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Salmon Stock Assessment in the North Pacific Ocean, 2010

by

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ABSTRACT

Results of annual research cruises on salmon stock assessment conducted by Japan in the summer of 2010 were summarized. Three Japanese salmon research vessels (*Oshoro maru, Kaiun maru* and *Wakatake maru*) conducted oceanographic observations, 47 gillnet (2,324 tans), 29 longline (800 hachi) and 15 hook-and-line fishing operations in the North Pacific and the Bering Sea from May to early August. Mean sea surface temperature and abundance of salmonids in 2010 were compared to those from 1992 to 2009. Mean sea surface temperature at gillnet research stations in 2010 were lower than the mean of 1992-2009 in the Bering Sea. A total of 7,739 salmonids was caught during fishing operations including 4,788 chum (61.9%), 1,486 pink (19.2%), 842 sockeye (10.9%), 488 coho (6.3%), 68 chinook salmon (0.9%), and 67 steelhead trout (0.9%). In the Bering Sea, mean CPUE of sockeye salmon in the summer of 2010 was higher than the mean in 1992-2010, while mean CPUEs of chum and pink salmon were lower. Mean CPUEs of other salmonids including coho, chinook salmon and steelhead trout were at a low level in 2010.

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 the Bering Sea during summer for salmon stock assessment. This report summarizes the oceanographic condition and abundance of salmon in the summer of 2010 comparing the results with the archival data from 1992 to 2009.

MATERIALS AND METHODS

Three Japanese salmon research vessels (*Oshoro maru, Kaiun maru* and *Wakatake maru*) conducted oceanographic observations, 47 gillnet (2,324 tans), 29 longline (800 hachi) and 15 hook-and-line fishing operations in the North Pacific and the Bering Sea from May to early August in 2010 (Fig. 1). We divided the research area in four 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). In the summer of 2010, there were no gillnet or longline stations in the eastern North Pacific. To examine abundance of salmonid species, mean number of fish caught by 30 tans of research gillnets (CPUE) was calculated (Takagi 1975).

RESULTS

Sea Surface Temperature

Mean sea surface temperature (SST) at gillnet stations of Japanese salmon researches was 17.7°C in the western North Pacific, 12.2°C in the central North Pacific, and 6.9°C in the Bering Sea in the summer of 2010 (Table 1). SST in 2010 was lower than the mean in 1992-2009 in the Bering Sea, but similar in the central North Pacific. In the western North Pacific, mean SSTs in 2006-2010 were higher than that of 1992-2005. This was caused by adding research stations during the *Kaiun maru* survey at a southern region of the water.

Salmonid and Non-Salmonid Catches

A total of 7,739 salmonids was caught using drift gillnet, longline, and hook-and-line operations including 4,788 chum (61.9%), 1,486 pink (19.2%), 842 sockeye (10.9%), 488 coho (6.3%), 68 chinook salmon (0.9%), and 67 steelhead trout (0.9%) (Tabel 2). Non-salmonids, including 3,643 Pacific saury (*Cololabis saira*), 1,289 neon flying squid (*Ommastrephes bartrami*), and 1,197 Pacific pomfret (*Brama japonica*), were also caught in 2010 surveys. In other fish species, a huge number of Japanese anchovy (*Engraulis japonicus*) was caught in small-mesh gillnets in the western North Pacific.

Salmon Abundance

Mean CPUE of sockeye salmon in the summer of 2010 was at a high level in 1992-2010 in the Bering Sea (Fig. 2). Sockeye salmon are mainly distributed in the Bering Sea and the eastern North Pacific in summer. In 2010, mean CPUE of sockeye salmon in the Bering Sea (52.2) was higher than the mean in 1992-2010 (40.8).

Mean CPUE of chum salmon in 2009 (168.0) was at a medium level during 1992-2010 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-numbered years than in even-numbered years. Chum CPUE in 2010 was 90.1% of the mean in even-numbered years during 1993-2010 (186.5) in the Bering Sea.

In the Bering Sea, pink salmon CPUE is higher in odd-numbered years than in even-numbered years. Mean CPUE of pink salmon in 2010 (6.6) was lower than the mean in even-numbered years in 1992-2010 (9.8) in the Bering Sea (Fig. 4).

Trend of mean CPUE of coho salmon showed a decrease from 1998 to 2002, however, it had turned to increase since 2003 in the central North Pacific. In the central North Pacific, mean CPUE was recorded the highest value in 2007 among recent 15 years, decreased in 2008 and 2009, but recovered in 2010 (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 at a low level in 2010.

Chinook salmon are mainly distributed in the Bering Sea in summer and their CPUE in 2010 (3.3) was lower than the mean in 1992-2010 (5.4) (Fig. 6). Steelhead trout are mainly distributed in the eastern North Pacific, but there were no gillnet stations in this water. In the central North Pacific, mean CPUE in 2010 (1.25) was higher than the mean in 1992-2010 (0.88). Mean CPUEs in the other waters in 2010 were still at a low level (Fig. 7).

ACKNOWLEDGMENTS

We thank scientists, captains, officers and crew on 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 1992-2010.

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	12.3	± 5.07	(16)	12.6	± 4.03	(33)	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	11.9	± 5.33	(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	± 0.45	(14)	13.2	± 2.44	(5)
2005	11.4	± 4.39	(8)	11.5	± 3.99	(28)	7.9	± 0.50	(10)	11.6	± 0.74	(3)
2006	15.3	± 7.19	(20)	12.2	± 3.64	(15)	7.2	± 0.27	(5)	9.6		(1)
2007	17.4	± 5.42	(16)	12.5	± 3.89	(15)	7.3	± 0.63	(14)			
2008	18.1	± 7.32	(15)	12.7	± 3.56	(16)	7.4	± 0.59	(14)			
2009	17.0	± 8.08	(13)	11.3	± 3.68	(17)	6.5	± 0.27	(15)			
92-09	12.1	± 5.61	(346)	12.0	± 3.94	(467)	7.4	± 0.88	(208)	10.3	± 2.08	(118)
2010	17.7	± 6.49	(22)	12.2	± 4.92	(16)	6.9	± 0.23	(9)			

Table 2. Numbers of salmonids and other organisms caught by the Japanese salmon research vessels in the summer of 2010 in the western (WNP), central (CNP), eastern North Pacific (ENP), and Bering Sea (BS).

Region	RV	Gear	Date	No. op.	Tan/ hachi	Sock-eye	Chum	Pink	Coho	Chin-ook	Steel-head	Flying squid	Other squid	Pacific pomfret	Pacific saury	Lance t fish	Sharks	Atka mackerel	Other fishes	Sea-birds	Mam-mals
Western	*Oshoro*	Research	May 13-Jul 5	9	276	0	103	605	4	0	0	61	116	153	23	0	8	0	65	7	0
North	*maru*	Commercial	May 13-Jul 5	9	121	0	127	135	7	0	1	0	0	53	0	0	10	0	12	2	1
Pacific		Small-mesh	May 13-Jul 4	9	44	0	0	0	0	0	0	7	21	9	1039	0	0	0	12763	0	0
		Hook & line	May 13-Jul 27	6		0	28	551	2	0	1	0	0	0	0	0	0	0	0	0	0
	Kaiun	Research	Jul 19-Aug 6	13	390	0	21	1	0	0	0	1008	199	168	40	1	8	0	1407	1	0
	maru	Commercial	Jul 19-Aug 6	13	234	0	47	0	0	0	0	7	0	34	0	0	16	0	252	0	2
		Small-mesh	Jul 19-Aug 6	13	26	0	0	0	0	0	0	49	46	0	1551	7	0	0	72	0	0
	Subtotal					0	326	1292	13	0	2	1132	382	417	2653	8	42	0	14571	10	3
Central	*Wakatake*	Research	Jun 18-Jun 26	8	240	10	134	36	140	6	19	7	76	265	10	2	9	0	229	9	0
North	*maru*	Commercial	Jun 18-Jun 26	8	152	2	2	19	117	4	25	12	0	192	0	0	8	0	7	5	0
		Longline	Jun 17-Jun 28	10	330	19	122	26	112	2	9	0	4	173	2	0	0	0	0	0	0
	Oshoro	Longline	Jul 19-Jul 22	5	70	23	42	3	42	4	7	0	0	0	0	0	0	2	0	0	0
	maru	Hook & line	Jul 7-Jul 23	9		11	37	1	17	0	3	0	0	0	0	0	0	0	0	0	0
	Kaiun	Research	Jul 7-Jul 14	8	240	0	22	0	22	0	1	111	66	110	0	0	22	0	116	3	0
	maru	Commercial	Jul 7-Jul 14	8	144	0	1	0	23	0	0	20	0	40	0	0	13	0	68	4	0
		Small-mesh	Jul 7-Jul 14	8	16	0	0	0	0	0	1	7	5	0	978	1	0	0	5	0	0
	Subtotal					65	360	85	473	16	65	157	151	780	990	3	52	2	425	21	0
Bering	*Wakatake*	Research	Jul 4-Jul 13	9	270	470	1512	59	0	30	0	0	20	0	0	0	0	1	0	11	0
Sea	*maru*	Commercial	Jun 4-Jul 13	9	171	216	1234	31	1	5	0	0	0	0	0	0	1	1	3	15	0
		Longline	Jun 29-Jul 12	13	390	91	1341	19	0	17	0	0	0	0	0	0	0	7	2	1	0
	Oshoro	Longline	Jul 22-Jul 22	1	10	0	15	0	1	0	0	0	0	0	0	0	0	3	0	0	0
	Subtotal					777	4102	109	2	52	0	0	20	0	0	0	1	12	5	27	0
Total						842	4788	1486	488	68	67	1289	553	1197	3643	11	95	14	15001	58	3

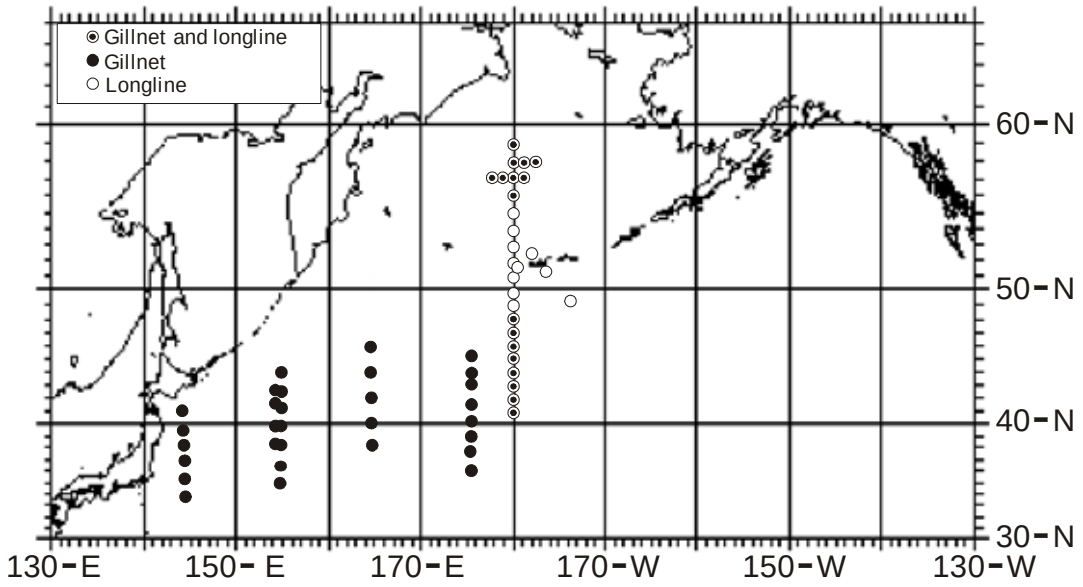

Fig. 1. Sampling locations for Japanese salmon research vessels in the North Pacific Ocean from May to August of 2010.

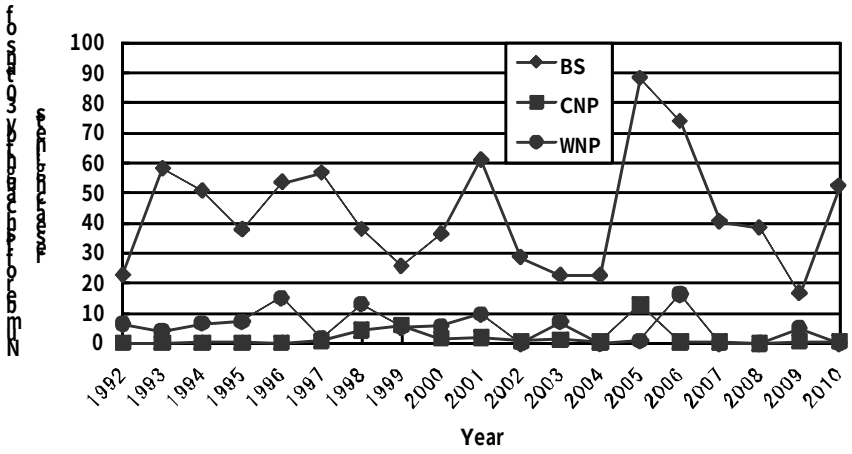

Fig. 2. Number of sockeye salmon caught by 30 tans of research gillnets in summer of 1992-2010 in the North Pacific Ocean.

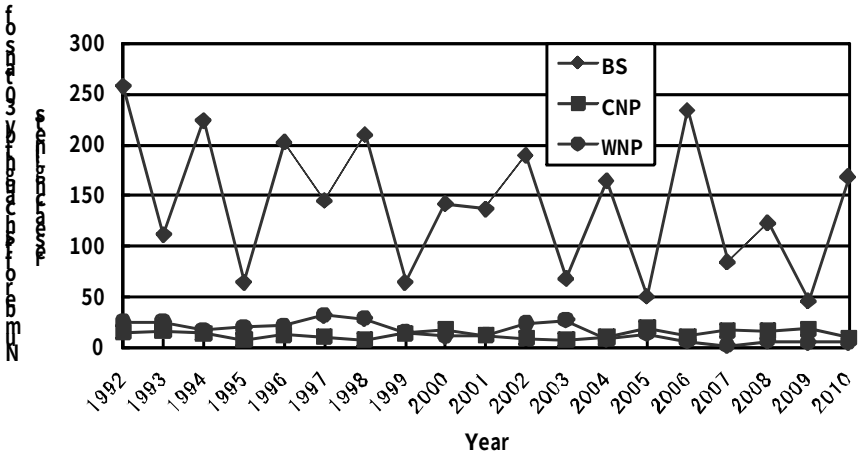

Fig. 3. Number of chum salmon caught by 30 tans of research gillnets in summer of 1992-2010 in the North Pacific Ocean.

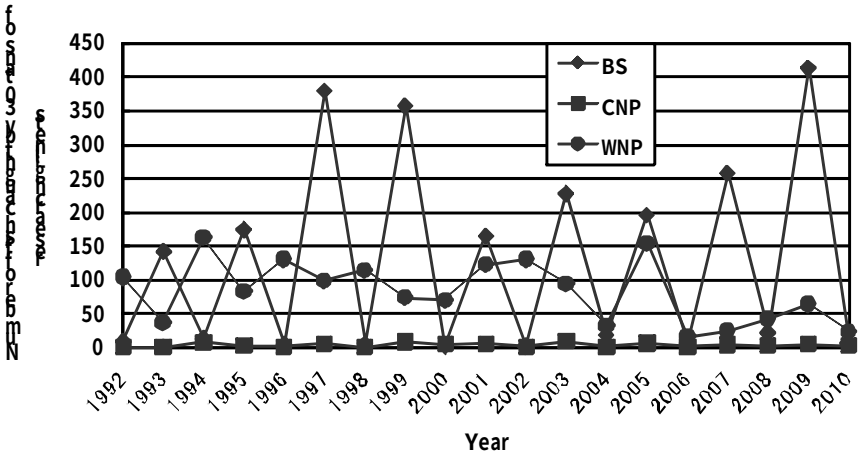

Fig. 4. Number of pink salmon caught by 30 tans of research gillnets in summer of 1992-2010 in the North Pacific Ocean.

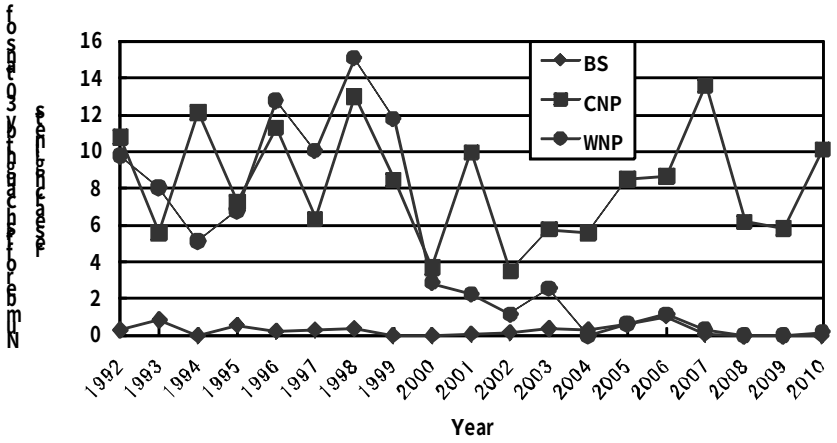

Fig. 5. Number of coho salmon caught by 30 tans of research gillnets in summer of 1992-2010 in the North Pacific Ocean.

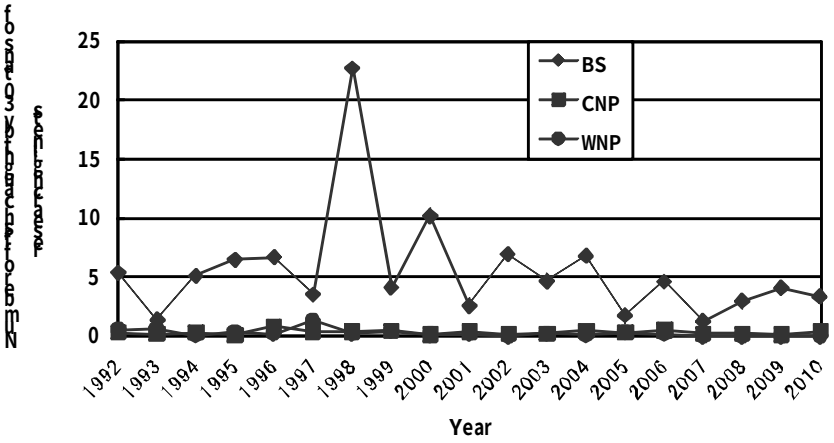

Fig. 6. Number of chinook salmon caught by 30 tans of research gillnets in summer of 1992-2010 in the North Pacific Ocean.

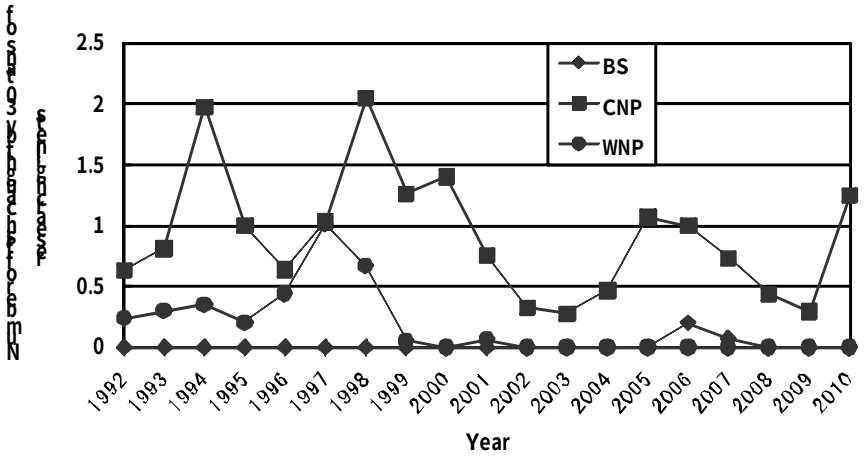

Fig. 7. Number of steelhead trout caught by 30 tans of research gillnets in summer of 1992-2010 in the North Pacific Ocean.