**Special Publication No. 16-08**

# 2016 Bristol Bay Sockeye Salmon Processing Capacity Survey Summary

**by**

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**and**

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**March 2016**

**Alaska Department of Fish and Game** **Divisions of Sport Fish and Commercial Fisheries**

## Symbols and Abbreviations

The following symbols and abbreviations, and others approved for the Système International d'Unités (SI), are used without definition in the following reports by the Divisions of Sport Fish and of Commercial Fisheries: Fishery Manuscripts, Fishery Data Series Reports, Fishery Management Reports, and Special Publications. All others, including deviations from definitions listed below, are noted in the text at first mention, as well as in the titles or footnotes of tables, and in figure or figure captions.

**Weights and measures (metric)**

| | |
|---|---|
| centimeter | cm |
| deciliter | dL |
| gram | g |
| hectare | ha |
| kilogram | kg |
| kilometer | km |
| liter | L |
| meter | m |
| milliliter | mL |
| millimeter | mm |

**Weights and measures (English)**

| | |
|---|---|
| cubic feet per second | $ft^3/s$ |
| foot | ft |
| gallon | gal |
| inch | in |
| mile | mi |
| nautical mile | nmi |
| ounce | oz |
| pound | lb |
| quart | qt |
| yard | yd |

**Time and temperature**

| | |
|---|---|
| day | d |
| degrees Celsius | °C |
| degrees Fahrenheit | °F |
| degrees kelvin | K |
| hour | h |
| minute | min |
| second | s |

**Physics and chemistry**

| | |
|---|---|
| all atomic symbols | |
| alternating current | AC |
| ampere | A |
| calorie | cal |
| direct current | DC |
| hertz | Hz |
| horsepower | hp |
| hydrogen ion activity (negative log of) | pH |
| parts per million | ppm |
| parts per thousand | ppt, ‰ |
| volts | V |
| watts | W |

**General**

| | |
|---|---|
| Alaska Administrative Code | AAC |
| all commonly accepted abbreviations | e.g., Mr., Mrs., AM, PM, etc. |
| all commonly accepted professional titles | e.g., Dr., Ph.D., R.N., etc. |
| at | @ |
| compass directions: | |
| east | E |
| north | N |
| south | S |
| west | W |
| copyright | © |
| corporate suffixes: | |
| Company | Co. |
| Corporation | Corp. |
| Incorporated | Inc. |
| Limited | Ltd. |
| District of Columbia | D.C. |
| et alii (and others) | et al. |
| et cetera (and so forth) | etc. |
| exempli gratia (for example) | e.g. |
| Federal Information Code | FIC |
| id est (that is) | i.e. |
| latitude or longitude | lat. or long. |
| monetary symbols (U.S.) | $, ¢ |
| months (tables and figures): first three letters | Jan,...,Dec |
| registered trademark | ® |
| trademark | ™ |
| United States (adjective) | U.S. |
| United States of America (noun) | USA |
| U.S.C. | United States Code |
| U.S. state | use two-letter abbreviations (e.g., AK, WA) |

**Mathematics, statistics**

| | |
|---|---|
| *all standard mathematical signs, symbols and abbreviations* | |
| alternate hypothesis | $H_A$ |
| base of natural logarithm | *e* |
| catch per unit effort | CPUE |
| coefficient of variation | CV |
| common test statistics | (F, t, $\chi^2$, etc.) |
| confidence interval | CI |
| correlation coefficient (multiple) | R |
| correlation coefficient (simple) | r |
| covariance | cov |
| degree (angular ) | ° |
| degrees of freedom | df |
| expected value | *E* |
| greater than | > |
| greater than or equal to | ≥ |
| harvest per unit effort | HPUE |
| less than | < |
| less than or equal to | ≤ |
| logarithm (natural) | ln |
| logarithm (base 10) | log |
| logarithm (specify base) | $\log_2$, etc. |
| minute (angular) | ' |
| not significant | NS |
| null hypothesis | $H_O$ |
| percent | % |
| probability | P |
| probability of a type I error (rejection of the null hypothesis when true) | α |
| probability of a type II error (acceptance of the null hypothesis when false) | β |
| second (angular) | " |
| standard deviation | SD |
| standard error | SE |
| variance | |
| population | Var |
| sample | var |

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# 2016 BRISTOL BAY SOCKEYE SALMON PROCESSING CAPACITY SURVEY SUMMARY

by

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# ABSTRACT

The *2016 Bristol Bay Sockeye Salmon Processing Capacity Survey Summary* reports results of the Alaska Department of Fish and Game, Division of Commercial Fisheries survey of the 12 major processors of Bristol Bay sockeye salmon. There was a 100% response rate from those processors who account for 99.0% of all 2015 sockeye salmon purchased in Bristol Bay. This survey provides estimates of total intended purchases, daily processing capacity, *in-Bristol Bay* tender fleet capacity, long-haul tender fleet capacity, and intended purchases in the Ugashik District. The results of this survey found the 2016 Bristol Bay total intended purchases of 35.5 million fish is approximately 6.0 million fish (20%) higher than the forecast harvest of 29.5 million fish. The survey estimated a maximum daily processing capacity of 2.6 million fish per day, which could be sustained for approximately 17 days.

Key words: Bristol Bay, salmon, processing capacity, forecast

# INTRODUCTION

The Alaska Department of Fish and Game (ADF&G) completed a survey of 12 salmon processors who are intending to buy sockeye salmon in Bristol Bay during the 2016 season. This 2016 Bristol Bay sockeye salmon processing capacity survey had a 100% response rate. All 12 processing companies completed and returned the survey before the March 2, 2016 deadline. All the processors surveyed had purchased salmon in Bristol Bay during the 2015 season; and taken together, accounted for 99.0% of the sockeye salmon purchased in Bristol Bay during the 2015 season. Individual processor's salmon capacities are protected as confidential information under Alaska statute (AS 16.05.815(a)). This document provides a nonconfidential summary of the 2016 Bristol Bay sockeye salmon processing capacity survey.

The Bristol Bay area commercial salmon fishery includes all coastal and inland waters east of a line from Cape Newenham to Cape Menshikof (Figure 1). The area includes 9 major river systems: Naknek, Kvichak, Alagnak, Egegik, Ugashik, Wood, Nushagak, Igushik, and Togiak. Collectively, these rivers are home to the largest commercial sockeye salmon *Oncorhynchus nerka* fishery in the world. Sockeye salmon are by far the most abundant salmon species that return to Bristol Bay each year, but Chinook, *O. tshawytscha*, chum *O. keta*, coho *O. kisutch*, and, in even years, pink salmon *O. gorbuscha* returns are important to the fishery as well. The Bristol Bay area is divided into 5 management districts (Naknek-Kvichak, Egegik, Ugashik, Nushagak, and Togiak) that correspond to major river systems. The management objective for each river is to achieve salmon escapements within established ranges while harvesting fish in excess of those ranges through orderly fisheries. In addition, regulatory management plans have been adopted for individual species in certain districts. The Bristol Bay sockeye salmon capacity survey estimates processing capacity for the entire Bristol Bay area and does not breakup capacity by district.

Results of the processing capacity survey should be viewed in relationship to the sockeye salmon forecast released by ADF&G (Appendix A). The primary function of the salmon forecast has always been to provide processors and harvesters an indication of what ADF&G is anticipating in salmon returns for the coming season. The 2016 forecast for sockeye salmon returning to Bristol Bay is 46.55 million fish with a range of 36.37 to 56.44 million. Escapement goals for all Bristol Bay systems are calculated to be 15.31 million. A return of this size is expected to produce a harvestable surplus of 29.52 million sockeye salmon in Bristol Bay. A Bristol Bay harvest of 29.52 million would be 8% greater than the previous 10-year mean harvest (27.32 million; range of 15.42 million to 36.45 million), and 46% greater than the long-term mean harvest of 20.20 million (Figure 2).

# BACKGROUND

The ADF&G Division of Commercial Fisheries conducted the first statewide salmon processing capacity survey in 1978. The division continued conducting voluntary and informal surveys of statewide processing capacity throughout the 1990s. Beginning in 2001, the department conducted formal salmon capacity surveys in which survey forms were mailed to selected processors who represented the majority of processing capacity in Alaska. These surveys were formal, but still voluntary. The voluntary nature of the surveys changed in 2004, when regulations were enacted that made participation a regulatory requirement (5 AAC 39.132). In addition, the regulations clarified that individual surveys were confidential under AS 16.05.815(a). In 2008, the division phased out salmon capacity surveys for all fishing regions except for Bristol Bay. Bristol Bay surveys were not conducted in the years 2012 to 2014 as processing capacity was not a preseason concern. The division decided to conduct a survey of processing capacity in 2015 and 2016 in light of the large forecasts. Large harvests have the potential to cause processing capacity bottlenecks, especially if run timing is compressed.

A large projected harvestable surplus can prompt questions about allowing foreign processing vessels into the internal waters of the State of Alaska. The Bristol Bay sockeye salmon processing capacity survey is an instrument that can be used to determine whether domestic processors have enough capacity to handle the expected harvest. The Magnuson-Stevens Fishery Conservation and Management Act provides the framework requirements that must be met before foreign processing ships are allowed into the internal waters of the state. The Magnuson-Stevens Fishery Conservation and Management Act requires the governor to determine whether adequate domestic processing capacity exists and whether that capacity will be used to process the available harvest, before allowing any foreign processors into state waters (16 U.S.C. § 1856(c)). Should the governor receive a request to bring foreign processing ships into the internal waters of the state to process salmon in Bristol Bay in 2016; information from this survey would be considered by the governor, along with other information, in determining whether foreign vessels should be allowed to enter the internal waters of the State of Alaska to process salmon (16 U.S. Code § 1856(c); 5 AAC 39.198).

Capacity is measured as a combination of actual physical processing capacity and the intent of processors to purchase and process salmon during the season in aggregate. Processors were asked to report the maximum amount of sockeye salmon in pounds that they intend to purchase and process during the upcoming Bristol Bay salmon fishing season. Information collected in this survey helps ADF&G plan for the expected return of salmon and is used for management purposes during the commercial fishing season.

Results of the 2016 Bristol Bay sockeye salmon capacity survey should be interpreted as a snapshot of anticipated processing capacity. This point in time estimate is made months before the fishery opens. The 2016 Bristol Bay sockeye salmon forecast was released on October 29, 2015. Processors were asked to provide their best estimate of their capacity by March 2, 2016, several months before the summer salmon fishing season begins. As processors finalize operational plans and assess the domestic and world markets for salmon, their plans may change between the time of the survey and the salmon fishing season. The salmon capacity estimated in this report is not guaranteed, nor is there an implied guarantee that all fishermen will have buyers for all of their salmon.

# METHODS

Processors were selected to receive survey forms based on 2 sources of information: ADF&G 2014 Commercial Operator's Annual Report (COAR) data and 2015 ADF&G fish ticket data. Processors were selected for inclusion in the survey if the processor reported buying more than 100,000 pounds of Bristol Bay sockeye salmon on their 2014 COAR reports or, if according to fish ticket records, the processor bought more than 100,000 pounds of Bristol Bay sockeye salmon in 2015. In the survey, processors were asked to estimate the amount of sockeye salmon they intended to purchase during the 2016 season from Bristol Bay. A copy of the ADF&G 2016 Bristol Bay sockeye salmon forecast was provided with the survey forms. A copy of the survey questions is provided in Appendix B.

The criteria outlined above identified 12 commercial salmon processing companies to receive surveys. These 12 companies represented 16 operations. Surveys were mailed on January 13, 2016. Processors were requested to return completed surveys by March 2, 2016. Compilation and analysis of the survey data began on March 2, 2016.

All processors that responded to the survey reported their intended purchases and capacity in pounds. To compare the survey capacity with the forecasted harvest (in numbers of fish), the survey capacity in pounds was divided by the 5-year (2011–2015) mean weight per fish for sockeye salmon to convert capacity to numbers of fish. There is considerable interannual variability in the mean weight of sockeye salmon returning to Bristol Bay (Table 1). Many factors affect the mean weight of returning sockeye and it is not possible to know with certainty the mean weight before the season begins. The 2015 mean weight of 5.3 pounds per sockeye is the smallest mean weight in the last 20 years. As such, the 5-year (2011–2015) mean weight of 5.73 pounds per fish was used to convert capacity from pounds to numbers of fish throughout this report. After the survey capacity was converted to numbers of fish, the projected capacity was compared to the forecasted return.

# BRISTOL BAY SOCKEYE SALMON PROCESSING CAPACITY

## TOTAL INTENDED PURCHASES

This survey provides an estimate of the total intended purchases for the entire season. The 12 surveyed processors indicated that they are prepared to purchase and process 203.2 million pounds or 35.5 million sockeye salmon during the 2016 Bristol Bay salmon season (Table 2). All processors that responded to the survey reported their total intended purchases in pounds. The 2016 Bristol Bay sockeye salmon total intended purchases is approximately 6.0 million fish (20%) above the forecast harvest of 29.5 million fish (Table 2).

## DAILY PROCESSING CAPACITY

In the 2016 Bristol Bay sockeye salmon processing capacity survey (Appendix B), processors were asked to estimate their daily processing capacity and to estimate the number of days their facility could operate at that daily capacity. They were also asked by what date they expect their facility to operate at their quoted daily capacity.

The total daily capacity reported in the survey was 14.7 million pounds or 2.6 million fish (Table 3). Surveyed processors expect to be able to sustain daily processing capacity for approximately

17 days. The mean date processors expect to be at their reported daily capacity is June 23, 2016 (Table 3).

The comparison of projected capacity to harvest forecast and past peak daily harvests allows an evaluation of the industry's capability to harvest this year's forecast. The projected daily capacity exceeds most historic peak daily harvests. At the maximum projected daily harvest capacity of 2.6 million fish per day, the forecast 29.5 million fish harvest could be achieved in 12 days. The preseason processor survey indicates that the daily capacity of 2.6 million fish could be sustained for approximately 17 days. The 2016 projected 2.6 million fish daily processing capacity has only been exceeded twice in the past 10 years (Table 4). In the most recent 10-year period, daily landings exceeded 2.0 million fish for a total of 15 days (Figure 3 and Table 4). Of the 15 days when total landings exceeded 2.0 million fish, 6 were in 2015. These 6 days were consecutive between July 10–15, 2015. It should be noted that processor limits likely restricted the daily maximums listed in Table 4, but it is not accounted for in this review.

Operating at maximum daily capacity is contingent on a number of factors that include, but are not limited to, mechanical operations, logistics, and employee availability. Although it appears that if every processor is operating at their reported daily capacity there would be sufficient daily capacity to handle a peak landing of salmon, this does not guarantee that all Bristol Bay salmon permit holders will have a buyer at all times during this season. Processors may choose to limit the number of permit holders from whom they purchase salmon and still processes the number of fish available for harvest.

## IN-BRISTOL BAY TENDER FLEET

Most Bristol Bay processors provide tenders that service locally inside of Bristol Bay waters. This fleet of tenders is considered the *in-Bristol Bay* tender fleet. Surveyed processors were asked if their company intends to provide tenders during the 2016 season, their tender fleet's *in-Bristol Bay* holding capacity, and the date they expect to have all their tenders available. Processors were asked to consider only their *in-Bristol Bay* fleet's capacity and exclude any additional capacity provided by their long-haul tender fleet.

Of the 12 companies surveyed, 11 will provide tenders inside Bristol Bay waters. The reported *in-Bristol Bay* tender fleet holding capacity is 39.1 million pounds, or 6.8 million salmon (Table 5). The mean date that the companies expect to have their tenders available is June 22, 2015.

## LONG-HAUL TENDER FLEET

Some Bristol Bay processors provide long-haul tenders that transport fish from Bristol Bay to other processing facilities around the state. Long-haul tenders allow processors to purchase more salmon during the peak of the season. Surveyed processors were asked if their company intends to provide long-haul tenders during the 2016 season, their long-haul tender daily capacity, season capacity, and the date they expect to have their long-haul tenders available by.

Of the 12 companies surveyed, 3 reported that they will provide long-haul tender services, but only 2 provided an estimate of their long-haul tender capacity. The mean date that the companies expect to have their tenders available is June 30, 2016. Long-haul tender use could add capacity to increase daily harvest. As only 2 processors reported their long-haul tender capacity, the long-haul tender capacity data is confidential. There is no way to predict when and where long-haul tenders will be used and it is unlikely that all will deploy at the same time.

## UGASHIK

The Ugashik District is the only fishing district that the surveyed processors were asked about specifically. The Ugashik District can be underserved by processing capacity; this section of the survey is to give managers an idea of processing capacity in the Ugashik district. Surveyed processors were asked if their company intended to purchase sockeye salmon in the Ugashik District in 2016, and if so, would their company be purchasing more sockeye salmon than compared to the 2015 season. Surveyed processors bought an aggregated 99.9% of the total 2015 sockeye salmon harvest from the Ugashik District.

While the exact number of processors that will purchase and process sockeye salmon in the Ugashik District is unknown at this early date, out of the 12 companies surveyed, 9 of the companies reported that their companies intend to operate in the Ugashik District in 2016. Of the 9 companies that intend to purchase sockeye in the Ugashik District, 4 intend to purchase more salmon than in 2015.

# SUMMARY

The 2016 Bristol Bay sockeye salmon processing capacity survey had a 100% response rate from the 12 processing companies surveyed before the March 2, 2016 deadline. The capacity survey is an estimate of the aggregate capacity for the entire season, and is made many months before the start of the season.

The results of this survey found the 2016 Bristol Bay sockeye salmon total intended purchases is approximately 6.0 million fish higher than the forecast harvest of 29.5 million fish. The survey estimated a maximum daily harvest capacity of 2.6 million fish per day which could be sustained for approximately 17 days. Total processing capacity, as estimated from total intended purchases, from the 2016 survey of 203.2 million pounds (35.5 million fish) remained almost the same as the 2015 estimated total processing capacity (35.5 million fish). Similarly, the 2016 estimated daily processing capacity of 14.7 million pounds (2.6 million salmon) is on par with the 2015 estimated daily capacity of 14.5 million pounds (2.5 million fish). These estimates are not directly comparable for a variety of reasons (fish weight, forecast, tender numbers, etc.) but are useful to provide context and understand this year's processing capabilities.

# FIGURES AND TABLES

Table 1.–Mean Bristol Bay sockeye salmon weights in pounds, 2001–2015.

| Year | Mean weight |
|---|---|
| 2001 | 6.7 |
| 2002 | 6.1 |
| 2003 | 6.3 |
| 2004 | 5.8 |
| 2005 | 6.3 |
| 2006 | 5.8 |
| 2007 | 5.8 |
| 2008 | 5.8 |
| 2009 | 5.9 |
| 2010 | 5.8 |
| 2011 | 6.1 |
| 2012 | 5.7 |
| 2013 | 6.0 |
| 2014 | 5.6 |
| 2015 | 5.3 |
| 5-yr Avg. | 5.73 |

Table 2.–Comparison of the 2016 Bristol Bay sockeye salmon harvest forecast and projected intended purchases.

| | Number of salmon | Pounds of salmon |
|---|---|---|
| Projected Harvest | 29.5 million | 169.1 million |
| Projected Intended Purchases | 35.5 million | 203.2 million |
| Difference (surplus of capacity) | 6.0 million | 34.0 million |

Table 3.–Projected daily processing capacity, duration, and start date for 2016 Bristol Bay sockeye salmon.

| Number of salmon | Pounds of salmon | Duration | Mean start date |
|---|---|---|---|
| 2.6 million | 14.7 million | 17 Days | 6/23/2015 |

Table 4.– Salmon daily landings, 10 year daily mean, minimum, and maximum, in numbers of fish, Bristol Bay, 2006–2015.

| Date Landed | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 10 Yr. daily avg. | 10 Yr. daily minimum | 10 Yr. daily maximum |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 06/25 | 598,378 | 472,046 | 150,337 | 979,598 | 738,806 | 497,932 | 236,470 | 939,243 | 1,458,791 | 222,338 | 629,394 | 150,337 | 1,458,791 |
| 06/26 | 855,701 | 535,951 | 656,482 | 1,205,859 | 1,111,657 | 1,396,661 | 366,589 | 1,191,241 | 1,903,878 | 266,935 | 949,095 | 266,935 | 1,903,878 |
| 06/27 | 889,029 | 880,512 | 684,574 | 1,350,326 | 1,242,919 | 1,475,687 | 864,863 | 851,459 | 2,656,823 | 359,254 | 1,125,545 | 359,254 | 2,656,823 |
| 06/28 | 905,401 | 765,692 | 856,865 | 2,053,623 | 1,782,934 | 1,149,366 | 570,833 | 966,002 | 2,094,884 | 602,857 | 1,174,846 | 570,833 | 2,094,884 |
| 06/29 | 949,689 | 801,177 | 1,169,836 | 2,123,463 | 898,716 | 1,434,091 | 791,392 | 933,169 | 1,273,626 | 677,687 | 1,105,285 | 677,687 | 2,123,463 |
| 06/30 | 1,053,398 | 995,166 | 1,262,228 | 1,349,172 | 857,950 | 1,603,764 | 1,095,340 | 1,481,104 | 1,265,110 | 962,114 | 1,192,535 | 857,950 | 1,603,764 |
| 07/01 | 1,078,687 | 1,378,584 | 1,603,301 | 1,230,663 | 1,215,539 | 1,461,489 | 948,548 | 1,196,211 | 1,046,503 | 984,353 | 1,214,388 | 948,548 | 1,603,301 |
| 07/02 | 1,074,144 | 877,704 | 2,628,496 | 1,815,481 | 921,730 | 1,816,913 | 1,397,607 | 775,245 | 1,384,731 | 1,335,670 | 1,402,772 | 775,245 | 2,628,496 |
| 07/03 | 1,028,279 | 2,099,295 | 2,063,748 | 2,126,877 | 1,396,672 | 1,246,319 | 1,448,759 | 571,279 | 1,600,237 | 1,371,041 | 1,495,251 | 571,279 | 2,126,877 |
| 07/04 | 1,473,717 | 1,952,318 | 1,604,651 | 1,795,565 | 1,663,434 | 1,516,598 | 1,986,592 | 349,930 | 1,895,292 | 1,119,428 | 1,535,753 | 349,930 | 1,986,592 |
| 07/05 | 1,754,799 | 1,648,242 | 1,658,797 | 1,725,578 | 1,095,152 | 1,178,472 | 2,037,036 | 142,548 | 1,998,527 | 713,686 | 1,395,284 | 142,548 | 2,037,036 |
| 07/06 | 1,503,211 | 1,553,910 | 1,830,794 | 1,609,455 | 1,284,031 | 1,002,838 | 1,827,163 | 182,304 | 1,250,072 | 958,028 | 1,300,181 | 182,304 | 1,830,794 |
| 07/07 | 1,438,633 | 1,566,318 | 1,573,565 | 1,603,672 | 1,612,432 | 732,322 | 1,495,548 | 78,718 | 964,051 | 1,042,702 | 1,210,796 | 78,718 | 1,612,432 |
| 07/08 | 1,641,546 | 1,735,605 | 1,599,854 | 1,632,660 | 1,160,600 | 328,551 | 1,357,513 | 199,246 | 1,498,389 | 1,475,821 | 1,262,979 | 199,246 | 1,735,605 |
| 07/09 | 1,259,583 | 1,572,564 | 1,912,873 | 1,452,020 | 1,600,639 | 441,748 | 1,435,330 | 310,819 | 1,463,862 | 1,953,972 | 1,340,341 | 310,819 | 1,953,972 |
| 07/10 | 1,228,414 | 1,773,336 | 1,446,124 | 1,059,846 | 1,520,126 | 244,680 | 694,300 | 740,952 | 1,002,443 | 2,305,153 | 1,201,537 | 244,680 | 2,305,153 |
| 07/11 | 1,489,542 | 1,880,275 | 811,041 | 698,187 | 1,974,555 | 368,935 | 639,185 | 339,457 | 994,526 | 2,495,292 | 1,169,100 | 339,457 | 2,495,292 |
| 07/12 | 1,356,884 | 1,713,291 | 974,284 | 580,018 | 943,437 | 178,226 | 319,692 | 289,343 | 1,158,866 | 2,231,846 | 974,589 | 178,226 | 2,231,846 |
| 07/13 | 1,762,365 | 1,166,363 | 1,037,483 | 511,215 | 711,917 | 152,107 | 350,196 | 182,531 | 635,340 | 2,098,899 | 860,842 | 152,107 | 2,098,899 |
| 07/14 | 1,504,684 | 944,600 | 455,446 | 403,469 | 1,259,429 | 639,613 | 282,147 | 105,620 | 386,287 | 2,161,125 | 814,242 | 105,620 | 2,161,125 |
| 07/15 | 1,018,420 | 1,132,117 | 696,766 | 343,798 | 1,105,916 | 419,053 | 216,706 | 108,044 | 209,838 | 2,414,858 | 766,552 | 108,044 | 2,414,858 |
| 07/16 | 370,699 | 1,227,842 | 491,170 | 339,180 | 621,458 | 219,999 | 268,766 | 93,335 | 138,441 | 1,664,051 | 543,494 | 93,335 | 1,664,051 |
| 07/17 | 882,084 | 566,262 | 327,862 | 210,118 | 557,393 | 155,341 | 195,985 | 67,976 | 112,016 | 1,660,494 | 473,553 | 67,976 | 1,660,494 |
| 07/18 | 602,996 | 379,165 | 300,019 | 136,121 | 496,161 | 231,531 | 184,723 | 47,922 | 99,278 | 1,362,440 | 384,036 | 47,922 | 1,362,440 |
| 07/19 | 509,940 | 401,052 | 196,286 | 69,924 | 505,437 | 156,190 | 113,491 | 17,484 | 31,909 | 1,132,118 | 313,383 | 17,484 | 1,132,118 |
| 07/20 | 544,928 | 355,483 | 156,387 | 154,430 | 320,839 | 129,191 | 68,843 | 2,034 | 27,889 | 784,126 | 254,415 | 2,034 | 784,126 |

Table 5.–Estimated *in-Bristol Bay* tender fleet holding capacity, 2016.

| Number of salmon | Pounds of salmon |
|---|---|
| 6.8 million | 39.1 million |

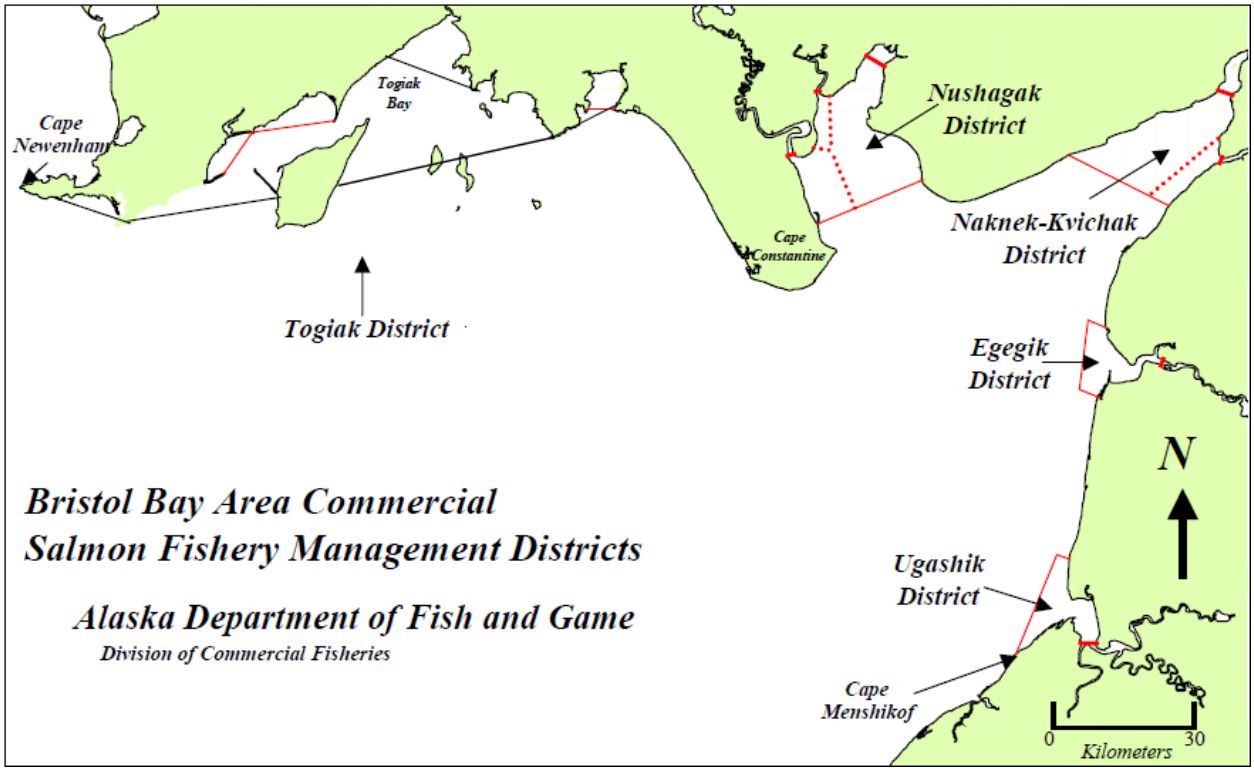


Figure 1.–Bristol Bay area commercial fisheries salmon management districts.

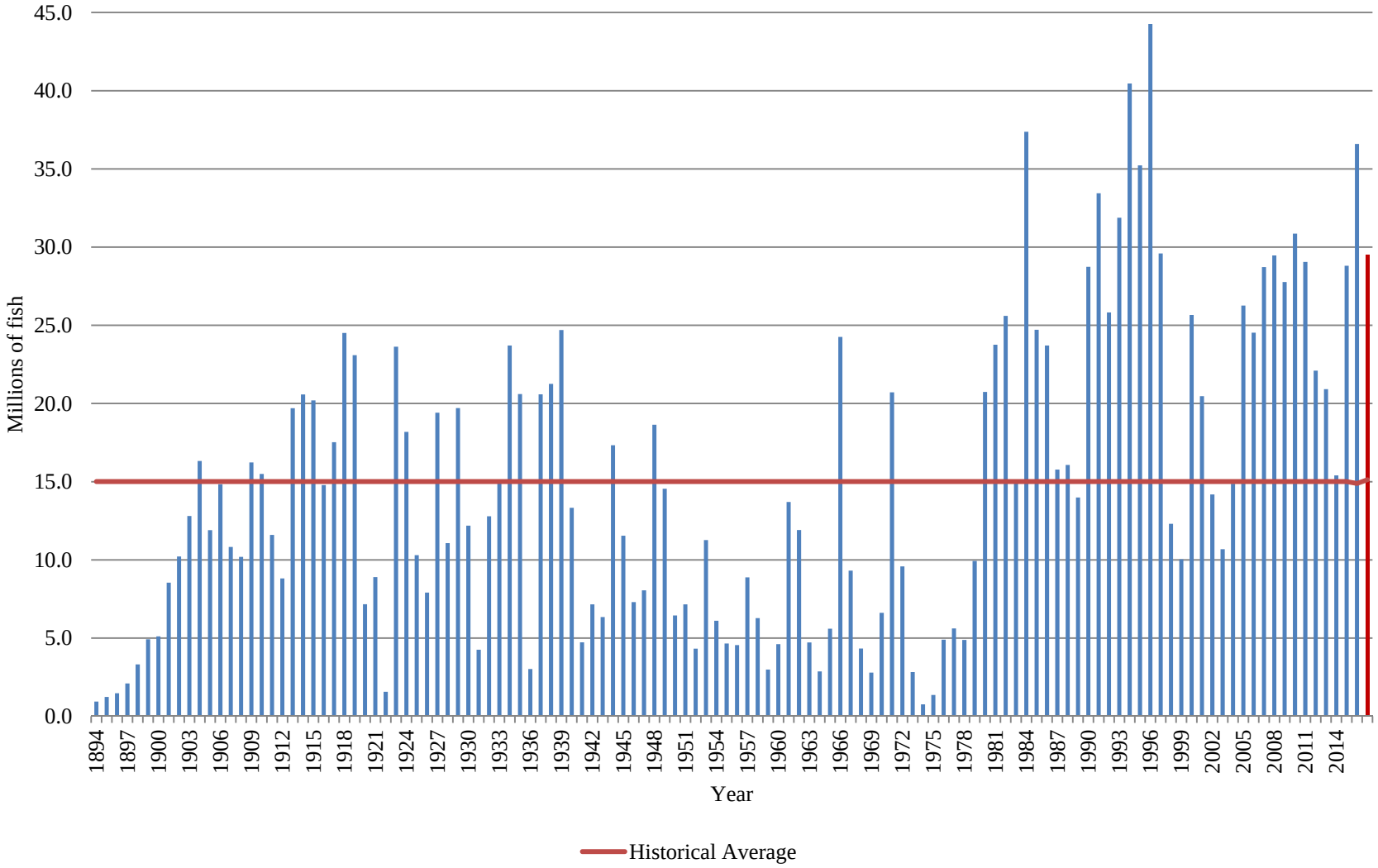


Figure 2.–Bristol Bay commercial sockeye salmon harvests, in thousands of fish, 1893–2015, with 2016 projected harvest and historical average.

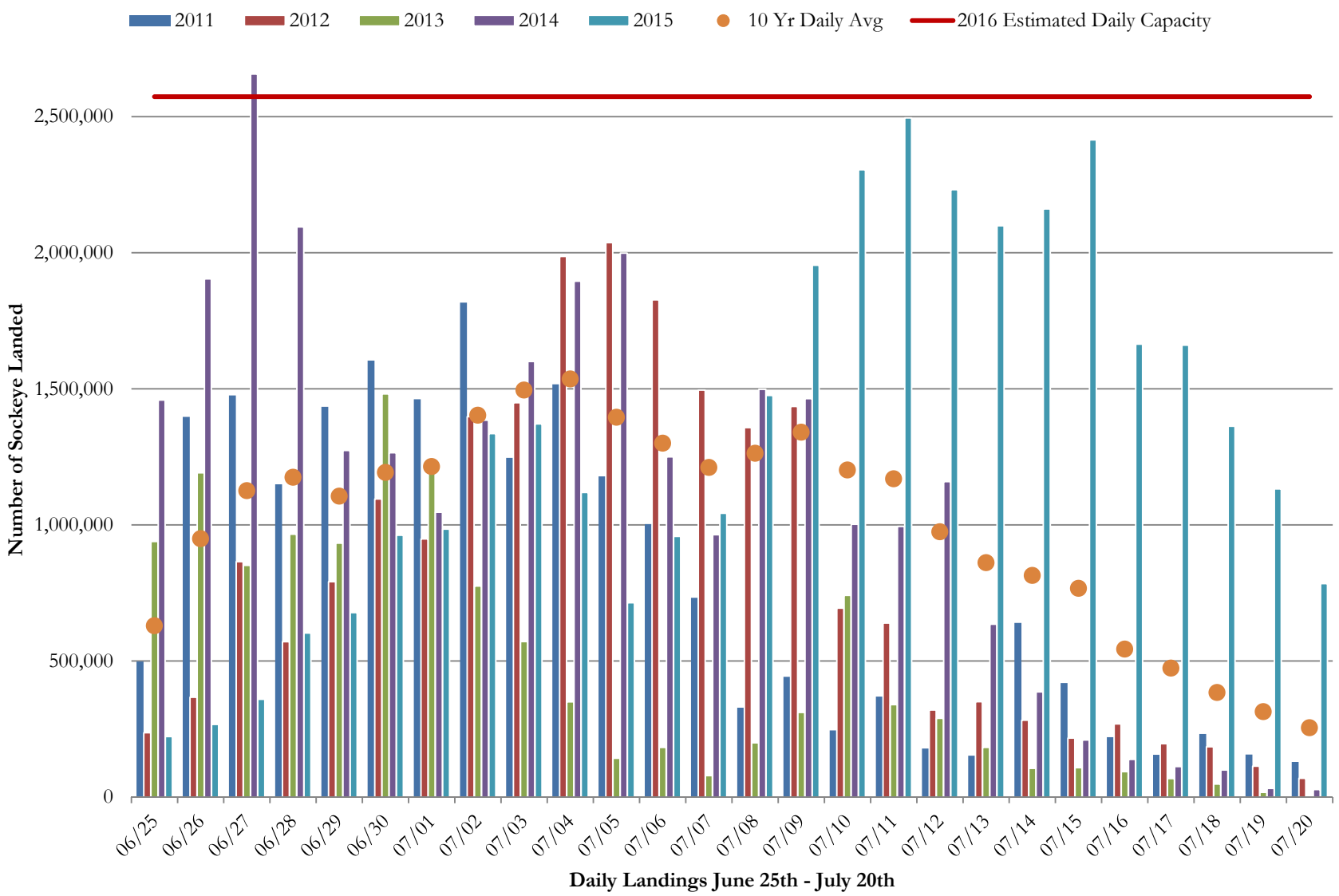


Figure 3.–Bristol Bay sockeye salmon daily landings, 2011–2015, with 10-year daily mean, and 2016 estimated daily capacity

# APPENDICES

# ALASKA DEPARTMENT OF FISH AND GAME
# DIVISION OF COMMERCIAL FISHERIES
## NEWS RELEASE

*Sam Cotten, Commissioner*
*Scott Kelley, Director*

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Anchorage Office
333 Raspberry Road
Anchorage, AK 99518
Date Issued: 10/29/2015
Time: 2:00 p.m.

### 2016 BRISTOL BAY SOCKEYE SALMON FORECAST

The 2016 Bristol Bay sockeye salmon forecast and harvest projections are provided below.

FORECAST AREA: **Bristol Bay**

SPECIES: **Sockeye Salmon**

FORECAST OF THE 2016 RUN:

| TOTAL PRODUCTION: | Forecast (millions) | Forecast Range (millions) |
|---|---|---|
| Total Run | 46.55 | 36.37–56.44 |
| Escapement | 15.31 | |
| Commercial Common Property Harvest | 31.24 | |
| Bristol Bay Harvest | 29.52 | |
| South Peninsula Harvest | 1.72 | |

METHODS

The 2016 Bristol Bay sockeye salmon forecast is the sum of individual predictions for nine river systems (Kvichak, Alagnak, Naknek, Egegik, Ugashik, Wood, Igushik, Nushagak, and Togiak rivers) and four age classes (ages 1.2, 1.3, 2.2, and 2.3, plus ages 0.3 and 1.4 for the Nushagak River). Adult escapement and return data from brood years 1972–2011 were used in the analyses.

Predictions for each age class returning to a river system were calculated from models based on the relationship between adult returns and spawners or siblings from previous years. Tested models included simple linear regression and recent year averages. In general, models chosen were those with statistically significant parameters having the greatest past reliability (accuracy and precision) based on mean absolute deviation, mean absolute percent error, and mean percent error between forecasts and actual returns for two time periods, 2013 through 2015 and 2011 through 2015.

The forecast range is the upper and lower values of the 80% confidence interval for the total run forecast. The confidence bounds were calculated using deviations of actual runs from published predictions from 2001 through 2015.

RESULTS

A total of 46.55 million sockeye salmon (range 36.67–56.44 million) are expected to return to Bristol Bay in 2016. This prediction is 15% greater than the previous 10-year mean of total runs and 41% greater than the long-term mean of 32.94 million. All systems are expected to meet their spawning escapement goals.

A run of 46.55 million sockeye salmon can produce a potential total harvest of 31.24 million fish. The projected harvest includes 29.52 million fish in Bristol Bay and 1.72 million fish in the South Peninsula fisheries. A Bristol Bay harvest of 29.52 million would be 8% greater than the previous 10-year mean harvest (27.32 million; range of 15.42 million to 36.45 million), and 46% greater than the long-term mean harvest of 20.20 million.

The run forecast to each district and river system is as follows: 23.17 million to Naknek-Kvichak District (12.69 million to Kvichak River; 5.72 million to Alagnak River; 4.76 million to Naknek River); 7.41 million to Egegik District; 4.95 million to Ugashik District; 10.36 million to Nushagak District (7.53 million to Wood River; 1.74 million to Nushagak River; 1.09 million to Igushik River); and 0.66 million to Togiak District (Table 1).

The total run forecast of 46.55 million sockeye salmon is expected to be comprised of 16.28 million age-1.2 fish (35%) followed by 12.70 million age-1.3 fish (27%), 11.40 million age-2.2 fish (24%), and 6.05 million age-2.3 fish (13%), with minor age classes contributing to the remainder of the return (Table 1).

DISCUSSION

Forecasting future salmon returns is inherently difficult and uncertain. We have used similar methods since 2001 to produce the Bristol Bay sockeye salmon forecast. These methods have performed well when applied to Bristol Bay as a whole. Forecasts since 2001 have averaged 8.2% below the actual total run. Run forecast differences have ranged from 35.9% below actual run in 2014 to 20.6% above actual run in 2011. Forecasted harvests have averaged 1.8% below actual harvest since 2001 and harvest differences have ranged from 39% below actual harvest in 2014 to 35% above actual harvest in 2011.

Individual river forecasts have greater uncertainty compared to Baywide forecasts. Since 2001, on average, we have under-forecasted the returns to the Alagnak (-34%), Togiak (-14%), Kvichak (-11%), Wood (-6%), and Nushagak (-1%) rivers and over-forecasted returns to Igushik (48%), Egegik (31%), Ugashik (15%), and Naknek (8%) rivers.

The overall Bristol Bay forecasts have been fairly accurate since 2001 in spite of a large amount of individual river forecast variability. This is the result of over-forecasting returns to some rivers and under-forecasting returns to other rivers. The forecasts to individual rivers offset each other such that the overall Bristol Bay forecast has been more accurate than the individual forecasts.

Historically, total runs of sockeye salmon to Bristol Bay have been highly variable. The 2016 forecast of 46.55 million is above the long-term (1963–2015) average of 32.93 million, and above the most recent 10-year (2006–20015) average of 40.54 million.

*Chuck Brazil, Fred West, and Greg Buck*
Bristol Bay Research Staff

Table 1.–Forecast of total run, escapement, and harvest of major age classes of sockeye salmon returning to Bristol Bay river systems in 2016.

| DISTRICT | Millions of Sockeye Salmon | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Forecasted Production by Age Class | | | | | Forecasted | | South |
| River | 1.2 | 2.2 | 1.3 | 2.3 | Total | Escapement | Harvest | Peninsula [a] |
| NAKNEK-KVICHAK | | | | | | | | |
| Kvichak | 4.30 | 6.09 | 1.25 | 1.06 | 12.69 | 6.34 | 5.87 | 0.47 |
| Alagnak | 1.78 | 0.07 | 3.73 | 0.15 | 5.72 | 2.86 [b] | 2.65 | 0.21 |
| Naknek | 0.94 | 1.44 | 1.41 | 0.98 | 4.76 | 1.40 | 3.18 | 0.18 |
| Total | 7.02 | 7.59 | 6.38 | 2.18 | 23.17 | 10.61 | 11.71 | 0.86 |
| EGEGIK | 0.30 | 3.12 | 0.50 | 3.49 | 7.41 | 1.40 | 5.74 | 0.27 |
| UGASHIK | 3.67 | 0.48 | 0.54 | 0.26 | 4.95 | 0.95 | 3.82 | 0.18 |
| NUSHAGAK | | | | | | | | |
| Wood | 4.91 | 0.16 | 2.38 | 0.08 | 7.53 | 1.25 | 6.00 | 0.28 |
| Igushik | 0.13 | 0.02 | 0.93 | 0.01 | 1.09 | 0.28 | 0.77 | 0.04 |
| Nushagak | 0.14 | 0.00 | 1.48 | 0.00 | 1.74 [c] | 0.64 | 1.04 | 0.06 |
| Total | 5.17 | 0.19 | 4.78 | 0.10 | 10.36 | 2.16 | 7.82 | 0.38 |
| TOGIAK [d] | 0.12 | 0.02 | 0.49 | 0.02 | 0.66 | 0.20 | 0.44 | 0.02 |
| BRISTOL BAY | 16.28 | 11.40 | 12.70 | 6.05 | 46.55 | 15.31 | 29.52 | 1.72 |
| | 35% | 24% | 27% | 13% | 100% | | | |

*Note*: This table summarizes the forecast of sockeye salmon in millions of fish. Any differences in addition are due to rounding.

[a] The projected harvest accounts for the harvest of Bristol Bay sockeye salmon in the South Peninsula commercial salmon fisheries. The South Peninsula harvest has averaged 3.7% of the total Bristol Bay sockeye salmon production during the last 5 years.

[b] The projected escapement to the Alagnak River was estimated based on exploiting the Alagnak River at the same exploitation rate as the Kvichak River.

[c] Nushagak River forecast includes age-0.3 (18,914) and age-1.4 (101,994) fish.

[d] Forecasts for Kulukak, Kanik, Osviak, and Matogak river systems are not included. These systems contribute approximately 50,000 to Togiak District harvest each year.

Appendix B.–2016 Bristol Bay sockeye salmon survey questions.

Please answer the following questions about your plans to purchase sockeye salmon in Bristol Bay in 2016 by March 2, 2016. Thank you for your time and quick response to this survey. Your cooperation is greatly appreciated. If you have any questions, please phone Jennifer at (907) 465-6133 or Bert Lewis at (907) 267-2173.

Please note that all capacity date provided int his survey is ***protected as confidential*** information under Alaska Statute 16.05.815

**1. Does your company intend to purchase and process Bristol Bay sockeye salmon during the 2016 season?**

- ◯ Yes
- ◯ No

**2. Please enter the amount of sockeye salmon your company intends to purchase in Bristol Bay in the 2016 season. Please provide this answer in POUNDS of fish.**

**Amount (in POUNDS)** _____

Please tell us about your company's daily processing capacity.

**3. What is your company's Daily Processing Capacity of sockeye salmon in Bristol Bay in 2016? Please provide the answer in POUNDS of fish.**

**Daily Processing Capacity:** _____

**4. How many days could your company sustain the daily processing capacity listed in Question 3?**

**Number of Days** _____

**5. What date do you expect to be at the daily processing capacity listed in Question 3?**

| | MM | DD | YYYY |
|---|---|---|---|
| Date | ____ / | ____ / | ____ |

**6. Comments on Daily Processing Capacity?**

_____

-continued-

In this section please tell us about your company's "In-Bristol Bay" tender fleet. Please do no include information about your long haul tender fleet in this section.

*** 7. Does your company provide tenders?**

- ◯ Yes
- ◯ No

**8. What is your tender fleet's "In Bristol Bay" holding capacity in POUNDS of fish? Please DO NOT include long hauls.**

In-Bristol Bay holding capacity:

**9. What date do you expect to have all your tenders in Bristol Bay?**

Date MM / DD / YYYY

**10. Comments on your company's tender fleet capacity?**

Please tell us about your company's long haul tender fleet

*** 11. Will your company provide long haul tenders?**

- ◯ Yes
- ◯ No

-continued-

**12. What is the DAILY capacity of your long haul tender fleet in POUNDS of fish?**

**Daily Capacity**

**13. What is the SEASON capacity of your long haul tender fleet in POUNDS of fish?**

**Season Capacity:**

**14. What date do you expect to have all your long haul tender fleet available by?**

Date MM / DD / YYYY

**15. Comments on your long haul tender fleet capacity?**

*** 16. Does your company plan to purchase sockeye salmon in the Ugashik District in 2016?**

- Yes
- No

**17. Will your company be purchasing more sockeye salmon from the Ugashik District than it did in 2015?**

- Yes
- No

Other (please specify)

-continued-

*** 18. Are there factors that would affect your company's ability to increase average daily capacity, and sustain this capacity at peak level, that you would like to tell us about?**

Thank you for completing this survey. Please fill out your contact information. If you have any additional questions or concerns please contact Bert Lewis at (907) 267 - 2173.

*** 19. Contact Information For Survey Respondent**

| | |
|---|---|
| Name | |
| Company | |
| Email Address | |
| Phone Number | |