Trends in the Russian fishery in the North Pacific in relation to basic stock conditions and its variability under the climate changes


Vladimir I. Radchenko
Sakhalin Research Institute of Fisheries \& Oceanography, 693023, Russia, vlrad@sakhniro.ru

# Russian fishery fleet composition in the Fareastern region, 1990-2004 



## Fishery methods' conribution to the total Russian fishery harvest (on example of 2005)

## 76,3\%



1 - bottom \& pelagic trawls; 2 - purse seine; 3 - beach seines and stationary nets; 4 Dutch seine; 5 - pots; 6 - long-line; 7 - divers; 8 - gillnets; 9 - dredge; 10 - saury traps

Composition of the Russian fishery harvest in the far-eastern region, on example of 2004

| Pelagic (\& semi-demersal) |  |  | Demersal and | $\mathbf{2 1 3 , 2 5 8}$ | $\mathbf{1 2 , 6 \%}$ |
| :--- | :---: | :---: | :--- | :---: | :---: |
| fish: | $\mathbf{1 3 6 3 , 3 8 6}$ | $\mathbf{8 0 , 4 \%}$ | groundfish: | 65,846 | $3,9 \%$ |
| walleye pollock | 880,746 | $51,9 \%$ | Pacific cod | 66,435 | $3,9 \%$ |
| Pacific herring | 190,114 | $11,2 \%$ | Flatfish | 22,028 | $1,3 \%$ |
| Pacific salmon | 166,050 | $9,8 \%$ | Grenadiers | 20,369 | $1,2 \%$ |
| Greenlings | 48,970 | $2,9 \%$ | Saffron cod | 17,030 | $1,0 \%$ |
| Pacific saury | 73,696 | $4,3 \%$ | Halibut and turbot | 15,981 | $0,9 \%$ |
| Anchovy | 0,117 | $0,0 \%$ | Sculpins | 1,655 | $0,1 \%$ |
| Capelin and smelts | 3,394 | $0,2 \%$ | Skates | 1,487 | $0,1 \%$ |
| Other | 0,299 | $0,0 \%$ | Hakeling | 1,067 | $0,1 \%$ |
| Mollusks: | $\mathbf{7 5 , 8 8 3}$ | $\mathbf{4 , 5 \%}$ | Sea perches | $\mathbf{1 , 3 6 0}$ | $0,1 \%$ |
| Commander squid | 55,992 | $3,3 \%$ | Other | 38,803 | $\mathbf{2 , 3 \%}$ |
| Other cephalopods | 4,088 | $0,2 \%$ | Crustaceans: | 25,670 | $1,5 \%$ |
| Gastropods | 9,923 | $0,6 \%$ | Snow crabs | 7,158 | $0,4 \%$ |
| Clams | 5,880 | $0,3 \%$ | King crabs | 0,010 | $0,0 \%$ |
| Echinoderms: | $\mathbf{1 , 1 9 4}$ | $\mathbf{0 , 1 \%}$ | Hairy crab | 5,096 | $0,3 \%$ |
| Sea algae: | $\mathbf{3 , 2 1 9}$ | $\mathbf{0 , 2 \%}$ | Northern shrimp |  | 0,869 |
|  |  |  | Other | $0,1 \%$ |  |

# List of fishery species regarded by WG 16 in priority order for the Russian fishery: 

- Highest priority:
- 1. walleye pollock
- 2. pink salmon
- 3. sockeye salmon
- 4. red king crab
- 5. Pacific herring
- 6. Pacific saury
- 7. chum salmon
- 8. Pacific cod
- 9. snow crab
- No significance:
- 1. Pacific hake
- 2. arrowtooth flounder
- 3. Pacific sardine
- 4. Spanish mackerel
- 5. small yellow croaker
- 6. hairtail

No significance now but the highest priority in the recent past:

1. Japanese sardine (1972-1993)
2. jack mackerel (1980-1990)

Low priority:

1. Tanner crab
2. rock sole (Note: yellowfin sole is regarded as the basic species of flatfish fishery)
3. Pacific ocean perch
4. common squid
5. flathead sole
6. chub mackerel
7. neon flying squid
8. anchovy

Russian catch of walleye pollock in the western Bering Sea according to different sources, 1965-2003


Fishery harvest in the westem Bering Sea, 1965-2005


Graph of the total fishery harvest in the western Bering Sea (in limits of Russian EEZ) looks as the unimodal curve with maximum in the end of 1980s. Collapse in the mid of 1990s is related to general industry depression during quick reformation of the Russian economy. Walleye pollock overwhelm other species in the harvest composition and blur their catch dynamics on the general picture. Removing Pollock, we can see that catches of Pacific cod, saffron cod, flatfish and Pacific salmon were relatively higher in the warm 1980s than in 1990s. Pacific salmon demonstrate biannual fluctuation due to interchange of low productive even year broodline and high productive odd year broodline of the eastern Kamchatka pink salmon. In the contrary, Pacific herring catches were significantly higher in years of low level of walleye pollock stocks.

## Walleye pollock catch by Rus sian fishery, 1965-2005



Russian fishery catch of $\mathrm{Pacific} \mathrm{cod}, 1965-2005$


Fishery harvest in the Sea of Okhotsk (Russian EEZ), 1965-2005


Fishery harvest graph in the Sea of Okhotsk reveals abrupt decline in 1976 related as to herring fishery collapse, as to decline in pollock catch.
Expected Okhotsk herring stock restoration occurred in the second half of 1990s.
However, it did not reach a level of 1960s. Pacific salmon ensure more stable contribution in the total harvest than in the Bering Sea. Productive broodline of pink salmon occurred on the eastern Sakhalin in the odd years while on the western Kamchatka and the western Iturup Island - in even years. Crabs and Pacific cod harvest decreased in the last years while flatfish and saffron cod stocks remained relatively stable. Crab stocks (red king crab-0.4\%, Snow crab-0.7\% of total) were strongly exhausted by fishery, but they continue to play important role because of the high market cost.

Pacific herring catch by Russian fishery, 1965-2005


Russian catch of Pacific sardine during their abundant approaches in 1974-1993


Russian fishery catch value in the western Bering Sea, 1965-2005



Russian fishery catch value in the western Bering Sea, residuals after the linear trend, 1965-2005





Russian fishery catch value in the Sea of Okhotsk, 1965-2005


Russian fishery catch value in the Sea of Okhotsk, residuals after the linear trend, 1965-2005




Pink salmon catch residuals relative to the ocean heat content, 1963-2004


No. of cases: 42
Tukey weights:0,000, 2500, 5000, 2500 0,000


Spectral analysis shows well expressed biannual cycle and supposes existence of 22 -years cycle

## Conclusions:

- 1. Fishery harvest variability reflects as the fishery stock condition dynamics as development of fishery and processing fleet.
- 2. Fishery stock dynamics can be blurred by different trends of regional stock components.
- 3. Among main natural factors effecting fishery and fish stock conditions, the periodically fluctuating processes and factors with lasting trends can be conditionally selected. E.g., Asian pink salmon catch dynamics are likely affected by both groups of factors.
- 4. Analysis of residuals is a promising tool in the catch data series studies.

