

NPAFC

Doc. 1045

Rev. \_\_\_\_\_

Rev. Date: \_\_\_\_\_

## **Salmon Stock Assessment in the North Pacific Ocean, 2007**

by

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**Submitted to the**

**NORTH PACIFIC ANADROMOUS FISH COMMISSION**

by

**JAPAN**

**October 2007**

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

Nagasawa, T., M. Fukuwaka, K. Morita, and T. Azumaya. 2007. Salmon stock assessment in the North Pacific Ocean, 2007. NPAFC Doc. 1045. 9 pp. Hokkaido National Fisheries Research Institute, Fisheries Research Agency. (Available at <http://www.npafc.org>).

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## ABSTRACT

Results of annual research cruises on salmon stock assessment conducted by Japan in the summer of 2007 were summarized. Three Japanese salmon research vessels (*Oshoro maru*, *Kaiun maru* and *Wakatake maru*) conducted oceanographic observations, 45 gillnet (2,200 tans) , 34 longline (920 hachi) and 10 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 2007

are compared to those from 1992 to 2006. Mean sea surface temperature at gillnet research stations in 2007 were close to the mean SST of 1992-2006. A total of 14,882 salmonids was caught using drift gillnets, longlines, hook and line, and trawl including 10,350 pink (69.7%), 2,940 chum (19.7%), 951 sockeye 6.4%), 545 coho (3.7 %), 57 chinook salmon (0.4%), and 39 steelhead trout (0.3%). Mean CPUE of sockeye salmon in the summer of 2007 was lower than previous two years, but middle level in 1992-2007. Mean CPUE of chum salmon in 2007 was also middle level in the 1992-2007 odd years in the Bering Sea. Mean CPUE of pink salmon in 2007 was rather high level for odd-years in 1992-2007.

## 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 2007 comparing the results with the archival data from 1992 to 2006.

## MATERIALS AND METHODS

Three Japanese salmon research vessels (*Oshoro maru*, *Kaiun maru*, and *Wakatake maru*) conducted 45 gillnet (2,200 tans) and 34 longline (920 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 traditionary: 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 summer of 2007, we have not done research operation in the eastern North Pacific. 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 12.6°C in the central North Pacific, 7.3°C in the Bering Sea in the summer of 2007 (Table 1). These were close to means in 1992-2006. In the Western North Pacific, mean SST in 2006 and 2007 were rather higher than that of 1992-2005 in 2005. This result was caused by changing position of research stations.

### Salmonid and Non-Salmonid Catches

A total of 14,882 salmonids was caught using drift gillnets, longlines, hook and line, and trawl including 10,350 pink (69.7%), 2,940 chum (19.7%), 951 sockeye 6.4%), 545 coho (3.7 %), 57 chinook salmon (0.4%), and 39 steelhead trout (0.3%) (Table 2). No dolly varden charr was caught in the summer of 2007. Non-salmonid, including 3,390 Pacific saury (*Cololabis saira*), 3,663 neon flying squid (*Ommastrephes bartrami*), and 2,347 Pacific pomfret (*Brama japonica*) were also caught in 2007 surveys.

### Salmon Abundance

Mean CPUE of sockeye salmon in the summer of 2007 was middle level in 1992-2007, in the Bering Sea (Fig. 2). Sockeye salmon are mainly distributed in the Bering Sea and the eastern North Pacific in summer. In 2007, mean CPUE of sockeye salmon in the Bering Sea (40.4) was 90% of the mean in 1992-2006 (44.9).

Mean CPUE of chum salmon in 2007 (83.9) was middle 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 odd years, chum CPUE in 2007 was the about 90% of the mean in recent 15 years in the Bering Sea.

In the Bering Sea, pink salmon CPUE is higher in odd years than in even years. Mean CPUE of pink salmon in 2007(257.6) was near the mean for odd-years CPUE (234.5) 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, and mean CPUE of 2007 was 2nd highest in recent 15 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 a low level in 2007.

Chinook salmon are mainly distributed in the Bering Sea in summer and their CPUE in 2007 was lower than mean in 1992-2006 (Fig. 6). Steelhead trout are mainly distributed in the eastern North Pacific, but we could not get data in this water. The mean CPUEs in the other waters in 2007 were still low level in 1992-2007 (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

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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 1992-2007.

| 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)  |
| 2006  | 15.3                  | ± 7.38 (20)  | 12.2                  | ± 3.77 (15)  | 7.2        | ± 0.30 (5)   | 9.6                   | (1)         |
| 92-06 | 11.3                  | ± 4.90 (300) | 11.9                  | ± 3.96 (409) | 7.5        | ± 0.92 (165) |                       |             |
| 2007  | 17.4                  | ± 5.60 (16)  | 12.6                  | ± 4.03 (15)  | 7.3        | ± 0.66 (14)  |                       |             |

Table 2. Numbers of salmonids and other organisms caught by the Japanese salmon research vessels (excluding *Hokko-maru*) in summer of 2007

| Region                     | RV                   | Gear       | Date          | No. operation | Tan/hachi | Sockeye | Chum | Pink  | Coho | Chinook | Steel | Dolly | Flying squid | Other squid | Pacific pomfret | Pacific saury | Lance t fish | Sharks | Atka mackerel | Walleye pollock | Other fishes | Sea-birds | Mammals |
|----------------------------|----------------------|------------|---------------|---------------|-----------|---------|------|-------|------|---------|-------|-------|--------------|-------------|-----------------|---------------|--------------|--------|---------------|-----------------|--------------|-----------|---------|
| Western                    |                      | Research   | May 14-Ju107  | 4             | 120       | 0       | 24   | 348   | 5    | 0       | 0     | 0     | 4            | 31          | 290             | 50            | 0            | 8      | 0             | 0               | 5            | 5         | 0       |
| North Pacific              | <i>Oshoro maru</i>   | Commercial | May 14-Jul 07 | 4             | 48        | 0       | 28   | 6     | 5    | 1       | 0     | 0     | 7            | 0           | 166             | 0             | 0            | 3      | 0             | 0               | 0            | 5         | 0       |
|                            |                      | Small-mesh | May 15-Ju107  | 4             | 28        | 0       | 1    | 0     | 0    | 0       | 0     | 0     | 0            | 7           | 4               | 831           | 0            | 0      | 0             | 0               | 0            | 4         | 0       |
|                            |                      | Longline   | Ju1 07        | 1             | 10        | 0       | 0    | 0     | 0    | 0       | 0     | 0     | 0            | 0           | 2               | 0             | 0            | 0      | 0             | 0               | 0            | 0         | 0       |
|                            |                      | Hook and L | Ju1 07-Ju1 09 | 3             |           | 0       | 8    | 5     | 19   | 0       | 0     | 0     | 0            | 0           | 0               | 0             | 0            | 0      | 0             | 0               | 0            | 0         | 0       |
|                            | <i>Kaiun maru</i>    | Research   | Jul 23-Aug 06 | 12            | 360       | 0       | 0    | 3     | 1    | 0       | 0     | 0     | 3259         | 254         | 151             | 580           | 6            | 14     | 0             | 0               | 1354         | 0         | 0       |
|                            |                      | Commercial | Jul 23-Aug 06 | 12            | 192       | 0       | 0    | 2     | 0    | 0       | 0     | 0     | 44           | 2           | 87              | 0             | 1            | 7      | 0             | 0               | 315          | 0         | 2       |
|                            |                      | Small-mesh | Jul 23-Aug 06 | 12            | 24        | 0       | 0    | 0     | 0    | 0       | 0     | 0     | 63           | 15          | 3               | 367           | 0            | 0      | 0             | 0               | 86           | 2         | 0       |
|                            |                      | Subtotal   |               |               |           | 0       | 61   | 364   | 30   | 1       | 0     | 0     | 3377         | 309         | 703             | 1928          | 7            | 32     | 0             | 0               | 1755         | 16        | 2       |
| Central North              | <i>Wakatake maru</i> | Research   | Jun 14-Jun 21 | 8             | 240       | 5       | 250  | 58    | 193  | 3       | 10    | 0     | 13           | 110         | 226             | 29            | 0            | 5      | 0             | 0               | 3            | 8         | 1       |
|                            |                      | Commercial | Jun 14-Jun 21 | 8             | 152       | 0       | 37   | 20    | 230  | 13      | 17    | 0     | 19           | 2           | 181             | 0             | 1            | 9      | 0             | 0               | 0            | 3         | 1       |
|                            |                      | Longline   | Jun 13-Jun 23 | 11            | 330       | 10      | 225  | 36    | 58   | 2       | 9     | 0     | 0            | 6           | 155             | 0             | 1            | 1      | 0             | 0               | 0            | 0         | 0       |
|                            | <i>Kaiun maru</i>    | Research   | Jul 12-Jul 18 | 7             | 210       | 0       | 8    | 0     | 11   | 0       | 1     | 0     | 213          | 87          | 799             | 755           | 0            | 2      | 0             | 0               | 147          | 0         | 1       |
|                            |                      | Commercial | Jul 12-Jul 18 | 7             | 112       | 0       | 16   | 1     | 6    | 0       | 1     | 0     | 38           | 2           | 277             | 0             | 0            | 49     | 0             | 0               | 88           | 0         | 0       |
|                            |                      | Small-mesh | Jul 12-Jul 18 | 7             | 28        | 0       | 0    | 0     | 0    | 0       | 0     | 0     | 3            | 33          | 6               | 778           | 0            | 0      | 0             | 0               | 56           | 0         | 0       |
|                            |                      | Subtotal   |               |               |           | 15      | 536  | 115   | 498  | 18      | 38    | 0     | 286          | 240         | 1644            | 1562          | 2            | 66     | 0             | 0               | 291          | 11        | 3       |
| Bering Sea and Chukchi Sea | <i>Wakatake maru</i> | Research   | Jun 29-Jul 12 | 14            | 420       | 565     | 1175 | 3606  | 1    | 17      | 1     | 0     | 0            | 37          | 0               | 0             | 0            | 0      | 4             | 0               | 1            | 12        | 0       |
|                            |                      | Commercial | Jun 29-Jul 12 | 14            | 266       | 306     | 599  | 5638  | 1    | 9       | 0     | 0     | 0            | 1           | 0               | 0             | 0            | 1      | 0             | 0               | 0            | 10        | 0       |
|                            |                      | Longline   | Jun 24-Jul 11 | 18            | 540       | 57      | 489  | 625   | 0    | 10      | 0     | 0     | 0            | 0           | 0               | 0             | 0            | 0      | 19            | 0               | 0            | 0         | 0       |
|                            |                      | Long line  | Jul 28-Aug 02 | 4             | 40        | 0       | 18   | 0     | 3    | 2       | 0     | 0     | 0            | 0           | 0               | 0             | 0            | 0      | 0             | 0               | 0            | 0         | 0       |
|                            | <i>Oshoro maru</i>   | Trawl      | Jul 31-Aug 01 | 3             |           | 0       | 51   | 0     | 0    | 0       | 0     | 0     | 0            | 0           | 0               | 0             | 0            | 0      | 0             | 0               | 0            | 0         | 0       |
|                            |                      | Hook and L | Jul 25-Aug 02 | 7             |           | 8       | 11   | 2     | 12   | 0       | 0     | 0     | 0            | 0           | 0               | 0             | 0            | 0      | 0             | 0               | 0            | 0         | 0       |
|                            |                      | SubTotal   |               |               |           | 936     | 2343 | 9871  | 17   | 38      | 1     | 0     | 0            | 38          | 0               | 0             | 0            | 1      | 23            | 0               | 1            | 22        | 0       |
| Total                      |                      |            |               |               |           | 951     | 2940 | 10350 | 545  | 57      | 39    | 0     | 3663         | 587         | 2347            | 3390          | 9            | 98     | 23            | 0               | 2047         | 49        | 5       |

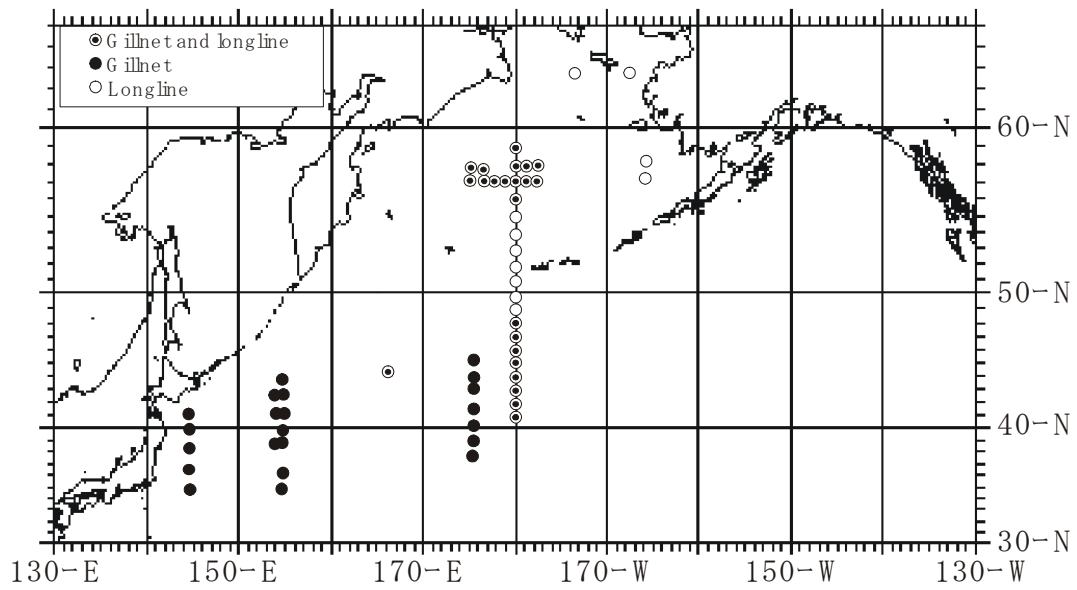


Fig. 1. Sampling locations for Japanese salmon research vessels in the North Pacific Ocean from May to August of 2007.

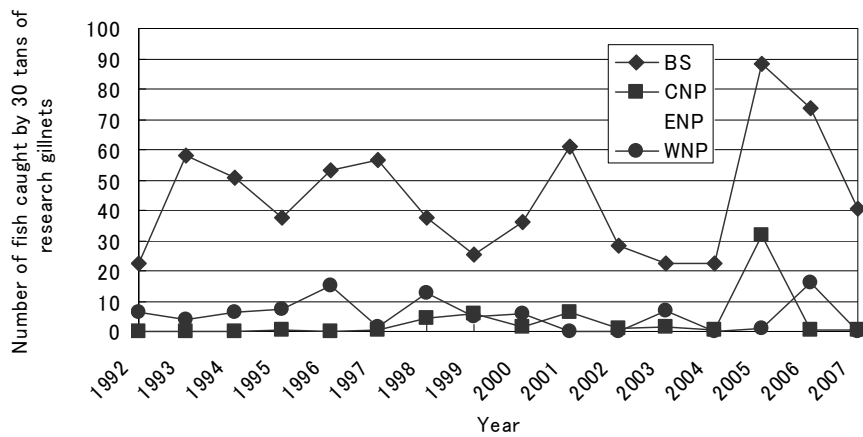


Fig. 2. Number of sockeye salmon caught by 30 tans of research gillnets in summer of 1992-2007 in the North Pacific Ocean.

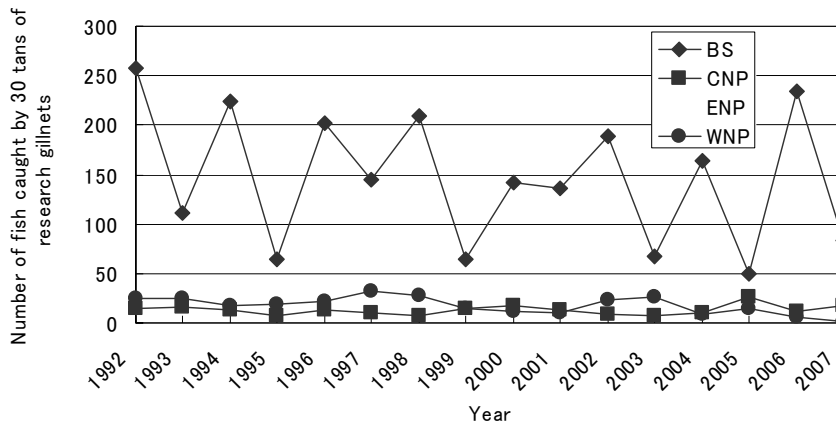


Fig. 3. Number of chum salmon caught by 30 tans of research gillnets in summer of 1992-2007 in the North Pacific Ocean.

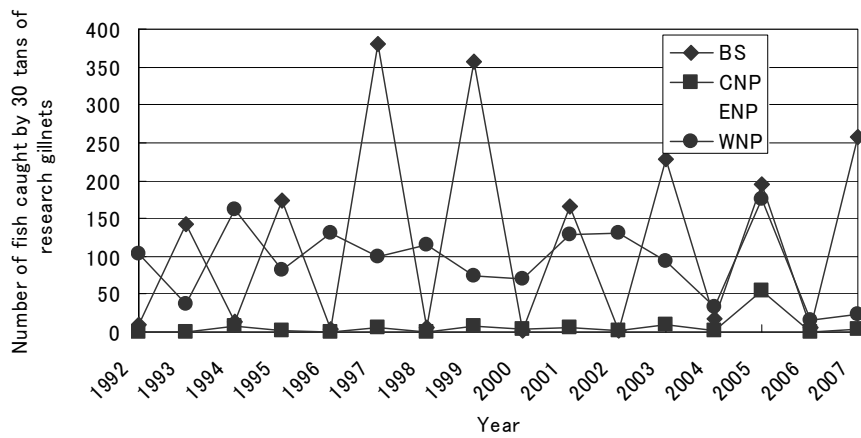


Fig. 4. Number of pink salmon caught by 30 tans of research gillnets in summer of 1992-2007 in the North Pacific Ocean.



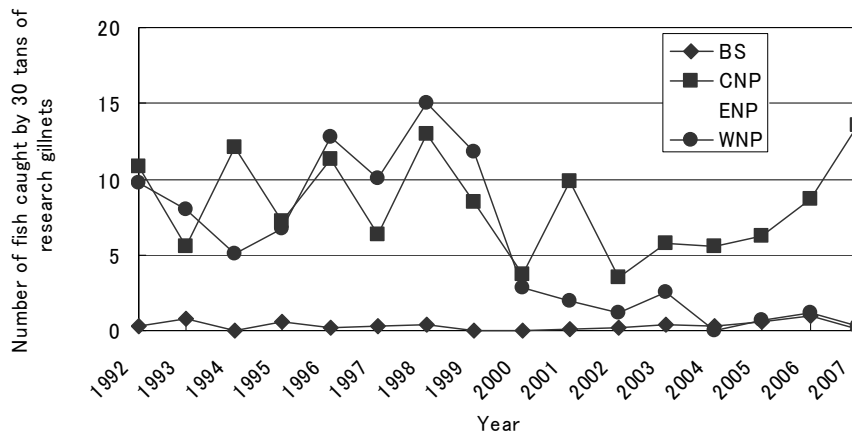


Fig. 5. Number of coho salmon caught by 30 tans of research gillnets in summer of 1992-2007 in the North Pacific Ocean.

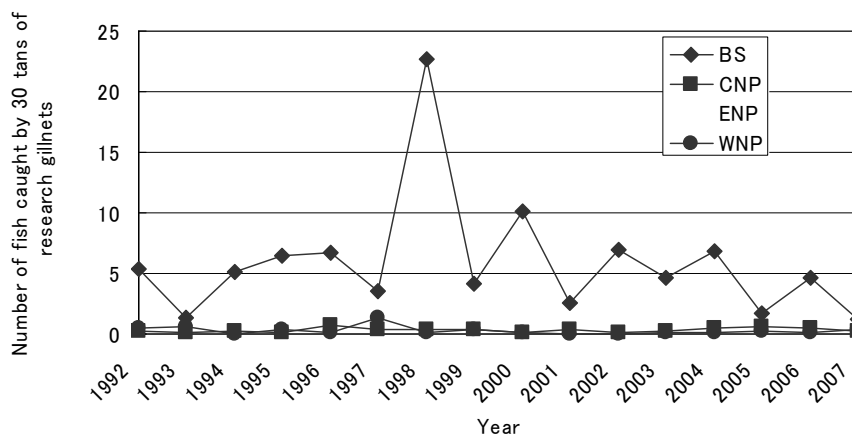


Fig. 6. Number of chinook salmon caught by 30 tans of research gillnets in summer of 1992-2007 in the North Pacific Ocean.

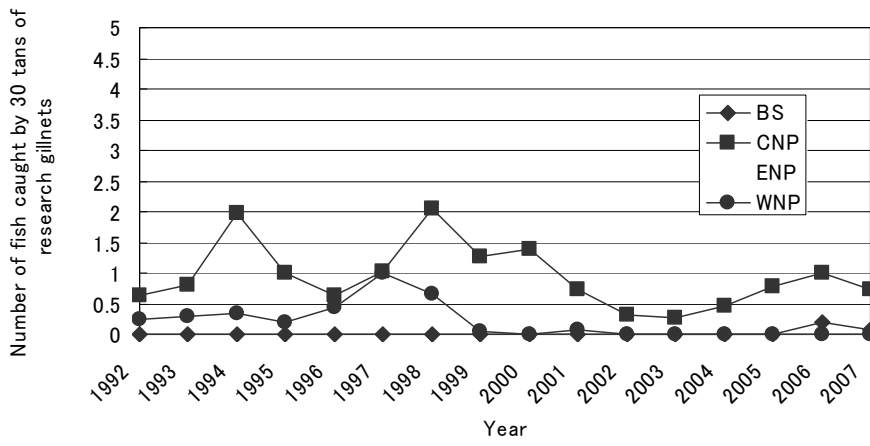


Fig. 7. Number of steelhead trout caught by 30 tans of research gillnets in summer of 1992-2007 in the North Pacific Ocean.