# North Pacific Salmon Catches and Hatchery Releases, 1993 to 2009

*Compilation and dissemination of catch and enhancement statistics for Pacific salmon and steelhead stocks in the Convention Area and adjacent seas are requirements of the NPAFC Convention for the Conservation of Anadromous Stocks in the North Pacific Ocean (Article X 2.[b]. Statistics compiled by the NPAFC comprise commercial, sports, and subsistence salmon catches stratified by country, species, and regional area, and provide the basis for assessment of North Pacific salmon stocks.*

Over the spring and early summer, I was involved in the production of the latest hard copy version of the NPAFC 2005-2007 Statistical Yearbook and updates through 2009 of the web-based statistics. This provided an opportunity to learn about current catch and release trends of North Pacific salmon. My objective in this summary is to highlight catch trends and indicate anadromous stock status reports recently prepared by researchers.

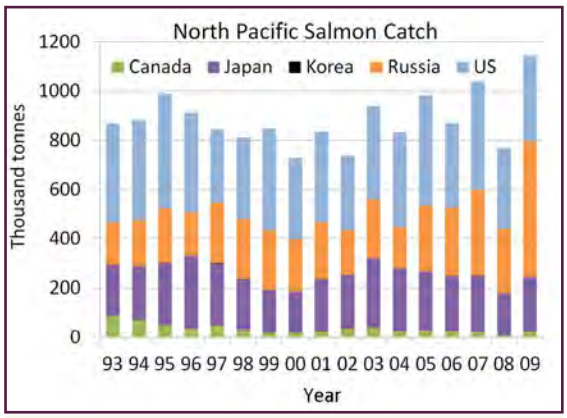


Fig. 1. Salmon commercial catch weight (tonnes) by NPAFC-member countries, 1993-2009.

Based on overall catch statistics, the stock status of North Pacific salmon is characterized as being in a favourable condition. For example, stock status has recently been reported as, "highest on record"[1], at a "high level of abundance"[2], and "very healthy"[3]. The total commercial catch of anadromous fish by NPAFC member countries in 2009 was 1.1 million tonnes; the highest recorded since 1993 (Fig. 1). Major catches in 2009 were reported by Russia (552 thousand tonnes), United States (Alaska; 332 thousand tonnes), and Japan (219 thousand tonnes). Pink (608 thousand tonnes) and chum salmon (359 thousand tonnes) constituted the majority of the catch, followed by sockeye (147 thousand tonnes), coho (20 thousand tonnes), and Chinook salmon (6 thousand tonnes) (Fig. 2).

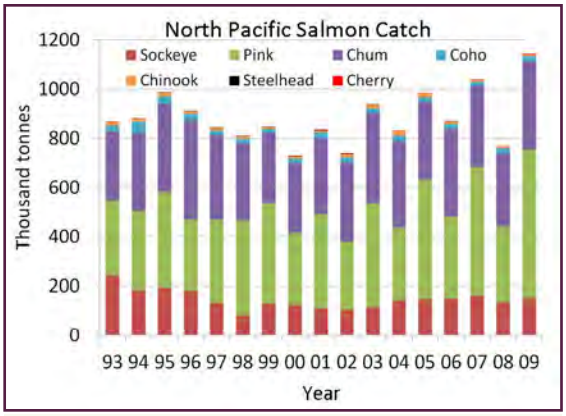


Fig. 2. Salmon commercial catch weight (tonnes) by species, 1993-2009.

Commercial catch data can be separated into stocks originating in the northwest (Japan, Korea, and Russia) and northeast Pacific (Canada and US; Fig 3). Salmon abundance can differ between the two regions: the northwest Pacific catches higher amounts of pink and chum salmon than the northeast. The high commercial catch in 2009 was generated mostly by commercial catches of pink salmon in the northwest Pacific (Fig. 4). In this region, pink salmon, known for its alternating-year abundance cycle[4], has shown high production in odd-numbered years since 2001 and the

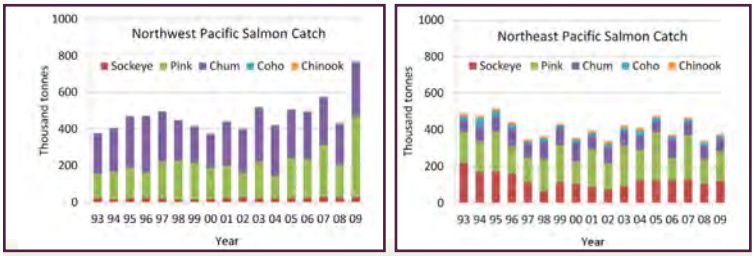


Fig. 3. Salmon commercial catch weight (tonnes) by species grouped by region. Northwest Pacific is the sum of catches by Japan, Republic of Korea, and Russia. Northeast Pacific is the sum of catches by Canada and US.

harvest in 2009 increased by 50% over what it was in 2007[5]. The northwest region produces approximately 80% of total North Pacific chum salmon catches (Fig. 5).

In contrast, the northeast North Pacific produced higher catches of sockeye, coho, and Chinook salmon (Figs. 6-8). Alaskan fisheries generally target chum, pink, and sockeye salmon and catches have been relatively high since 1993. Although overall commercial catch of these species in North America has been highly stable for the past decade, Chinook and coho salmon

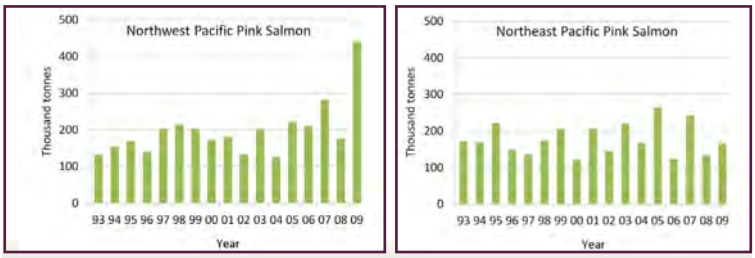


Fig. 4. Pink salmon commercial catch weight (tonnes) grouped by region. Northwest Pacific is the sum of catches by Japan, Republic of Korea, and Russia. Northeast Pacific is the sum of catches by Canada and US.

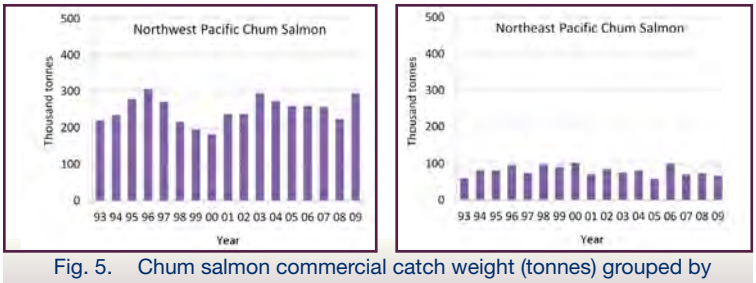


Fig. 5. Chum salmon commercial catch weight (tonnes) grouped by region. Northwest Pacific is the sum of catches by Japan, Republic of Korea, and Russia. Northeast Pacific is the sum of catches by Canada and US.

catches are decreasing in southern British Columbia and the US Pacific Northwest[1].

Recent studies have reported that fluctuation in salmon abundance, growth, or survival is associated with climatic regime shifts[6, 7, 8]. It has been suggested these environmental changes are linked to salmon populations by changing water temperature and salmon prey abundance[2]. The current high abundance of North Pacific salmon is likely related to favourable conditions for northern stocks associated with an oceanic regime starting in 1989[9].

Current high salmon production may also result from increases in the quantity and quality of salmon hatchery production. In 2009, salmon hatcheries released nearly 4.8 billion salmon into the North Pacific, mostly released from Japan (41.2%), United States (33.7%), and Russia (18.8%), followed by a much lesser degree by Canada (6.2%) and Korea (0.1%, Fig. 9). Most salmon hatchery releases were chum (62.6%) and pink salmon (27.8%), followed by sockeye (4.7%), Chinook (3.2%), and coho salmon (1.3%). Survival of hatchery releases may contribute to the total stock size of adult fish. However, some view high salmon abundance, especially in Asia, to be more closely related to climate change than to increased hatchery releases, or at least a combination of both factors[10]. In recent years, the number of hatchery releases has been decreasing in the US Pacific Northwest and British Columbia, probably due to the focus in those regions on wild stock conservation. Wild juveniles might have higher survival rates than hatchery fish in a stressful marine environment[11], and it is reasonable to prepare for future climate change by focusing on conservation of wild runs, particularly in regions near the southern limits of salmon distribution.

One might ask “what if salmon abundance was to approach or exceed

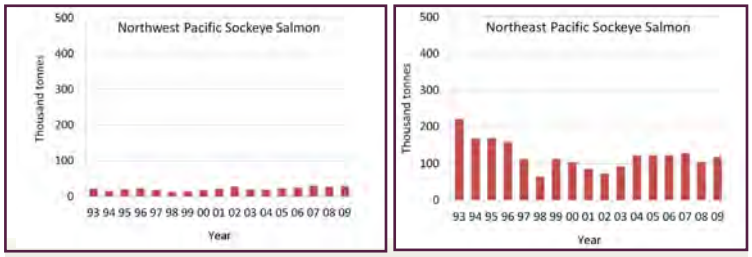


Fig. 6. Sockeye salmon commercial catch weight (tonnes) grouped by region. Northwest Pacific is the sum of catches by Japan, Republic of Korea, and Russia. Northeast Pacific is the sum of catches by Canada and US.

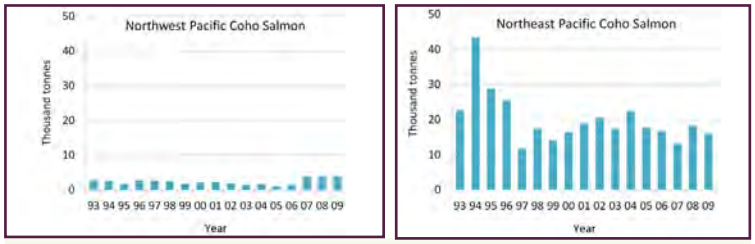


Fig. 7. Coho salmon commercial catch weight (tonnes) grouped by region. Northwest Pacific is the sum of catches by Japan, Republic of Korea and Russia. Northeast Pacific is the sum of catches by Canada and US.

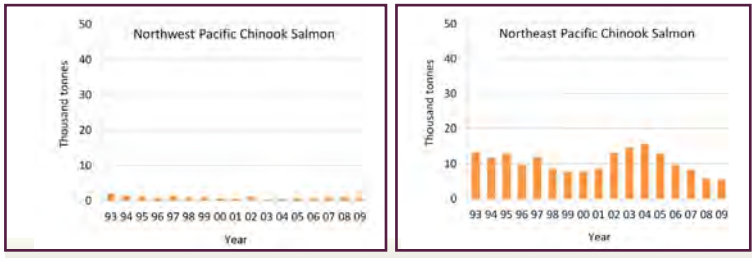


Fig. 8. Chinook salmon commercial catch weight (tonnes) grouped by region. Northwest Pacific is the sum of catches by Japan, Republic of Korea, and Russia. Northeast Pacific is the sum of catches by Canada and US.

carrying capacity?" Although Pacific salmon can cover vast areas of the ocean during their migration, exceeding carrying capacity could result in something similar to putting too many fish in one water tank: decreased food and increased stress. Studies of Hokkaido chum salmon suggest that under some conditions, increases in fish population result in smaller adult size and increased age of maturity[12, 13, 14, 15]. With an eye to minimizing the decline of economic yields from salmon[16], future hatchery projects should be carefully considered.

In summary, recent statistical data show us there are still regional stocks that warrant concerns despite high total commercial salmon catches by NPAFC member countries. It is likely that the historically high pink and chum salmon stock abundance is at least partially generated by the present favourable climate regime. Improved hatchery practices also likely contribute to high salmon abundance. Catches of sockeye, coho, and Chinook salmon in British Columbia and the US Pacific Northwest are decreasing, where hatchery releases are lower and there is growing concern for wild-run conservation.

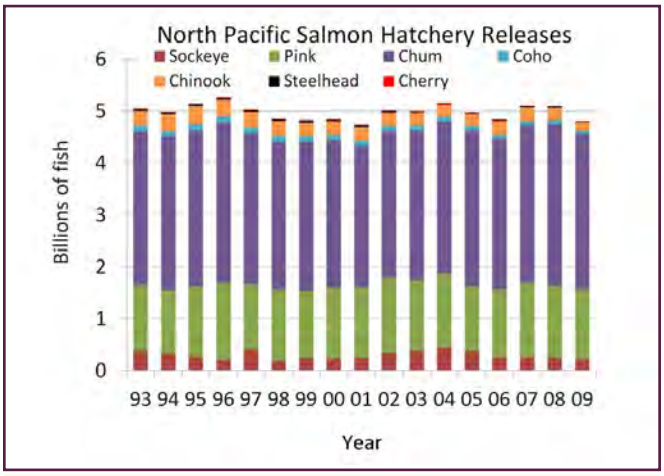


Fig. 9. Salmon hatchery releases by NPAFC-member countries, 1993-2009.

Abundance of North Pacific salmon is sensitive to ocean conditions and human activities (e.g. fisheries, hatcheries, dam construction); therefore, integration of knowledge from multiple scientific fields is critical to improve forecasts[17]. In October the NPAFC will host a workshop for experts to review explanations for the high abundance of pink and chum salmon, discuss likely future trends, and suggest areas for future research to improve forecasting (see announcement, this issue). Monitoring salmon stock status and increasing the capacity to forecast stock fluctuations of Pacific salmon is now a major focus for information exchange and cooperation among NPAFC member countries.

References and notes

[1] J. Irvine, M. Fukuwaka, ICES J. Marine Sci, **68**, 1122 (2011)
[2] R. Beamish, NPAFC Bull. **4,** 1 (2007)
[3] R. Beamish, PICES Press, **14,** 23 (2006)
[4] Pink salmon have genetically distinct runs in alternate years because of their prescribed 2-year life-cycle.
[5] V. Radchenko, O. Temnykh, V. Lapko, NPAFC Bull. **4**, 7 (2007)
[6] R. Beamish, D. Bouillon, Clim. Change North. Fish Pop. 585 (1995)
[7] M. Kaeriyama *et al*., Fish. Oceanogr. **13**, 197 (2004)
[8] D. Noakes, R. Beamish, Mar. Coastal Fish. **1**, 155 (2009)
[9] J. Irvine *et al*., NPAFC Doc. 1199 (2009)
[10] K. Morita, H. Morita, M. Fukuwaka, Can. J. Fish. Aquatic. Sci., **63**, 55 (2006)
[11] M. Saunders, NPAFC Doc. 1219 (2010)
[12] M Kaeriyama, H. Seo, H. Kudo, NPAFC Bull. **5**, 293 (2009)
[13] K. Nagasawa, NPAFC Bull. **2**, 21 (2000)
[14] M. Kaeriyama, NPAFC Bull. **1**, 90 (1998)
[15] M. Fukuwaka *et al*., NPAFC Bull. **4**, 35 (2007)
[16] Morita *et al*., ICES J. Marine Sci., **63**, 1353 (2006)
[17] R. Beamish, Am. Fish. Soc. Symp., **71**, 45 (2009)

***Yuka Ogata***
***NPAFC Intern***

Ms. Yuka Ogata was born in Niigata, Japan. Her interest in the natural world started in childhood with an early skill in catching crawfish from local ponds. She later went on to complete a BA in Oceanography from Tokai University and a MS in Agriculture from University of Tokyo. She is currently a PhD candidate at University of Tokyo in the Department of Global Agricultural Sciences where she will soon complete her studies on developing culture techniques in Southeast Asia for zooplankton (rotifers), which is a critical live food source for first-feeding larval fish used in fish farming.

Yuka joined the NPAFC Secretariat in January, 2011, for six months as its first intern. During her stay in Vancouver, Yuka could often be found jogging the circuit in Stanley Park, visiting local antique shops in her quest for vintage kitchenware, or following her favourite local ice hockey team.