

**Salmon Stock Assessment in the North Pacific Ocean, 2004**

**by**

**Toru Nagasawa, Masa-aki Fukuwaka, and Tomonori Azumaya**

**Hokkaido National Fisheries Research Institute, Fisheries Research Agency**

**Submitted to the**

**NORTH PACIFIC ANADROMOUS FISH COMMISSION**

**by**

**JAPAN**

**October 2004**

**THIS PAPER MAY BE CITED IN THE FOLLOWING MANNER:**

Nagasawa, T., M. Fukuwaka, and T. Azumaya. 2004. Salmon stock assessment in the North Pacific Ocean, 2004. (NPAFC Doc. 785). Hokkaido National Fisheries Research Institute, Fisheries Research Agency, 116 Katsurakoi, Kushiro 085-0802, Japan. 10 p.

# Salmon Stock Assessment in the North Pacific Ocean, 2004

Nagasawa, T., M. Fukuwaka and T. Azumaya

Hokkaido National Fisheries Research Institute, Fisheries Research Agency

## ABSTRACT

We summarize results of research cruises on salmon stock assessment conducted by Japan in the summer of 2004. Three Japanese salmon research vessels (*Oshoro maru*, *Kaiun maru* and *Wakatake maru*) conducted oceanographic observations, 57 gillnet (2,793 tans) and 31 longline (860 hachi) fishing operations in the western, central, eastern North Pacific, and the Bering Sea from May to July. Mean sea surface temperature and abundance of Pacific salmon in 2004 are compared to those from 1992 to 2003. Mean sea surface temperature at salmon research stations in 2004 was higher than the mean of 1992-2003 especially in the Bering Sea. A total of 8,422 salmonids was caught using drift gillnets and longlines, including including 5,462 chum (64.9%), 1,223 pink (14.5%), 742 sockeye (8.8%), 677 coho (8.0 %), and 260 chinook salmon (3.1%), and 58 steelhead trout (0.7%). Mean CPUE of sockeye salmon was in a low level in 1992-2004. Mean CPUE of chum salmon in the Bering Sea was lower than the mean in even-years, and the next lowest year to 2000, from 1992 to present. Mean CPUE of pink salmon in 2004 was rather higher than the mean for even-years in 1992-2004 in the Bering Sea and in the western North Pacific. In the western North Pacific, mean CPUEs in even years were higher than in odd years from 1992 to 1999, but pink salmon CPUE in 2004 was lower than the mean in even-years of 1994-2004.

## INTRODUCTION

According to the 2004 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 2003). This report summarizes the oceanographic conditions, abundance, of salmon in the North Pacific Ocean and Bering Sea in the summer of 2004 from the salmon research conducted by Japan in the North Pacific Ocean. In this report, we compared results in 2004 with those from 1992 to 2003.

## MATERIALS AND METHODS

Three Japanese salmon research vessels (*Oshoro maru*, *Kaiun maru*, and *Wakatake maru*) conducted 57 gillnet (2,793 tans) and 31 longline (860 hachi) fishing operations in the North Pacific Ocean and Bering Sea from May to July 2004 (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).

## RESULTS

### Sea Surface Temperature

Mean sea surface temperature at gillnet stations of Japanese salmon researches was 13.5°C in the western North Pacific, 12.2°C in the central North Pacific, 8.3°C in the Bering Sea, and 13.2°C in the eastern North Pacific in the summer of 2004 (Table 1). These were higher than means in 1992-2003. In the Bering Sea, mean sea surface temperature (SST) was higher than the long-term mean SST during the summer of 2004 (Japan Meteorological Agency 2004).

### Salmonid and Non-Salmonid Catches

A total of 8,422 salmonids was caught using drift gillnets and longlines, including 5,462 chum (64.9%), 1,223 pink (14.5%), 742 sockeye (8.8%), 677 coho (8.0%), and 260 chinook salmon (3.1%), and 58 steelhead trout (0.7%) in 2004 (Table 2). No Dolly Varden was caught. Dominant non-salmonid catches included 7,428 Pacific saury (*Cololabis saira*), 1,123 neon flying squid (*Ommastrephes bartrami*), and 4,505 Pacific pomfret (*Brama japonica*). More than 5,000 Japanese anchovy (*Engraulis japonicus*), were counted as “other fishes”.

### Salmon Abundance

Mean CPUE of sockeye salmon in the summer of 2004 was in a low level in 1992-2004 (Fig. 2). Sockeye salmon are mainly distributed in the Bering Sea and the eastern North Pacific in summer. In 2004, mean CPUE of sockeye salmon in the Bering Sea ( $22.4 \pm 18.6$  SD) was 54.8% of the mean in 1992-2003. Sockeye CPUE in the eastern North Pacific ( $26.2 \pm 20.8$  SD) was 66.4% of the mean in 1992-2003 ( $39.4$ ).

Mean CPUE of chum salmon in 2003 was in the moderate 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 higher in even years than in odd years. Mean CPUE of chum salmon in the Bering Sea ( $164.4 \pm 89.9$  SD) was lower than the mean in even-years of 1992-2004 ( $196.9 \pm 88.5$  SD), and the next lowest year to 2000 from 1992.

Mean CPUE of pink salmon in 2004 was rather higher than the mean for even-years in 1992-2004 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 even years are lower than in odd years. Mean CPUE in this region of 2004 ( $18.35 \pm 15.78$  SD) was rather higher than the mean in even-years of 1992-2004 ( $8.23 \pm 10.20$  SD). In the western North Pacific, mean CPUEs in even years were higher than in odd years from 1992 to 1999, but pink salmon CPUE in 2004 ( $32.2 \pm 36.9$  SD) was lower than the mean in even-years of 1994-2004 ( $80.3 \pm 116.9$  SD).

Trend of mean CPUE of coho salmon showed decrease from 1998 to 2003. In 2004, mean CPUE of coho salmon in eastern North Pacific showed the highest value in the recent 12 years (Fig. 5). Coho salmon are mainly distributed in the western, central, and eastern North Pacific, mean CPUE of western and central North Pacific were both still low level in 2004. Chinook salmon are distributed in the Bering Sea and their CPUE in 2004 was similar to the mean in 1992-2004 (Fig. 6). Steelhead trout are mainly distributed in the eastern North Pacific and their CPUE in 2004 was still low level in 1992-2004 (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.

### **REFERENCES**

- Japan Meteorological Agency 2004. Kaisuion Kairyu (Sea water temperature and current: oceanographic information).  
<http://www.data.kishou.go.jp/marine/ocean/index.html>.
- North Pacific Anadromous Fish Commission. 2004. Consideration of scientific research and statistics. Annual Report & Documents 2003.
- 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 1992-2004.

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)
92-03	11.0	± 4.54 (264)	11.9	± 3.96 (349)	7.4	± 0.94 (136)	10.2	± 1.99 (109)
2004	13.5	± 4.74 (9)	12.2	± 4.09 (28)	8.3	± 0.45 (14)	13.2	± 2.44 (5)

Table 2. Numbers of salmonids and other organisms caught by the Japanese salmon research vessels in summer of 2004.

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	Mar- mals	
Western	<i>Oshoro</i>	Research	May 13-Jul 01	9	270	0	78	290	0	1	0	199	95	456	28	0	10	0	0	87	1	0	
North	<i>maru</i>	Commercial	May 13-Jul 01	9	108	0	121	32	0	2	0	162	3	139	0	4	3	0	0	4	4	1	
Pacific		Small-mesh	May 13-Jul 01	9	63	0	0	1	0	0	0	2	20	19	2039	1	0	0	0	5579	0	0	
		Longline		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total			May 15-Jul 09	11		0	199	323	0	3	0	363	118	614	2067	5	13	0	0	5670	5	0	
Central	<i>Wakatake</i>	Research	Jun 17-Jun 24	8	240	10	175	29	81	8	8	13	74	393	150	0	2	1	0	1	6	0	
North	<i>maru</i>	Commercial	Jun 17-Jun 24	8	142	5	15	23	138	5	14	27	1	358	0	0	6	0	0	0	4	0	
Pacific		Small-mesh	Jun 15-Jun 19	6	12	0	0	0	0	0	0	0	0	0	873	0	0	0	0	0	0	0	0
		Longline	Jun 16-Jun 26	11	330	14	81	14	58	2	5	0	3	249	0	2	0	1	0	0	1	0	
	<i>Kaiun maru</i>	Research	Jul 08-Jul 29	21	666	0	113	4	75	4	5	308	154	2099	605	0	75	0	0	131	15	0	
		Commercial	Jul 08-Jul 29	21	279	0	154	8	84	4	7	374	0	286	0	0	44	0	0	91	19	1	
		Small-mesh	Jul 08-Jul 29	21	94	0	0	0	0	0	0	5	23	3	2505	0	0	0	0	496	0	0	
Total			Jun 14-Jul 29	32		29	538	78	436	23	33	727	255	3288	4133	2	127	2	0	713	45	1	
Bering Sea	<i>Wakatake maru</i>	Research	Jul 1-Jul 15	14	420	313	2302	257	4	95	0	0	45	0	0	0	1	83	0	0	45	3	
		Commercial	Jul 1-Jul 15	14	266	230	1318	286	9	78	0	0	1	0	0	0	1	1	0	1	35	2	
		Longline	Jun 27-Jul 14	18	510	22	830	34	3	44	0	0	0	0	0	0	0	1	0	2	2	0	
Total			Jun 25-Jul 13	18		565	4450	577	16	217	0	0	46	0	0	0	2	85	0	3	82	5	
Eastern	<i>Oshoro</i>	Research	Jul 30-Aug 03	5	150	131	266	111	104	11	14	32	114	473	5	0	53	0	0	10	2	0	
North	<i>maru</i>	Commercial	Jul 30-Aug 03	5	60	17	9	131	118	6	11	31	0	119	0	0	24	0	0	6	7	0	
Pacific		Small-mesh	Jul 30-Aug 03	5	35	0	0	2	2	0	0	0	39	5	1218	0	0	1	0	4	0	0	
		Longline	Jul 30-Jul 30	2	20	0	1	1	1	0	0	0	0	0	6	0	0	0	0	0	0	0	0
Total			Jul 30-Aug 03	5		148	275	245	225	17	25	33	153	603	1223	0	77	1	0	20	9	0	
Total			May 15-Aug 03	64		742	5462	1223	677	260	58	1123	572	4505	7428	7	219	88	0	6403	141	6	

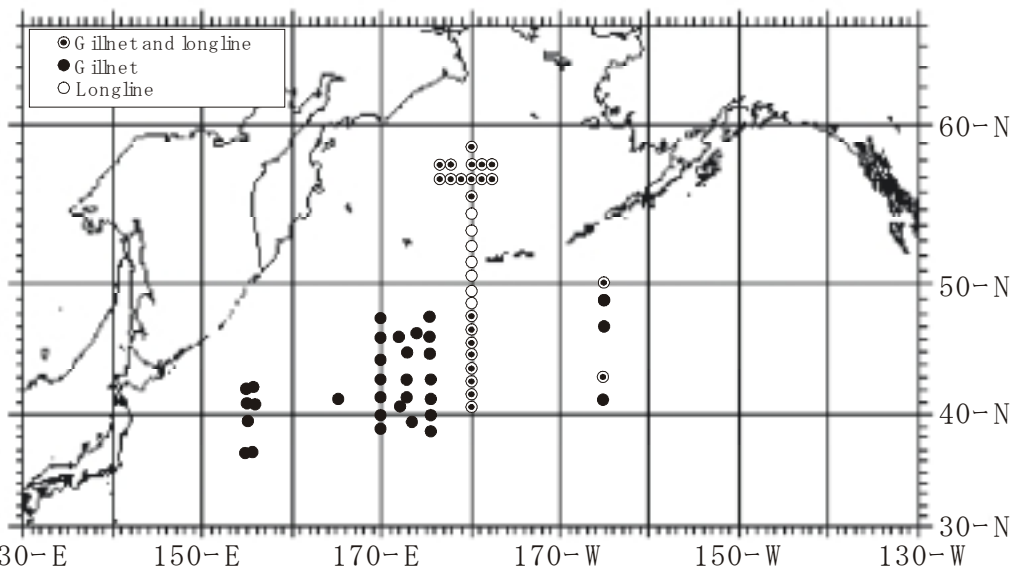


Fig. 1. Sampling locations for Japanese salmon research vessels in the North Pacific Ocean from May to August of 2004.

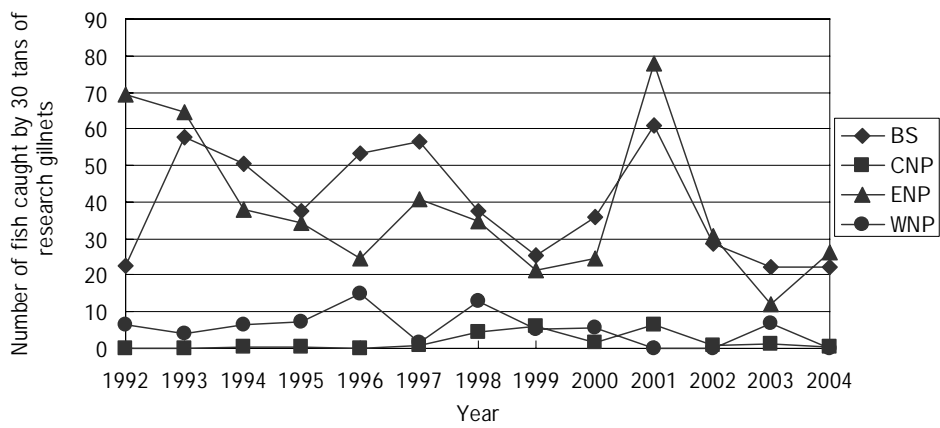


Fig. 2. Number of sockeye salmon caught by 30 tans of research gillnets in summer of 1992-2004 in the North Pacific Ocean.

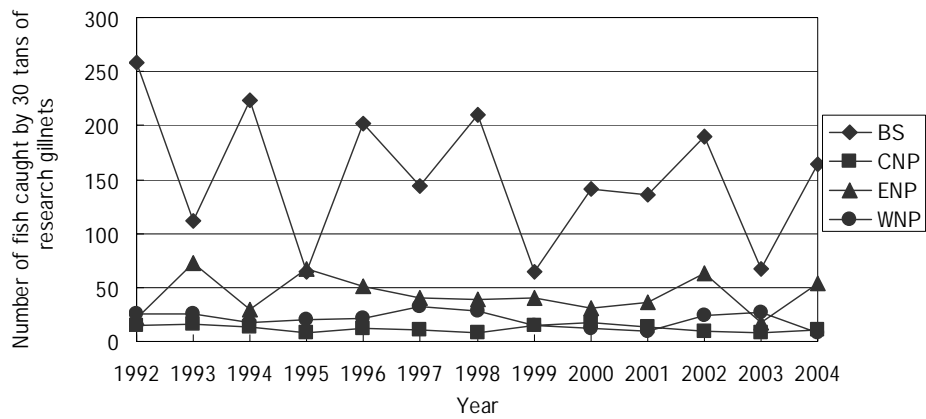


Fig. 3. Number of chum salmon caught by 30 tans of research gillnets in summer of 1992-2004 in the North Pacific Ocean.

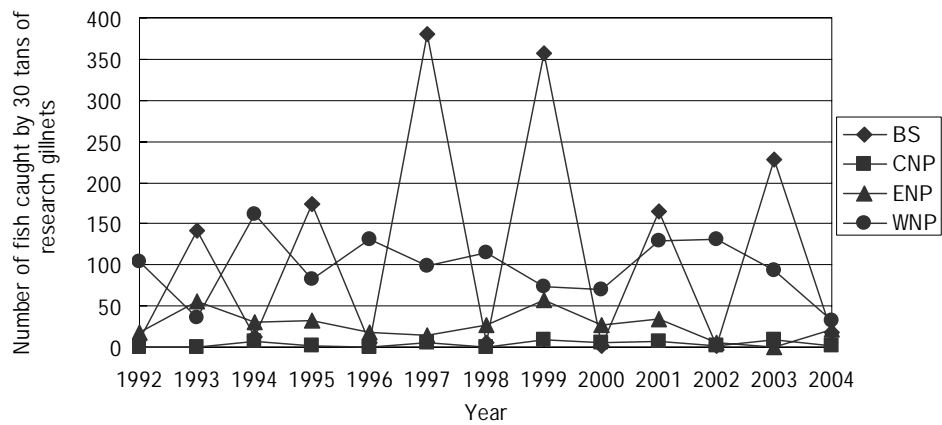


Fig. 4. Number of pink salmon caught by 30 tans of research gillnets in summer of 1992-2004 in the North Pacific Ocean.



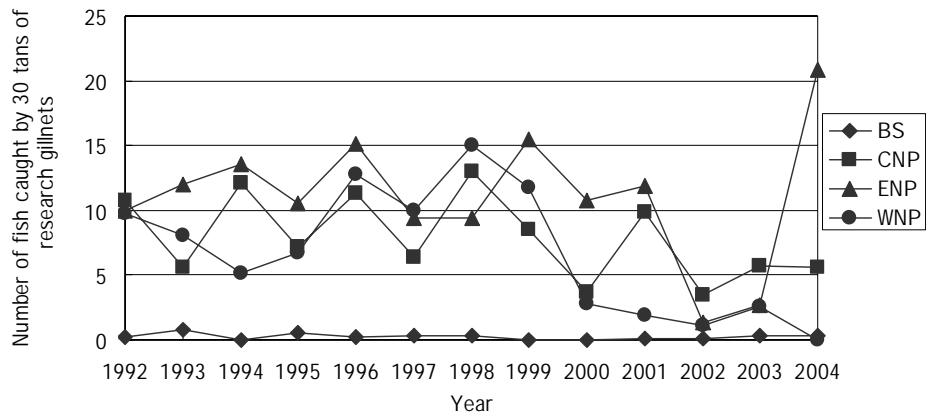


Fig. 5. Number of coho salmon caught by 30 tans of research gillnets in summer of 1992-2004 in the North Pacific Ocean.

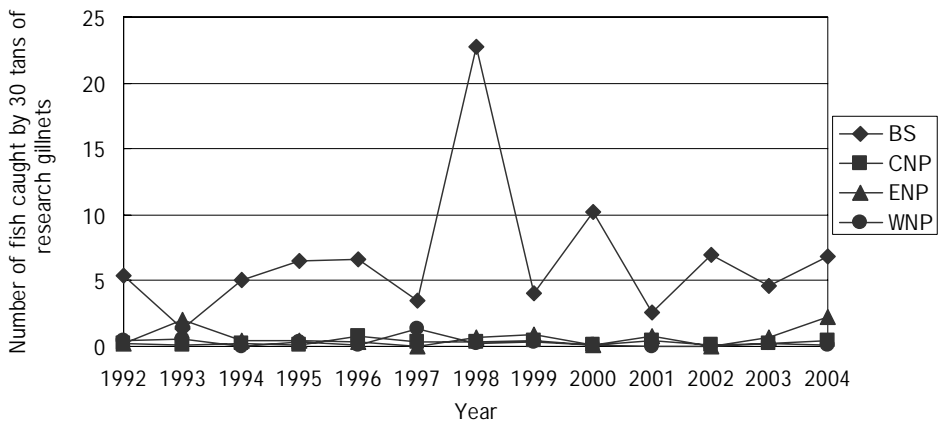


Fig. 6. Number of chinook salmon caught by 30 tans of research gillnets in summer of 1992-2004 in the North Pacific Ocean.

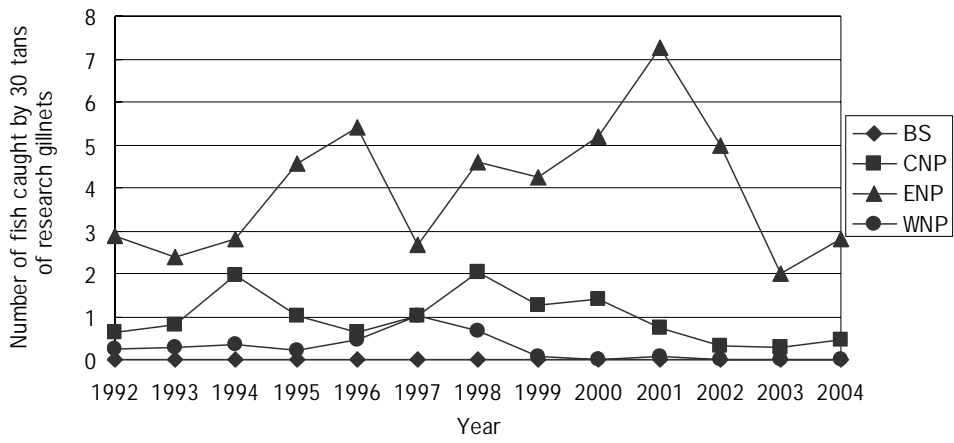


Fig. 7. Number of steelhead trout caught by 30 tans of research gillnets in summer of 1992-2004 in the North Pacific Ocean.