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Salmon Stock Assessment in the North Pacific Ocean, 2009

by

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ABSTRACT

Results of annual research cruises on salmon stock assessment conducted by Japan in the summer of 2009 were summarized. Three Japanese salmon research vessels (*Oshoro maru, Kaiun maru* and *Wakatake maru*) conducted oceanographic observations, 45 gillnet (2,220 tans), 28 longline (800 hachi) and 26 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 2009 were compared to those from 1992 to 2008. Mean sea surface temperature at gillnet research stations in 2009 were lower than the mean of 1992-2008 in the central North Pacific and Bering Sea. A total of 18,833 salmonids was caught during fishing operations including 15,782 pink (83.8%), 2,019 chum (10.7%), 602 sockeye (3.2%), 308 coho (1.6%), 86 chinook salmon (0.5%), and 36 steelhead trout (0.2%). Mean CPUEs of sockeye and chum salmon in the summer of 2009 were the lowest among recent years, while mean CPUE of pink salmon was the highest in the Bering Sea. Mean CPUEs of other salmonids including coho, chinook salmon and steelhead trout were at a low level in 2009.

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 2009 comparing the results with the archival data from 1992 to 2008.

MATERIALS AND METHODS

Three Japanese salmon research vessels (*Oshoro maru, Kaiun maru* and *Wakatake maru*) conducted oceanographic observations, 45 gillnet (2,220 tans), 28 longline (800 hachi) and 26 hook-and-line fishing operations in the North Pacific and the Bering Sea from May to early August in 2009 (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 2009, 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 17.0°C in the western North Pacific, 11.3°C in the central North Pacific, and 6.5°C in the Bering

Sea in the summer of 2009 (Table 1). SST in 2009 was lower than the mean in 1992-2008 in the central North Pacific and the Bering Sea. In the western North Pacific, mean SSTs in 2006-2009 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 18,833 salmonids was caught using drift gillnet, longline, and hook-and-line operations including 15,782 pink (83.8%), 2,019 chum (10.7%), 602 sockeye (3.2%), 308 coho (1.6%), 86 chinook salmon (0.5%), and 36 steelhead trout (0.2%) (Tabel 2). Non-salmonids, including 1,624 Pacific pomfret (*Brama japonica*), 1,071 neon flying squid (*Ommastrephes bartrami*), and 364 Pacific saury (*Cololabis saira*), were also caught in 2009 surveys.

Salmon Abundance

Mean CPUE of sockeye salmon in the summer of 2009 was the lowest in 1992-2009 in the Bering Sea (Fig. 2). Sockeye salmon are mainly distributed in the Bering Sea and the eastern North Pacific in summer. In 2009, mean CPUE of sockeye salmon in the Bering Sea (16.3) was 41% of the mean in 1992-2009 (40.3).

Mean CPUE of chum salmon in 2009 (45.2) was also the lowest during 1992-2009 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 2009 was 53.9% of the mean in odd-numbered years during 1993-2009 (83.9) 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 2009 (413.5) was the highest in odd-numbered years in 1993-2009 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, but decreased in recent two years (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 2009.

Chinook salmon are mainly distributed in the Bering Sea in summer and their CPUE in 2009 (4.1) was lower than the mean in 1992-2009 (5.5), but higher than in 2008 (Fig. 6). Steelhead trout are mainly distributed in the eastern North Pacific, but there were no gillnet stations in this water. Mean CPUEs in the other waters in 2009 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.

REFERENCES

Takagi, K. 1975. A non-selective salmon gillnet for research operations. Int. North Pac. Fish. Comm. Bull. 32:13-41.

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 1992-2009.

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)			
92-08	11.9	± 5.40	(333)	12.0	± 3.95	(450)	7.5	± 0.88	(193)	10.3	± 2.08	(118)
2009	17.0	± 8.08	(13)	11.3	± 3.68	(17)	6.5	± 0.27	(15)			

Table 2. Numbers of salmonids and other organisms caught by the Japanese salmon research vessels (excluding *Hokko-maru*) in the summer of 2009 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	Chi-nook	Steel-head	Flying squid	Other squids	Pacific pomfret	Pacific saury	Lancet-fish	Sharks	Atka mackerel	Walleye pollock	Other fishes	Sea-birds	Mam-mals
WNP	*Oshoro*	Research	May 12-Jun	5	150	62	67	829	0	0	0	1	14	61	0	0	4	1	0	14	2	0
	maru	Commercial	May 12-Jun	5	60	28	66	386	0	0	0	1	2	19	0	0	9	0	0	2	6	0
		Small-mesh	May 12-Jun	5	35	0	0	0	0	0	0	0	8	2	207	0	0	0	0	361	0	0
		Hook-&-line	May 11-Jun	8		3	18	682	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Kaiun	Research	Jul 24-Aug 2	8	240	0	0	0	0	0	0	292	441	73	5	4	15	0	0	902	0	0
	maru	Commercial	Jul 24-Aug 2	8	160	0	0	0	0	0	0	29	29	28	0	0	11	0	0	67	0	0
	Subtotal					93	151	1897	0	0	0	323	494	183	212	4	39	1	0	1346	8	0
CNP	*Wakatake*	Research	Jun 12-Jun 21	8	240	3	198	7	73	0	4	32	142	207	151	1	9	0	0	73	4	0
	maru	Commercial	Jun 12-Jun 21	8	152	0	18	5	118	1	10	50	51	246	0	1	8	0	0	5	0	3
		Longline	Jun 11-Jun 23	11	330	3	85	19	62	2	12	0	4	542	0	0	0	0	0	0	0	0
	Oshoro	Research	Jun 11-Jun 13	2	60	7	108	75	22	2	1	0	19	0	0	0	0	48	0	0	1	0
	maru	Commercial	Jun 11-Jun 23	2	24	1	25	3	13	2	2	0	0	0	0	0	0	0	0	0	0	0
		Small-mesh	Jun 11-Jun 23	2	14	0	2	0	0	0	0	0	17	0	0	0	0	3	0	0	0	0
		Longline	Jun 14	1	10	0	12	10	0	0	5	0	0	0	0	0	0	0	0	0	0	0
		Hook-&-line	Jun 9-Jun 28	10		10	15	70	11	0	2	0	0	0	0	0	0	0	0	0	0	0
	Kaiun	Research	Jul 9-Jul 19	7	210	0	6	0	4	0	0	306	419	361	1	3	33	0	0	91	5	2
	maru	Commercial	Jul 9-Jul 19	7	140	0	16	0	2	0	0	360	360	85	0	0	27	0	0	6	2	2
	Subtotal					24	485	189	305	7	36	748	1012	1441	152	5	77	51	0	175	12	7
ENP	*Oshoro*	Hook-&-line	Jul 10-Jul 17	2		3	1	4	1	0	0	0	0	0	0	0	0	0	0	0	0	0
BS	*Wakatake*	Research	Jun 29-Jul 10	12	360	200	468	5073	0	58	0	0	9	0	0	0	0	4	0	2	56	0
	maru	Commercial	Jun 29-Jul 12	12	228	122	368	5428	2	13	0	0	0	0	0	0	1	0	0	3	45	0
		Longline	Jun 24-Jul 8	15	450	89	242	1283	0	5	0	0	0	0	0	0	0	17	0	0	2	0
	Oshoro	Research	Jul 2-Jul 4	3	90	45	210	1130	0	3	0	0	4	0	0	0	0	2	0	0	11	0
	maru	Commercial	Jul 2-Jul 4	3	36	16	87	723	0	0	0	0	0	0	0	0	1	0	0	1	8	0
		Small-mesh	Jul 2-Jul 4	3	21	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0
		Longline	Jun 30	1	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Hook-&-line	Jun 17-Jul 3	6		10	7	54	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Subtotal					482	1382	13692	2	79	0	0	14	0	0	0	2	23	0	6	122	0
Total						602	2019	15782	308	86	36	1071	1520	1624	364	9	118	75	0	1527	142	7

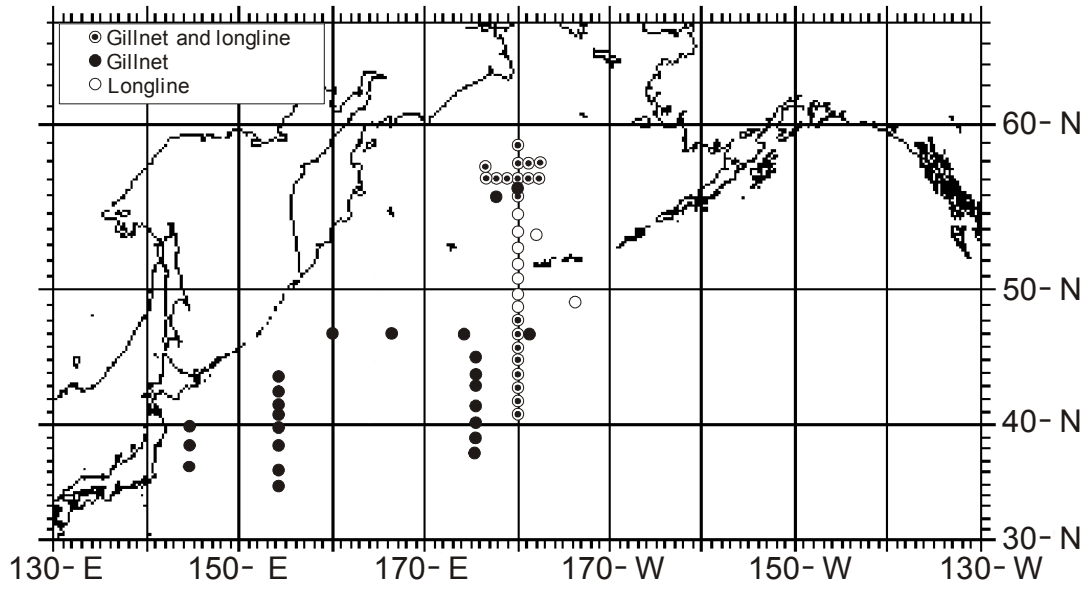

Fig. 1. Sampling locations for Japanese salmon research vessels in the North Pacific Ocean from May to August of 2009.

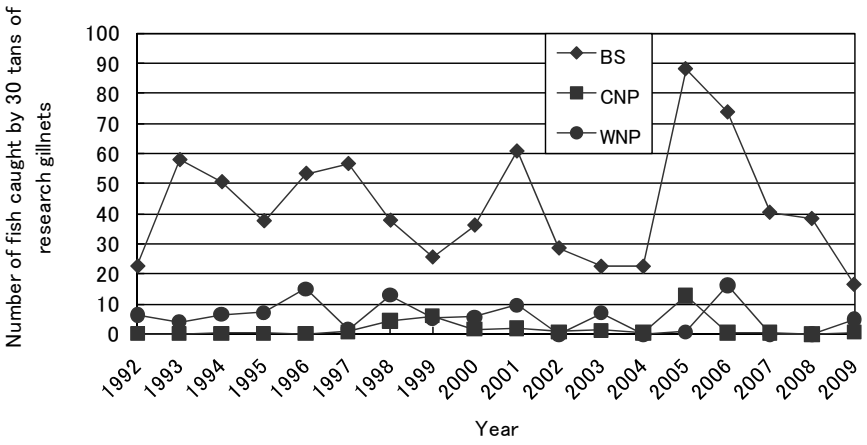

Fig. 2. Number of sockeye salmon caught by 30 tans of research gillnets in summer of 1992-2009 in the North Pacific Ocean.

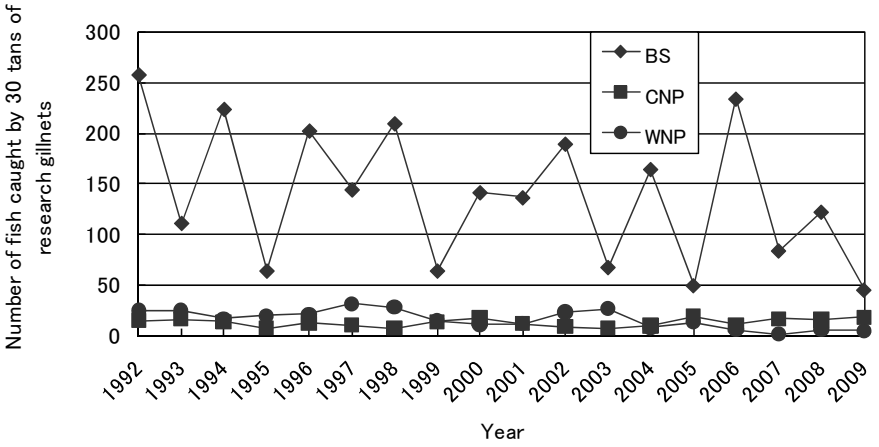

Fig. 3. Number of chum salmon caught by 30 tans of research gillnets in summer of 1992-2009 in the North Pacific Ocean.

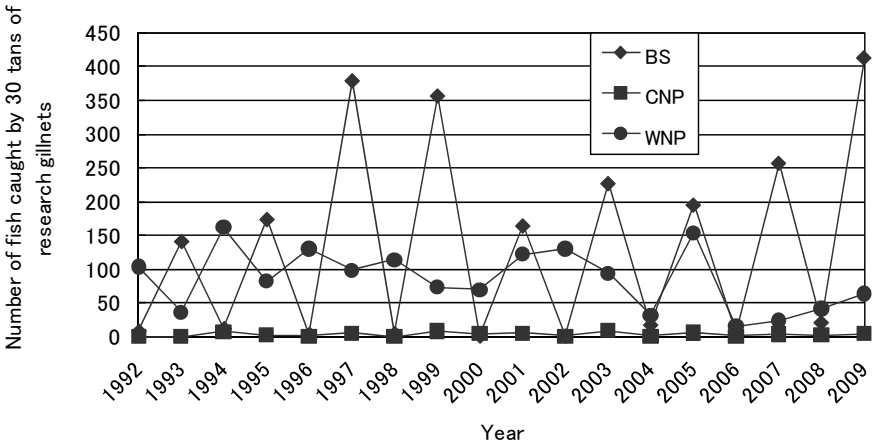

Fig. 4. Number of pink salmon caught by 30 tans of research gillnets in summer of 1992-2009 in the North Pacific Ocean.

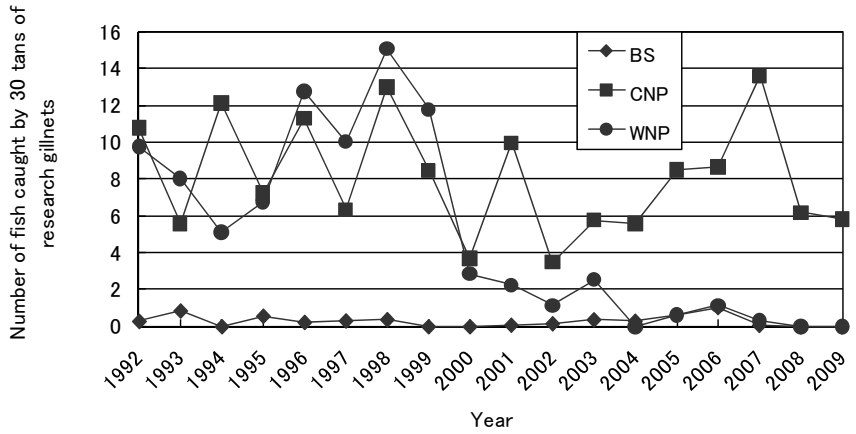

Fig. 5. Number of coho salmon caught by 30 tans of research gillnets in summer of 1992-2009 in the North Pacific Ocean.

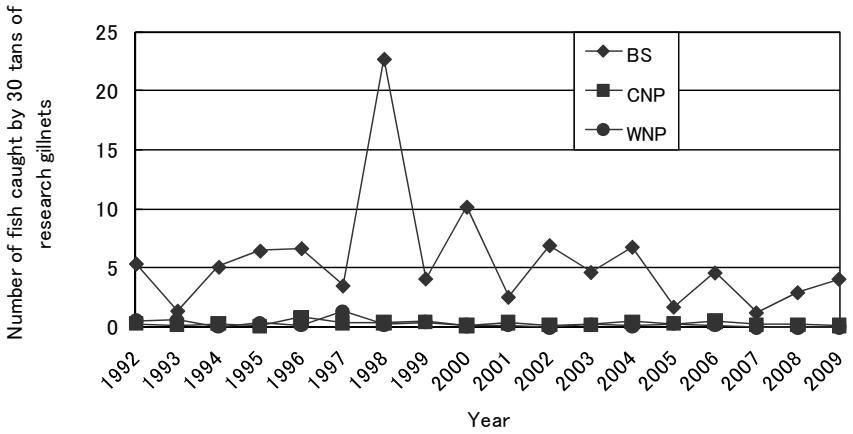

Fig. 6. Number of chinook salmon caught by 30 tans of research gillnets in summer of 1992-2009 in the North Pacific Ocean.

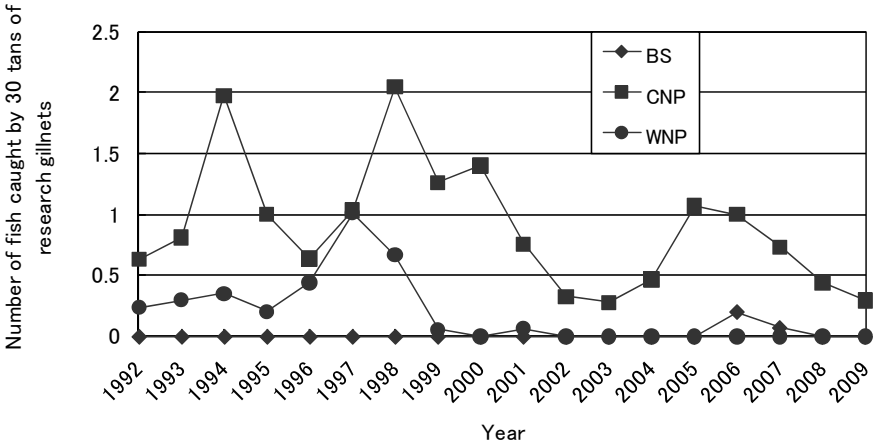

Fig. 7. Number of steelhead trout caught by 30 tans of research gillnets in summer of 1992-2009 in the North Pacific Ocean.