
Economic Contributions and Impacts of Salmonid Resources in Southeast Alaska

FINAL REPORT

Prepared for:

**Trout Unlimited
Alaska Program**

419 Sixth Street, Suite 200
Juneau, Alaska 99801
Contact: Mark Kaelke
(907) 321-4464

Prepared by:

TCW Economics

2756 9th Avenue
Sacramento, CA 95818
Contact: Thomas Wegge
(916) 451-3372

With Technical Assistance from:

Dr. Edward Waters
Beaverton, OR

July 2010

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EXECUTIVE SUMMARY

In southeast Alaska where natural resources are the foundation of many industries and a way of life for residents, salmonids resources make important contributions to commercial, sport, and subsistence/personal use fisheries. Primary salmon species include Chinook, coho, sockeye, chum and pink salmon. Steelhead, Dolly Varden and several trout species (Rainbow, brook and cutthroat) also are important, particularly to sport fisheries.

The strong condition of wild salmonids in Alaska is attributed largely to the relative absence of dams and agricultural and urban development, as well as high marine survival rates, intensive harvest management and the prevalence of intact watersheds. In spite of the degradation of some watersheds in southeast Alaska, the region still supports a disproportionately high share of the wild anadromous stocks of salmonids remaining in the Pacific Northwest. Limiting further habitat degradation will be a key factor in conserving both salmonids and their economic contributions to southeast Alaska.

Although previous studies have examined the economics of southeast Alaska fisheries individually, this study focuses on estimating the combined economic values and impacts of commercial, recreational, and personal use/subsistence salmonid fisheries in southeast Alaska. The 2007 fishing season is used to develop a “snapshot” of these values and impacts. Catch data compiled by the Alaska Department of Fish & Game are used with economic factors, including prices paid for the commercial salmon harvest and expenditures made by recreational anglers, to develop economic values. An input-output model for the southeast Alaska economy was developed and used to estimate the regional economic impacts of the salmonid fisheries.

Some highlights of the economic contributions that salmonid fisheries in southeast Alaska make include:

CONTRIBUTIONS TO COMMERCIAL FISHERIES

Between 2003 and 2007, the commercial salmon harvest in southeast Alaska annually ranged between 30 million and 70 million fish. Pink salmon accounted for about 74 percent of all salmon commercially caught in southeast Alaska, followed by chum (18% of all salmon), sockeye (4% of all salmon), coho (2% of all salmon), and Chinook (0.7% of all salmon). Across all salmon species, salmon commercially harvested in southeast Alaska comprised about 28 percent of all commercially caught salmon statewide.

In terms of landing value (also known as ex-vessel value), commercially-caught salmon in southeast Alaska ranged in value between 2003 and 2007 from \$63.7 million to \$113.4 million. The wholesale value of salmon commercially-harvested in southeast Alaska in 2007 is estimated at \$260.9 million, including \$34.1 million in net economic values (profits to harvesters and processors).

Fishing vessels, processors, and industry-support businesses generate economic activity throughout the southeast Alaska region. The commercial harvest of salmon generated an estimated \$288.5 million in direct expenditures in 2007, and supported an estimated 4,682 full- and part-time jobs, including 2,998 jobs in commercial fishing and 846 jobs in processing, and generated an estimated \$94.3 million in personal income, including \$27.8 million for commercial harvesters and \$32.3 million for processors. The value of total (direct, indirect, and induced) output generated by commercial fishing and processing of salmon is estimated at \$599.3 million in 2007.

CONTRIBUTION TO SPORT FISHERIES

Sport fishing in Alaska attracts large numbers of both resident and non-resident anglers. Statewide, anglers participated in 2.5 million days of fishing in 2007, with about 1.5 million days occurring in freshwaters and 1.0 million days occurring in marine waters. Similar to other areas of Alaska, sport fishing opportunities in southeast Alaska are abundant. In most management areas of the region, anglers can fish for all five salmon species, as well as for Dolly Varden, brook trout, rainbow/steelhead trout, cutthroat trout, grayling, halibut and lingcod. Most angling in southeast Alaska occurs in marine waters, and nonresidents of Alaska account for a larger share of the sport fishing activity.

Between 2003 and 2007, the annual sport catch of salmon in southeast Alaska ranged from 748,480 fish to 1.26 million fish. Coho accounted for about 41 percent and pink salmon accounted for about 31 percent of all salmon caught in southeast Alaska sport fisheries. Across all salmon species, the sport harvest of salmon in southeast Alaska in 2007 comprised about 28 percent of all recreationally-caught salmon statewide.

In terms of angler expenditures, recreational fishing for salmonids in southeast Alaska generated an estimated \$174 million in angler expenditures in 2007, including trip-related expenditures, fishing equipment, and fishing-related real estate expenditures. Net economic values (or net willingness to pay) for sport fishing in southeast Alaska during 2007 were an estimated \$8.2 million for resident anglers and \$21.8 million for nonresident anglers.

Similar to commercial fisheries, sport fisheries in southeast Alaska are an important contributor to the regional economy. Purchases of goods and services by resident and nonresident anglers fishing for salmonids support a large number of businesses in southeast Alaska. The value of total output (including direct, indirect, and induced effects) related to purchases by salmonid anglers in southeast Alaska was an estimated \$358.7 million in 2007, and supported an estimated 2,334 jobs and generated \$84.7 million in personal income.

CONTRIBUTION TO PERSONAL USE AND SUBSISTENCE FISHERIES

Personal use fishing is defined as the taking of, or fishing for fishery resources by Alaska residents for personal use and not for sale or barter, and subsistence fishing is defined as the taking of, or fishing for fishery resources by a resident for subsistence uses. In 2007, 3,153 permits were issued in southeast Alaska (including Yakutat) for personal use and subsistence fishing, with a catch of 41,863 salmon (88 percent was sockeye).

Personal use and subsistence fishing trips generated an estimated \$453,500 in expenditures in 2007. Net economic values associated with personal use and subsistence fishing in southeast Alaska are estimated at \$320,270 for 2007. Based on \$453,500 in trip-related spending, economic activity included the support of five jobs and \$195,000 in personal income throughout the region.

CONTRIBUTION OF HATCHERY OPERATIONS TO THE REGIONAL ECONOMY

Almost all salmon smolts from hatcheries in southeast Alaska are produced at facilities owned and operated by private nonprofit (PNP) corporations. Local expenditures made by salmon hatcheries in southeast Alaska are estimated at \$11.6 million in 2007, including salary costs and the local purchase of goods and services that support hatchery operations. Hatchery operations directly supported an estimated 174 jobs and generated \$6.4 million in income to hatchery staff and proprietors. The direct expenditures by hatcheries multiply as they ripple through the regional economy, thereby resulting in a total of 260 jobs and \$9.7 million in personal income in the region.

SUMMARY OF ECONOMIC CONTRIBUTIONS

Salmonid resources create value for persons participating in commercial, sport, and personal use/subsistence fisheries (use values) in southeast Alaska, as well as generate economic activity in local and regional economies. The “use values” of salmonid resources to commercial fisheries in southeast Alaska are estimated at \$260.9 million in 2007. The value of salmonid resources to recreational fisheries in southeast Alaska is estimated at \$204.4 million in 2007, including expenditures of \$174.4 million and net economic values of \$30.0 million. The value of salmonid resources to personal use/subsistence fisheries is estimated at \$0.77 million, including \$453,500 in expenditures and \$320,300 in net economic values. In sum, these three components of use values total \$466.1 million in 2007.

Salmonid fisheries of southeast Alaska and hatchery operations also contribute to economic activity in the region. Total economic output associated with the three fisheries and hatchery operations is estimated at \$986.1 million in 2007, which includes multiple rounds of economic activity resulting from the multiplier effect. The total (direct, indirect, and induced) number of jobs supported by southeast Alaska salmonid fisheries and hatchery operations are estimated at 7,282, and total personal income (wage earnings, profits, and other income) generated by these fisheries and hatchery operations is an estimated \$188.9 million.

Fishing for salmon in southeast Alaska, including commercial, recreational and personal use/subsistence and the processing of commercially harvested salmon, accounts for an estimated 10.8 percent of all employment in southeast Alaska. By comparison, logging and forestry support operations generate an estimated 1.7 percent, and mining supports about 1.0 percent of all regional employment. Employment in state and local government accounts for 21.8 percent of the regional jobs, and employment in the Federal government represents 6.6 percent.

INTRODUCTION

Southeast Alaska includes hundreds of large and small watersheds dispersed throughout more than 1,000 islands strung together just offshore the mainland (Figure 1). The area extends about 500 miles from the U.S./Canada border just below Prince of Wales Island north to Yakutat and Cape Suckling. The Tongass National Forest encompasses over 90 percent of the land area of southeast Alaska.



Figure 1. Southeast Alaska Study Area

Understanding the economic values and impacts of the fisheries of southeast Alaska is important for assessing the contributions of watershed programs designed to conserve and enhance natural resources. In southeast Alaska, natural resources are the foundation of many industries and a way of life for residents. Salmonids are important resources that substantially contribute to commercial, sport, and subsistence/personal use fisheries. Primary salmon species include Chinook, coho, sockeye, chum and pink salmon. Steelhead, Dolly Varden/Arctic Char, and several trout species (Rainbow, brook, and cutthroat) also are important, particularly to sport fisheries.

Throughout the western United States and British Columbia, Canada, numerous stocks of anadromous salmonids are at risk of extinction, declining, or of serious concern. Of the four salmon producing regions of North America, including Alaska, British Columbia, Pacific Northwest, and Northeast, Alaska is the only region where the condition of wild salmon stocks are considered strong (Knapp 2007). The watersheds of southeast Alaska support a disproportionately high share of the wild anadromous stocks of salmon remaining in the Pacific Northwest (Bryant and Everest 1998). Average commercial catches of wild salmon stocks from Alaska accounted for 89 percent of the estimated 385 million tons of wild salmon stocks harvested in North America over the 1996 through 2001 period.

The relatively strong condition of wild salmon in southeast Alaska is attributed largely to the absence of dams and agricultural and urban development, and to intact watersheds. Intensive human exploitation of watersheds in southeast Alaska began only a few decades ago; however, large scale habitat degradation and fishing pressure pose potential risks to salmonids stocks in southeast Alaska (Bryant and Everest 1998).

Although the economic contribution of southeast Alaska's salmonid resources to commercial and recreational fisheries have been previously studied (Knapp 2007; Northern Economics 2009; ISER 1999; Jones & Stokes Associates 1991), the goal of this study is to conduct a more holistic review of the contribution of salmonid resources to affected fisheries, including subsistence and personal use fisheries. In addition, the role that salmon hatcheries play in supporting salmon fisheries in southeast Alaska and in contributing to the regional economy is examined. Specific objectives of the study are to:

Economic values and impacts are two widely used but distinctly different economic measures. Economic values associated with commercial, recreational, and personal use fisheries measure the monetary importance of these fisheries to those who participate in them. Economic impacts, on the other hand, measure the contribution that the fisheries make to economic activity within a region, as measured in terms of jobs and personal income. Both indicators help to describe the economic importance (or contribution) of fisheries such as salmonid fisheries in southeast Alaska.

- identify harvest statistics for commercial, sport, and subsistence/personal use salmonid fisheries in southeast Alaska,
- characterize resident and non-resident sport fishing activity by species group,
- estimate gross and net economic values associated with the commercial, sport, and personal use fisheries in southeast Alaska,
- estimate regional economic impacts (purchases, jobs, and earnings) associated with salmonid fisheries in southeast Alaska, and compare to levels of economic activity for other natural resources-based (e.g., timber, mining, oil and gas) and other important industries in southeast Alaska; and
- characterize relevant statistics (e.g., number of facilities, annual operating budgets, jobs) pertaining to salmonid hatchery operations in southeast Alaska.

This report is organized by “user type” of salmonid fishery in southeast Alaska. The contribution that salmon hatcheries make to southeast Alaska fisheries and to the regional economy is presented first, followed by characterizations and economic assessments of commercial, sport, and personal use/subsistence salmonid fisheries. Most statistics presented pertain to these fisheries in 2007; harvest and catch data between 2003 and 2007 also are presented for additional context. Lastly, the economic importance of salmonid resources to fishery participants and the regional economy as a whole is presented.

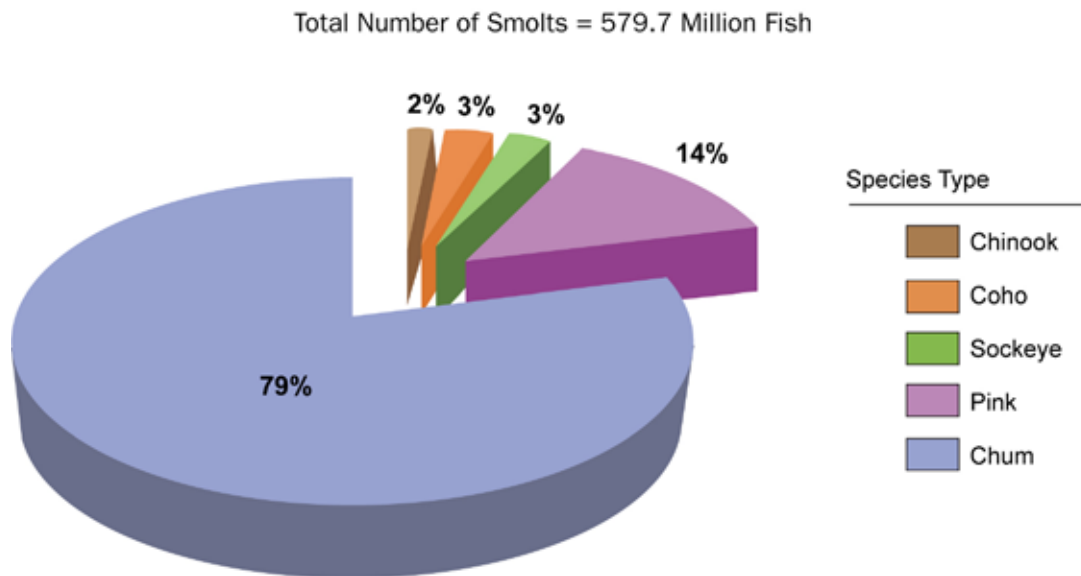
HATCHERY OPERATIONS

In response to declining wild-stock runs of salmon during the late 1960’s and early 1970’s, the Fisheries Rehabilitation, Enhancement and Development Division of the Alaska Department of Fish and Game (ADF&G) embarked on a significant program in the mid-1970s focused on constructing salmon hatcheries to enhance harvest opportunities in both commercial and recreational salmon fisheries. By the late 1990’s and early 2000’s, statewide hatchery production annually ranged from between 27 and 63 million adult fish.

The ADF&G oversees and regulates all state and private sector salmon enhancement and rehabilitation projects in Alaska. Salmon hatcheries are located in two primary regions of Alaska: the Cook Inlet and Prince William Sound area, and southeast Alaska. As shown in *Figure 1*, salmon hatcheries in southeast Alaska are dispersed throughout the region. In 2007, releases of salmon smolts produced at salmon hatcheries in southeast Alaska was about 580 million fish, representing 37 percent of the statewide totals. Chum salmon account for nearly 80 percent of all salmon released from hatcheries in southeast Alaska in 2007 (*Figure 2*).

Almost all salmon at hatcheries in southeast Alaska are produced at facilities owned and operated by private nonprofit (PNP) corporations. The Alaska State Legislature authorized in 1974 the establishment of private nonprofit hatcheries in Alaska. The legislature also authorized the formation of regional associations comprised of representatives from local communities to develop and maintain regional salmon production through rehabilitation and enhancement,

Figure 2.
Releases of Salmon Smolts from Southeast Alaska Hatcheries (Year 2007)



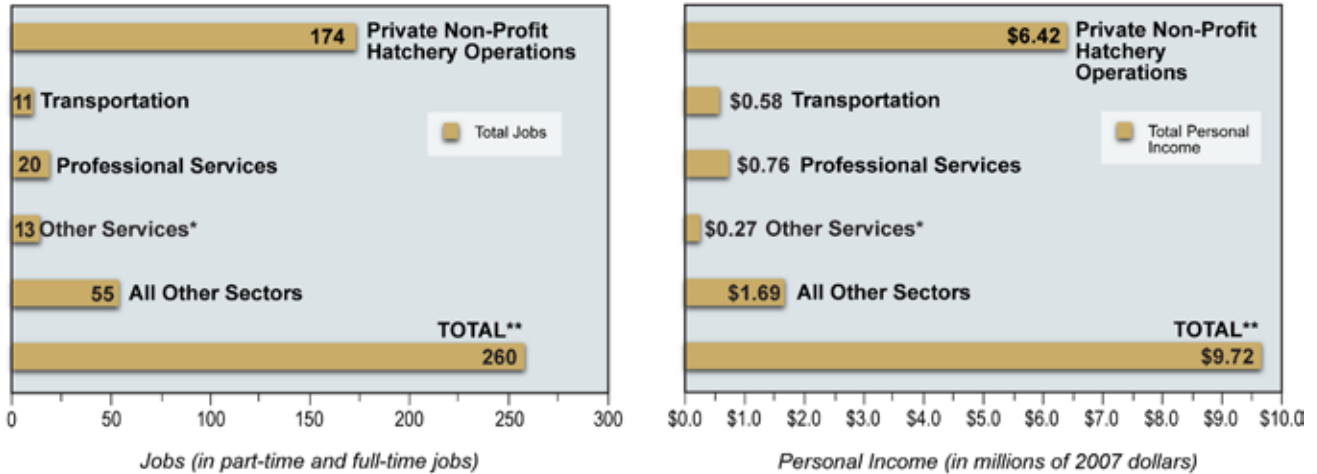
including operation of the PNP hatcheries. These regional associations collect a 3-percent salmon enhancement tax on some commercial landings for enhancement operations, and receive cost-recovery income through the harvest and sale of a portion of the hatchery returns. (McDowell Group 2000)

In addition to hatchery-bred salmon produced primarily for commercial harvest, several hundred thousand smolts and a small number of catchable sized salmon are produced at hatcheries in southeast Alaska for sport enhancement projects. Small numbers of rainbow trout eggs and grayling fry also are supplied to southeast Alaska stocking projects. Typically, rainbow trout eggs are incubated at the Fort Richardson hatchery near Anchorage and then are sent to the Deer Mountain hatchery in southeast Alaska for rearing and stocking. Grayling eggs are taken from the Chena River in Fairbanks, incubated and reared in Anchorage and then flown to southeast Alaska for stocking. (Milton, personal communication)

Hatchery operations in southeast Alaska generate economic impacts within the region based on hatchery expenditures on labor and on the local procurement of goods and services needed for operations. Local expenditures made by salmon hatcheries in southeast Alaska are estimated at \$11.6 million in 2007, including the costs for salaries and the local purchase of goods and services that support hatchery operations. Fish food is a major cost for salmon hatcheries, but most fish food is purchased from out-of-state vendors (Pryor, personal communication). In terms of impacts on the regional economy, hatchery operations directly support an estimated 174 jobs and generate \$6.4 million in income to hatchery staff and proprietors (*Figure 3*). Direct expenditures (\$11.6 million) by hatcheries multiply as they ripple through the regional economy, resulting in a total of 260 jobs and \$9.7 million in personal income throughout the region.

Figure 3.
Economic Impacts of Salmon Hatchery Operations in Southeast Alaska on Sectors of the Southeast Alaska Regional Economy (Year 2007)

Hatchery Operations-Related Expenditures = \$11.63 million



* Other services include machinery and equipment repair and maintenance, and other lesser-important services.

** Total jobs and personal income include "induced" effects resulting from spending of income received by households and revenues received by local governments.

Source: Results from IMPLAN-based economic impact model developed by Ed Waters; refer to Appendix A for modeling details.

COMMERCIAL FISHERIES

Industry and Activity Overview

Commercial harvesting of salmon resources in southeast Alaska began in the late 1870's. All five Pacific salmon species (Chinook, coho, sockeye, pink and chum) are annually harvested in the waters off of southeast Alaska. Sockeye salmon was the primary species harvested until the early 1900's when pink salmon began to dominate (ADF&G 2008). Between 2000 and 2008, pink salmon accounted for 73 percent of the salmon harvest (numbers of fish) in southeast Alaska. (ADF&G undated)

The State of Alaska took over management control of salmon resources in Alaska from the federal government soon after statehood in 1959 (Northern Economics 2010). For management purposes, southeast Alaska is divided into six management areas: Juneau, Ketchikan/Craig, Petersburg/Wrangell, Sitka, Haines, and Yakutat. These management areas closely correspond with the management areas for sport fishing in southeast Alaska (Figure 1). Prior to each salmon season, ADF&G develops detailed management plans that specify how salmon fisheries will be managed for that year. Specific management actions that specify times and areas of fishery openings are identified; additional measures are also implemented during the season through emergency orders.

Salmon are commercially harvested in southeast Alaska using purse seines, drift nets, and hand and power troll gear; set gillnets are used instead of purse seines and drift gillnets in the Yakutat region of southeast Alaska. Drift and set gillnets are confined to state waters (generally within 3 miles), whereas troll fisheries operate in both state waters and in the federal waters of the Exclusive Economic Zone. (ADF&G 2008)

Because of the mixed stock and mixed species nature of salmon returns, and because different gear groups often harvest the same stocks of fish, the management of commercial salmon fisheries in southeast Alaska is complex. The Southeast region contains an estimated 5,500 salmon producing streams and tributaries of various productivity levels, making stock-specific fisheries management according to run strength impractical for most individual returns. Additionally, some salmon harvested in the region originate from other states (primarily Washington and Oregon) and from Canada. Net and troll fisheries in southeast Alaska are managed for sustained yield, allocated among users according to Alaska Board of Fisheries regulations, and in accordance with harvest sharing provisions of the Pacific Salmon Treaty between the U.S. and Canada. (ADF&G 2008)

Fish Harvesting and Ex-Vessel Values

Along with groundfish, herring, and shellfish, salmon is one of the most important commercial fisheries in southeast Alaska. As *Figure 4* shows, the annual salmon harvest ranged between 30 and 70 million fish between 2003 and 2007. In terms of species, pink salmon accounted for about 74 percent of all salmon commercially caught in southeast Alaska between 2003 and 2007, followed by chum (18.1% of all salmon), sockeye (4.4% of all salmon), coho (2.9% of all salmon), and Chinook (0.7% of all salmon).

As a percent of the statewide harvest, Chinook, coho and chum commercially harvested in southeast Alaska each accounted for more than 50 percent of the statewide totals (*Figure 5*). The harvest of pink salmon in southeast Alaska accounted for about 31 percent of all pink salmon commercially caught in Alaska between 2003 and 2007, and the commercial harvest of sockeye in southeast

Figure 4.
Commercial Harvest, Sport Catch and Personal Use/Subsistence Harvest of Salmon in Southeast Alaska, 2003-2007

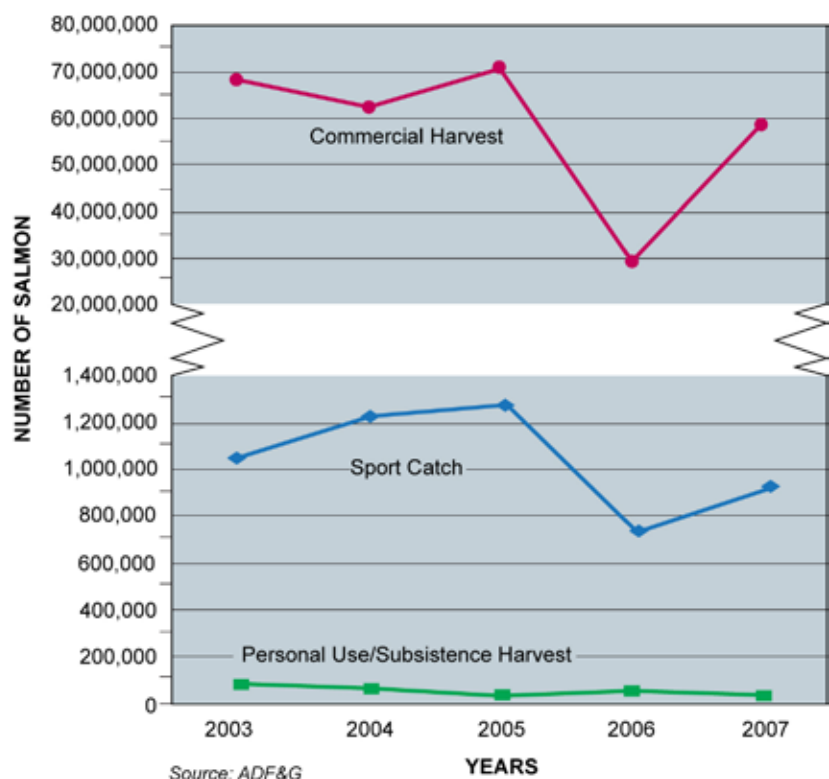
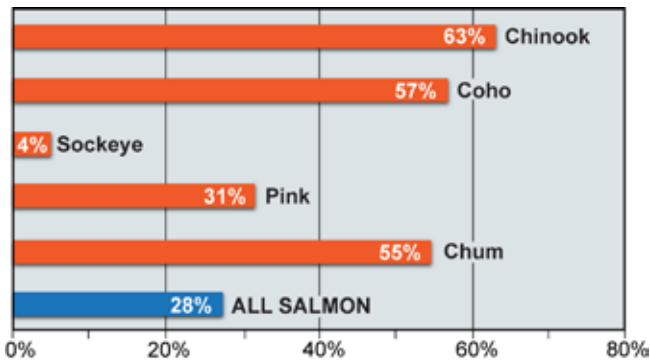


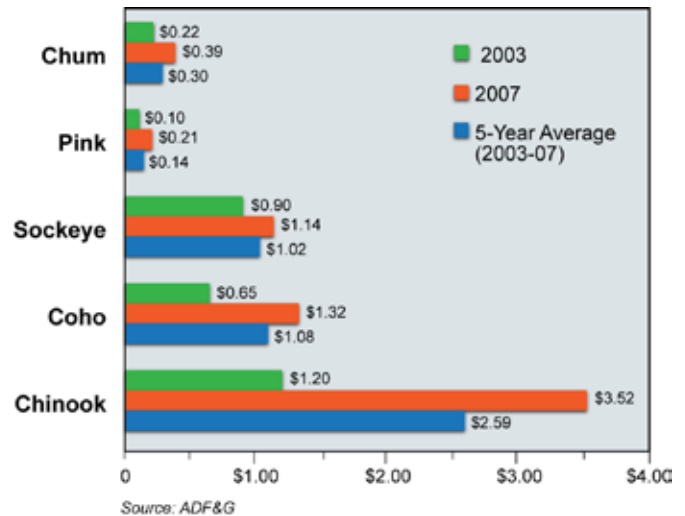
Figure 5.
2007 Commercial Harvest of Salmon in Southeast Alaska as a Percent of Statewide Total



Source: ADF&G

Alaska accounted for only about 4 percent of the statewide total. Across all salmon species, salmon commercially harvested in southeast Alaska comprised about 28 percent of all commercially caught salmon statewide.

Figure 6.
Average Price Paid (Exvessel Value) for Salmon Harvested in Southeast Alaska (Years 2003 - 2007)



Source: ADF&G

In terms of landing value (also known as ex-vessel value), commercially-caught salmon in southeast Alaska ranged in value from \$63.7 million in 2003 to \$113.4 million in 2007. This compares to 2007 exvessel values of \$6.9 million for groundfish (state-managed waters only) and \$21.5 million for shellfish. (ADF&G undated)

The average price paid “at the dock” for salmon varies considerably over the five types of salmon species. In 2007, the average price paid for Chinook salmon landed at ports in southeast Alaska was \$3.52 per pound, followed by coho salmon at \$1.32 per pound, sockeye salmon at \$1.14 per pound, chum salmon at \$0.39 per pound, and pink salmon at \$0.21 per pound. These average prices represent a significant increase over prices paid earlier in the decade. In 2003, average prices in southeast Alaska were \$1.20 per pound for Chinook, \$0.65 for coho, \$0.90 for sockeye, \$0.22 for chum, and \$0.10 for pink salmon (*Figure 6*).

Because of the variation in average price across species, the total landing value associated with the different salmon species is more evenly distributed than the number of fish harvested, with the average annual value between 2003 and 2007 as follows: Chinook, \$15.8 million; coho, \$17.6 million; sockeye, \$10.1 million; pink, \$20.4 million; and chum, \$25.9 million. Based on average margins by product (canned, fresh, and frozen) for Alaska salmon processors between 2000 and 2004, the wholesale value of salmon commercially-harvested in southeast Alaska in 2007 is estimated at \$260.9 million. (This value likely underestimates the actual value because of the increase in salmon prices since the 2000 to 2004 period.)

As explained more thoroughly by Knapp (2007), prices for salmon products at the retail level vary considerably, making determination of the value of salmon products to consumers very difficult. For all species of salmon, prices paid by the consumer “can and do change from year to year, from season to season, and even from day to day.” Salmon prices paid by consumers can range from \$2.99 per pound in supermarkets, to the equivalent of \$30 or more a pound at restaurants. For these and other reasons, the value of salmon commercially harvested from southeast Alaska waters is estimated at the processing (or wholesale) level. It should be recognized, however, that additional value is added as salmon products move up distribution channels.

Net Economic Values

Net economic value is a gauge of the amount of wealth generated for participants in the commercial fisheries. For this study, net economic value for the commercial fishery is defined as the gross revenues generated by commercial harvesting and processing *minus* the costs to harvest and process seafood. In other words, net economic value represents the profits to commercial harvesters and processors.

As discussed previously, the commercial harvest of salmon from southeast Alaska waters generated about \$113.4 million in ex-vessel value for harvesters in 2007 and \$260.9 million in wholesale value after processing. The net economic value (or profit) associated with the harvesting and processing of the 2007 commercial harvest from southeast Alaska waters is estimated at \$34.1 million, based on net income factors estimated by The Research Group (2009) and applied to the 2007 harvest of the different salmon species.

Economic Impacts

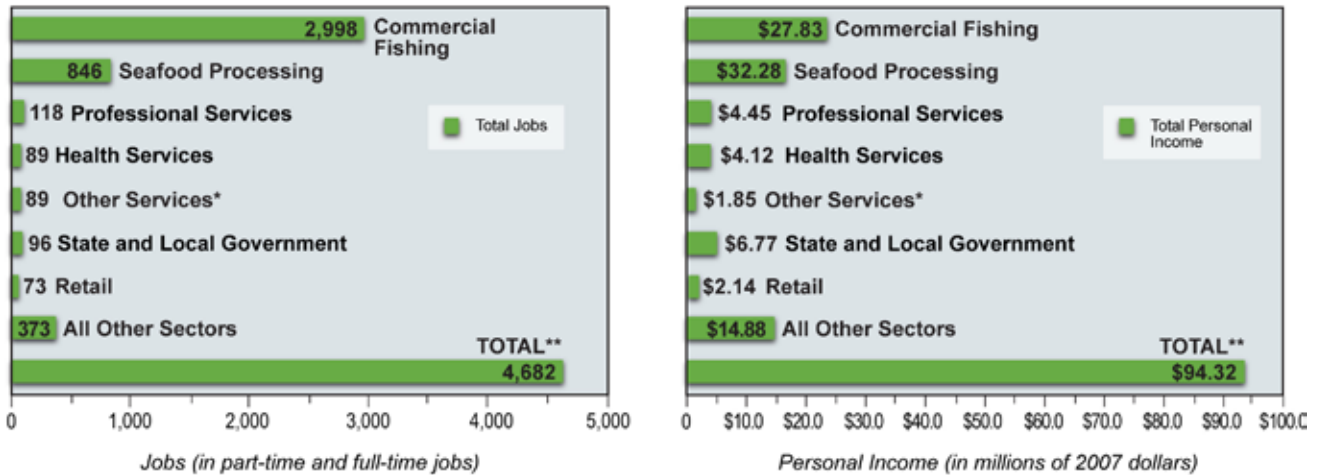
Fishing vessels, processors, and industry-support businesses generate economic activity throughout the southeast Alaska region. The economic impacts of the commercial salmon fishery in southeast Alaska can be characterized in terms of the economic output (total expenditures) of the commercial harvesting and processing sectors, and by the employment and personal income directly and indirectly generated by those activities. As described in Appendix A, an economic impact model based on the IMPLAN input-output modeling platform and database was constructed to assess economic impacts of the 2007 commercial harvest in southeast Alaska.

The estimated economic impacts, including output, jobs and personal income, generated by the harvesting and processing of seafood from southeast Alaska waters in 2007 are shown in *Figure 7*. The commercial harvest of salmon generated \$288.5 million in direct expenditures in 2007 that supported an estimated 4,682 full- and part-time jobs, including 2,998 jobs in commercial fishing and 846 jobs in seafood processing. Personal income in southeast Alaska generated by the commercial harvesting of salmon was an estimated \$94.3 million, including \$27.8 million for

commercial harvesters and \$32.3 million for processors. The value of total (direct, indirect, and induced) output generated by commercial fishing and processing of salmon was an estimated \$599.3 million in 2007.

Figure 7.
Economic Impacts of Commercial Fisheries in Southeast Alaska on Sectors of the Southeast Alaska Regional Economy (Year 2007)

Commercial Fishing-Related Expenditures = \$288.48 million



* Other services include machinery and equipment repair and maintenance, and other lesser-important services.

** Total jobs and personal income include "induced" effects resulting from spending of income received by households and revenues received by local governments.

Source: Results from IMPLAN-based economic impact model developed by Ed Waters; refer to Appendix A for modeling details.

SPORT FISHERIES

Activity Overview

Sport fishing opportunities for salmon in Alaska are world-renowned, and attract large numbers of both resident and nonresident anglers. According to the U.S. Fish and Wildlife Service (U.S. Department of the Interior 2008), 180,000 anglers participated in sport fishing throughout Alaska in 2006, of which state residents accounted for 76,000 (42%) and nonresidents of Alaska accounted for 104,000 (58%).

Similar to other areas of Alaska, sport fishing opportunities in southeast Alaska are abundant. In most management areas of the region, anglers can fish for all five salmon species, as well as for Dolly Varden, brook trout, rainbow/steelhead trout, cutthroat trout, grayling, halibut and lingcod. Unlike fishing opportunities in the more populated areas of Southcentral Alaska, most angling in southeast Alaska occurs in marine waters, and nonresidents of Alaska account for a larger share of the sport fishing activity. Overall, most sport fishing in southeast Alaska occurs without guide services, although nonresidents (51%) are much more likely than residents (8%) to take guided

fishing trips (Southwick Associates 2009). Both resident and nonresident anglers in southeast Alaska are more likely to fish in marine waters than in freshwaters.

ADF&G regulates marine and freshwater sport fishing in southeast Alaska on a region-wide basis. Although regulations are developed region-wide, specific exceptions to these regulations are developed on a management area-by-management area basis. There are seven sport fishing management areas in southeast Alaska: Ketchikan, Prince of Wales Island, Petersburg-Wrangell, Sitka, Juneau-Glacier Bay, Haines-Skagway, and Yakutat (*Figure 1*). In addition to the region-wide marine and freshwater regulations, ADF&G has specific regulations for trout in southeast Alaska, which are based on ADF&G research on cutthroat trout and steelhead. (ADF&G 2010)

Catch, Effort and Expenditures

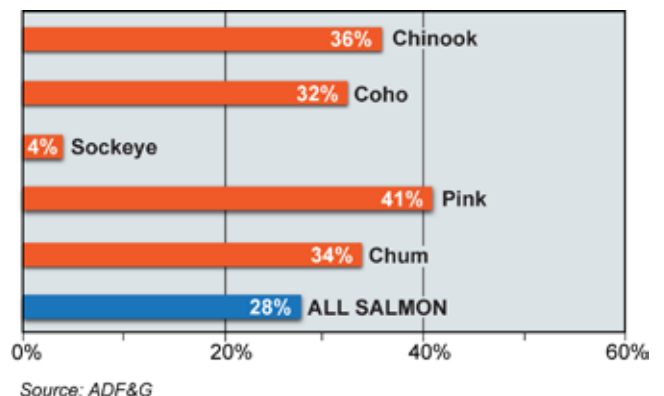
Between 2003 and 2007, the annual sport catch of salmon in southeast Alaska ranged from 748,480 fish (in 2006) to 1.26 million fish (in 2005) (*Figure 4*). In terms of numbers of salmon caught, coho accounted for about 41 percent of all salmon caught in southeast Alaska sport fisheries between 2003 and 2007, followed by pink salmon (31% of all salmon caught), Chinook (18%), chum (6%), and sockeye (4%).

As a percent of the statewide catch, pink salmon caught in southeast Alaska sport fisheries is the only salmon species that accounted for more than 40 percent of the statewide totals in 2007 (*Figure 8*). The harvest of Chinook, coho, and chum salmon in southeast Alaska each accounted for between 25 percent and 35 percent of the statewide totals for these species, and the harvest of sockeye accounted for about 4 percent of the statewide totals in 2007. Across all salmon species, the sport harvest of salmon in southeast Alaska in 2007 comprised about 28 percent of all recreationally-caught salmon statewide.

In 2007, salmon accounted for 929,751 fish (57.4%) of the total number of fish caught (1,619,272 fish) in all sport fisheries in southeast Alaska (ADF&G undated). Catch of Dolly Varden/Arctic Char was 53,656 fish (3.3% of all fish caught), trout (including rainbow, Cutthroat, brook, and Lake) was 28,967 fish (1.8%), and steelhead was 14,853 fish (0.9%).

In southeast Alaska, recreational anglers participated in 540,260 days of fishing in 2007 (about 22% of statewide totals). Of this total, 81 percent (435,340 days) were in marine waters and 19 percent (104,920 days) were in freshwaters. Residents of Alaska accounted for 219,130 days, or about 41 percent of all angler days, and nonresidents of Alaska accounted for 321,150, or 59 percent. (Southwick Associates 2008)

Figure 8.
2007 Sport Catch of Salmon in Southeast Alaska as a Percent of Statewide Total



In terms of angler expenditures, recreational anglers fishing in southeast Alaska spent an estimated \$274 million in 2007 on equipment, boats, and trip-related and other items (including construction and maintenance of real estate primarily used for sport fishing), representing about 20 percent of statewide spending on recreational fishing in 2007. Saltwater fishing accounted for almost half (\$132 million) of all angler spending in southeast Alaska. Resident anglers accounted for 36 percent of all Southeast sport fishing-related spending and non-residents accounted for 64 percent. Based on the catch of salmonids (including steelhead, trout, and Dolly Varden) as a percentage of the total sport catch in southeast Alaska (63.4%), it is estimated that recreational fishing for salmonids in southeast Alaska accounted for about \$174 million of the \$274 million in angler expenditures in 2007.

Net Economic Values

A widely-accepted notion is that anglers fishing for salmon, steelhead and other salmonids typically receive some value associated with their fishing experience that is over and above the out-of-pocket expenditures that anglers make to participate in these activities. This “surplus value” concept, which is often referred to as net willingness to pay, is important for understanding the total economic value of sport fisheries and for assessing the economic feasibility of investments to improve the quality of the fishing experience. In essence, these “net economic values” measure the benefits to sport anglers (over and above the costs) of fishing opportunities

Net economic values of sport fishing activities typically are determined based on the value associated with an angler day (or trip). Angler surveys often are used to estimate these values, which can differ by type of activity, including species sought, mode of fishing (e.g., shore fishing or fishing from a boat), and angler success.

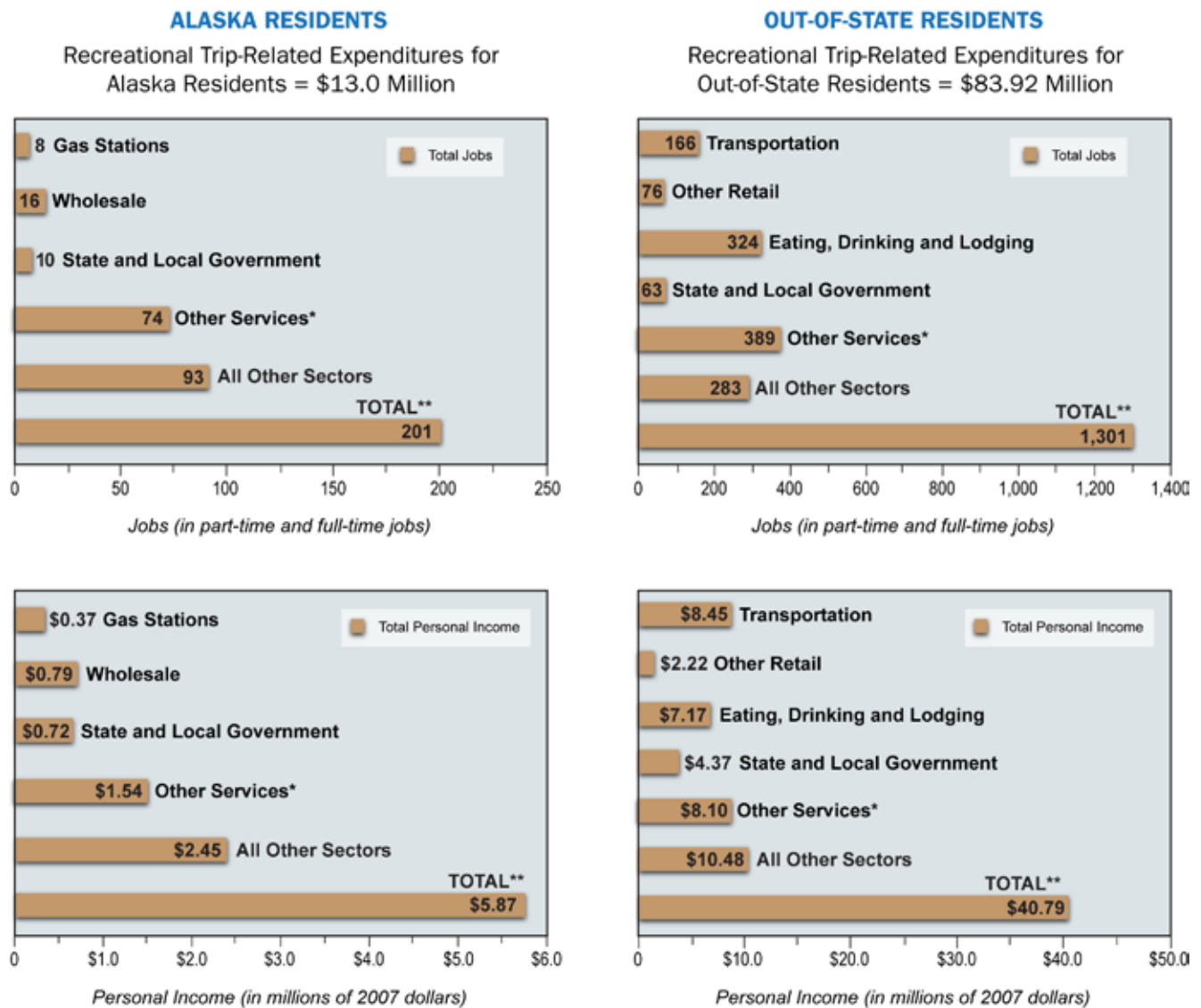
For this study, net economic values for sport fishing for salmonids are estimated based on values derived from a 1999 study of sport fishing in Alaska (ISER 1999). Net economic values (on an angler-day basis) derived from the ISER study are \$26.45 per angler day for resident anglers and \$47.79 per angler day for nonresident anglers; values were adjusted to 2007 dollars using the consumer price index (1.4194 times 1993 values). These adjusted angler day values were then multiplied by the number of angler days for 2007 reported above—219,130 angler days for resident anglers and 321,150 angler days for nonresidents. These calculations result in estimates of net economic values for sport fishing in southeast Alaska during 2007 of \$8,226,100 for resident anglers, and of \$21,783,600 for nonresident anglers.

It should be noted that these estimates of net economic value are approximations that are based on average per angler-day values. More precise estimates could be developed by considering important site and species characteristics, such as catch rates and other indicators of sport fishing quality. Collecting and analyzing these types of data, however, are beyond the scope of this study, which necessitates using readily available information instead.

Economic Impacts

Similar to commercial fisheries, sport fisheries in southeast Alaska are an important contributor to the regional economy. Resident and nonresident anglers make purchases of many goods and services that in turn support, both directly and indirectly, a large number of businesses in southeast Alaska. These purchases include trip-related items such as food and lodging, fish packages that include travel arrangements as well as food, lodging, and guiding services, and fishing equipment

Figure 9.
Economic Impacts of Sport Fisheries in Southeast Alaska on Sectors of the Southeast Alaska Regional Economy (Year 2007): Trip-Related and Package Expenditures



* Other services include amusement and recreation services, automobile repair and maintenance, household goods repair and maintenance, and other lesser-important services.

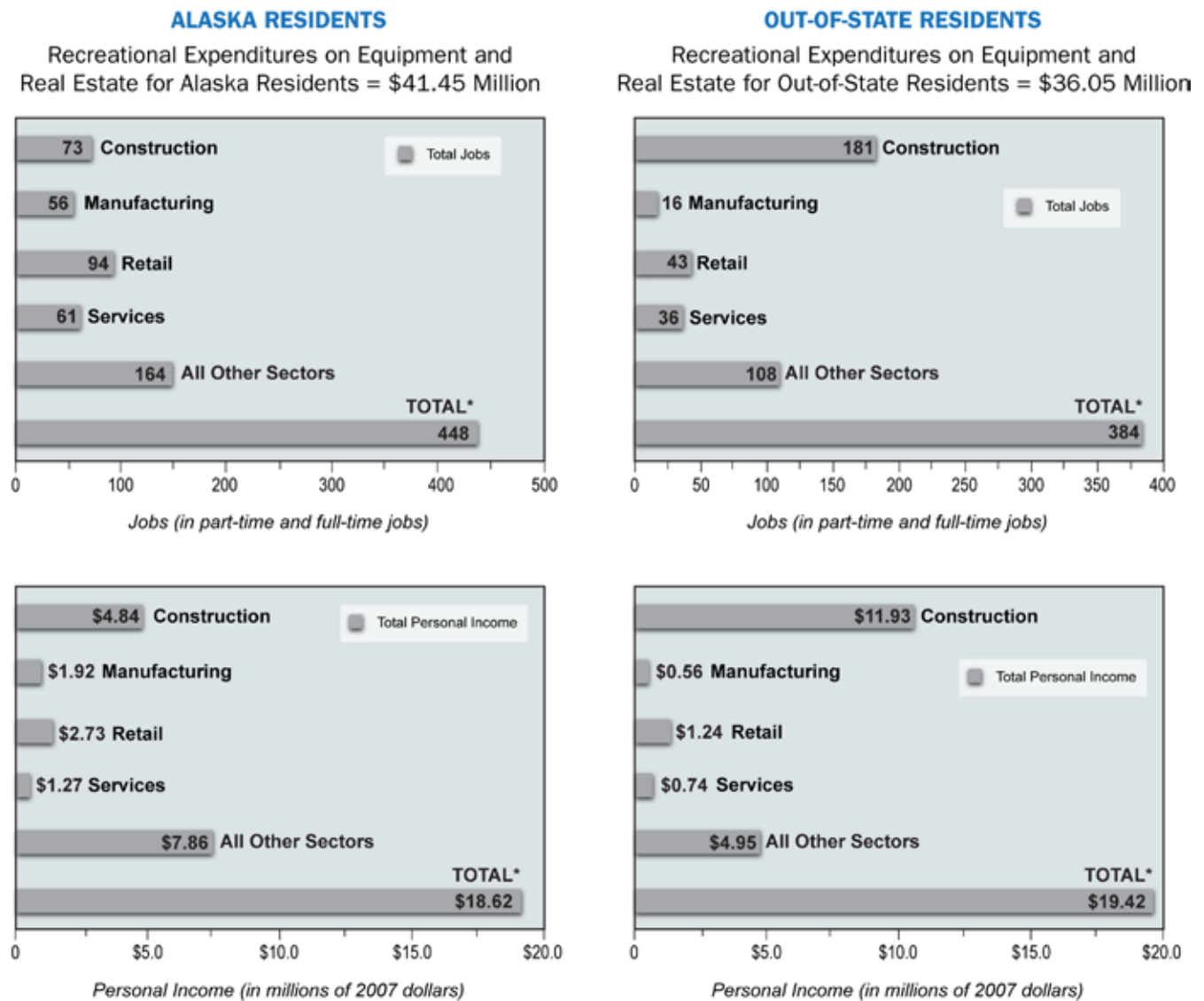
** Total jobs and personal income include "induced" effects resulting from spending of income received by households and revenues received by local governments.

Source: Results from IMPLAN-based economic impact model developed by Ed Waters; refer to Appendix A for modeling details.

(including boats). Some resident and nonresident anglers also make fishing-related expenditures for the leasing or owning of real estate that is used for sport fishing purposes.

The expenditures made by anglers for sport fishing activities generate additional economic effects throughout the regional economy beyond the initial angler spending. These additional economic effects are typically estimated with regional input-output models that relate changes in some specific industry to impacts on other industries in the regional economy. For this study, an economic impact model based on the IMPLAN input-output modeling platform and database

Figure 10.
Economic Impacts of Sport Fisheries in Southeast Alaska on Sectors of the Southeast Alaska Regional Economy (Year 2007): Equipment and Real Estate Expenditures



* Total jobs and personal income include "induced" effects resulting from spending of income received by households and revenues received by local governments.

Source: Results from IMPLAN-based economic impact model developed by Ed Waters; refer to Appendix A for modeling details.

was constructed (see Appendix A) to assess the economic impacts of expenditures made by resident and nonresident anglers for sport fishing for salmonids in southeast Alaska.

Resident anglers who fished for salmonids in southeast Alaska made an estimated \$13.0 million in trip-related expenditures, including the purchase of fishing-related packages, in 2007 (Figure 9). These purchases by residents of southeast Alaska supported an estimated 201 jobs and generated \$5.9 million in personal income. The value of total output (including multiplier effects) related to purchases by salmonids resident anglers in southeast Alaska was an estimated \$26.8 million in 2007.

As Figure 9 shows, the impacts on the regional economy generated by nonresident anglers are substantially higher than those generated by resident anglers. Nonresident anglers spent an estimated \$83.9 million on trip-related and package expenditures that supported an estimated 1,301 jobs and generated \$40.8 million in personal income. The value of total output generated by nonresident angler purchases was \$176.4 million.

The impacts on the regional economy of spending on equipment (including the purchase and maintenance of boats) and real estate-related purchases by resident and non-resident salmonid anglers are shown in Figure 10¹. Unlike for trip-related purchases, resident anglers make greater expenditures on equipment and real estate-related purchases than nonresident anglers do. In 2007, resident anglers spent an estimated \$41.4 million on equipment and real estate-related purchases, as compared to an estimated \$36.1 million for nonresident anglers.

PERSONAL USE AND SUBSISTENCE FISHERIES

Personal use fishing is defined as the taking of, or fishing for fishery resources by Alaska residents for personal use and not for sale or barter, whereas subsistence fishing is defined as the taking of, or fishing for fishery resources by a resident for subsistence uses (ADF&G undated). In southeast Alaska, a permit is required to participate in personal use fishing.

Although the estimates of economic impacts (jobs and personal income) generated by resident and nonresident anglers are conceptually consistent, these two components of economic impacts are fundamentally different in terms of their contribution to the regional economy. Tourism spending by nonresident anglers is considered a basic industry (much like exporting industries) because money flows into the regional economy from nonresidents of the region, whereas the spending by residents of southeast Alaska is generally considered a reallocation of regional income from one sector to another.

¹ Expenditures by sport anglers on real estate-related repairs and construction are included in this study because these expenditures were included in the Southwick Associates study that is the source of recreational fishing expenditure data. It should be acknowledged, however, that accurately estimating legitimate real estate-related expenditures associated with recreational fishing is very difficult; as a result, the economic impacts identified in this study that are based on these expenditures should be interpreted cautiously.

As a practical matter, the main difference between personal use fishing and subsistence fishing in southeast Alaska is where anglers fish (Harris, personal communication). Personal use fishing in southeast Alaska occurs in areas designated as “nonsubsistence areas”. The Joint Board of Fisheries and Game has designated two nonsubsistence areas in southeast Alaska – the Ketchikan Nonsubsistence Area and the Juneau Nonsubsistence Area.

Personal use fishing in southeast Alaska is managed by the Commercial Fish Division of the ADF&G. Subsistence fishing in state waters also is managed by the Commercial Fish Division, whereas subsistence fishing on Alaska’s federal lands and non-navigable waters has been managed since 1990 by the Federal government.

The main reason that Alaska residents participate in personal use and subsistence fishing is the underlying economics. Depending on where the fishing occurs, bag limits are anywhere from 5 to 50 sockeye per day, with annual limits either set at the daily limit or some multiple of it. The gear used is typically dip nets, beach seines, cast nets, and gaffs. Often a group of permit holders will work together and share the harvest. (Harris, personal communication)

Similar to recreational fisheries, the value of personal use or subsistence fishing can be estimated in terms of the expenditures made by participants in the fishery, and by the surplus value or net willingness to pay associated with fishing opportunities. As *Figure 4* shows, the harvest of salmon in personal use and subsistence fisheries in southeast Alaska annually ranged from about 42,000 fish to 79,000 fish between 2003 and 2007. In 2007, 3,153 permits were issued in southeast Alaska (including Yakutat) for personal use and subsistence fishing, with a catch of 41,863 salmon (88 percent was sockeye). Permits were issued to households with an average of three persons per household. Assuming that persons participating in personal use and subsistence fisheries caught, on average, 10 fish on each trip and have per-trip expenditures for bait, fuel, food, and lodging similar to sport anglers, it is estimated that these trips generated \$453,500 in expenditures.

A study of personal use and subsistence fisheries in the Copper River of Alaska (Henderson et. al 1999) estimates that residents participating in personal use and subsistence fishing received between \$50.93 and \$56.88 (1990 values) in net economic value per trip. Using the mid-point of this range and adjusting to 2007 dollars using the consumer price index, per-trip values for 2007 are estimated at \$76.51. Using this average per-trip value and the estimated 4,186 trips, net economic values for personal use and subsistence fishing in southeast Alaska are estimated at \$320,270 for 2007.

The trip-related spending by persons participating in personal use and subsistence fisheries also generates economic impacts on the regional economy. Based on estimates of \$453,500 in trip-related spending in southeast Alaska, this level of spending directly and indirectly supports five jobs and generates \$195,000 in personal income throughout the region.

ECONOMIC CONTRIBUTIONS AND IMPACTS OF SOUTHEAST ALASKA SALMONID RESOURCES

Salmonid resources create value for persons participating in commercial, sport, and personal use/subsistence fisheries (use values), as well as generating economic activity in the local and regional economies affected by these fisheries. Salmonid resources also generate societal values to persons who do not directly participate in these fisheries, but who place monetary value on knowing that salmonid resources are being protected for current and future generations (existence and bequeath values). Although not evaluated in this study, these “non-use” components of value contribute to the total economic value of natural resources such as salmonids (Peterson and Sorg 1987).

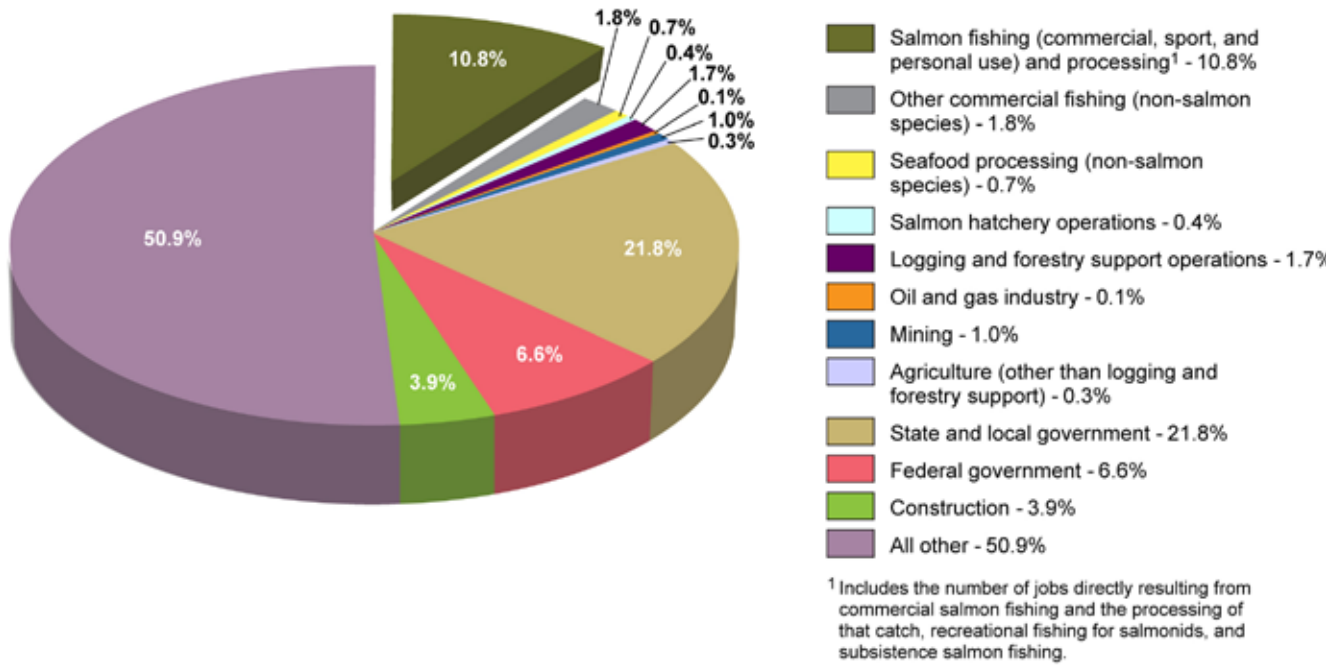
As estimated in this study, the use value of salmonid resources to commercial fisheries in southeast Alaska is estimated at \$260.9 million in 2007. The value of salmonid resources to recreational fisheries in southeast Alaska is estimated at \$204.4 million in 2007, including expenditures of \$174.4 million and net economic values of \$30.0 million. The value of salmonid resources to personal use/subsistence fisheries is estimated at \$0.77 million in 2007, including \$453,500 in expenditures and \$320,300 in net economic values. In sum, these three components of use values total \$466.1 million.

In addition to contributing to use values, the salmonid fisheries of southeast Alaska and hatchery operations contribute to economic activity in the region. Total output associated with the three fisheries and hatchery operations, which includes the additional rounds of economic activity resulting from the multiplier effect, is estimated at \$986.1 million. The total number of jobs directly and indirectly supported by southeast Alaska fisheries and hatchery operations are estimated at 7,282, and total personal income (wage earnings, profits, and other income) generated by these fisheries and hatchery operations is an estimated \$188.9 million.

Fishing for salmon in southeast Alaska, including commercial, recreational and personal use/subsistence and the processing of commercially-harvested salmon, accounts for an estimated 10.8 percent of total employment in southeast Alaska (*Figure 11*). (Note that direct employment effects of salmon fishing and the processing of commercially-harvested salmon are compared in *Figure 11* to total employment by industry in the remainder of the economy.) By comparison, logging and forestry support operations generate an estimated 1.7 percent, and mining supports about 1.0 percent of all regional employment. Employment in state and local government accounts for 21.8 percent of the regional jobs, and employment in the Federal government represents 6.6 percent.

Figure 11.
Southeast Alaska Employment by Industry

Total Employment = 50,077 Estimated Jobs (part- and full-time)



Sources: Jobs for salmon fishing (commercial, recreational, and personal use/subsistence) were derived for this study based on 2007 fishing activity. Jobs for all other sectors are from 2008 IMPLAN data for southeast Alaska.

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APPENDIX A – ECONOMIC IMPACTS MODELING AND ESTIMATION

This appendix describes the procedures used to estimate the regional economic impacts of the fisheries and hatchery operations in southeast Alaska (SEAK). An IMPLAN-based economic impact model was developed in Excel by Dr. Edward Waters for use in conducting the economic impact analysis. The following steps describe model development and the analysis of economic impacts. References to cell numbers and ranges refer to the Excel spreadsheet in which the model was constructed.

Step 1: Aggregate 2008 IMPLAN data from the following ten boroughs and special areas and use to generate the SEAK IMPLAN model.

- Haines Borough
- Hoonah-Angoon Division
- Juneau Borough
- Ketchikan Gateway Borough
- Petersburg Census Area
- Prince of Wales Area
- Sitka Borough
- Skagway Borough
- Wrangell Borough
- Yakutat Borough

Step 2: Generate “Social Accounting Matrix (SAM)>computable general equilibrium (CGE) reports” for the SEAK IMPLAN model using IMPLAN version 2.

Step 3: Use GAMS (General Algebraic Modeling System) to import the CGE reports files and to construct an “import purged” SAM based on the industry aggregation scheme shown in <SE_AK_2008_INDUSTRY_MAP_(IMPLAN_440).xls>.

Step 4: Configure the SEAK SAM with the following “endogenous” industries (i.e., sectors whose activity levels are determined at least partially by the model).

- 1 AGRI
- 2 FISHING
- 3 OIL_GAS
- 4 MINING
- 5 UTILITIES
- 6 CONSTR
- 7 FOOD
- 8 SEAFOOD
- 9 OTHMANU
- 10 WHOLESALE

- 11 TRANSPORT
- 12 FOODST
- 13 GASST
- 14 OTHRETAIL
- 15 INFO
- 16 FIRE
- 17 PROFSERVS
- 18 EDUSERVS
- 19 HEALTHSERV
- 20 EDL
- 21 OTHSERVS
- 22 MISC
- 23 SLGOVENT
- 24 FEDGOVENT
- 25 SLGOVI
- 26 FEDGOVI

Step 5: Include the following endogenous transfer and institutional accounts in the SAM.

- 27 LAB (employee compensation)
- 28 PROP (proprietors' income)
- 29 OPI (other property income: dividends, interest and rent)
- 30 INDT (indirect business taxes)
- 31 LOW_HH (the three lowest IMPLAN household income categories)
- 32 MED_HH (the three middle IMPLAN household income categories)
- 33 HI_HH (the three highest IMPLAN household income categories)
- 34 SLGOVT (state and local government)

Step 6: Export the SAM to an Excel file (see tab 'GAMS'). Note that values in the SAM are expressed in million of dollars.

Step 7: Make minor adjustments to certain terms in the SAM to balance row and column sums (see tab 'Modified'). The resulting SAM is shown in tab 'Ixl SAM'.

Step 8: Adjust the Fishing industry sector to align Fishing industry output with total 2007 ex-vessel revenues resulting from SE Alaska landings taken from the Alaska Department of Fish & Game website: <http://www.cf.adfg.state.ak.us/> (see note 1 below). Elements of the IMPLAN Fishing sector production function were scaled up based on the 2007 ADFG ex-vessel revenue estimates. A corresponding adjustment was made to IMPLAN Fishing industry employment and to estimated inter-industry purchases of local raw fish inputs by the Seafood processing sector. The resulting SAM is shown in tab 'Ixl SAM (2)'.

Step 9: Construct the SAM regional economic model using standard matrix algebra techniques (see tab 'Ixl SAM MODEL'). The SAM model includes the above 34 endogenous sectors. In this type of model, “**direct effects**” originating from defined external demand (or exogenous spending items) are assumed to stimulate indirect and induced economic activity in the region. “**Indirect effects**” are determined by resulting inter-industry transactions in response to this activity; and “**induced effects**” are triggered by the resulting respending of income and taxes by resident households and local government. Note that a model employing these types of assumptions about the range of endogenous transfer and institutional sectors (i.e., resident households and local government administration) will tend to produce higher multiplier results than would a model that assumes a lower level of endogenous institutional activity.

Step 10: Configure the following impact scenarios for analysis (details are shown in <SEAK_INPUTS_FOR_IO_Analysis_03-12-2010.xls> and <SEAK_Hatchery_Budget.xls>).

Commercial Harvesting & Processing (Note that Washington state FEAM processor margins were used to estimate ex-processor sales.)

Recreational Trip Expenditures & Packages (Note that data were provided by Tom Wegge and mapped to IMPLAN industries and to aggregated SAM sectors.)

- SEAK Residents
- Non-Residents of SEAK

Recreational Equipment & Real Estate (Note that data were provided by Tom Wegge and then adjusted from producer price to purchaser price basis for equipment purchases and mapped to IMPLAN industries and to aggregated SAM sectors.)

- SEAK Residents
- Non-Residents of SEAK

Personal & Subsistence (Note that data were provided by Tom Wegge and mapped to IMPLAN industries and to aggregated SAM sectors.)

Hatchery Operations (Note that expenditure share data from “Yakama Basin Coho and Fall Chinook Acclimation Project” were used to distribute total expenditures to underlying cost categories and mapped to IMPLAN industries and to aggregated SAM sectors).

Step 11: “**Margining**” (i.e., conversion from purchaser prices to producer prices) was performed on the estimated direct expenditures by recreational and personal use anglers in order to properly align expenditure amounts with the industry sector actually providing the goods and services. For example, the price paid for processed food purchased at a local convenience store includes significant transportation and trade margins in addition to the cost of the goods themselves. An attempt was made to “unbundle” these types of transactions to correctly assign expenditures to the list of industries providing the goods and services.

Step 12: Array impact scenarios as consecutive input vectors in cells AK155:AT192 in tab 'Ixl SAM MODEL'.

Step 13: Post-multiply each impact scenario vector by the SAM inverse matrix $((I-A)^{-1})$. These **"output impact"** results (\$ million) are displayed in cells A193:J233.

Step 14: Calculate **employment impacts** (# of jobs) by multiplying each element of the output impact results vectors by the corresponding sector employment-to-output ratio. These results are displayed in cells A235:J276.

Step 15: Calculate **income impacts** (\$ million) by multiplying each element of the output impact results vectors by the corresponding sector income-to-output ratio. These results are displayed in cells A278:J319.

Notes:

1. While IMPLAN generally does a good job tracking actual employment and payroll in most regional industries, notable exceptions are the agriculture and fishing sectors, where employment is often part-time or seasonal and therefore not subject to reporting requirements under state unemployment insurance programs. As such, employment and compensation amounts for these "non-covered" industries reported in state employment data and also in IMPLAN tend to be substantially underestimated.
2. **"Leakage"** (i.e., loss of income from the regional spending stream) is determined in regional economic models by (1) the level of goods and services purchased from outside a region ("Imports"), and (2) the relative number of non-resident workers employed in the region. IMPLAN estimates the proportion of non-labor inputs in a region using regional purchase coefficients (RPCs) that are calculated within IMPLAN by a statistical technique that uses available regional data. In the SE Alaska SAM model, the combined "non-services" industries (Agriculture, Fishing, Mining, Utilities, Construction and Manufacturing) imported 39% of their non-labor inputs. The combined "services" sectors (Trade, Transportation, Information, Finance, Insurance, Real Estate, Professionals, Private Education, Health, Accommodations, Restaurants, etc.) imported 30% of their non-labor inputs. Also, about 39% of regional households' purchases were assumed to be imported from outside SE Alaska, and about 19% of employee compensation was assumed paid to nonresident workers.