The Enforcement Evaluation and Coordination Meeting (EECM) was held on April 20-21, 2010 at the Sakhalin Convention Center in Yuzhno-Sakhalinsk, Russia. The meeting was opened by Vladimir Fedorenko, Executive Director of the NPAFC and chaired by the Chairman of the Committee on Enforcement (ENFO), Jun Inamura of Japan.

The member countries provided detailed information on their 2009 patrol activities in the Convention Area regarding their patrolled areas and hours, assets used and radar satellite system. The Parties reported that no HSDN fishing activities were observed during their patrols in the area.

The United States Coast Guard (USCG) presented their 2009 threat assessment noting that the overall threat area has shifted north and that the High-Threat area is the western portion of the NPAFC Convention Area. This could be as the result of the high fuel prices and of shifts in water surface temperatures. A couple of possible HSDN vessels were sighted but believed to have been targeting neon flying squids. The record high salmon catches in Russian waters, the high number of frozen stored salmon availability and the shift of targeting species could be the reasons for the reduced numbers of HSDN vessels. However, the reduced number of enforcement patrols may have also contributed to the reduction of sighting numbers. The USCG categorized the overall threat level for 2010 HSDN activity in the North Pacific Ocean to be medium.

A Russian scientist from SakhNIRO (Sakhalin Research Institute of Fisheries and Oceanography) informed the group that the 2009 salmon catches were a record high in the Sakhalin region with more than 250,000t of pink, and 40,000t of chum, though 2010 catches will not be as large as in 2009. A low return for 2011 is expected with the main species likely to be pink salmon.

The Parties exchanged their patrol plans for the 2010 season. The United States proposed bi-weekly conference calls through the 2010 season among the Parties to discuss enforcement activities and to exchange information in a more timely manner. While waiting for the official approval from the Parties at the next Annual Meeting, the United States invited the Parties to join their own bi-weekly conference calls starting in May.

Standardizing the map of NAPFC Convention Area’s patrol area was proposed by the United States. A Universal Convention Area Patrol Grid would make better use of the assets and would alleviate the use of different patrol grids of the Convention Area. While there are detailed issues to be clarified and solved before obtaining approval of its use at the 2010 Annual Meeting, the
The NPAFC Committee on Scientific Research and Statistics (CSRS) held the Research Planning and Coordinating Meeting (RPCM) in Vancouver, Canada on May 19-20, 2010. All Parties of the Commission and the Secretariat were represented at the meeting.

The Parties presented 2010 research plans and cruise activities, and reviewed exchange of biological samples, data, and personnel. Canada currently maintains two research programs to understand the processes regulating Pacific salmon production: an offshore program conducted off the west coast of British Columbia and Southeast Alaska, and an inshore program conducted in the Strait of Georgia and Puget Sound. Japan explained salmon research cruise plans by R/V Oshoro maru, Wakatake maru and Kaiun maru in the western and central North Pacific Ocean and Bering Sea. Russia described three research cruise plans on studies for the marine life of Pacific salmon. The TINRO-Center will continue monitoring of the state of ecosystems in the Bering Sea, Okhotsk Sea and western North Pacific Ocean by R/V TINRO and R/V Professor Kaganovsky. The United States presented cruise plans for the Southeast Alaska Coastal Monitoring and eastern Bering Sea. The NOAA ship Oscar Dyson will be used to collect biological information and provide descriptions of the physical and biological oceanographic conditions.

The Scientific Sub-Committee (SSC) members reviewed current 2006-2010 Science Plan, development of new Science Plan, future symposia and workshops. The Working Group on Stock Assessment (WGSA) noted that the total salmon catch in 2009 was the highest in record (approximately 1.1 million tonnes). The increase was mainly due to large pink salmon catches in Russia. The Working Group on Salmon Marking (WGSM) met via email, and submitted the report of their discussion. The status of the NPAFC Otolith Mark Database is much more complete than it was a year ago. The ad hoc Working Group on Stock Identification (WGSI) corresponded through email to report updates on projects of mutual interest to the NPAFC Parties. The Working Group on Salmon Tagging (WGST) discussed by email communication on: (1) new design of NPAFC-logo tag; (2) tagging plans in 2010; (3) donation of reward caps by the High Seas Salmon Group; and (4) updating and improvement of...
tagging information on the NPAFC website.


Each Party suggested the format of future RPCM, which will be decided at the next 2010 Annual Meeting. SSC chairperson proposed to hold a workshop in conjunction with the 19th Annual Meeting in Nanaimo, Canada in fall of 2011 or spring of 2012. The workshop topic might be “Why can pink and chum salmon keep their high biomass in the ocean?” SSC will prepare a workshop proposal in cooperation with the Secretariat for consideration at the next Annual Meeting.

NPAFC will celebrate its 20th anniversary in 2012. According to the Commission’s recommendation at 2009 NPAFC Annual Meeting, the editorial group proposed a publication plan for the anniversary book. The editorial group will facilitate the publication as scheduled and will report its progress at the next Annual Meeting.

The 2010 RPCM was very productive and meaningful for the future work. All the participants appreciated the excellent hosting of the meeting by Canadian delegation. The Parties look forward to the 18th Annual Meeting in Busan, Korea.

Jin Yeong Kim
CSRS Chairperson

RPCM in session
Photos by NPAFC Secretariat
A special workshop examining climate change impacts on salmon was held on April 25, 2010 in association with PICES/ICES/FAO International Symposium on Climate Effects on Fish and Fisheries held in Sendai, Japan. Scientists working with the North Pacific Anadromous Fish Commission (NPAFC) organized the workshop that consisted of 9 oral presentations (20 min each), 5 oral poster presentations (10 min each), and 2 discussion sessions. Presentations were diverse and informative. The majority (12/14) dealt with Pacific salmon (9 marine, 2 fresh water, 1 knowledge/database) while 2 presentations dealt with Atlantic salmon.

The first presentation by Irvine and Fukuwaka set the stage for much of the rest of the day, providing an overview of abundance trends for Pacific salmon at the scale of the North Pacific, Asia, and North America (Fig. 1). All nation’s commercial catch data indicate that marine production of Pacific salmon is at all time high levels, dominated by chum and pink salmon, albeit with significant contributions from hatcheries. High levels of synchrony among regions for catches of chum and pink salmon were found by Fukuwaka et al., although the response of salmon abundance to various climate indices varied among regions. Hyunju Seo, who presented the paper by Kaeriyama et al., showed that increased temperatures have resulted in faster growth and survival for Hokkaido age-1 chum salmon. Interestingly, this may lead to population density-dependent effects that will ultimately reduce the growth and extend the maturation schedule for chum salmon in the Bering Sea. Farley et al. reported results from their research in the eastern Bering Sea that fortuitously covered four consecutive warm years (2002-2005) followed by four cool years (2006-2009). Warm years tended to benefit age 0 walleye pollock resulting in higher growth potential for salmon. Farley et al. also reported preliminary results from Russian work carried out in Feb/March 2009 evaluating sockeye salmon lipid levels.

Mundy and Evenson concluded that the timing of spawning migrations of high latitude Chinook salmon will become more highly variable as climate warms. Wainwright and Wettkamp used an ecosystem approach to evaluate climate effects on Oregon coho salmon. They concluded that climate change will likely have a strong negative effect on coho, although there remains great uncertainty in biological responses. Reed et al. applied an evolutionary model to predict how well some Fraser River sockeye salmon might respond to predicted changes in river temperature resulting from global warming. They concluded the persistence of some salmon populations will depend on their ability to adapt quickly, which will be determined by the existence of sufficient genetic variation. Peterman et al. described the development of a Salmon Monitoring Web site designed to help in the design of salmon monitoring.
monitoring programs. Wasserman described the successful experience of the Skagit Climate Science Consortium who are integrating scientific analyses at the watershed level in order to manage salmon populations in the face of climate change.

Both Piou and Prévost and Prusov et al. described their findings on populations of Atlantic salmon in the Scorff River (France) and the White Sea (northwest Russia) respectively. Piou and Prévost’s models projected climate change-related life history effects, concluding that marine conditions and fresh water flow regimes are of utmost importance in determining stock abundance. Prusov et al. documented changes in Atlantic salmon growth and age compositions during recent years of increasing temperatures but concluded that changes in management practices have thus far had the greatest impact on the status of northern populations of Atlantic salmon. Miyakoshi et al. documented changes in coastal temperatures around Hokkaido and described plans to adjust the release timing of young chum salmon to take advantage of these changes in an attempt to increase salmon survivals. Ishida and his colleagues’ archeological work showed that the distribution of chum salmon in Japan during an earlier warmer period was more northerly than it is today, and predicted similar northerly shifts in salmon distribution with climate change. Jennifer Neilson, presenting the paper by Ruggerone et al., demonstrated that Chinook salmon growth was related to their previous growth history and pink salmon abundance while coho salmon growth was strongly linked with pollock abundance, which was linked to temperature.

Following presentation of papers and posters, separate discussion sessions considered the broad topics of forecasting impacts and long-term research needs. Participants had been previously provided with a link to the recent NPAFC document describing a proposed long term research and monitoring plan (www.npafc.org/new/pub_special.html). Although it was not possible to thoroughly debate all the above questions in the limited time available, there appeared to be consensus on some issues:

- The North Pacific is currently producing large amounts of salmon but rates of increase seen during the last 20 years will not continue.
- Climate change is already affecting salmon differently in northern and southern regions. There will be additional northward shifts in the southern boundary of salmon distribution. There was no consensus whether the northern boundary would shift further in to the Arctic.
- Marine production of pink and chum salmon is increasing, but there was no consensus how much of this might be due to ecosystem changes vs. enhancement.
- A proper understanding of climate effects on salmon requires consideration of each life history stage. Phases to focus on include: freshwater residence, early marine (first couple of months) and the first winter at sea.
- Important areas of future research include improving our understanding of effects of interactions between hatchery and wild salmon in their early marine environment, and linkages between coastal oceanography and young salmon growth and survival.
- Integrated research programs including experts from multiple disciplines and countries are most likely to improve our knowledge base.

Manuscripts submitted following the workshop will be reviewed and considered for publication in the symposium proceedings to be published by ICES Journal of Marine Science.

The workshop was organized and convened by Drs. Jim Irvine (Canada), Masa-aki Fukuwaka (Japan), Suam Kim (Republic of Korea), Vladimir Radchenko (Russia, unable to attend), Loh-Lee Low (USA), and Shigehiko Urawa (NPAFC).
Bill Heard Marked 50 Years of Service in Salmon Research


His first involvement with Pacific salmon was in 1958 as a graduate student at Brooks Lake in Katmai National Park, Bristol Bay, Alaska. After earning a bachelor’s degree in zoology and a master’s degree in fisheries from Oklahoma State University, he returned to Brooks Lake in 1960 with a permanent job as a NOAA fisheries biologist studying sockeye salmon and other fishes. In 1965 his work began in Southeast Alaska to research the life histories and stock enhancement of pink, chum, coho, and Chinook salmon. Since the 1980s he has managed the Marine Salmon Interactions Program at Auke Bay Laboratories, which focuses on the early marine ecology of juvenile salmon to determine the primary causes of marine mortality and development of year class strength.

Bill has always been interested in fishes and most other vertebrates and all aspects of natural history including the life histories and behavior of birds and mammals. He has produced over 60 scientific publications including his famous review paper “Life History of Pink Salmon” which appeared in “Pacific Salmon Life Histories” edited by Groot and Margolis (1992).

He is currently a regular US science adviser for NPAFC and an active member of the Working Group on Salmon Tagging, where he has made valuable contributions such as creation of NPAFC-logo disc tags for the international high-seas tagging program. Bill is also serving as an adviser for the Pacific Salmon Commission and the Aquaculture Panel for the United States and Japan Cooperative Program in Natural Resources.

Bill lives in beautiful Juneau, Southeast Alaska with his wife Charlotte. He is also known as a famous sport fisherman and bird-watcher. Of course, a rocking-chair retirement is out of the question for him. With his limitless energy, constant good humor, and consummate professionalism, Bill is building his science legacy in Alaska.

Shigehiko Urawa, NPAFC Secretariat

Parties agreed in principle on the efficiency and the usefulness of the map.

Canada presented a short promotional DVD on tuna management and enforcement used at ICCAT. The Parties were all in favour of NPAFC creating a similar film which would educate the public of the NPAFC’s enforcement activities and at the same time act as part of a deterrent for illegal harvesting industries. The Committee of Scientific Research and Statistics (CSRS) may join ENFO in order to have scientific coverage included in the film.

It was still winter in Yuzhno-Sakhalinsk with streets still covered with snow (it even snowed one day). However, the Russian host’s warm hospitality made all the participants forget the cold weather and made it feel like spring. The United States invited to host the next EECM but the location has yet to be announced.

Jun Imamura
ENFO Chairman
**Project Overview**

High seas salmon tagging has been conducted since the 1950s by placing disk tags (Photo 1) on salmon and steelhead during research cruises in the North Pacific Ocean, Gulf of Alaska, and Bering Sea. These studies have been used to investigate ocean distribution, migration, and growth of salmon at sea. Reporting salmon and steelhead tag recoveries is important because it provides direct evidence of the current distribution and ocean habitat of salmon, which can be affected by climatic changes and helps to conserve salmon stocks in North Pacific ecosystems. Some disk-tagged fish also carry an electronic tag (Photo 2 and 3). Recoveries of undamaged electronic tags provide detailed information on the individual salmon’s behavior by recording the fish’s swimming depth and other information about the fish’s habitat (see NPAFC Newsletter No. 22). Disk tags and electronic tags are easy to see because they are placed outside the fish’s body, near the dorsal fin. Please return high seas salmon and steelhead tags.

**Rewards for Tag Recovery**

Everyone in the public (except for fishery-agency personnel) who returns a NPAFC High Seas Tag will receive a custom-embroidered baseball cap with the high seas salmon tagging emblem (Photo 4). In addition, people who return tags will be entered into a drawing for cash prizes. There will be a total of three prizes:

- 1st Prize CDN$500
- 2nd Prize CDN$300
- 3rd Prize CDN$200

The drawing will take place at the NPAFC 19th Annual Meeting in 2011/2012. Only non-fishery agency personnel are eligible for receiving the cap and the entry into the drawing. Each drawing entry must include the name and mailing address of the person who returned the high seas tag to national contacts (see list below) between October 15, 2009 and 15 days before the 19th NPAFC Annual Meeting (the exact date will be announced on the NPAFC website: www.npafc.org).

**What to do if you catch a tagged fish**

1. Collect tag (if tag cannot be collected then record tag number and description)
2. Record catch location, date, time, species, sex, length, weight, fishing gear
3. Collect scales (if possible) for age and growth information
4. Send the tags and other information to one of the contact persons listed. Ensure to include your name, address, and a phone number, so we can send you your tag recovery reward and provide you with information on when and where in the ocean your fish was tagged and released. Or call one of the contact numbers listed below.

To see our tag return poster for details (in English, Japanese, Korean, or Russian), visit the NPAFC website (www.npafc.org/new/science_fishtag2.htm).
Under a cloudy sky and favorable weather, the Japanese salmon research gillnetter, *Wakatake maru* (666 gross tones) departed Port of Kushiro at noon June 10 for her last salmon research cruise at the date line (180° longitude). The Fisheries Research Agency (FRA) has decided after completion of the 2010 salmon survey to bring this ship’s date line salmon research survey era to a close. The current ship was built in 1997 at Muroran, Hokkaido, and is owned by the Hokkaido Education Committee, Bureau of Training Ships at Hakodate. The ship is dedicated to teaching seamanship, including navigation, communications, engineering, and fishing technology, to high school students by conducting research surveys for tuna, salmon, pelagic fishes, and oceanography. Since 1991 the former and current *Wakatake maru*, chartered by FRA, has returned annually to the same transect along the date line in the central North Pacific and Bering Sea to monitor salmon abundance, conduct tagging experiments, and collect oceanographic and plankton samples. In recognition of the ship’s important contribution to Phase-1 of the Bering-Aleutian Salmon International Survey (BASIS) the *Wakatake maru* was commemorated by the Commission in 2008.

Oceanographic data collected by the annual *Wakatake maru* surveys have contributed significantly to our understanding of salmon habitats of the central North Pacific by extending a set of oceanographic observations begun over 30 years ago. The *Oshoro maru* (Hokkaido University) established oceanographic observations along the 180° longitude line during 1979-2000 and the *Wakatake maru* continued monitoring the same transect since 1991. The transect was listed as a long-term monitoring site for oceanographic observation by the North Pacific Marine Science Organization (PICES) in 2001. Results of these onboard observations are available in the World Ocean Database managed by the National Oceanic and Atmospheric Administration (NOAA), USA. In addition to direct oceanographic observations, the *Wakatake maru* deployed ARGO floats, an automatic vertical temperature-and-salinity profiler, in the central North Pacific as requested by the Japan Agency for Marine-Earth Science and Technology. In the future, automatic oceanographic observation by instruments such as these could replace onboard-ship observations.

Using *Wakatake maru* fishing data in the central North Pacific, scientists investigated the southern limit of ocean distribution of salmon. Survey results indicated salmon distribution is affected by oceanographic conditions, especially water temperature and salinity. Salmon prefer the cool, less saline water north of the Subarctic Boundary, which separates these waters from warmer, more saline subtropical waters to the south. Although the Convention Area includes waters north of 33°N, salmon distribution is usually limited to a narrower area. Information on the southern limit of salmon distribution is not only of scientific value, but also provides practical information useful for enforcement activities in areas of likely salmon distribution. Information gathered from *Wakatake maru* salmon surveys were provided to the Committee on Enforcement at the Enforcement Evaluation and Coordination Meeting (EECM) in Fukuoka 2009.

Many salmon migrate into the Bering Sea in summer. Tagging experiments conducted by the *Wakatake maru* and analysis of genetic samples collected by this ship and others have shown maturing and immature Japanese chum salmon are widely distributed in the Bering Sea in summer. In the international waters of the Bering Sea, also known as the “Donut Hole” the *Wakatake maru* monitored abundance and body size of salmon using a research gillnet. Although stock identification studies showed a significant proportion of Japanese chum salmon stocks in the Bering Sea, *Wakatake maru* chum salmon catches did not reflect the magnitude of Japanese coastal returns (Fig. 1) and was, therefore, not used for preseason forecasts of chum salmon run size. However, chum salmon body size from her surveys was an
indicator of salmon growth and, possibly, ocean condition in the Bering Sea because the temporal trend of chum salmon body size in survey catches is well correlated with the body size of adult fish caught in rivers (Fig. 2). Results show chum salmon body size decreased from the 1970s until the mid-1990s, and increased recently.

The *Wakatake maru* is the last remaining Japanese research vessel to use a drift research gillnet to catch salmon for FRA salmon research. In 1916 a standardized fishing technique using a salmon drift gillnet was developed by the Hokkaido Fisheries Experimental Station (at present, split into Hokkaido National Fisheries Research Institute, FRA, and Fisheries Research Department of Hokkaido Research Organization) and used by the mothership salmon fishery off Kamchatka before World War II. After the war, Japanese salmon driftnet fisheries were conducted in the high seas area of the North Pacific under the Convention for the Conservation of Anadromous Stocks in the North Pacific Ocean, salmon gillnet survey effort decreased because of the reduced importance of surveys to industry. In recent years, salmon gillnet surveys were conducted by only two vessels, the *Oshoro maru* and the *Wakatake maru*. Another research vessel, the *Kaiun maru*, uses a salmon research gillnet on its neon flying squid surveys and provides information on the overlap in salmon and squid distribution to salmon scientists.

The FRA plans to continue surveying salmon abundance and the Bering Sea ecosystem using a stern trawler, the *Hokko maru*. The former *Hokko maru* was a gillnetter built in 1976, which was used primarily for salmon and herring surveys. The current ship was built in 2004 chiefly for walleye pollock surveys. Since 2007, the ship has conducted surveys on salmon abundance in the Bering Sea where Japanese chum salmon are distributed in summer. In 2009 the ship explored the northern limit of Japanese chum salmon distribution in the northern Bering Sea and Chukchi Sea.

In considering the previous twenty years of salmon, zooplankton, and oceanographic data generated by the *Wakatake maru* date line surveys, I am reminded of the tireless work of the officers, crew, and students through the years, and I am thankful to my predecessors who created and supported the date line surveys for a long time. Looking to the future, I hope results from upcoming *Hokko maru* surveys will expand our scientific knowledge of salmon population dynamics and the Bering Sea pelagic ecosystem.
**NPAFC Bulletin No. 5**

Climate Change, Production Trends, and Carrying Capacity of Pacific Salmon in the Bering Sea and Adjacent Waters

Edited by: E. Farley, Jr., T. Azumaya, R. Beamish, M. Koval, K. Myers, K.B. Seong, and S. Urawa


**Opening Remarks**

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Closing Remarks
Summary and future plan of BASIS
E.V. Farley, Jr.
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PUBLICATIONS

NPAFC Annual Report 2009 including results of the Commission’s major activities such as Annual Meeting, symposium, workshop and other NPAFC events is now available on CD-ROM and online.

NPAFC Special Publication No. 1 (2009)  
A Long-term Research and Monitoring Plan (LRMP) for Pacific Salmon in the North Pacific Ocean  
The LRMP represents a consensus of a large group of researchers from all Pacific salmon producing countries. The plan will improve the ability of each country to forecast how their salmon populations will respond to the changing marine ecosystems. An electronic version is available online.

NPAFC Special Publication No. 2 (2010)  
Climate Impacts on Pacific Salmon: Bibliography  
This issue supplements the LRMP with a bibliography that lists literatures associated with climate and ocean change impacts on Pacific salmon. The bibliography covers over 500 literatures published up to 2009, most of them with abstracts. An electronic version is available online.

Upcoming Event

NPAFC 18th Annual Meeting  
Lotte Hotel Busan  
Busan, Republic of Korea  
November 1–5, 2010

Visiting the NPAFC website: http://www.npafc.org for more information on events, publications, scientific documents, and salmon catch statistics.