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Canada

(i) Proposed Thermal Marks for Salmon from British Columbia for Brood Year 2006 (Doc. 947)

In British Columbia thermal marking continues to play an important role for both research and for fisheries management. For 2006 it is proposed that a total of 45 thermal mark releases will take place from 17 hatcheries. The plan is similar to the marking proposal submitted for 2005 with a few changes. New marks are proposed for one chinook stock on the East Coast Vancouver Island from Cowichan River and for three sockeye stocks from Lower Fraser River (Pitt River), Lower Skeena River (Lakelse) and West Coast Vancouver Island (Henderson Lake).

(ii) Hatchery and Wild Percentages of Coho Salmon in the Strait of Georgia are Related to Shifts in Species Dominance (Doc. 981)

The Strait of Georgia is the major rearing area for juvenile Pacific salmon on the west coast of Canada. Historically, there have been major commercial and recreational fisheries for all five species of Pacific salmon in the strait. In recent years, fisheries for coho have collapsed. At the same time abundances of other species increased. Presently there may be three and a half times more juvenile Pacific salmon in the strait than in the past. Our studies of the hatchery percentages of wild and hatchery coho indicate that early food production for juvenile salmon may be shifting the Strait of Georgia to an ecosystem that is more favourable for pink, chum and sockeye salmon and less favourable for coho and chinook salmon.

(iii) Evidence of a Linkage between Fall-Winter Ocean Conditions and the Critical Size Hypothesis for a Study of Pink Salmon in the Central Coast Area of British Columbia (Doc. 982)

Intercirculi spacing of scales from the even year line of pink salmon from stocks in areas of the central coast of British Columbia was measured for the 2003/2004 and 2005/2006 brood years. Juvenile pink salmon had an average of approximately five circuli by the end of June. The average spacing of the first five circuli of juveniles in 2003 was similar to the spacing of the first five circuli on the scales of the adults from the same brood year that returned to spawn in 2004. In 2006, the spacing observed on the scales of returning adult pink salmon from the same line (even year) was significantly larger than the spacing observed on scales of juveniles in 2005. The marine survival was exceptionally high in 2003/2004 and lower in 2005/2006. We propose that feeding and ocean conditions were favourable for juvenile pink salmon after they left the coastal area in 2003. The ocean conditions probably were less favourable for growth and survival in 2005/2006, resulting in large mortalities of the smaller pink salmon consistent with the critical size-critical period hypothesis. The timing of the size-based mortality is not known except that significant mortality of the smaller pink salmon occurred after June or July, 2005.

Japan

(i) Proposed Cruise Plans of Japanese Research Vessels for Salmon in the North Pacific Ocean in 2006/2007 Fiscal Year (Doc. 892 Rev. 2)

This document describes research cruise plans of four Japanese research vessels that were tentatively scheduled to conduct scientific research in the North Pacific, Bering Sea, and Okhotsk Sea in the 2006/2007 fiscal year. In case of gillnet operations, gillnets less than 2.5 km in length at sea were to be used.

(ii) Cruise Plans of Japanese Research Vessels Involving Incidental Takes of Anadromous Fish in the North Pacific Ocean in 2006/2007 Fiscal Year (Doc. 934)

This document describes 12 cruises of Japanese research vessels that were tentatively scheduled to conduct scientific research on non-salmonid pelagic fishes in the North Pacific in the 2006/2007 fiscal year. There were some possibilities of incidental catch of salmon during these cruises. In case of gillnet operation, lengths of gillnet operation, the lengths of gillnets were to be less than 2.5 km at sea.

(iii) Proposed Otolith Marks for Brood Year 2006 Salmon in Japan (Doc. 938 Rev. 1)

Brood year 2006 salmon (approximately 139 million chum, 13.7 million pink, 3.3 million masu, and 30 thousand sockeye salmon) were proposed to be marked with 44 discrete thermal patterns and some ALC (alizarin complexone) patterns at 20 hatcheries in Japan. The thermal marking pattern is presented as the RBr notation (Munk and Geiger 1998; Hagen 1999) and Hatch code notation (Hagen et al. 2000). As the base mark, two rings in the first band have been adopted to distinguish Japanese chum and pink salmon from other stocks since 1999 brood year stock (Urawa et al. 2000). All thermal rings are induced by cooler temperature exposures. The ALC marks were to be used for chum and pink salmon surveys by Hokkaido Fish Hatchery.

(iv) Incidental Catches of Anadromous Fish by Japanese Research Vessel in the North Pacific Ocean in 2005 (Doc. 939)

Some Japanese research vessels conducted the scientific fisheries operation with possibilities of the incidental catch of anadromous fish in 2005. Among them, *R/V Tomi maru No.58*, which conducted the experimental towing of the surface and mid water trawl gear 153 times to develop the commercial fishery on pacific pomfret (*Brama japonica*) during a period from 6th June to 6th September 2005, had caught a total of 3,340 pacific salmon incidentally. Total of 151 salmomids including 27 chum salmon, 108 pink salmon, 15 coho salmon, and 1 steel head trout had also caught by gill net survey for Pacific saury in July 2005.

(v) Results of 2005 Salmon Research Cruise of the Oshoro maru (Doc. 940)

In order to continue to collect oceanographic and biological data included for salmonids, oceanographic observations and mainly gillnet surveys were conducted along 155°E, 165°E, and 165°W in the northern North Pacific Ocean. Each survey was conducted during Cruise #157 (May), Cruise #158 (June), and

Cruise #159 (June–Aug.), 2005. In May along 155°E, the Polar Front occurred near at 43°N and the Subarctic Boundary occurred near at 40°N where was more northern area than that in 2002, 2003, and 2004. In June along 155°E, oceanographic structure could not be analyzed because the number of observation was only three owing to the bad weather. In early July along 165°E, the Polar Front occurred near at 45.3°N but it did not appear clearly. In late July along 165°W, the vertical 4°C isotherm which indicates the Polar Front occurred from 200m to 300m depth near at 47.7°N, but it did not reach 100 m depth. Gillnet survey was conducted at four stations during Cruise #157, at two station during Cruise #158, and at four station in early and late June during Cruise #159. In May along 155°E, salmonids were dominant species at 41°N and 42.5°N in the Transition Domain but no salmonids were collected at 38°N and 36.5°N in the Subtropical Water. Chum salmon was more abundant at 41°N than at 42.5°N. But pink salmon was more abundant at 42.5°N than at 41°N. This distribution pattern about chum salmon and pink salmon was also observed in 2002, 2003, and 2004. In June along 155°E, chum salmon and pink salmon were increasing to the north. This distributional change by latitude was also observed in 2000–2004. In early July along 165°E, the drift gillnet survey was conducted only one time at 47°N owing to the bad weather. Seven sockeye, 36 chum, 77 pink, 12 coho, and one chinook salmon were collected. In late July along 165°W, sockeye and salmon was collected only at 48.5°N in the Subarctic region. Chum salmon and coho salmon were collected at 48.5°N and 47°N, and chum salmon were more abundant at 47°N, but coho salmon were more abundant at 48.5°N. Only two pink salmon were collected at 47°N. Steelhead salmon was collected in a small number at every station. Sockeye salmon collected in a small number at 47°N, 165°E in early July divided into three size groups, and immature fish were dominant. On the other hand, mature fish were dominant than immature fish at 48.5°N, 165°W in late July. This result was different from that of 2003's survey. Almost all chum salmon collected in May and June along 155°E were mature fish ranged between 500–640 mm FL. Chum salmon collected at 47°N, 165°E in early July consisted of various age fish almost at the similar rate. Chum salmon collected at 165°W line in late July were all immature fish ranged between 340–580mm FL. These different biological characteristics by season and survey area were also observed in 2003's survey. Fork length frequency distributions of pink salmon were different among three surveys as sampling season advances.

(vi) International Salmon Research Aboard the R/V Kaiyo maru in the North Pacific Ocean during the Winter of 2006 (Doc. 957)

A winter high-seas salmon research cruise was conducted in the western and eastern North Pacific from January 25 to March 6, 2006, onboard the Japanese research vessel, *Kaiyo maru*, to investigate salmon stock condition in winter. Research activities included collection of data on oceanography, zooplankton, micronekton, salmon, and other organisms. Nineteen experimental fishing stations were located in the Transition Domain and the Subarctic Current in the western North Pacific and seven stations were located in the Dilute Domain in the eastern North Pacific. However, trawl fishing operations were completed at 24 stations. A total of 2,336 salmon was caught: 1,696 in the western North Pacific and 640 in the eastern North Pacific. In the western North Pacific, pink salmon was the most abundant species (77.0% of the salmon catch), followed by chum salmon (13.9%), sockeye salmon (8.8%), and chinook salmon (0.3%). In the eastern North Pacific, chum salmon was the most abundant salmon species (83.6%), followed by sockeye salmon (9.5%), pink salmon (3.4%), coho salmon (3.0%), and chinook salmon (0.5%). Twenty-four disk-tagged salmon were released, and 584 salmon stomachs were examined during the survey. A total of 3,827 tissues, round, or gutted samples was collected from 1,321 salmon and sent to laboratories in Japan, U.S., and Korea for further examination.

(vii) The Spring International Cooperative Salmon Research Cruise of the R/V Kaiyo maru (Doc. 958)

A spring high-seas research cruise to investigate the stock condition of Pacific salmon was conducted in the North Pacific Ocean and the Bering Sea from 22 April to 20 May (first leg) and from 24 May to 22 June (second leg) onboard the Japanese research vessel *Kaiyo maru*. Research cruise activities included the collection of data on oceanography, primary production, zooplankton, micronekton, salmonid fishes, and other organisms. A total of 7,197 salmonids were caught by midwater trawl and angling: 4,487 fishes in the first leg and 2,627 fishes in the second leg. In the first leg, chum salmon was the most abundant species (42.3%), followed by pink (34.4%), sockeye (22.5%), chinook (0.45%), and coho salmon (0.33%). In the second leg, chum salmon was the most abundant species (50.3%), followed by sockeye (21.1%), pink (21.0%), chinook (7.45%), and coho salmon (0.11%). A total of 5,109 salmonids were measured for fork length, body and gonad weight, lipid content by fat meter, sexed, and removed scales for age determination. Isotope (n = 210), genetic (n = 2,278), otolith (n = 2,798), stomach contents (n = 4,319), lipid (n = 1,160), muscle (n = 113), parasite (n = 60) samples were obtained for future studies. There were 122 salmon (47 sockeye, 46 chum, 24 pink, 1 coho, and 4 chinook salmon) tagged and released in the North Pacific Ocean and the Bering Sea. From among fish released, 15 sockeye, five chum, and four chinook salmon were released carrying archival tags.

(viii) International Salmon Research Aboard the R/V Wakatake maru in the Central North Pacific Ocean and Bering Sea during the Summer of 2006 (Doc. 959)

An annual high-seas salmonid research cruise was conducted in the central North Pacific Ocean and Bering Sea from June 6 to July 20, 2006 onboard the Japanese research vessel *Wakatake maru*, to investigate salmon stock condition. Research cruise activities included collection of data on oceanography, primary production, zooplankton, salmonids, and other organisms. Average sea surface temperatures in the North Pacific were 2.0°C warmer than in 2005. The Subarctic Boundary was located between 43°N (St. 5) and 44°N (St. 6), which was further north than in previous years. In the Bering Sea, sea surface temperatures in 2006 were 0.7°C cooler than in 2005. A few days of fishing were lost midway through the cruise for medical reasons. Therefore, 17 experimental fishing stations were surveyed, fewer than surveyed in previous years. A total of 3,872 salmonids was caught by longline and gillnet: 878 fish in the central North Pacific Ocean (St. 3–13) and 2,994 fish in the central Bering Sea (St. 14–26; Table 2). In the North Pacific Ocean, coho salmon was the most abundant species (43.8% of the salmonid catch), followed by chum (37.9%), steelhead (6.2%), sockeye (5.1%), pink (4.1%) and chinook salmon (2.8%). In the Bering Sea, chum salmon was the most abundant species (74.5% of the salmonid catch), followed by sockeye (19.2%), pink (2.4%), chinook (2.4%), Dolly Varden (1.1%), coho (0.4%), and steelhead (0.03%). Twenty-three snouts of 24 adipose-fin clipped salmonids (all steelhead) were collected for later retrieval of CWT tags, and one adipose-fin clipped steelhead was double-tagged with disk tags and released. A total of 789 disk tags were placed on salmonids during the survey, which included 30 sockeye, 160 chum, seven pink, 124 coho, three chinook salmon, and four steelhead released in the central North Pacific and 41 sockeye, 368 chum, eight pink, one coho, seven chinook salmon and six Dolly Varden released in the Bering Sea.

(ix) Salmon Stock Assessment in the North Pacific Ocean, 2006 (Doc. 960)

Results of annual research cruises on salmon stock assessment conducted by Japan in the summer of 2006 were summarized. Three Japanese research vessels (*Oshoro maru*, *Kaiun maru* and *Wakatake maru*) conducted oceanographic observations, 34 gillnet (1,624 tans), 23 longline (566 hachi) and one 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 2006 are compared to those from 1992 to 2005. Mean sea surface temperature at salmon research stations in 2006 were close to the mean of 1992–2005. A total of 5,530 salmonids were caught using drift gillnets, longlines and hook and line including 2,912 chum (52.7%), 1,221 sockeye (22.1%), 655 pink (11.8%), 520 coho (9.4%), 108 chinook salmon (2.0%), 82 steelhead trout (2.0%), and 32 dolly varden charr (0.6%). Mean CPUE of sockeye salmon in the summer of 2006 was in the second highest level in 1992–2006, especially in the Bering Sea. Mean CPUE of chum salmon in 2006 was also in the second highest level during 1992-2006 in the Bering Sea. Mean CPUE of pink salmon in 2006 was an average level for even-years in 1992-2006 in the Bering Sea, but lower in the western North Pacific.

(x) Recoveries of High-Seas Tags in Japan in 2005, and Tag Releases and Recoveries of Fin-Clipped Salmon from Japanese Research Vessel Surveys in the North Pacific Ocean in 2006 (Doc. 961)

During 2005, six tagged chum salmon were recovered along the Japanese coast from releases of tagged fish in the Bering Sea and central North Pacific. Recoveries included one chum salmon with the LTD tag. The tag recovery rate for chum salmon released and recovered in 2005 (2.7%) was similar to the recovery rate since 1995 (1.6–3.6%), except for 1998 (8.8%), 2001 (6.9%) and 2004 (4.9%). From January to July 2006, two Japanese research vessels, *Kaiyo maru* and *Wakatake maru,* conducted 62 trawl, 11 hook-and-line, and 17 longline (510 hachi) operations to attach archival and disk tags on salmonids. Eight salmonids (one sockeye and seven pink salmon) in the western North Pacific, 336 salmonids (32 sockeye, 166 chum, seven pink, 124 coho, three chinook salmon, and four steelhead trout) in the central North Pacific, 492 salmonids (75 sockeye, 385 chum, 14 pink, one coho, 11 chinook salmon, and six Dolly Varden) in the Bering Sea, and 69 salmonids (27 sockeye, 23 chum, 18 pink, and one coho salmon) in the eastern North Pacific, were tagged and released. Of these fish, 24 salmonids with LTD or CTD tags were released in the eastern North Pacific and Bering Sea. During research surveys in summer of 2006, Japanese salmon research vessels recovered 28 steelhead trout lacking the adipose fin.

(xi) Total Lipid Contents of Winter Chum and Pink Salmon in the Western North Pacific Ocean and Gulf of Alaska (Doc. 962)

This study reports the total lipid content of chum and pink salmon caught in the western North Pacific Ocean and the Gulf of Alaska in winter (January–March), 2006. The Total lipid content was extracted from the white muscle of 145 chum and 117 pink salmon using chloroform and methanol and then measured gravimetrically. The total lipid content of ocean age one chum salmon was much lower than that of older (ocean age 2–5) fish, averaging 2.4% in the western North Pacific Ocean and 1.2% in the Gulf of Alaska. The mean total lipid contents of chum and pink salmon were significantly higher in the western North Pacific Ocean than in the Gulf of Alaska. The present preliminary results as well as the past studies

suggest that the trophic status of high-seas salmon is variable depending on the conditions of their ocean habitats, which may be related with climate changes. Thus long-term trophic monitoring of high-seas salmon is important to understand relationships between fish growth and mortalities.

(xii) Stock Identification of Winter Chum Salmon by Mitochondrial DNA and SNP Analysis (Doc. 963)

Mitochondrial (mt) DNA and SNP markers were used to estimate the stock origins of chum salmon caught in the western North Pacific Ocean and central Gulf of Alaska. Most young chum salmon (ocean age 1) were collected at three stations in the western North Pacific Ocean (42°30'–44°30'N, 165°E), while most of older chum salmon (ocean age 2–5) were collected at seven stations in the Gulf of Alaska (48–54°N, 145°W). In the central Gulf of Alaska, the stock composition of ocean age 2–5 chum salmon estimated by mtDNA analysis was 70–92% North American stock in the north area (51–54ºN), while the Japanese and Russian stock contributions were 54–78% in the south area (48–50ºN). A mtDNA stock estimate of ocean age 1 chum salmon in the western North Pacific Ocean was 17% Japanese, 67% Russian, and 16% North American stocks. SNP analysis showed a similar estimate (25.0% Japanese, 60.3% Russian, and 14.7% North American stocks), but the 90% confidence intervals were tighter than those of mtDNA analysis, maybe due to a difference in number of markers.

(xiii) Genetic Variation among Pacific Rim Chum Salmon Populations Inferred from the Microsatellite DNA Analysis (Doc. 964)

The genetic variation and population structure of chum salmon in the Pacific Rim were investigated using allelic variation at four polymorphic microsatellite DNA (msDNA) loci of more than 3,300 individuals from 76 populations representing Japan, Russia and North America. Genetic variation was greater in the populations of Japan than those of Russia and North America, although allelic variation was different among the examined loci. Pairwise population F_{ST} estimates revealed substantial genetic differentiation among the three regional groups of populations. The analysis of molecular variance demonstrated clear structuring among the three geographic groups of populations and within Russian and North American populations but weak to moderate structuring within Japanese populations. These results suggest that the observed geographic pattern of the three regions is congruent with the patterns obtained by the previous mtDNA analysis, and hence the two DNA markers will become useful for construction of a better baseline for genetic stock identification of chum salmon in high seas.

(xiv) Growth Estimation for Juvenile Chum Salmon (Oncorhynchus keta) on the Basis of Otolith Check (Doc. 965)

An otolith microstructure analysis was applied for juvenile chum salmon collected from the Nemuro Strait, eastern Hokkaido, Japan, during late June 1999–2002. Sea entry check on otoliths was used as a benchmark for counting otolith growth increments, and its radius (i.e., distance from the otolith core to sea entry check) was employed for estimating size at sea entry of individual fish. The large part of fish migrated to the sea in late May, except for 2002. The timing of seaward migration was coincident with temporal patterns of chum releases in the northern areas of the Nemuro Strait. The annual fork length at sea entry ranged from 48.10 to 51.10 mm on the average, which was close to the average fork length at release. Specific growth rates during coastal residency were weakly, but significantly correlated with fork lengths at

sea entry, except for 2001. The present study indicated that the otolith microstructure analysis is valuable for estimating early life history of juvenile chum salmon.

(xv) Otolith-Marked Salmon Released from Japan in the Fall of 2005 and Spring of 2006 (Doc. 968)

This document provided information of Japanese otolith mark releases, including release site, date, number, and mark patterns with images to establish the international database of otolith mark releases. In the spring of 2006, approximately 146.4 million chum, 6.0 million pink, 1.8 million masu, and 24 thousand sockeye salmon fry (2005 brood year) with thermal marks or ALC (alizarin complexone) patterns were released from 19 hatcheries in Japan. In addition, 503 thousand masu salmon smolts (2004 brood year) were released in the spring of 2006 after thermally marked. In the fall of 2005, 637 thousand juveniles of otolith-marked masu salmon (2004 brood year) were also released. Two thermal rings as base mark were adopted to distinguish Japanese salmon from other stocks. ALC marks were used for chum and pink salmon surveys by the Hokkaido Fish Hatchery.

(xvi) Proposed Cruise Plans of Japanese Research Vessels for Salmon in the North Pacific Ocean in 2007 (Doc. 969)

This document describes research cruise plans for four Japanese research vessels that were tentatively scheduled to conduct scientific research in the North Pacific and Bering Sea in 2007. In case of gillnet operation, gillnets less than 2.5 km in length at sea were to be used.

(xvii)Heavy Infections of Anisakis simplex (Nematoda: Anisakidae) Larvae in the Muscle of Maturing Chum Salmon: a Preliminary Report (Doc. 993)

Heavy infections with 3rd-stage larvae of *Anisakis simplex* (sensu strico) were observed in the muscle of maturing chum salmon caught in the central Bering Sea (53-54ºN, 180º) and the Chitose River, Hokkaido, Japan. In adult chum salmon returning to the Chitose River, the abundance of *A. simplex* larvae was less than 20 parasites/fish in 2002 and before, while it increased rapidly for four consecutive years since 2003, reaching to 160 parasites/fish in the 2006 fall run season. A high increase of the parasite infections was also observed in maturing chum salmon caught in the central Bering Sea in June 2006. The complex life cycle of *A. simplex* includes paratenic crustacean hosts and final cetacean hosts especially mink whale. The unusual mass infection of *A. simplex* may reflect some changes in the North Pacific ecosystems. This is also a concern for human health, because *A. simplex* larvae occasionally cause gastric anisakiasis when humans consume the infected fish. Further investigations are required to assess the infection levels of *A. simplex* in Pacific salmon and other hosts in various areas.

Korea

(i) Releases and Recoveries of Coded Wire Tag for Chum Salmon in Korea (Doc.973)

Korea has released CWT tagged juvenile chum salmon since 2003 and sixty-six CWT chum salmon were recovered at Yangyang hatchery during the spawning seasons in 2005. Among 66 chum salmon, 34 salmon were male and 32 were female. Most salmon sampled were age 3 (92%), which were released in 2003.

(ii) Otolith Thermal Mark for Brood Year 2005 and Proposed Thermal Marks for Brood Year 2006 Chum Salmon in Korea (Doc. 974)

Korea released 2.2 million thermal marked chum salmon in March 2006. The mark was a 3,3nH (1:1.3, 2.3n). Korea plans to mark approximately 3.0 million chum salmon, which covers about 50% of release of BY 2006 chum salmon at Namdae-cheon (river). Chum salmon will be marked at Salmon Research Center (Yangyang hatchery) using only one thermal mark (3,1,2H).

(iii) Korean Research Plan for Chum Salmon in 2007 (Doc. 975)

Salmon enhancement program in Korea started in 1967 and the program has been more activated since Salmon Research Center of Korea was established at Yangyang in 1984. The major activities of the Salmon Research Center were the release of chum salmon fingerlings and the catch of adult chum salmon for the artificial fertilization. The range of return rate to the Korean waters maintained in 0.71–1.52% during 1990s, but it has seriously reduced since 2000. To overcome the low return rate and enhance the chum salmon resources in the Korean waters, 10-year-science plan were made in 2004. This document describes a brief summary of the science plan.

(iv) Research on the Early Life History of Chum Salmon in Korea (Doc. 976)

Since 1991, investigations have been conducted in Namdae-cheon (river) for collecting biological and environmental data to determine the behaviour of chum salmon fingerlings' out-migration and to investigate the source of early mortality during out-migration. High water temperature since late April would be inadequate for the survival of juvenile chum salmon. Mean water temperature for last 26 years (1980–2005) in the coastal waters near the mouth of Namdae-cheon was 9.8°C in April and 12.9°C in May. Negative correlations between return rate and mean water temperature of the coastal waters in April and May were observed (r = -0.485, $p < 0.05$ in April; r = -0.599, $p < 0.01$ in May). Zooplankton biomass in the coastal waters didn't show any significance with the return rate of Korean chum salmon. Chum salmon fingerlings were released into Namdae-cheon in mid-February and early March in 2005. The proportion of wild salmon to total catch was 11.2%. Catch of juvenile salmon increased after salmon release, peaked in mid-March, and gradually decreased. They seemed to stay in Namdae-cheon about 30 days and then move to the coastal area. Some stayed persistently at upper stream and grew up to over 7 cm of body length. Most salmon were smoltified since late April, which matched with water temperature increase. The majority of prey eaten was clearly Diptera, which occupied 92% of number of prey items and 41% of wet weight. The food items from stomach of juvenile salmon were matched with living organisms in the river. Therefore, it seemed that there was no food selectivity of juvenile chum salmon in

Namdae-cheon.

(v) Metazoan Parasites of Chum Salmon (Oncorhynchus keta) in Korea (Doc. 989)

Korea investigated metazoan parasites of 40 chum salmon (Fork length ranges from 46.0–64.5 cm, Total weight ranges from 3.05–2.64 kg) caught in 2005, and compared with those of 80 chum salmon caught in 2004. Parasite species found were one digenea (*Brachycephallus crenatus*), three cestoda (*Eubothrium* sp., *Nybelinia* sp. plerocercoid, one cestoda sp.), four nematoda *(Anisakis simplex* larva, *Anisakis* sp. larvae, *Contracaecum* sp. larva. *Contracaecum* sp. two larvae), and one copepoda (*Lepeophtherius salmonis*). When compared with the parasites species found in 2004, the composition of parasite species in 2005 was thought to be similar, although the parasitic species identification was not precisely conducted in 2004.

Russia

(i) Acoustic Method of Monitoring and Ecosystem Studies of Pacific Salmon in the Bering and Okhotsk Seas (Summer–Autumn 2003–2004)(Doc. 929)

The results of EK-500 (SIMRAD) scientific echo sounder using for registration of Pacific salmon during anadromous and catadromous migrations in the Bering and Okhotsk Seas are submitted. Advantage of acoustic sounding is the continuity of the salmon echosigns registration during survey and possibility of estimation of their vertical distribution. It has provided to study the structure of vertical distribution and daily vertical migrations of salmon in upper epipelagic layer of sea by data of acoustic sounding. Distinctions in daily and seasonal vertical distribution of salmons are connected with thermal structure of waters and daily vertical migrations of food organisms.

(ii) Trawl Survey Plans for Pacific Salmon Marine Life Period Studies in the Far Eastern Seas in 2006 by Russia (Doc. 943)

This document describes research cruise plans that were scheduled to conduct scientific research on Pacific salmon in 2006. The cruises were to be carried out by TINRO-Centre (R/V *TINRO*, R/V *Kaganovsky*), SakhNIRO (R/V *Dmitry Peskov*), and KamchatNIRO (MRTK-type vessels, and STR-503-type vessels).

(iii) Identification Local Stocks of Sockeye Salmon Oncorhynchus nerka by Scale Pattern Analysis in the Western Part of Bering Sea from Trawl Catches R/V "TINRO" in September–October 2004 (Doc. 946 Rev. 1)

The work has represented the results of the identification of the complexes of local stocks of immature sockeye salmon from the data of the trawl survey by R/V *TINRO* on the program Bering-Aleutian Salmon International Survey (BASIS) in the Western Bering Sea in September–October 2004. The research was carried out according to the system of districts, accepted in TINRO-Centre for biocenological studies. The differential used was the scale structure. In the total the age composition of mixed ocean samples was assessed for 898 sockeye salmon individuals, including directly identified 596 individuals. In the analysis there were used only the dominant age groups 1.1, 1.2, 2.1 and 2.2, summary taking over 90% of

immature sockeye salmon in the trawl catches. The scale baselines consisted of 2926 sockeye salmon individuals of the ages 1.2, 1.3, 2.2 and 2.3. The basis data lines were formed with using the cluster and discriminate analysis. Four complexes of sockeye salmon stocks were figured out: Eastern and North-Eastern Kamchatka + Chukotka, Western Kamchatka, Central (Bristol Bay) and South-Western Alaska and Kodiak Island. The resolution of the basis data lines was 87.42% (the age 1.) and 90.35% (the age 2.). Preliminary results of the identification of the local stock complexes have indicated the dominance of Asian stocks – 85 % (the district 12) and 65% (the districts 3–8) - in the Western Bering Sea in September-October in feeding aggregations. Among these stocks the share of the Eastern and North-Eastern Kamchatka and Chukotka took 44% (the district 12) and 56% (the districts 3–8). The share of the Western Kamchatka stocks was in these districts 41 and 9%, respectively. The Western Kamchatka complex was mainly represented with the Ozernaya River stock – 88% (the district12) and 100% (the districts 3–8). North American sockeye salmon was in a great number only in the districts 3–8, the share being up to 35%. That was the group of stocks of Central (Bristol Bay) and South-Western Alaska. To the south in the district 12 the share of this complex was not over 13%. There was also revealed the feeding aggregation (2%) of sockeye salmon from Kodiak Island there. On the base of the assessments of sockeye salmon abundance distribution, obtained by TINRO-Centre, and also of the represented results of the identification there was estimated the relative abundance of the figured out stock complexes during the fall feeding in the Western Bering Sea.

(iv) Reproduction Indices of the Iturup Island Pink Salmon (Kuril Islands) (Doc. 977)

This document presents the long-term data on pink salmon abundance on spawning grounds, wild and hatchery-reared downstream juvenile migrants, and their return. Numbers of returning pink salmon were less dependent on the numbers of downstream migrants from rivers than on further survival of these generations during marine life period. It is suggested that changes in pink salmon abundance were mainly dependent on habitat conditions for juveniles in the coastal zone, whereas the biomass changes were dependent on habitat conditions in the open waters. It is shown that the long-term trends of changes in pink salmon body sizes do not conform to conception of the density-dependent regulation.

(v) Cruise Report of the R/V "TINRO" BASIS Survey in the Western Bering Sea, June–July 2005 (Doc. 985)

The results of complex survey in the epipelagic layer of the western Bering Sea in summer season of 2005 by R/V *"TINRO"* are provided. The data on oceanographic conditions is presented along with information on allocation and abundance on main zooplankton groups, and quantitative distribution of nekton. The abundance and biomass of fish and cephalopods in the western Bering Sea and adjacent Pacific waters are evaluated. The quantitative distribution of salmon is studied very closely. The information on salmon feeding in different areas of the western Bering Sea is included. The brief analysis of the current status of plankton and nekton epipelagic communities of the western Bering Sea is offered.

(vi) Pacific Salmons in the Nekton Communities in Upper Epipelagic Southern Part of the Sea of Okhotsk in Autumn 2005 (Doc. 986)

Combined survey of the upper epipelagic (0–50) southern part of the Sea of Okhotsk was carried out in October–November, 2005. Total biomass and number of the nekton were estimated, prevailing groups and species were reported, the share of salmon in nekton community was determined and their short description (distribution of catches and dimensions structure of the salmon) was given.

(vii) Feeding of Pacific Salmons in the Eastern Bering Sea in 2005 (Doc. 987)

The research of feeding of Pacific salmon was conducted in the eastern Bering Sea in August–October 2005 under the BASIS program, onboard R/V *Sea Storm* (USA). Materials on fish feeding were taken from trawl yield. A sample usually included 10 or some other available number of stomachs for each size group of the same fish species. Stomach contents were weighed, mass of each food component determined, digestibility classified on 5-level scale, and value of the components estimated (% of food weight).

(viii) Information on Pacific Salmon Tagging Activities during TINRO-Centre Research Survey for BASIS Program in the Western Bering Sea during Summer Period of 2005 (Doc. 988)

The present document summarizes information on Pacific salmon tagging activities during TINRO-Centre research survey for BASIS program in the western Bering Sea during June–July 2005. Standard tagging procedures were applied. Fish were caught by midwater rope trawl and immediately placed in large tank with flowing water to allow them to recover. Fork length was measured and scales were carefully sampled. Tagging was done with FRI disk tags. Biological parameters of tagged salmon individuals are provided in the tables included. Technical characteristics of respective trawl stations are given in the present document.

(ix) Marked Salmon Production by the Hatcheries of the Far East of Russia in 2006 (Doc. 997)

This document summarizes information on otolith-marked salmon of 2005 brood year stocks released from Russia in a table.

(x) The Plan for Salmon for the Brood Year 2006 Marking at the Hatcheries of the Far East of Russia (Doc. 998)

This document summarizes information on the plan of otolith-marked salmon of 2006 brood year stocks released from Russia in a table.

United States

(i) Proposed Thermal Marks for Brood Year 2006 Salmon in Alaska (Doc. 936 Rev. 2)

In Alaska, mass-marking of salmon using otolith thermal marking is an effective research and management tool applicable to a variety of situations. For brood year 2006, approximately 53 million sockeye, 7 million chinook, 505 million chum, 9 million coho, and 730 million pink salmon will be marked at 23 different hatcheries using 78 thermal marks.

(ii) Southeast Alaska Coastal Monitoring (SECM) Cruise Plan for 2006 (Doc. 937)

The Southeast Alaska Coastal Monitoring (SECM) project in Alaska was initiated in 1997 by the Auke Bay Laboratory, National Marine Fisheries Service, to study the habitat use and early marine ecology of juvenile (age-0) Pacific salmon (*Oncorhynchus* spp.). This document presents information on the objectives and mothods of SECM research in 1997–2005, planned SECM research in 2006, and future research directions.

(iii) United States National Cruise Plan for BASIS Research, August–September, 2006 (Doc. 941)

This document describes plans for research cruises in the eastern Bering Sea in August–September, 2006, as part of BASIS research by the National Marine Fisheries Service (NMFS), Ocean Carrying Capacity (OCC) program. The goal of OCC/BASIS salmon research cruises is to understand mechanisms underlying the effects of environment on the distribution, migration, and growth of juvenile salmon in the eastern Bering Sea. Primary objectives of the BASIS survey will be to: 1) determine the extent of offshore migrations of juvenile salmon from rivers draining into the eastern Bering Sea, 2) describe the physical environment of the eastern and northeastern Bering Sea shelf waters occupied by juvenile salmon, and 3) collect biological information on other ecologically important species.

(iv) A Proposal to Designate Specific Thermal Marks for Each Country by Species and Brood Year (Doc. 942)

As more countries have adopted thermal marking to identify Pacific salmon stocks, the duplication of marks throughout the Pacific Rim has increased. For many years, the Working Group on Salmon Marking has discussed the need for "country codes" or some similar method to determine the country of origin of a salmon otolith collected on the high seas. In Fall 2004, the United States Party agreed to examine this issue and to identify a solution to this problem. In this paper, we propose an approach that would reserve sets of thermal mark patterns for individual countries to minimize duplicate marks.

(v) A Proposal to Simplify the Thermal Mark Code Notation (Doc. 944)

Thermal marks are characterized by groups of dark rings in one or more bands on the otolith. Marks are distinguished based on the numbers of rings and the spacing among the rings and bands. Current specifications allow both rings and bands to be spaced at three distances. Although that approach provides for a large number of combinations, many are difficult or impossible to distinguish. We are proposing to simplify the current specifications to improve our ability to distinguish among marks. We propose that only two types of spaces be allowed for rings and bands. Spaces between bands would be identified with a comma (,) or a dash (-). Ring spacing would be either narrow or normal. Other symbols for thermal mark codes are discussed.

(vi) Incidental Catches of Salmonids by U.S. Groundfish Fisheries in the Bering Sea/Aleutian Islands and the Gulf of Alaska, 1990–2006 (Doc. 954)

Incidental catches of Pacific salmonids in U.S. groundfish fisheries off Alaska are presented for 1977 through August 12, 2006. Estimated numbers of salmonids caught incidentally in these fisheries in the Bering Sea/Aleutian Islands were 30,501 in 1990; 79,142 in 1991; 83,405 in 1992; 289,284 in 1993; 138,369 in 1994; 45,311 in 1995; 141,265 in 1996; 117,524 in 1997; 121,128 in 1998; 61,833 in 1999; 67,550 in 2000; 101,278 in 2001; 122,167 in 2002; 248,744 in 2003: 520,416 in 2004; and 786,304 in 2005. In the Gulf of Alaska, incidental catches were 21,085 in 1990; 53,848 in 1991; 28,010 in 1992; 80,853 in 1993; 50,839 in 1994; 79,439 in 1995; 19,937 in 1996; 18,539 in 1997; 30,528 in 1998; 38,129 in 1999; 37,700 in 2000; 21,167 in 2001; 16,139 in 2002; 26,408 in 2003; 23,965 in 2004; and 38,298 in 2005. Through August 12, 2006, the incidental catches were 301,395 salmon in the Bering Sea/Aleutian Islands and 13,302 salmon in the Gulf of Alaska. The last joint venture operations took place in 1990 in the Bering Sea/Aleutian Islands, with an incidental catch of 152 salmon.

(vii) Annual Survey of Juvenile Salmon and Ecologically-Related Species and Environmental Factors in the Marine Waters of Southeastern Alaska, May–August 2005 (Doc. 955)

Juvenile Pacific salmon (*Oncorhynchus* spp.), ecologically-related species, and associated biophysical data were collected by the Southeast Coastal Monitoring Project along primary marine migration corridors in the southern and northern regions of southeastern Alaska. Up to 17 stations were sampled in four time periods (40 sampling days) from May to August 2005. This survey marked the ninth consecutive year of systematic monitoring of how juvenile salmon interact in marine ecosystems, and was implemented to identify the relationships among biophysical parameters that influence the habitat use, marine growth, predation, stock interactions, and year-class strength of salmon. Typically, at each station, fish, zooplankton, physical profile data, and water samples were collected using a surface rope trawl, conical and bongo nets, a conductivity-temperature-depth profiler, and a water sampler during daylight. Surface (3-m) temperatures and salinities ranged from 9.3 to 15.7ºC and 13.8 to 31.5 PSU over the season. A total of 6,874 fish and squid, representing 19 taxa, were captured in 92 rope trawl hauls from June to August. Juvenile salmon comprised 96% of the total fish and squid catch in each region. Juvenile salmon occurred frequently in both regions, with pink (*O. gorbuscha*), chum (*O. keta*), sockeye (*O. nerka*), and coho (*O. kisutch*) occurring in 63–86% of the trawl hauls, and juvenile Chinook salmon occurring in 20–25% of the trawl hauls. Of the 6,651 salmonids caught, over 99% were juveniles. In both regions, only two non-salmonid species represented > 1% of the catch: market squid (*Loligo* spp.) in the southern region (2%) and crested sculpin (*Blepsias bilobus*) in the northern region (2%). Temporal and spatial differences were observed in the catch rates, size, condition, and stock of origin of juvenile salmon species. Catch rates of juvenile salmon were highest in June for all species except pink salmon, which had the highest catch rates in August. Size of juvenile salmon increased steadily throughout the season; mean fork lengths in June, July, and August were, respectively: 92, 127, and 170 mm for pink; 108, 124, and 191 mm for chum; 115, 123, and 180 mm for sockeye; 184, 207, and 239 mm for coho; and 205, 245, and 255 for Chinook salmon. Coded-wire tags were recovered from 17 juvenile coho, six juvenile Chinook, and two immature Chinook salmon; all but six of these fish were from hatchery and wild stocks of southeastern Alaska origin. The non-Alaska stocks were juvenile coho and Chinook salmon originating from Oregon and Washington. Alaska enhanced stocks were also identified by thermal otolith marks from

53% of the chum, 18% of the sockeye, 9% of the coho, and 50% of the Chinook salmon. Onboard stomach analysis of 63 potential predators, representing eight species, revealed one predation instance on juvenile salmon by a spiny dogfish (*Squalus acanthias*). Forecasting models using catch-per-unit effort (CPUE) of juvenile pink salmon in strait habitat of the northern region in 2003 and 2004 produced accurate predictions of southeastern Alaska pink salmon harvests in 2004 and 2005. However, the models using 2005 CPUE as a predictor overestimated harvest of pink salmon in 2006, indicating that CPUE alone is not sufficient to consistently predict year class strength. These results suggest that in southeastern Alaska, juvenile salmon exhibit seasonal patterns of habitat use and abundance, and display species- and stock-dependent migration patterns. Long-term monitoring of key stocks of juvenile salmon, on both intra- and interannual bases, will enable researchers to better understand ecological interactions that affect interannual variation in salmon abundance and the role that salmon play in North Pacific marine ecosystems.

(viii) Diel Epipelagic Distribution of Juvenile Salmon, Rockfish, Sablefish and Ecological Interactions with Associated Species in Offshore Habitats of the Northeast Pacific Ocean (Doc. 956)

Diel epipelagic sampling for juvenile Pacific salmon (*Oncorhynchus* spp.), rockfish (*Sebastes* spp.), sablefish (*Anoplopoma fimbria*), and associated species was conducted to identify factors that may affect year-class success of these commercially important species. Surface trawls were fished from 10 to 20 August 2005, in the upper 20 m of the water column along transects up to 78 km offshore in the coastal northeast Pacific Ocean near 58°N. Along two transects, three habitats were sampled over a 24-hr period: the continental shelf (< 200 m depth), the continental slope (400-750 m), and abyss (> 2,000m depth). A total of 38,747 fish and squid representing 24 species were sampled in 56 trawl hauls. Of the targeted juvenile fish species, a total of 587 salmon, 11 rockfish, and 70 sablefish were captured. Sampling during day (1500-1900) and night (2200-0200) periods indicated that biomass of fish and squid was 3.9 times higher at night pooled across the habitats in the two transects. No distinct patterns between day or night occurrence were noted for juvenile pink salmon (*O. gorbuscha*), chum salmon (*O. keta*), sockeye salmon (*O. nerka*), or coho salmon (*O. kisutch*); however, juvenile Chinook salmon (*O. tshawytscha*) were encountered only at night. Catches of juvenile rockfish and sablefish were quite low in this study, and larger sample sizes of these fish are needed to adequately determine their diel distribution. Diel differences were apparent with forage species such as Pacific herring (*Clupea pallasi*), capelin (*Mallotus villosus*), and eulachon (*Thaleichthys pacificus*) that were almost exclusively sampled at night. The offshore distribution patterns of target species were distinctly different, with the most common occurrences of juvenile salmon over continental shelf habitats, juvenile sablefish over continental shelf and slope habitats, and juvenile rockfish over slope and abyss habitats. Pacific herring, capelin, eulachon, and Pacific sardines (*Sardinops sagax*) were found over continental shelf habitats, whereas small squid and myctophids occurred primarily in slope and abyss habitats. The greatest overall catch biomass was of jellyfish (gelatinous species), which was consistently higher than that of all fish and squid combined, usually by an order of magnitude. Individual fish or squid species with highest average weight per haul were pomfret (*Brama japonica*), adult coho salmon, Humboldt squid (*Dosidicus gigas*), and blue sharks (Prionace glauca). The occurrence of the latter two warm-water species and Pacific sardines was of interest because this study occurred during an anomalously warm year and the capture of Pacific sardines and Humboldt squid represent northern range extensions for there species. Stomach content analysis of potential predator species of the target species showed that only adult coho salmon were predating on

juvenile salmon and sablefish, and only pomfret were predating on juvenile rockfish. Further sampling of the target species is needed in there habitats during more normal environmental conditions to validate these observations.

(ix) Thermal Mark Patterns Applied to Salmon from Alaska, Treaty Tribes and Other Northwest States for Brood Year 2005 (Doc. 970)

In Washington and Alaska, mass-marking of salmon using otolith thermal marking is an effective research and management tool for a variety of situations. The specific needs and applications for marking, however, are not same in each state. This document contains a report of thermal mark patterns applied to salmon stocks from the 2005 brood year. It includes release numbers where known and mark patterns applied in Alaska, Washington, Oregon, Idaho and by Treaty Tribes.

(x) Revised Web-Based North Pacific Salmon Otolith Mark Directory (Doc. 971)

In 2002 Alaska Department of Fish and Game provided the Working Group on Salmon Marking with a public web site and database to document all salmon otolith marks generated and released in the North Pacific. A complete rewrite of this resource has been performed. This document explains shortcomings associated with the old system, improved features of the new system, and details of adjusted methods, data definitions and conventions required by the new implementation. A notable new feature is the ability for each jurisdiction to enter and correct their data from any location in the world through a web browser. A tool is included that allows marks to be referenced as either codes or as visual patterns drawn on the screen using a mouse. Database searching and reporting functions have also been improved. A comprehensive list of basic data validation rules enforced by the new application is provided. A proposal for an unambiguous method for assigning codes to mark patterns is provided under the name "Uniform Hatch Code."

(xi) High Seas Salmonid Coded-Wire Tag Recovery Data, 2006 (Doc. 978)

Information on high seas recoveries of coded-wire tagged (CWT) salmonids (*Oncorhynchus* spp.) has been reported annually to the International North Pacific Fisheries Commission (1981–1992) and to the North Pacific Anadromous Fish Commission (NPAFC, 1993–present). Data from these CWT recoveries are also reported into the coastwide on-line CWT recovery database (http://www.rmpc.org) maintained by the Regional Mark Processing Center (RMPC) of the Pacific States Marine Fisheries Commission (PSMFC). This document lists recovery data for 1135 CWT salmonids that will be reported to PSMFC/RMPC for the first time. These 1135 CWTs were recovered from the 2005–2006 U.S. groundfish trawl fisheries in the eastern Bering Sea-Aleutian Islands (58 Chinook salmon, *Oncorhynchus tshawytscha)* and Gulf of Alaska (19 Chinook salmon), from the 2002–2005 Pacific hake (*Merluccius productus*) trawl fishery in the Northern Pacific Ocean off Washington/Oregon/California (WA/OR/CA, 877 Chinook salmon and 43 coho salmon, *Oncorhynchus kisutch)*, from the 2002–2005 limited-entry non-hake groundfish trawl fishery off WA/OR/CA (134 Chinook salmon), and from 2005–2006 Japanese research vessel operations in the central North Pacific Ocean (four steelhead, *Oncorhynchus mykiss*). Significant northwestern extensions of the known ocean ranges for Chinook salmon originating from Southeast Alaska, British Columbia, Washington, and Oregon into the Bering Sea are also reported.

(xii) Eastern Bering Sea (BASIS) Coastal Research (August–October 2005) on Juvenile Salmon (Doc. 992)

An eastern Bering Sea research cruise was conducted by National Marine Fisheries Service scientists from the Auke Bay Laboratory, Ocean Carrying Capacity program during August–October 2005 to study early marine distribution, migration, and growth of juvenile salmon (*Oncorhynchus* spp.) salmon on the eastern Bering Sea shelf. A total of 16,615 salmon were captured including juvenile pink (*O. gorbuscha*; 9.2%), chum (*O. keta*; 14.9%), sockeye (*O. nerka*; 69.8%), coho (*O. kisutch*; 0.9%), and chinook (*O. tshawytscha*; 2.5%) salmon; less than 3% of the catch consisted of immature and mature chum, sockeye, and chinook salmon. Juvenile pink and chum salmon were generally distributed north of 58°N with large catches occurring near Nunivak Island. Juvenile sockeye salmon were widely distributed within Bristol Bay (159°W) to as far east as 170°W with the largest catches occurring within Bristol Bay and south of Nunivak Island. Juvenile coho and chinook salmon were distributed within nearshore waters less than 50-m depth from Bristol Bay to Norton Sound with the largest catches occurring within Bristol Bay. Greater than 75% (percent body weight) of the prey items found in juvenile salmon stomachs consisted of larval and juvenile fish with the exception of juvenile pink and chum salmon (approximately 53% and 67% larval and juvenile fish respectively). Analyses of plankton, and of salmon age, size, growth data, and genetic stock identification, will be done to gain additional information on the early marine ecology of salmon along the eastern Bering Sea shelf.

(xiii) Report of the Second Annual SNP Workshop, Anchorage, Alaska, USA, Sept. 21–22, 2006 (Doc. 996)

Genetic stock identification using a comprehensive allozyme baseline has been extremely valuable for high-seas and coastal migration studies from throughout the Pacific Rim. However, newer DNA techniques provide significant advantages over allozymes in sampling, sample handling, and the potential for improved resolution. Of the various DNA markers, single nucleotide polymorphisms (SNPs) assayed through high-throughput technologies are particularly appropriate for NPAFC applications. Unlike marker types based on fragment size, SNPs are based on the actual DNA sequence and, SNP data can be easily transferred between laboratories and instrument platforms. We review two SNP workshops held in Alaska in 2005 and 2006 that brought scientists from throughout the Pacific Rim together for research discussions on discovery, applications, laboratory techniques, and statistics. Scientists from four NPAFC Parties (Canada, Japan, Russia, and United States) attended both workshops. The status of current SNP baselines for sockeye, chum, Chinook, and coho salmon was reviewed at the workshops and is included here. Over 60 SNPs have been described for chum and Chinook salmon, nearly 40 for sockeye salmon, and 22 for coho salmon. The baseline for chum salmon is being used for BASIS research, while the Alaska Department of Fish and Game is extensively using the sockeye salmon baseline in Bristol Bay studies. SNPs are a simple and cost effective method that can be readily incorporated into NPAFC laboratories for BASIS and similar high-seas applications.