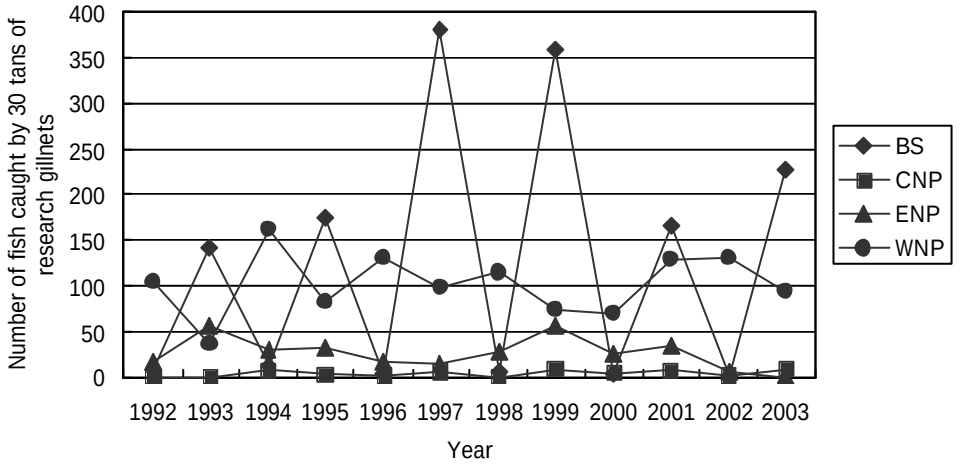

Fig. 4. Number of pink salmon caught by 30 tans of research gillnets in summer of 1992-2003 in the North Pacific Ocean.

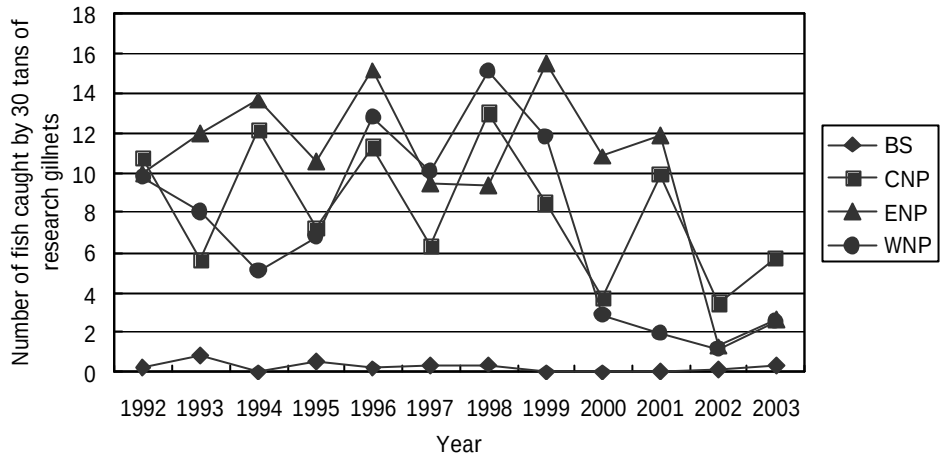

Fig. 5. Number of coho salmon caught by 30 tans of research gillnets in summer of 1992-2003 in the North Pacific Ocean.

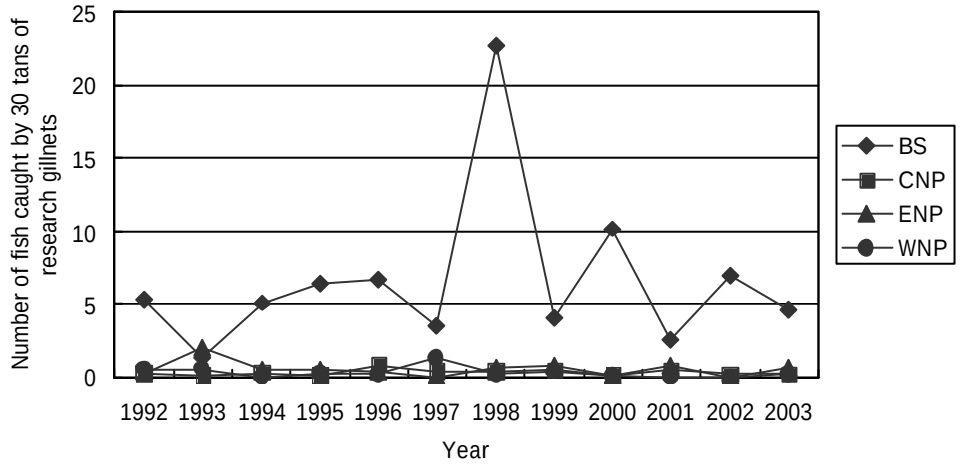

Fig. 6. Number of chinook salmon caught by 30 tans of research gillnets in summer of 1992-2003 in the North Pacific Ocean.

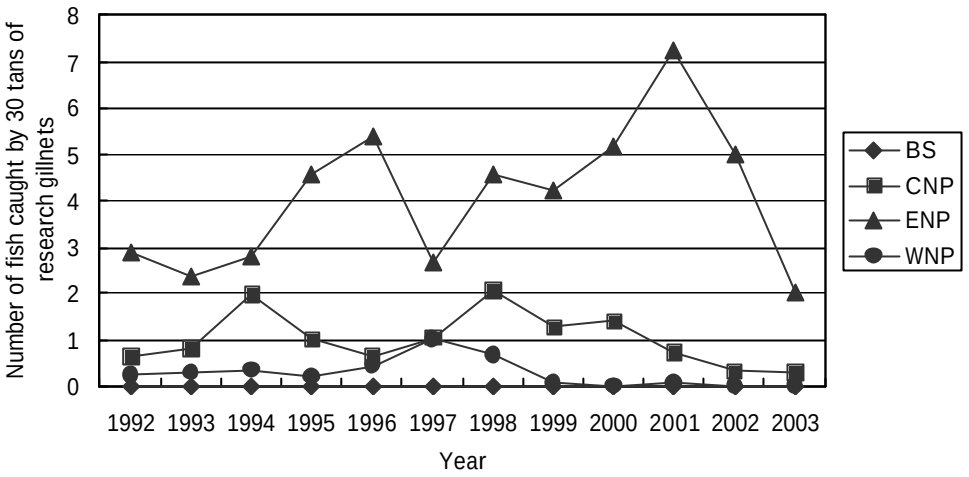

Fig. 7. Number of steelhead trout caught by 30 tans of research gillnets in summer of 1992-2003 in the North Pacific Ocean.

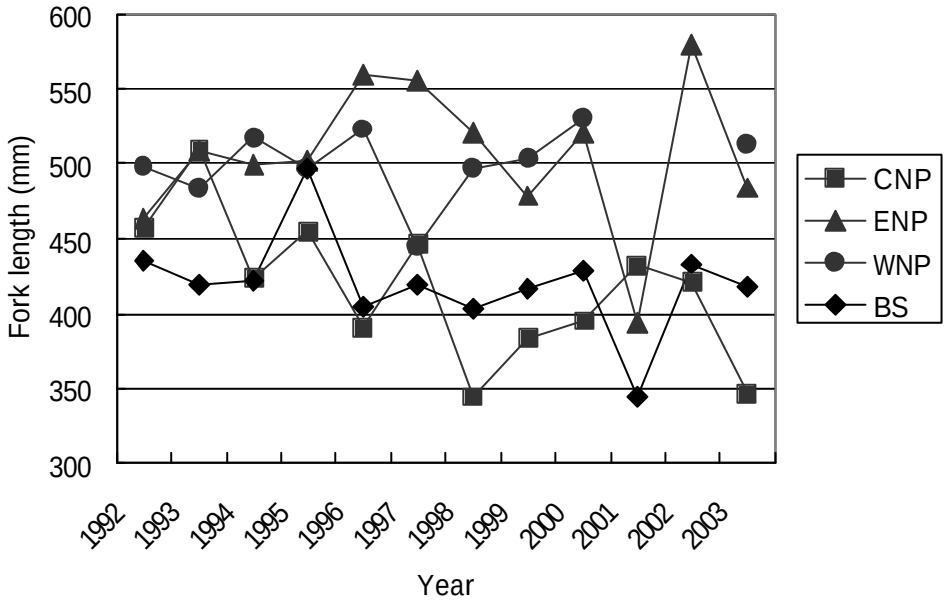

Fig. 8. Mean fork length of sockeye salmon caught by research gillnets in summer of 1992-2003 in the North Pacific Ocean.

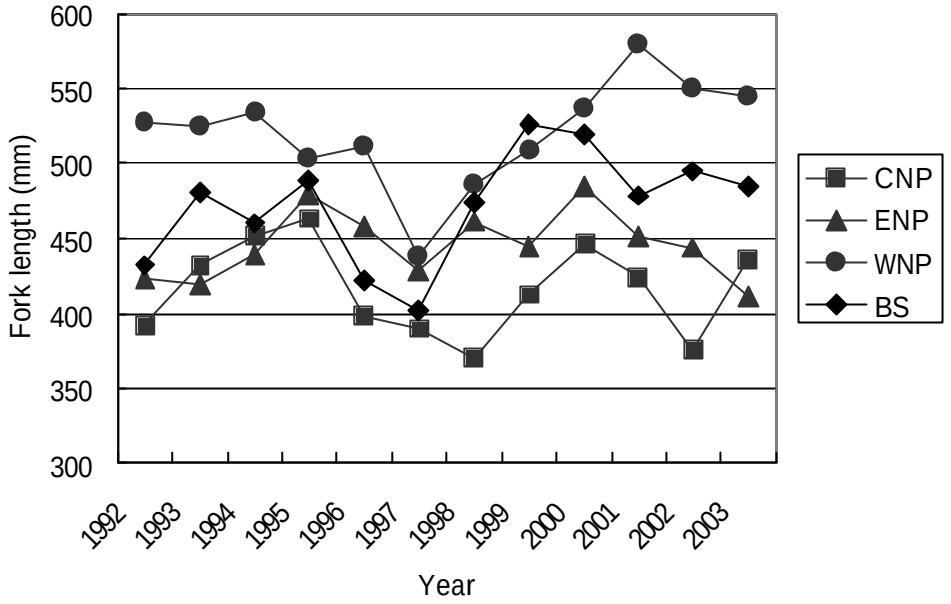

Fig. 9. Mean fork length of chum salmon caught by research gillnets in summer of 1992-2003 in the North Pacific Ocean.

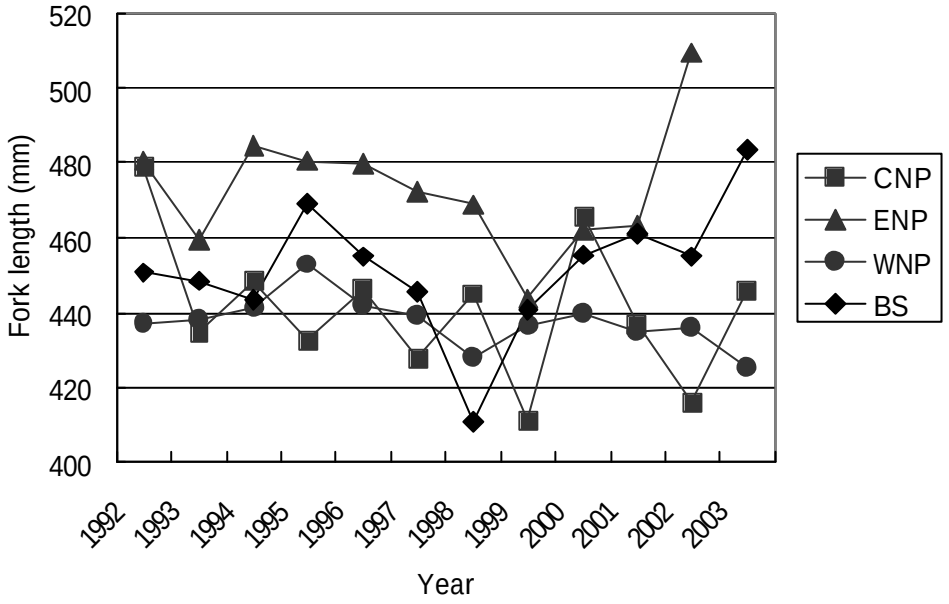

Fig. 10. Mean fork length of pink salmon caught by research gillnets in summer of 1992-2003 in the North Pacific Ocean.

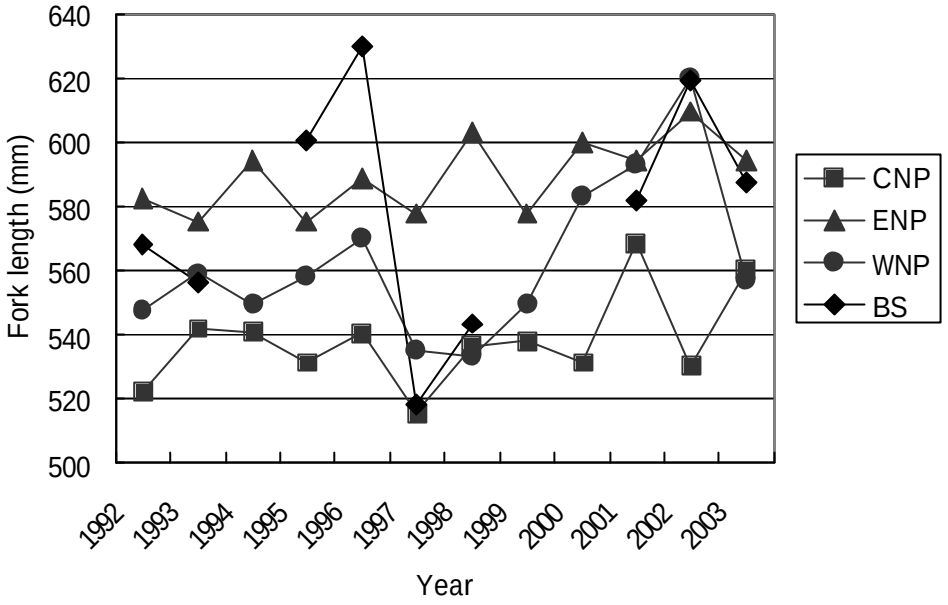

Fig. 11. Mean fork length of coho salmon caught by research gillnets in summer of 1992-2003 in the North Pacific Ocean.

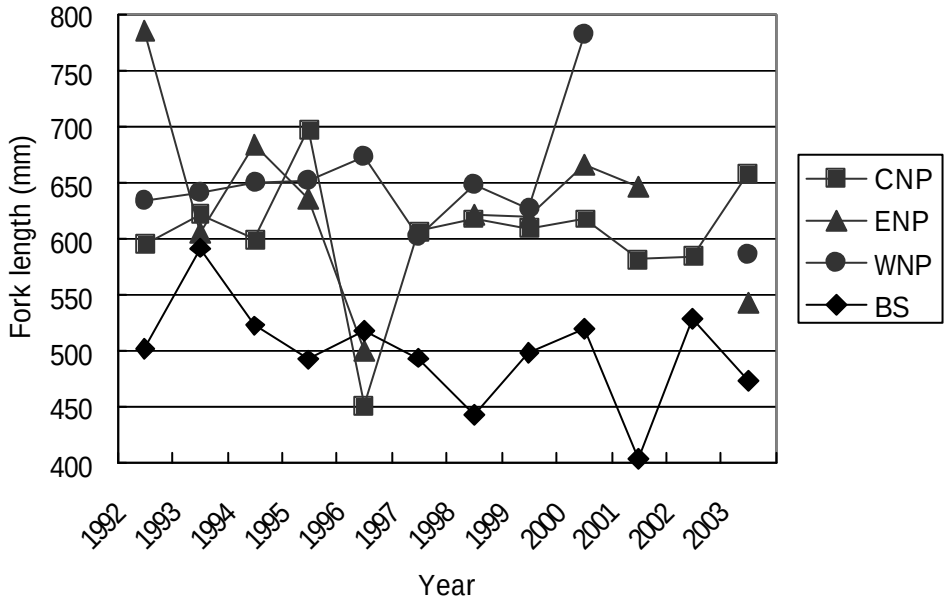

Fig. 12. Mean fork length of chinook salmon caught by research gillnets in summer of 1992-2003 in the North Pacific Ocean.

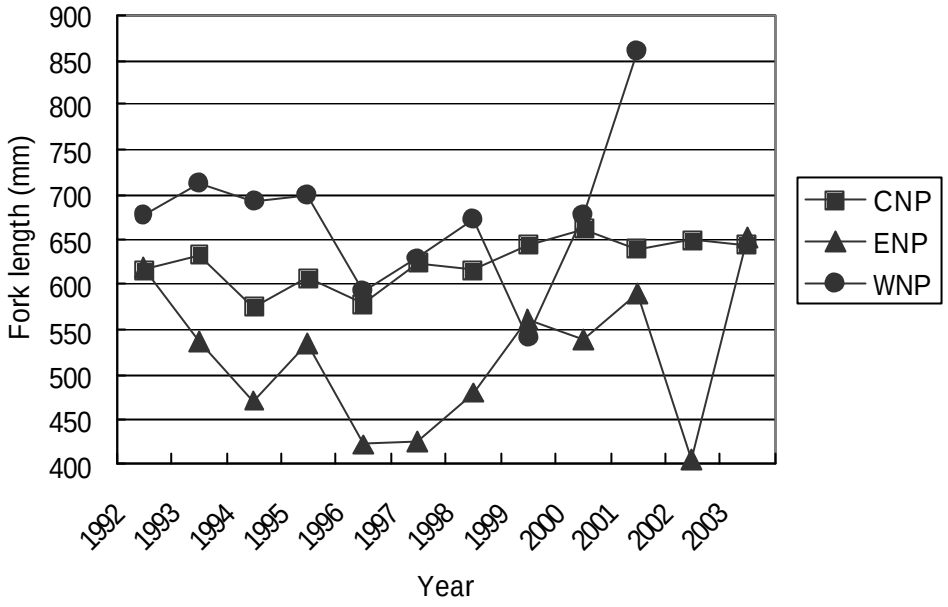

Fig. 13. Mean fork length of steelhead trout caught by research gillnets in summer of 1992-2003 in the North Pacific Ocean.