

Salmon Stock Assessment in the North Pacific Ocean, 2006

by

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Submitted to the

NORTH PACIFIC ANADROMOUS FISH COMMISSION

by

JAPAN

October 2006

THIS PAPER MAY BE CITED IN THE FOLLOWING MANNER:

Nagasawa, T., M. Fukuwaka, K. Morita, and T. Azumaya. 2006. Salmon stock assessment in the North Pacific Ocean, 2006. (NPAFC Doc.960). 10 p. Hokkaido National Fisheries Research Institute, Fisheries Research Agency, 116 Katsurakoi, Kushiro 085-0802, Japan.

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ABSTRACT

Results of annual research cruises on salmon stock assessment conducted by Japan in the summer of 2006 were summarized. Three Japanese salmon research vessels (*Oshoro maru*, *Kaiun maru* and *Wakatake maru*) conducted oceanographic observations, 34 gillnet (1,624 tans) , 23 longline (566 hachi) and 1 hook and lines fishing operations in the western, central, eastern North Pacific, and the central Bering Sea from May to Early August. Mean sea surface temperature and abundance of Pacific salmon in 2006 are compared to those from 1992 to 2005. Mean sea surface temperature at salmon research stations in 2006 were close to the mean of 1992-2005. A total of 5,530 salmonids was caught using drift gillnets, longlines and hook and line including 2,912 chum (52.7%), 1,221 sockeye (22.1%), 655 pink (11.8%), 520 coho (9.4 %), 108 chinook salmon (2.0%), 82 steelhead trout (2.0%), and 32 dolly varden charr (0.6%). Mean CPUE of sockeye salmon in the summer of 2006 was in the 2nd highest level in 1992-2006, especially in the Bering Sea. Mean CPUE of chum salmon in 2006 was also in the 2nd highest level during 1992-2006 in the Bering Sea. Mean CPUE of pink salmon in 2006 was an average level for even-years in 1992-2006 in the Bering Sea, but lower in the western North Pacific .

INTRODUCTION

The Japanese high-seas salmon research has been conducted since 1952. We have used research driftnet as standard gear (Takagi 1975), and we have accumulated biological and oceanographic data in the North Pacific Ocean and Bering Sea during summer for salmon stock assessment. This report summarizes the oceanographic conditions, and abundance of salmon in the summer of 2006 comparing the results with the archival data from 1992 to 2005.

MATERIALS AND METHODS

Three Japanese salmon research vessels (*Oshoro maru*, *Kaiun maru*, and *Wakatake maru*) conducted 34 gillnet (1,624 tans) and 23 longline (566 hachi) fishing operations in the North Pacific Ocean and Bering Sea from May to July 2006 (Fig. 1). We divided the research area in 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).

RESULTS

Sea Surface Temperature

Mean sea surface temperature (SST) at gillnet stations of Japanese salmon researches was 12.2°C in the central North Pacific, 7.2°C in the Bering Sea, and 11.6°C in the summer of 2006 (Table 1). These were close to means in 1992-2005. In the Bering Sea, mean SST was lower than that in 2005, but little higher than the long-term mean SST during the summer of 2006 (Japan Meteorological Agency 2006). In 2006, mean SST in the western North Pacific was rather higher than in other years, but the position of many gillnet stations have changed in the western North Pacific (Fukuwaka and Watanabe 2006), so that we cannot exactly compare the mean SST.

Salmonid and Non-Salmonid Catches

A total of 5,530 salmonids were caught using drift gillnets, longlines and hook and line including 2,912 chum (52.7%), 1,221 sockeye (22.1%), 655 pink (11.8%), 520 coho (9.4%), 108 chinook salmon (2.0%), 82 steelhead trout (2.0%), and 32 dolly varden charr (0.6%). In this year, 32 dolly varden charr was caught in the central Bering Sea. Dominant non-salmonid, including 4,198 Pacific saury (*Cololabis saira*), 1,494 neon flying squid (*Ommastrephes bartrami*), and 3,864 Pacific pomfret (*Brama japonica*) were caught in 2006 surveys.

Salmon Abundance

In 2006, gillnet operation by Japanese Research vessel in the eastern North Pacific was done at only one station, so that we do not include the eastern North Pacific in this analysis.

Mean CPUE of sockeye salmon in the summer of 2006 was in the 2nd highest level in 1992-2006, in the Bering Sea (Fig. 2). Sockeye salmon are mainly distributed in the Bering Sea and the eastern North Pacific in summer. In 2006, mean CPUE of sockeye salmon in the Bering Sea (73.8) was 172% of the mean in 1992-2005 (42.8). In contrast, sockeye CPUE in the central North Pacific (0.47) was lower than mean in recent 14 years (3.84).

Mean CPUE of chum salmon in 2006 (234.0) was in the high level during 1992-2006 in the Bering Sea (Fig. 3). Chum salmon are mainly distributed in the Bering Sea in summer. In this region, chum CPUE is higher in even years than in odd years. Among even years, chum CPUE in 2006 was the 2nd highest in recent 15 years in the Bering Sea.

Mean CPUE of pink salmon in 2006 was near the mean for even-years in 1992-2006 in the Bering Sea (Fig. 4).

Trend of mean CPUE of coho salmon showed a decrease from 1998 to 2003, however mean CPUE of coho salmon in the central North Pacific have turned to increase since 2004 (Fig. 5). Coho salmon are mainly distributed in the western, central, and eastern North Pacific. The mean CPUE in the western North Pacific was still a low level in 2006.

Chinook salmon are mainly distributed in the Bering Sea in summer and their CPUE in 2006 was lower than mean in 1992-2005 (Fig. 6). Steelhead trout are mainly distributed in the eastern North Pacific, but we could not get enough data in this water, and their CPUEs in the other waters in 2006 were still low level in 1992-2006 (Fig. 7).

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 ($^{\circ}\text{C}$), 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 1992-2006.

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)
2003	13.9	± 5.38	(11)	13.4	± 5.03	(29)	8.0	± 0.35	(14)	14.7	± 0.34	(3)
2004	13.5	± 4.74	(9)	12.2	± 4.09	(28)	8.3	± 0.94	(14)	13.2	± 2.44	(5)
2005	10.3	± 4.74	(7)	10.8	± 4.02	(39)	7.9	± 0.53	(10)	11.6	± 0.74	(3)
92-05	11.0	± 4.56	(280)	11.9	± 3.95	(394)	7.4	± 0.93	(160)	10.3	± 2.10	(117)
2006	15.3	± 7.38	(20)	12.2	± 3.77	(15)	7.2	± 0.30	(5)	9.6		(1)

Table 2. Numbers of salmonids and other organisms caught by the Japanese salmon research vessels in summer of 2006.

Region	RV	Gear	Date	No. operation	Tan/hachi	Sockeye	Chum	Pink	Coho	Chinook	Steel	Dolly	Flying squid	Other squid	Pacific pomfret	Pacific saury	Lancet fish	Sharks	Atka mackerel	Walleye pollock	Other fishes	Sea-birds	Marine mammals
Western North Pacific	<i>Oshoro maru</i>	Research	May 13-Jun 11	8	240	322	128	311	22	3	0	0	15	72	150	0	0	1	0	0	20	10	0
		Commercial	May 13-Jun 11	8	96	170	136	118	10	2	0	0	18	0	135	0	0	4	0	0	1	3	0
		Small-mesh	May 15-Jun 11	8	56	10	1	0	0	0	0	0	0	11	1	236	0	0	0	0	0	0	0
		Longline	Jun 08-Jun 11	3	26	2	2	2	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	<i>Kaiun maru</i>	Research	Jul 23-Aug 6	12	360	0	0	3	1	0	0	0	602	120	143	5	9	11	0	0	516	0	0
		Commercial	Jul 23-Aug 6	12	192	0	0	2	0	0	0	0	113	0	48	0	0	8	0	0	44	0	0
		Small-mesh	Jul 23-Aug 6	12	24	0	0	0	0	0	0	0	20	21	0	352	0	0	0	0	529	0	0
	Total					504	268	436	38	5	0	0	768	224	477	593	9	24	0	0	1110	13	0
Central North Pacific	<i>Wakatake maru</i>	Research	Jun 16-Jun 22	8	240	7	123	13	124	7	13	0	72	68	261	157	0	9	0	0	27	4	0
		Commercial	Jun 16-Jun 22	8	152	6	9	10	108	15	37	0	199	0	303	0	0	19	0	0	0	1	0
		Longline	Jun 16-Jun 26	11	330	32	201	13	153	3	4	0	0	2	525	0	1	1	0	0	0	1	0
	<i>Kaiun maru</i>	Research	Jul 12-Jul 18	7	210	7	43	0	6	0	2	0	228	40	1930	1539	1	79	1	0	161	0	0
		Commercial	Jul 12-Jul 18	7	112	0	8	66	3	0	8	0	227	1	361	2	1	35	0	0	175	0	0
		Small-mesh	Jul 12-Jul 18	7	28	0	0	0	0	0	0	0	0	4	7	1907	0	0	0	0	951	0	0
	Total					52	384	102	394	25	64	0	726	115	3387	3605	3	143	1	0	1314	6	0
Bering Sea	<i>Wakatake maru</i>	Research	Jul 10-Jul 14	5	150	369	1170	32	5	23	1	16	0	13	0	0	0	1	6	0	0	4	0
		Commercial	Jul 10-Jul 14	5	95	157	481	31	6	37	0	10	0	0	0	0	0	0	0	0	0	8	0
		Longline	Jun 25-Jul 14	6	180	48	580	10	1	11	0	6	0	0	0	0	0	0	13	0	0	1	0
	Total					574	2231	72	12	71	1	32	0	13	0	0	0	1	13	0	3	13	0
Eastern North Pacific	<i>Oshoro maru</i>	Research	Jul 3	1	30	49	26	12	29	2	9	0	0	3	0	0	0	0	0	0	0	0	0
		Commercial	Jul 3	1	6	40	2	12	26	5	5	0	0	0	0	0	0	0	0	0	0	0	0
		Small-mesh	Jul 3	1	7	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Longline	Jul 4-Jul 5	3	30	2	1	5	18	0	1	0	0	0	0	0	0	0	0	0	0	0	0
		Hook & line	Jul 4	1	0	1	11	16	2	0	2	0	0	0	0	0	0	0	0	0	0	0	0
	Total		Jul 25-Jul 29			91	30	45	76	7	17	0	0	3	0	0	0	0	0	0	0	0	0
Total						1221	2912	655	520	108	82	32	1494	355	3864	4198	4	168	14	0	2424	32	0

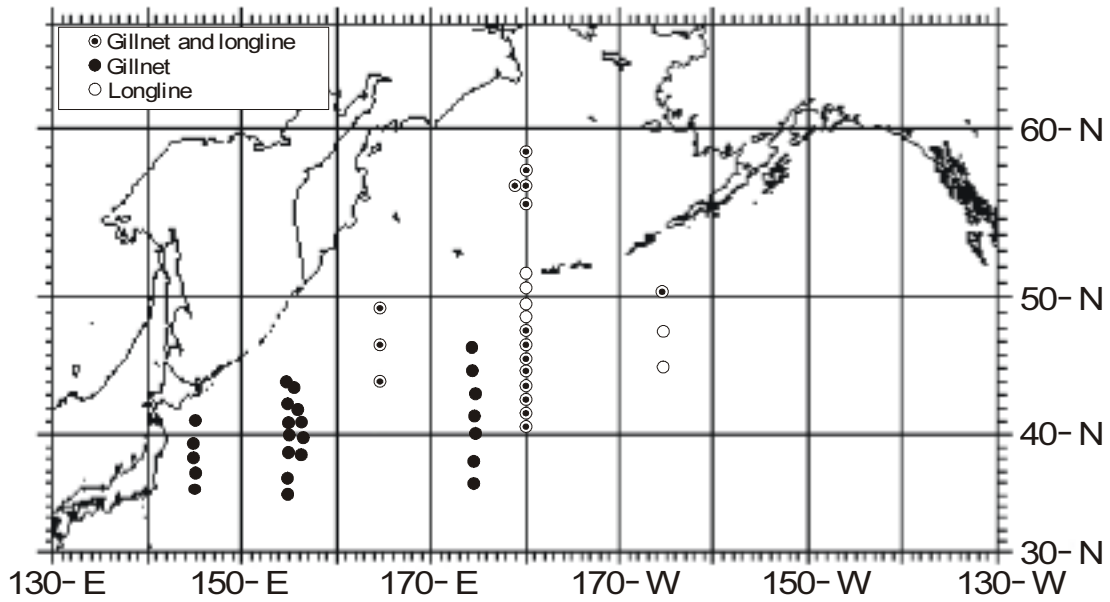


Fig. 1. Sampling locations for Japanese salmon research vessels in the North Pacific Ocean from May to August of 2006.

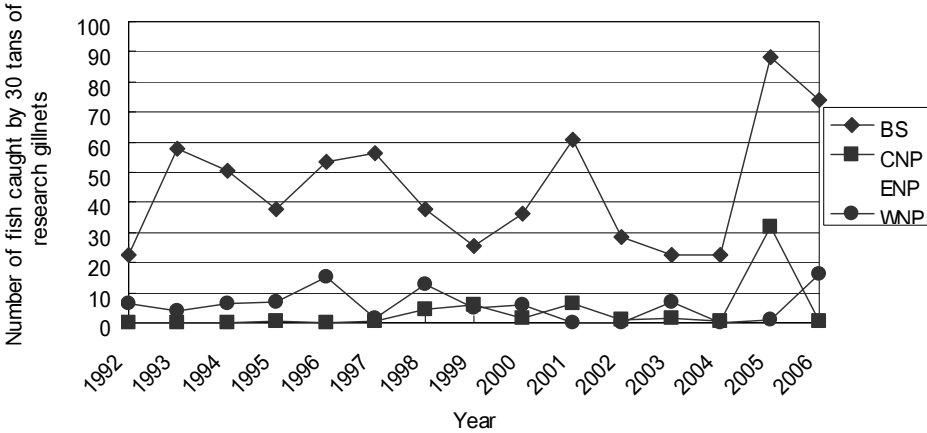


Fig. 2. Number of sockeye salmon caught by 30 tans of research gillnets in summer of 1992-2006 in the North Pacific Ocean.

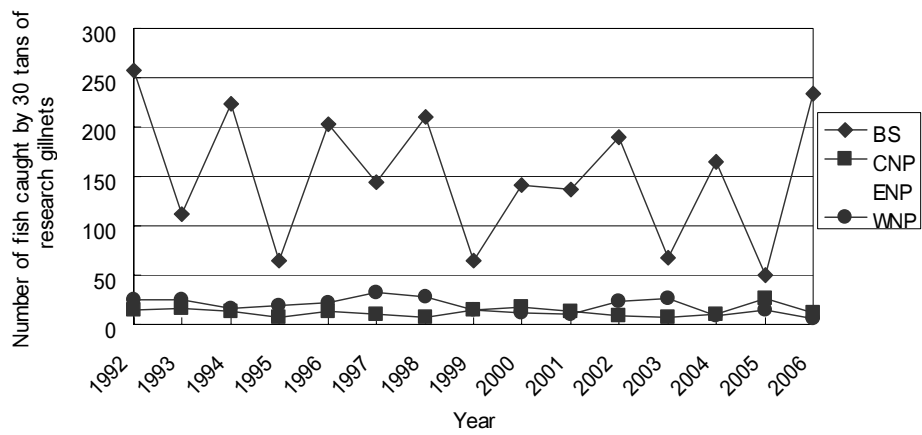


Fig. 3. Number of chum salmon caught by 30 tans of research gillnets in summer of 1992-2006 in the North Pacific Ocean.

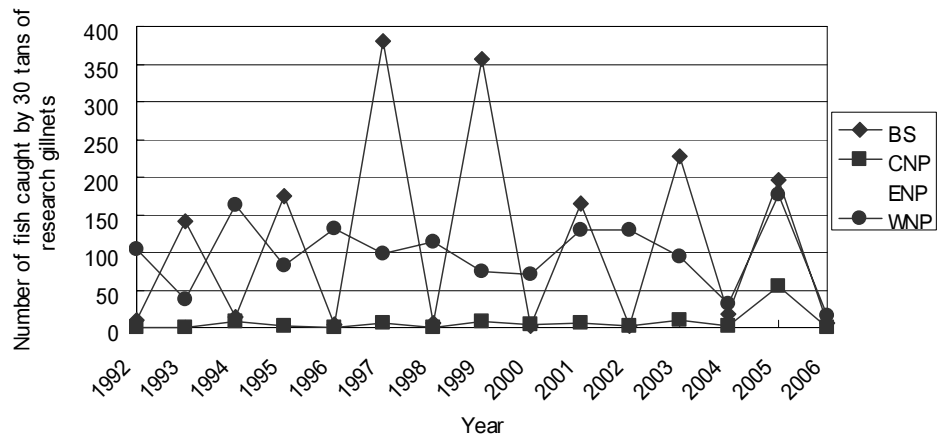


Fig. 4. Number of pink salmon caught by 30 tans of research gillnets in summer of 1992-2006 in the North Pacific Ocean.

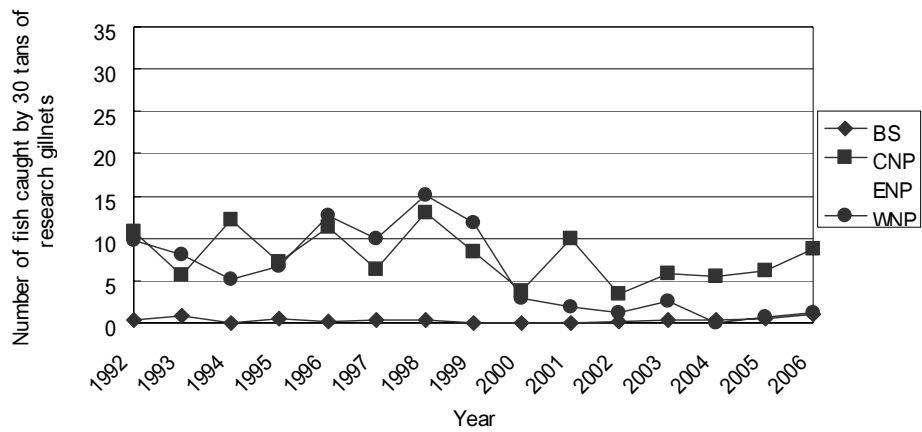


Fig. 5. Number of coho salmon caught by 30 tans of research gillnets in summer of 1992-2006 in the North Pacific Ocean.

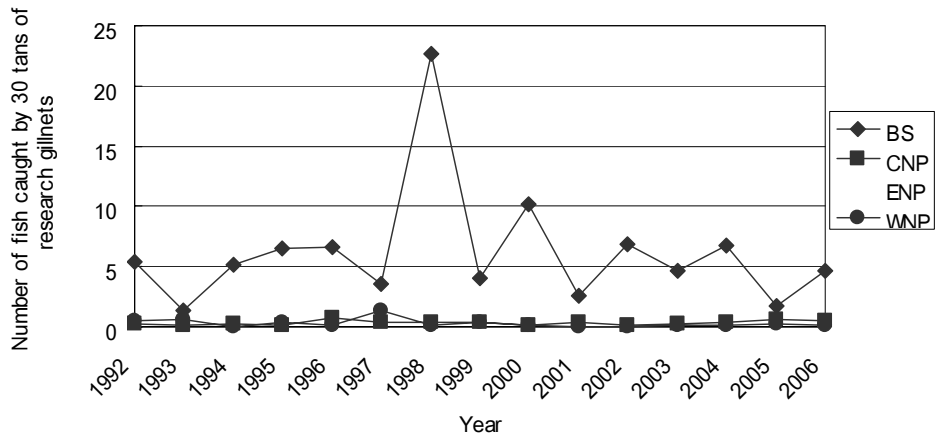


Fig. 6. Number of chinook salmon caught by 30 tans of research gillnets in summer of 1992-2006 in the North Pacific Ocean.

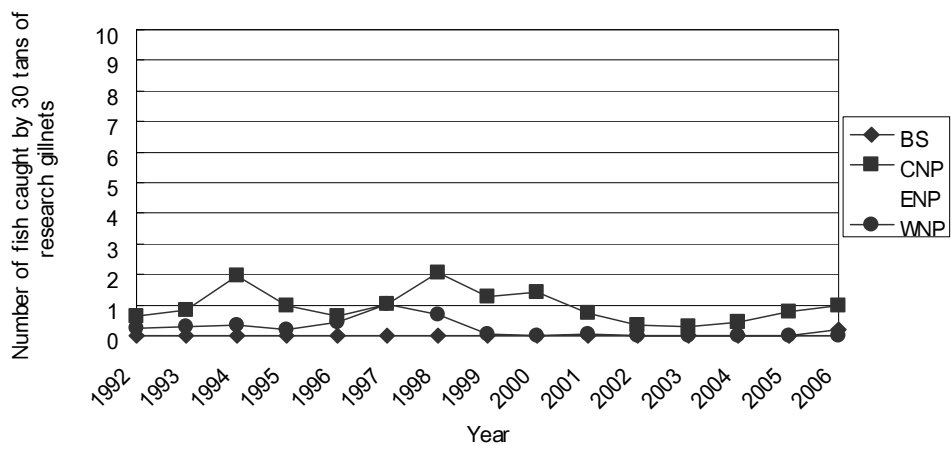


Fig. 7. Number of steelhead trout caught by 30 tans of research gillnets in summer of 1992-2006 in the North Pacific Ocean.