Revised Final Report

Economics of Wild Salmon Watersheds: Bristol Bay, Alaska

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Trout Unlimited, Alaska

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Executive Summary

This report provides estimates of the economic values associated with sustainable use of wild salmon ecosystem resources, primarily fisheries and wildlife, of the major watersheds of the Bristol Bay, Alaska region. Both regional economic significance and social benefit-cost accounting frameworks are utilized. This study reviews and summarizes existing economic research on the key sectors in this area and reports findings based on original survey data on expenditures, net benefits, attitudes, and motivations of the angler population.

The major components of the total value of the Bristol Bay area watersheds include subsistence use, commercial fishing, sportfishing and other recreation, and the preservation values (or indirect values) held by users and the U.S. resident population. The overall objectives of this proposed work are to estimate the share of the total regional economy (expenditures, income and jobs) that is dependent on these essentially pristine wild salmon ecosystems, and to provide a preliminary but relatively comprehensive estimate of the total economic value (from a benefit-cost perspective) that could be at risk from extractive resource development in the region.

The rivers that flow into the Bristol Bay comprise some of the last great wild salmon ecosystems in North America (Figure 1). The Kvichak River system supports the world's largest run of sockeye salmon. While these are primarily sockeye systems, all five species of Pacific salmon are abundant, and the rich salmon-based ecology also supports many other species, including Alaska brown bears and healthy populations of rainbow trout. The Naknek, Nushagak, Kvichak, Igushik, Egegik, Ugashik, and Togiak watersheds are all relatively pristine with very few roads or extractive resource development. Additionally, these watersheds include several very large and pristine lakes, including Lake Iliamna and Lake Becherof. Lake Iliamna is one of only two lakes in the world that supports a resident population of freshwater seals (the other is Lake Baikal in Russia). The existing mainstays of the economy in this region are all wilderness-compatible and sustainable in the long run: subsistence use, commercial fishing, and wilderness sportfishing. The commercial fishing is largely in the salt water outside of the rivers themselves and is closely managed for sustainability. The subsistence, sportfish and other recreation sectors are relatively low impact (primarily personal use and catch and release fishing, respectively). Additionally, there are nationally-important public lands in the headwaters, including Lake Clark National Park and Preserve, Katmai National Park and Preserve, Togiak National Wildlife Refuge, and Wood-Tikchick State Park (the largest state park in the U.S.).

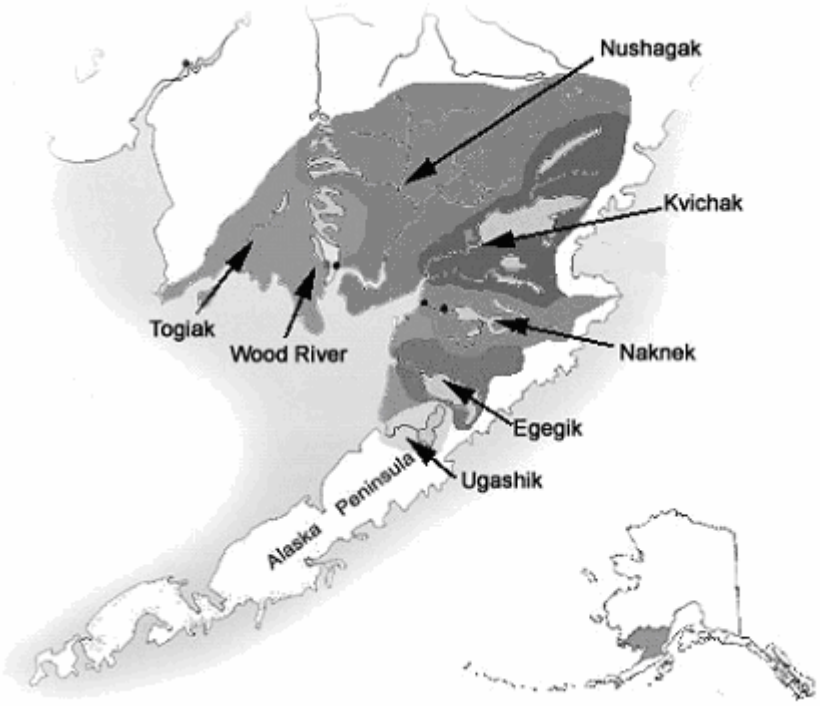


Figure 1. Map of Bristol Bay Study Area

A complete economic analysis would be conducted in several phases. The current study focuses on: 1) an overview of values based on existing data and previous studies, 2) original data collection focused on the sportfish sector, including angler surveys, and 3) estimation of both the regional economic significance (focusing on jobs and income) of these ecosystems using an existing regional economic model, as well as total value in a social benefit-cost framework. The objective is to provide a preliminary but relatively comprehensive estimate of the range of fishery-related values in this region (Figure 1).

This summary provides a brief characterization of each of the major sectors, followed by the primary economic findings.

The Bristol Bay economy is a mixed cash-subsistence economy. The primary features of these socio-economic systems include use of a relatively large number of wild resources (on the order of 70 to 80 specific resources in this area), a community-wide seasonal round of activities based on the availability of wild resources, a domestic mode of production (households and close kin), frequent and large scale noncommercial distribution and exchange of wild resources, traditional systems of land use and occupancy based on customary use by kin groups and communities, and a mixed economy relying on cash and subsistence activities (Wolfe and Ellanna, 1983; Wolfe et al. 1984). The heart of this cash-subsistence economy is the resident population of 7,611 individuals (in the year 2000) located in 25 communities (Table 1) spread across this primarily un-roaded area (Figure 2). Archeological evidence indicates that Bristol Bay has been continuously inhabited by humans at least since the end of the last major glacial period about 10,000 years ago. Three primary indigenous cultures are represented here:

Aleuts, Yupik Eskimos, and the Dena'ina Athapaskan Indians. The share of the population that is Alaska Native is relatively high at 70 percent, compared to Alaska as a whole, with 16 percent.

Table 1. Bristol Bay Area Communities, Populations, and Subsistence Harvest

Bristol Bay Area Community /year of harvest data	Population (2000 census)	Per Capita Harvest	Total Annual Harvest	% Native Population
Aleknagik 1989	221	379	54,079	81.9%
Clark's Point 1989	75	363	20,325	90.7%
Dillingham 1984	2,466	242	494,486	52.6%
Egegik 1984	116	384	37,450	57.8%
Ekwok 1987	130	797	85,260	91.5%
Igiugig 1992	53	725	33,915	71.7%
Iliamna 2004	102	508	51,816	50.0%
King Salmon 1983	442	220	81,261	29.0%
Kokhanok 1992	174	1,013	175,639	86.8%
Koliganek 1987	182	830	154,705	87.4%
Levelock 1992	122	884	97,677	89.3%
Manokotak 1985	399	384	118,337	94.7%
Naknek 1983	678	188	72,110	45.3%
New Stuyahok 1987	471	700	247,494	92.8%
Newhalen 2004	160	692	110,720	85.0%
Nondalton 2004	221	358	79,118	89.1%
Pedro Bay 2004	50	306	15,300	40.0%
Pilot Point 1987	100	384	24,783	86.0%
Port Alsworth 2004	104	133	13,832	4.8%
Port Heiden 1987	119	408	41,985	65.6%
South Naknek 1992	137	297	39,893	83.9%
Ugashik 1987	11	814	8,144	72.7%
Togiak City	809	--	--	86.3%
Portage Creek	36	--	--	86.1%
Twin Hills	69	--	--	84.1%
Total communities	7,447	--	--	--
Unincorporated areas	164	--	--	--
Total (interpolated to include unincorporated areas)	7,611	315	2,397,970	69.6%

Sources: US Census Bureau (2000 census statistics), and ADF&G Division of Subsistence Community Profile Data Base. & Fall et al. 2006. Note: % native indicates those who classify themselves as Native only.

Wild renewable resources are important to the people of this region and many residents rely on wild fish, game and plants for food and other products for subsistence use. Total harvest for these 25 communities is on the order of 2.4 million pounds based largely on surveys undertaken in the late 1980's and early 1990's, as summarized in the Alaska Division of Subsistence community profile data base. A new round of surveys is now underway to update this data. Estimates for the 2004 study year (Fall et al. 2006) for five communities (Newhalen, Nondalton, Iliamna, Pedro Bay, and Port Alsworth) are included in the data presented in Table 1. Per capita harvests averaged about 315 pounds. Primary resources used include salmon, other freshwater fish, caribou, and moose. Subsistence use continues to be very important for communities of this region, based on

these recent surveys, and participation in subsistence activity, including harvesting, processing, giving and receiving is quite high. Compared to other regions of Alaska, the Bristol Bay area has some characteristic features, including the great time depth of its cultural traditions, its high reliance on fish and game, the domination of the region's market economy by the commercial salmon fishery, and the extensive land areas used by the region's population for fishing, hunting, trapping and gathering. (Wright, Morris, and Schroeder, 1985).

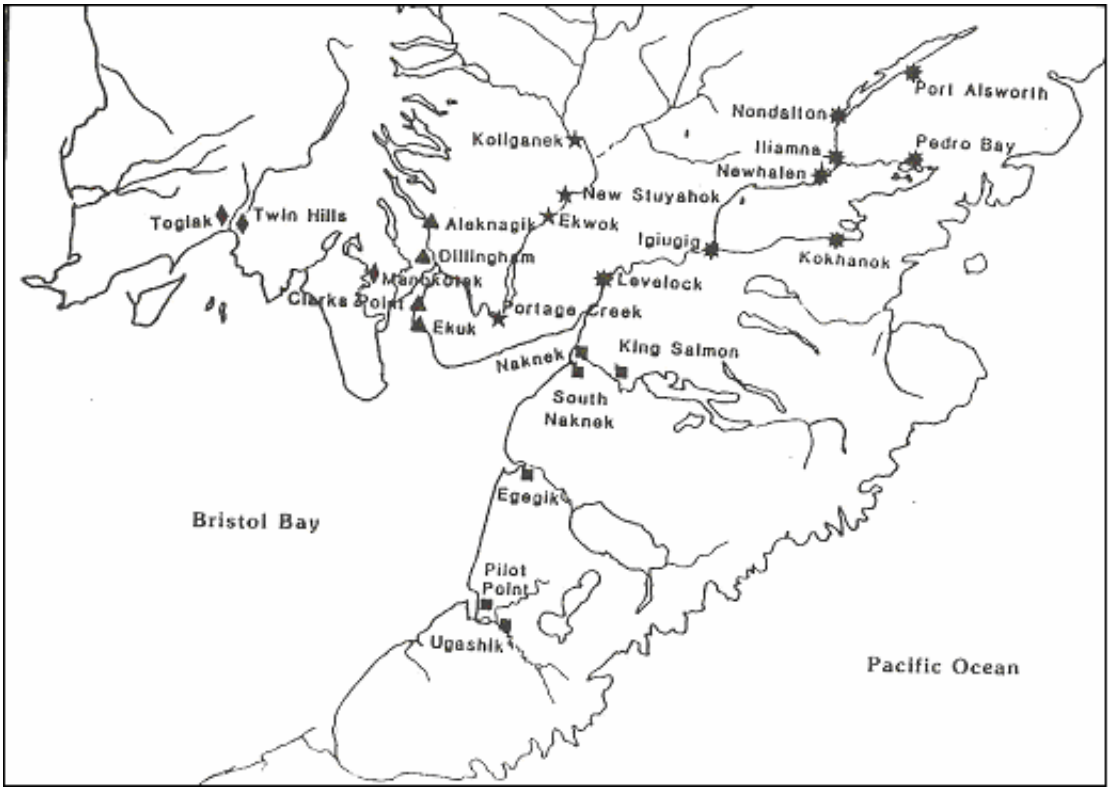


Figure 2. Bristol Bay Area Location and Major Communities

The primary private source of cash employment for participants in Bristol Bay's mixed cash-subsistence economy is the commercial salmon fishery. The compressed timing of this fishery's harvesting activity makes it a good fit with subsistence in the overall Bristol Bay cash-subsistence economy. Many commercial fishing permit holders and crew members, as well as some employees in the processing sector, are residents of Bristol Bay's dominantly-native Alaskan villages. In 2004, there were 952 resident commercial fishing permit holders in the Bristol Bay study area, as well as 920 crew members. This is a significant share of the area's total adult population. An ADF&G summary of subsistence activity in Bristol Bay (Wright, Morris, and Schroeder 1985) noted that as of the mid-1980's traditional patterns of hunting, fishing, and gathering activities had for the most part been retained, along with accommodations to participate in the commercial fishery and other cash-generating activities. In the abstract to this 1985 paper, the authors

characterize the commercial salmon fishery as “a preferred source of cash income because of its many similarities to traditional hunting and fishing, and because it is a short, intense venture that causes little disruption in the traditional round of seasonal activities while offering the potential for earning sufficient income for an entire year.” Commercial fishing is a form of self employment requiring many of the same skills, and allowing nearly the same freedom of choice as traditional subsistence hunting and fishing. (Wright, Morris, Schroeder 1985; p. 89).

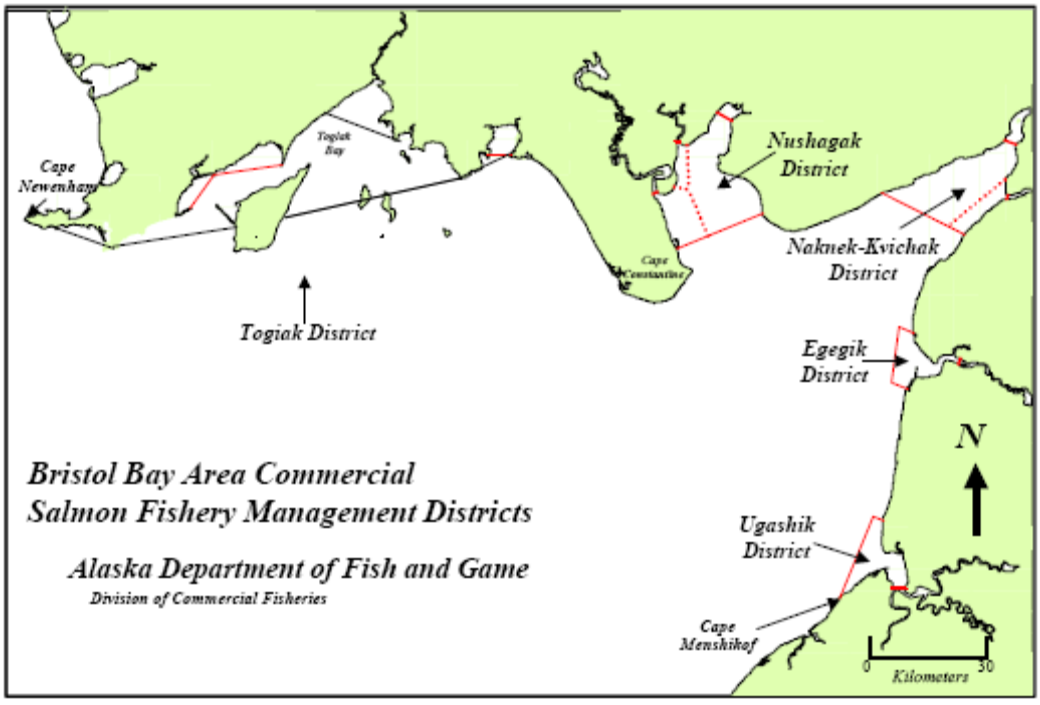


Figure 3. Bristol Bay Area Commercial Salmon Fishery Management Districts

The Bristol Bay commercial fisheries management area encompasses all coastal and inland waters east of a line from Cape Menshikof to Cape Newhenham (Figure 3). This area includes eight major river systems: Naknek, Kvichak, Egegik, Ugashik, Wood, Nushagak, Igushik and Togiak. Collectively these rivers support the largest commercial sockeye salmon fishery in the world (ADF&G, 2005). This is an interesting and unique fishery, both because of its scale and significance to the local economy, but also because it is one of the very few major commercial fisheries in the world that has been managed on a sustainable basis.

The five species of pacific salmon found in Bristol Bay are the focus of the major commercial fisheries. Sockeye salmon is the primary species harvested both in terms of pounds of fish and value. Annual commercial catches between 1984 and 2003 averaged nearly 24 million sockeye salmon, 69,000 chinook, 971,000 chum, 133,000 coho, and 593,000 (even year only) pink salmon (ADF&G, 2005). Prices for sockeye salmon are typically higher than for other salmon species, making the Bristol Bay fishery the most

valuable of Alaska's salmon fisheries (CFEC, 2004). Nearly one-third of all earnings from Alaska salmon fishing come from the Bristol Bay fishery (Table 2). This is also the largest Alaska fishery in terms of the number of permit holders. In 2004, there were 1,857 potentially active entry permits in the drift gillnet fishery and 992 in the set gillnet fishery (CFEC, 2004).

Table 2. Bristol Bay and Alaska Commercial Fishery Permits, Harvest, and Gross Earnings, 2002

Sector	# permit holders	# permits	Pounds	Gross earnings
Bristol Bay Salmon	**2,850**	**2,276**	**165,582,203**	**$94,571,755**
Drift gillnet	1,862	1,447	135,549,944	$77,243,936
Set gillnet	988	829	30,032,259	$17,327,819
All Alaska Salmon	10,594	7,508	872,577,336	$293,147,368
All Alaska Fisheries	14,318	13,463	3,842,853,863	$990,099,365

Source: Derived from ADFG (2005)

The fishery is organized into five major districts (Figure 3) including Togiak, Nushagak, Naknek-Kvichak, Egegik, and Ugashik. Management is focused on discrete stocks with harvests directed at terminal areas at the mouths of the major river systems (ADF&G, 2005). The stocks are managed to achieve an escapement goal based on maximum sustained yield. The returning salmon are closely monitored and counted and the openings are adjusted on a daily basis to achieve desired escapement. Having the fisheries near the mouths of the rivers controls the harvest on each stock, which is a good strategy for protection of the discrete stocks and their genetic resources. The trade-off is that the fishery is more congested and less orderly, and the harvest is necessarily more of a short pulse fishery, with most activity in June and early July. This has implications for the economic value of the fish harvest, both through effects on the timing of supply, but also on the quality of the fish. Most fish are canned or frozen, rather than sold fresh. The fishery is quite cyclical in terms of run size and potential harvest. For example, harvests were as low as only several million fish in the early 1970's, but exceeded 45 million fish in the early 1990's. Prices have also varied quite dramatically historically. In real terms (constant 2005 dollars) prices peaked at $3.15 per pound in 1989 and reached a recent historical low of about $0.40 a pound in 2002. Prices are currently low because of competition with farmed salmon and other factors. For the period 1985 to 2005, total production value for processors averaged about $288 million, with a low of $95 million in 2002. Total production value in 2005 was $225 million. According to the Commercial Fish Entry Commission (2004) the total salmon return to Bristol Bay is strongly influenced by sockeye returns to the Kvichak River, which is historically the largest salmon resource in the region, and perhaps the largest in the world. The sockeye return to the Kvichak is highly variable, and exhibits a pattern of oscillating cycles. In recent years the Kvichak sockeye return has been weaker, and the river has been classified as a "stock of management concern" by the Alaska Department of Fish and Game and the Alaska Board of Fisheries.

Next to commercial fishing and processing, recreational angling is the most important private economic sector in the Bristol Bay region. The 2005 Bristol Bay Angler Survey, which was undertaken for purposes of this report, confirmed that the fresh water rivers, streams, and lakes of the region are a recreational resource equal or superior in quality to other world renowned fisheries.

In their survey responses Bristol Bay anglers consistently emphasized the importance of Bristol Bay's un-crowded, remote, wild setting in their decisions to fish the area. Additionally, a significant proportion of respondents to the survey specifically traveled to the region to fish the world-class rainbow fisheries. These findings indicate that Bristol Bay sport fishing is a relatively unique market segment, paralleling the findings of Romberg (1999) that angler motivation and characteristics vary significantly across Alaska sport fisheries.

Recreational fishing use of the Bristol Bay region is roughly divided between 65% trips to the area by Alaska residents and 35% trips by nonresidents. These nonresidents (approximately 13,000 trips in 2005 (personal communication, ADF&G, 2006)) account for the large majority of total recreational fishing spending in the region. It is estimated that in 2005 approximately $48 million was spent in Alaska by nonresidents specifically for the purpose of fishing in the Bristol Bay region. In total, it is estimated that $61 million was spent in Alaska in 2005 on Bristol Bay fishing trips.

While sport fishing within the Bristol Bay region comprises the largest share of recreational use and associated visitor expenditures, several thousand trips to the region each year are also made for the primary purpose of sport hunting and wildlife viewing.

Table 3 through 8 detail the summary results of the analysis of economic values. Table 3 shows estimated direct expenditures in Alaska related to harvest or use of Bristol Bay area renewable resources. Total estimated direct expenditures (that drive the basic sector of the economy) were estimated to be $324 million in 2005. The largest component is commercial fishing harvesting and processing. These estimates were obtained from the Alaska Department of Revenue and the Commercial Fishing Entry Commission. The range shown of low and high estimates reflects the cyclical nature of this sector, and is based on a 95 percent confidence interval for total earnings in this sector between 1985 and 2005. The next most significant component is sportfishing at $61 million in 2005. This estimate is derived from original survey data as described below, and a 95 percent confidence interval for this 2005 estimate is relatively imprecisely estimated at zero to $123.2 (this broad range reflects the statistical uncertainty within a number of estimated parameters used to estimate spending, including average spending per angler and average number of trips per year per angler). Sport hunting and wildlife viewing / tourism are less important economically. The wildlife viewing and tourism estimates are approximate, and reflect a small share of the visitation at Katmai National Park. Most of the visitation at Katmai is expected to be picked up in the sportfishing use estimates and is excluded here to avoid double-counting.

Table 3. Summary of Regional Economic Expenditures Based on Wild Salmon Ecosystem Services (Million 2005 $)

Ecosystem Service	Estimated direct expenditures / sales per year	Low estimate	High estimate
Commercial fish wholesale value	$226.0	$226.0	$346.0
Sport fisheries	$61.2	0	$123.2
Sport hunting	$12.4	$12.4	$12.4
Wildlife viewing / tourism	$17.1	$17.1	$17.1
Subsistence harvest expenditures	$7.2	$7.2	$7.2
Total direct annual economic impact	**$323.90**	**$262.70**	**$505.90**

Table 4 provides additional detail on recreation expenditures, including number of trips and spending by residence of the participants. A large share of sportfish expenditures, and hence of total recreation expenditures, is by nonresident anglers ($48 of $61 million). This reflects the high quality of this fishery, in that it is able to attract participants from a considerable distance in the lower 48 states as well as foreign countries.

Table 4. Total Estimated Recreational Direct Spending in Alaska Attributable to Bristol Bay Wild Salmon Ecosystems, 2005

Sector	Alaska Residents			Nonresidents	Total
	Local residents	Non-local residents	Total Alaska		
(A) TRIPS					
Sport fishing	19,488	4,450	23,938	12,966	60,842
Sport hunting	-	1,538	1,538	2,310	3,848
Wildlife viewing / tourism	-	1,000	1,000	9,000	10,000
Total	**19,488**	**6,988**	**26,476**	**24,276**	**50,752**
(B) SPENDING					
Sport fishing	$6,606,432	$6,397,747	$13,004,179	$48,207,588	$61,211,767
Sport hunting	-	$2,214,720	$2,214,720	$10,870,860	$13,085,580
Wildlife viewing / tourism	-	$970,010	$970,010	$16,168,280	$17,138,290
Total	**$6,606,432**	**$9,582,477.00**	**$16,188,909**	**$75,246,728.00**	**$91,435,637.00**

Table 5 summarizes the full time equivalent employment associated with the sectors of the Bristol Bay economy that are dependent on wild salmon ecosystems. A total of 5,540 full time equivalent jobs are supported, with an estimated 1,598 of these held by local residents of Bristol Bay, 1,829 by non-local Alaskans (for a total of 3,430 Alaska jobs) and 2,110 by nonresidents. Three-fourths of these jobs are in the commercial fish sector (4,239) and about one-fourth in recreation. A small number of jobs (49) are also shown for subsistence, based on expenditures made by subsistence participants for supplies and

equipment to support subsistence activity. However, this perspective on subsistence is somewhat misleading, as it is only from the cash side of the mixed cash-subsistence economy. The level of full-time equivalent subsistence jobs was estimated for a similar sized population of Bristol Bay residents by Goldsmith et al. (1998) at 762 jobs. This is based on the approximation that the average Alaska Native (3,048 in Goldsmith's population) participates in subsistence activities a total of three months a year, and that non-natives participate not at all. Unfortunately there is not much evidence to support or refute this estimate, but it does indicate the possible significance of subsistence employment from a broader perspective than that of just the cash economy as shown in Table 5.

Table 5. Total Full Time Equivalent (FTE) Employment in Alaska Dependent on Bristol Bay Wild Salmon Ecosystems, 2005

Sector	Alaska Residents			Nonresidents	Total FTE jobs
	Local residents	Non-local residents	Total Alaska		
Commercial fishing	689	667	1,357	1,172	2,529
Commercial processing	465	449	914	796	1,710
Sport fishing	288	435	723	123	846
Sport hunting	60	105	165	2	167
Wildlife viewing / tourism	82	139	222	17	239
Subsistence	14	34	49	0	49
Total FTE jobs	1598	1829	3,430	2,110	5,540

A related perspective is that angler effort in the sport fishery is on the order of 100,000 angler days (for example, 106,000 in the year 2000), mostly in the June-September period. From the theoretical economic "household production" perspective of anglers utilizing capital and labor resources to produce themselves a good outdoor experience, this is the equivalent of about 400 full time equivalent jobs. An interesting feature of the sportfish sector, and one that limits its economic impact relative to the commercial fishery, is that there is essentially no (or only a very limited) processing sector in this dominantly catch and release fishery.

The overall structure of the Bristol Bay economy is shown in Table 6. This estimate was derived by starting from the official employment data reported by the U.S. Bureau of Economic Analysis and the Alaska Department of Labor. These sources miss some of the wage and salary employment in the region as well as non local resident proprietors (self employed). Revised employment data developed for this study shows that the annual average employment in the Bristol Bay economy was 7,691 jobs in 2004. The private sector basic employment in this economy is currently almost totally dependent on Bristol Bay's wild salmon ecosystems with mining contributing a small amount. The only other basic driver is government employment (here including hospitals and other non profit enterprises which are publicly funded). As a share of all basic employment, the salmon ecosystem-dependent sectors account for 64 percent of all the basic employment that drives this cash economy. A good share of the non-basic employment is also derived

through induced and indirect effects (multiplier effect) from the ecosystem sectors as well. Furthermore, although government is here considered a BASIC sector activity because it brings money into the local economy, in the absence of the salmon ecosystem, regional population would surely be smaller and the government presence would also shrink.

Table 6. Structure of the Bristol Bay Economy, 2004

	ANNUAL AVERAGE	SUMMER (July)	WINTER (January)	SWING (Jan-July)
JOBS BY PLACE OF WORK	**7,691**	**16,631**	**3,640**	**12,991**
BASIC	6,251	15,028	2,304	12,724
Fish Harvesting	2,552	7,657	0	7,657
Fish Processing	1,150	4,193	200	3,993
Recreation	311	933	0	933
Government / Health	2,098	1,795	2,104	(309)
Mining	150	450	0	450
NON-BASIC	1,440	1,603	1,336	267
Construction	64	80	56	24
Trade/Transport/Leisure	642	765	580	185
Finance	127	118	116	2
Other Wage and Salary	180	213	157	56
Other Proprietors	427	427	427	0
JOBS BY PLACE OF RESIDENCE				
Local Resident	4,233	5,741	3,640	2,101
All Non Local	3,458	10,890	0	10,890

Table 6 also shows the extreme seasonal nature of this economy. From a winter low of 3,640 jobs, employment climbs by almost 13 thousand jobs to a total of 16,631 in summer. Since the total resident population (including children and the elderly) is only about 7,600 a large share of the seasonal increase must be filled by non local residents. The most seasonally stable component of the economy is government, which actually declines by about 300 jobs in summer, reflecting the academic year schedules of teachers. The winter employment pattern reveals the bare bones of the local cash economy, absent almost all of the cash employment jobs associated with fishing and recreation, except for about 200 jobs in commercial fish processing.

Subsistence users are not the only hunter-gatherers in this economy. Essentially the entire private economy is “following the game” (or, in this case, the fish), with many commercial fishers, processors, sport anglers, sport hunters and wildlife viewers coming from elsewhere in Alaska or the lower 48 to be part of this unique economy at the time that fish and game are available.

The estimated payroll associated with the salmon ecosystem-dependent jobs is shown in Table 7. The total is $161 million in 2005, including $46.8 million to Bristol Bay residents and a total of $103.4 million to all Alaska residents.

Table 7. Total Alaska Payroll Associated with Use of Bristol Bay Wild Salmon Ecosystems, 2005 (Million 2005 dollars)

Payroll paid to:	Commercial fishing	Sport Fishing	Hunting	Other Recreation	Subsistence	Total
Local residents	$34.554	$8.180	$1.536	$2.015	$0.525	**$46.810**
Non-local residents	$33.242	$14.491	$3.392	$4.235	$1.183	**$56.543**
All Alaska Residents	$67.796	$22.671	$4.929	$6.250	$1.707	**$103.353**
Non Residents	$52.694	$4.303	$.087	$.597	$0	**$57.681**
TOTAL	$120.490	$26.974	$5.016	$6.847	$1.707	**$161.034**

The preceding discussion has focused on a regional economic accounting framework. Table 8 introduces the net economic value measures for evaluation of the renewable Bristol Bay resources. Commercial salmon fishery net economic values are derived by annualizing permit values, which are exchanged in an open market and reported by the Commercial Fish Entry Commission. These are on the order of $51,200 for a drift gillnet permit in 2005 in total, but have been as high as $200,000 as recently as 1993. Subsistence harvests are valued based on the willingness-to-pay revealed through tradeoffs of income and harvest in choice of residence location (Duffield 1997).

The sportfish net economic value is based on original data collected for purposes of this study, as reported below. These estimates are consistent with values from the extensive economic literature on the value of sportfishing trips. Sport hunting and wildlife viewing values are based on studies conducted about fifteen years ago in Alaska, and which need to be updated. Direct use values total from $104 million to $179 million.

A major unknown is the total value for existence and bequest (also called passive use values). Goldsmith et al. (1998) estimated the existence and bequest value for the federal wildlife refuges in Bristol Bay at $2.3 to $4.6 billion per year (1997 dollars). There is considerable uncertainty in these estimates, as indicated by the large range of values. Goldsmith's estimates for the federal wildlife refuges are based on the economics literature concerning what resident household populations in various areas (Alberta, Colorado) (Adamowicz et al. 1991; Walsh et al. 1984; Walsh et al. 1985) are willing to pay to protect substantial tracts of wilderness. Similar literature related to rare and endangered fisheries, including salmon, could also be appealed to here. It is possible that from a national perspective the Bristol Bay wild salmon ecosystems and the associated economic and cultural uses are sufficiently unique and important to be valued as highly as wilderness in other regions of the U.S. Goldsmith et al's (1998) estimates assume that a significant share of U.S. households (91 million such households) would be willing to pay on the order of $25 to $50 per year to protect the natural environment of the Bristol Bay federal wildlife refuges. The number of these households is based on a willingness to pay study (the specific methodology used was contingent valuation) conducted by the State of Alaska Trustees in the Exxon Valdez oil spill case (Carson et al. 1992). The

findings of this study were the basis for the $1 billion settlement between the State and Exxon in this case. These methods are somewhat controversial among economists, but when certain guidelines are followed, such studies are recommended for use in natural resource damage regulations (for example, see Ward and Duffield 1992). They have also been upheld in court (Ohio v. United States Department of Interior, 880 F.2d 432-474 (D.C. Cir.1989)) and specifically endorsed by a NOAA-appointed blue ribbon panel (led by several Nobel laureates in economics) (Arrow et al. 1993).

Goldsmith's estimates for just the federal refuges may be indicative of the range of passive use values for the unprotected portions of the study area. However, there are several caveats to this interpretation. First, Goldsmith et al. estimates are not based on any actual surveys to calculate the contingent value specific to the resource at issue in Bristol Bay. Rather, they are based on inferences from other studies (benefits transfer method). Second, these other studies date from the 1980's and early 1990's and the implications of new literature and methods have not been examined. Additionally, the assumptions used to make the benefits transfer for the wildlife refuges may not be appropriate for the Bristol Bay study area. This is an area for future research.

Table 8. Summary of Bristol Bay Wild Salmon Ecosystem Services, Net Economic Value per Year (Million 2005 $)

Ecosystem Service	Low estimate	High estimate
Commercial salmon fishery	$9.4	$18.8
Sport fishing	$13.5	$13.5
Sport hunting	$1.8	$1.8
Wildlife viewing / tourism	$1.8	$1.8
Subsistence harvest	$77.8	$143.1
Total Direct Use Value	**$104.30**	**$179.00**
Existence and Bequest Value	Not estimated	Not estimated

The estimates in Table 8 are for annual net economic values. Since these are values for renewable resource services that in principle should be available in perpetuity, it is of interest to also consider their present value (e.g. total discounted value of their use into the foreseeable future). Recent literature (EPA 2000; Weitzman 2001) provides some guidance on the use of social discount rates for long term (intergenerational) economic comparisons. A rate as low as 0.5% has been recommended by EPA (2000). Weitzman, based on an extensive survey of members of the American Economic Association, suggests a declining rate schedule, which may be on the order of 4 percent (real) in the near term and declining to near zero in the long term. He suggests a constant rate of 1.75% as an equivalent to his rate schedule. Applying this parameter to the net economic values shown in Table 8 results in a net present value of $6.0 billion to $10.2 billion for just the direct uses.

1.0 Introduction

This report provides information on the importance of wild fisheries and the natural environment in the Bristol Bay region to the economies of the Bristol Bay region, the State of Alaska and the U.S. as a whole.

1.1 Study Objectives

This report provides estimates of the economic values associated with sustainable use of wild salmon ecosystem resources, primarily fisheries and wildlife, of the major watersheds of the Bristol Bay, Alaska region. Both regional economic significance and social benefit-cost accounting frameworks are utilized. This study reviews and summarizes existing economic research on the key sectors in this area and reports on original survey data on expenditures, net benefits, attitudes and motivations of the angler population.

The major components of the total value of the Bristol Bay area wild salmon ecosystems include subsistence use, commercial fishing and processing, sportfishing, and the preservation values (or indirect values) held by users and the U.S. resident population. The overall objectives of this work are to estimate the share of the total regional economy (expenditures, income and jobs) that is dependent on these essentially pristine wild salmon ecosystems, and to provide a preliminary but relatively comprehensive estimate of the total economic value (from a benefit-cost perspective) associated with the ecosystem.

1.2 Definition of Study Area

The Bristol Bay region is located in southwestern Alaska. The area is very sparsely populated and the large majority of its population is comprised of Alaskan Natives (Table 9). The region, which includes Bristol Bay Borough, the Dillingham Census Area, and a large portion of Lake and Peninsula Borough contains a relatively small number of communities, the largest of which are shown in Figure 4. Although median household income varies among census areas within the region, outside of the relatively small Bristol Bay Borough, income is somewhat lower than for the state of Alaska as a whole. As noted, Alaskan Natives make up over two-thirds of the total population within the region as compared to approximately 16% for the entire state (Table 9)

Table 9. Demographic and Socioeconomic Characteristics of the Bristol Bay Region

Area	*Population 2004*	*Percent Alaska native*	*Percent 18 or over*	*Number of households*	*Median household income 1999*
Bristol Bay Borough	1,103	43.7%	68.7%	490	$ 52,167
Dillingham Census Area	4,924	70.1%	61.9%	2,341	$ 43,079
Lake & Peninsula Borough	1,584	73.5%	62.2%	588	$ 36,442
Total Bristol Bay Region	7,611	67.0%	62.9%	3,419	$ 43,015
State of Alaska	655,435	15.6%	69.6%	221,600	$ 51,571

Source: US Census Quickfacts. Quickfacts.census.gov

Table 10. Bristol Bay Area Communities and Populations

Bristol Bay Area Community	*Population (2000 census)*	*% Native Population*
Aleknagik	221	81.9%
Clark's Point	75	90.7%
Dillingham	2,466	52.6%
Egegik	116	57.8%
Ekwok	130	91.5%
Igiugig	53	71.7%
Iliamna	102	50.0%
King Salmon	442	29.0%
Kokhanok	174	86.8%
Koliganek	182	87.4%
Levelock	122	89.3%
Manokotak	399	94.7%
Naknek	678	45.3%
New Stuyahok	471	92.8%
Newhalen	160	85.0%
Nondalton	221	89.1%
Pedro Bay	50	40.0%
Pilot Point	100	86.0%
Port Alsworth	104	4.8%
Port Heiden	119	65.6%
South Naknek	137	83.9%
Ugashik	11	72.7%
Togiak City	809	86.3%
Portage Creek	36	86.1%
Twin Hills	69	84.1%

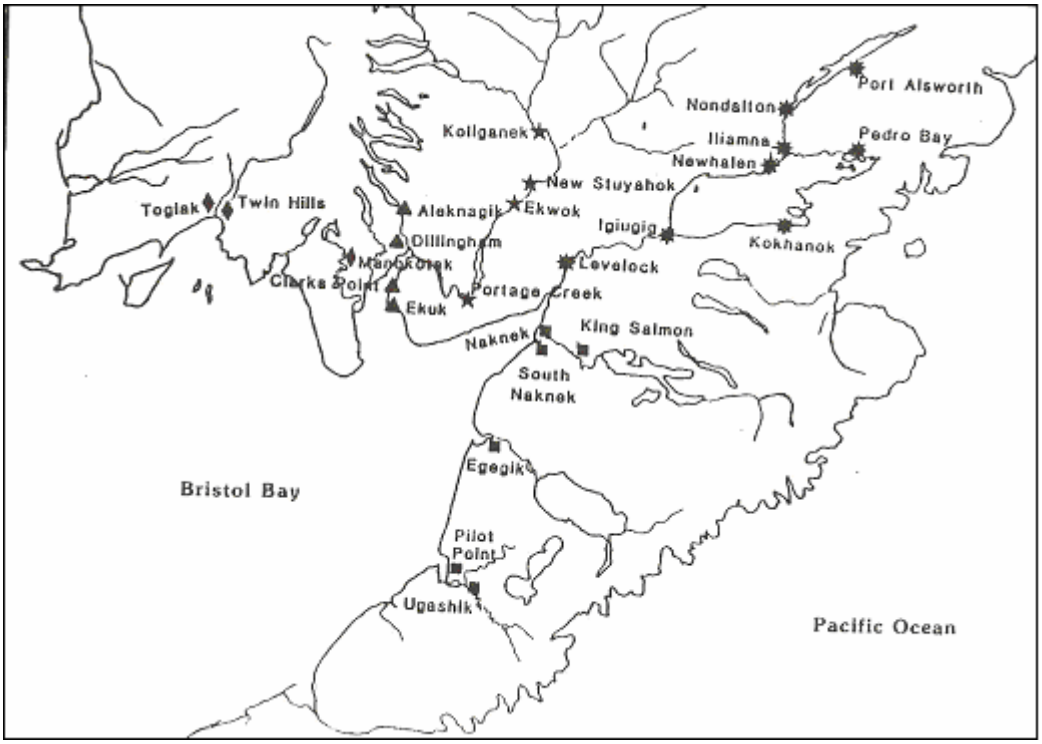


Figure 4. Bristol Bay Area Location and Major Communities

This study focuses on the economic contributions of the Bristol Bay ecosystem. The rivers that flow into the Bristol Bay comprise some of the last great wild salmon ecosystems in North America (Figure 5). All five species of Pacific salmon are abundant, and the rich salmon-based ecology also supports many other species, including healthy populations of rainbow trout. The Naknek, Nushagak-Mulchatna, and Kvichak-Lake Iliamna watersheds are relatively pristine with very little roading or extractive resource development. The existing mainstays of the economy in this region are all wilderness-compatible and sustainable in the long run: subsistence use, commercial fishing, and wilderness sportfishing. The commercial fishing is largely in the salt water outside of the rivers themselves and is closely managed for sustainability. The subsistence and sportfish sectors are relatively low impact (primarily personal use and catch and release fishing, respectively). Additionally, there are important pubic lands in the headwaters, including Lake Clark National Park and Preserve, Katmai National Park and Preserve, and Togiak National Wildlife Refuge.

The Bristol Bay area includes the political designations of Bristol Bay Borough, the Dillingham census area, and most of Lake and Peninsula Borough. The largest town in the area is Dillingham. In 2004 the Dillingham census area had an estimated population of 4,294 (US Census, Quick Facts).

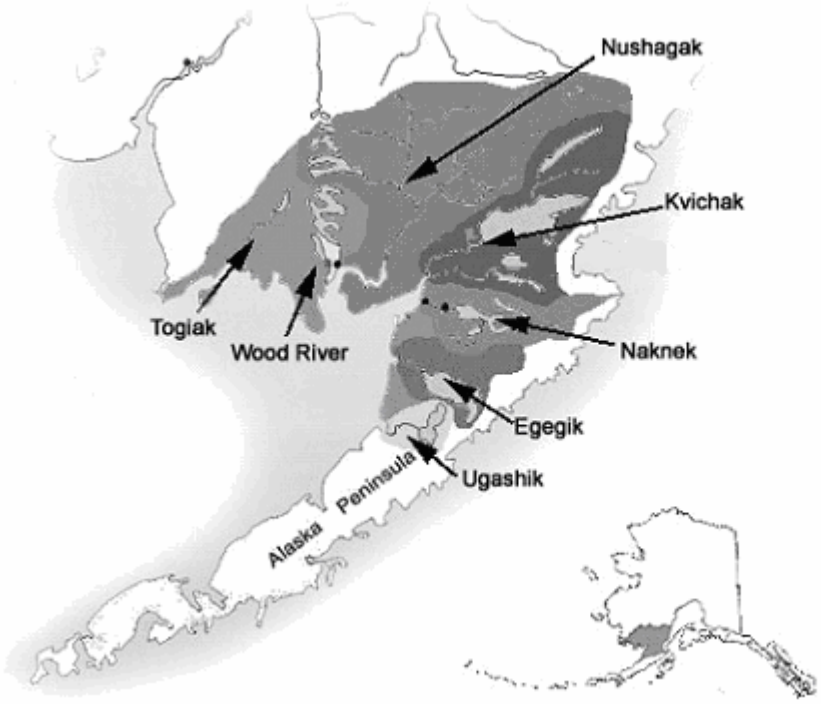


Figure 5. Map of Bristol Bay Study Area

1.3 Focus of Study-Economic Uses

The current research focuses on the ecosystem services provided by the Bristol Bay Region. These services are broad and substantial and include, but are not limited to commercial, aesthetic, recreational, cultural, natural history, wildlife and bird life, and ecosystem services.

A primary dichotomy of economic values is the division of values into those that are, or can be traded within existing economic markets, and those for which no developed market exists. Examples of resource services specific to the Bristol Bay region that are traded in markets are commercial fish harvests and guided fishing trips. While a number of services provided by the Bristol Bay natural resources can be classified as market services (with associated market-derived values), there are many services provided by this area that are classified as non-market services. These non-market resource services include noncommercial fishing, wildlife watching, subsistence harvests, protection of cultural sites, and aesthetic services.

A second dichotomy of resource services and associated values is that of direct use and passive use services and values. The most obvious type, direct use services, relates to direct onsite uses. The second type of resource services are so-called passive use services. These services have values that derive from a given resource and are not dependent on direct on-site use. Several of the possible motives for passive use values were first described by Weisbrod (1964) and Krutilla (1967), and include existence and bequest values. Existence values can derive from merely knowing that a given natural environment or population exists in a viable condition. For example, if there were a proposal to significantly alter the Bristol Bay natural ecosystem, many individuals could experience a real loss, even though they may have no expectation of ever personally visiting the area.

While use services may or may not have associated developed markets for them, passive use services are exclusively non-market services.

When passive use and use values are estimated together, the estimate is referred to as total valuation. This concept was first introduced by Randall and Stoll (1983) and has been further developed by Hoehn and Randall (1989).

The National Research Council in their 2005 publication "Valuing Ecosystem Services: Toward Better Environmental Decision Making" provided an outline of ecosystem services. Table 11 provides an application of the NRC outline to Bristol Bay resources, and details examples of the ecosystem services, both use and passive use, that are produced by natural resources such as those found in the Bristol Bay region. Additionally, Figure 6 diagrams the flow of ecosystem services.

Table 11: Types of Ecosystem Services

Use Values		*Nonuse Values*
Direct	**Indirect**	**Existence and Bequest Values**
Commercial and recreational fishing	Nutrient retention and cycling	Cultural heritage
Aquaculture	Flood control	Resources for future generations
Transportation	Storm protection	Existence of charismatic species
Wild resources	Habitat function	Existence of wild places
Potable water	Shoreline and river bank stabilization	
Recreation		
Genetic material		
Scientific and educational opportunities		

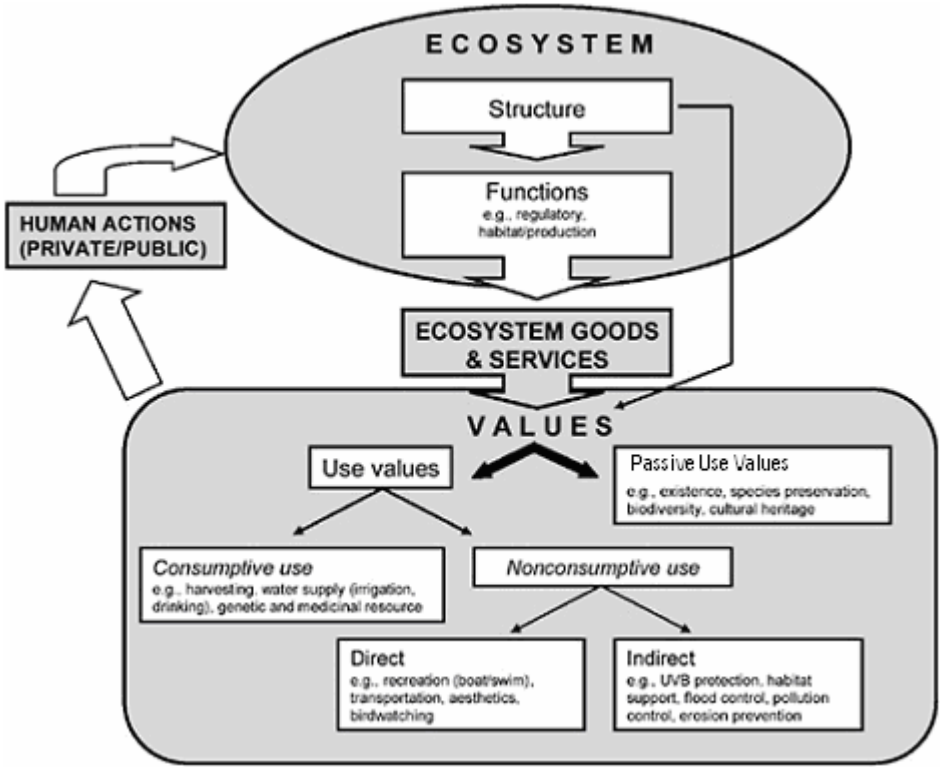


Figure 6. Flows of Ecosystem Services (Adapted from NRC 2005)

A comprehensive economic evaluation of these Bristol Bay wild salmon ecosystems needs to include two accounting frameworks. One is regional economics or economic significance, focused on identifying cash expenditures that drive income and job levels in the regional economy. The other is a net economic value framework that includes all potential costs and benefits from a broader social (usually national) perspective. The latter necessarily includes nonmarket and indirect benefits, such as the benefits anglers derive from their recreational activity, over and above their actual expenditure. Both perspectives are important for policy discussions and generally both accounting frameworks are utilized in evaluating public decisions, for example through the NEPA process (such as environmental impact statements) or in informing public opinion.

2.0 Methods

This section provides information on the statistical methods and modeling procedures utilized in the following analysis.

2.1 Sample Design Methods

The sample for the 2005 Alaska sportfish angler internet survey (and random mail survey) was designed as a random sample of a large share of Alaska Department of Fish and Game 2005 fishing license sales in South-central Alaska. The pool of possible license holders was sampled through a stratified random sample design to increase the probability of sampling freshwater anglers who had fished Bristol Bay streams or lakes in 2005. Respondents were weighted appropriately in analysis to reflect the actual distribution of license sales among the subset of South-central Alaska license vendors that were sampled.

In addition to population weighting, survey responses were also weighted to correct for potential non-response bias using methods developed by Kanninan, Chapman and Hanemann (1992).

The survey procedure followed a standard Dillman (2000) survey methodology using initial contact and repeat follow-ups. Further detail is presented below in Section 4. An example of the angler survey instrument is included as Attachment A.

All analysis and data manipulation was completed using SAS statistical software, and Microsoft Excel.

2.2 Net Economic Value Analysis Methods

The estimation of willingness to pay models described below (see Table 33) was derived using a maximum likelihood interval approach (Welsh and Poe 1998). Respondents were asked to choose the highest amount he or she was willing to pay from a list of possible amounts. It was inferred that the respondent's true willingness to pay was some amount located in the interval between the amount the respondent chose and the next highest amount presented. Let X_{iL} be the maximum amount that the ith person would be willing to pay and X_{iU} be the lowest presented amount that person would not pay. Given this, WTP must lie in the interval $\left[X_{iL}, X_{iU}\right]$ If $F\left(X_i;\beta\right)$ is the statistical distribution function for WTPi, with parameter vector β then the probability that WTPi

lies between two given payment bid amounts is $F\left(X_{iU}\ ;\beta\right)-F\left(X_{iL}\ ;\beta\right)$ and the associated log-likelihood function is:

$$\ln(L)=\sum_{i=1}^{n}\ln\left[F\left(X_{iU}\ ;\beta\right)-F\left(X_{iL}\ ;\beta\right)\right]$$

The SAS statistical procedure LIFEREG was used to estimate the parametric model of willingness to pay based on the underlying payment card responses.

2.3 Regional Economic Modeling Methods

Calculations of the economic significance of the various uses of the Bristol Bay ecosystem were carried out using the ISER regional Input-Output Model (Goldsmith, 2000). This model has been specifically designed and constructed using Alaska data to calculate the employment, wage, value added, and sales effects on Alaska regional economies from different activities including commercial fishing, recreational spending, and household spending.

Dollars spent in the Bristol Bay region and elsewhere in Alaska by the commercial fishing sector, by recreational visitors, or by subsistence users are input into the model, and the indirect and induced effects of those expenditures are calculated. The indirect effect is the increase in jobs and wages that results from local businesses supplying goods and services to the commercial fishing businesses, visitors, or subsistence hunters. The induced effect is the increase in jobs and wages from consumer purchases by households working for these various businesses. The sum of these effects provides a measure of the importance of these activities to the economy of the region.

The model incorporates a number of structural features that account for unusual characteristics of the regional economies of Alaska. In particular it tracks the residence of workers in different industries and "leakages" of expenditures. Large shares of the workers in both the commercial fishing and recreation industries move into the Bristol Bay region during the summer but live either in other parts of Alaska or outside the state. The model divides the economic effect of the worker payroll between their place of work and their place of residence. Much of the spending by businesses and households in the Bristol Bay region occurs in other parts of Alaska or outside the state. The model tracks where this spending "hits the street" and its impact on jobs and wages is calculated at that location.

3.0 Data Collection

A major emphasis of this study was to update in part the previous data collection efforts that provide information on recreational angling in the Bristol Bay region (Ackley 1988, Romberg 1999). To this end, the current study designed and implemented a suite of surveys in the region. The three populations surveyed included licensed anglers, destination fishing lodge owners within Bristol Bay, and Bristol Bay fishing lodge clients.

Section 4 of this report details the design and implementation of the Bristol Bay angler survey. The main objectives of the survey were to measure angler expenditures, preferences and attitudes, net economic values, and demographic characteristics. The Bristol Bay angler survey was designed to collect a stratified random sample of anglers that would support extrapolation of the survey results to a good share of the population of licensed anglers in south central Alaska. The primary population sampled was anglers who had purchased a 2005 Alaska Sportfishing license. Table 12 shows the populations surveyed, and data collected. The primary survey sample used for analysis was the sample of 2,400 licensed anglers. These anglers were asked questions relating to their fishing trips, expenditures, opinions, and preferences.

A second sample of Bristol Bay fishing lodge owners was asked detailed questions regarding their lodge operations as well as financial information on payroll and other business expenditures.

Finally, a third population, a sample of Bristol Bay fishing lodge clients, was also contacted and surveyed on their fishing trips, expenditures, opinions, and preferences.

Table 12: Bristol Bay Surveys: Sample Frame and Design

Population	***Source/sample size***	***Data Collected***
Licensed Alaska Anglers	Alaska F&G License database – 2,400 anglers	Trip information Opinions and preferences Expenditures Net economic value estimates Preservation value estimates
Destination fishing lodge owners	Listing of major lodges in Bristol Bay – 45 Lodges	Services provided Rates and occupancy Business expenditure patterns
Bristol Bay Lodge clients	Lodge client information supplied by cooperating lodges (330 lodge clients)	Same as for licensed Alaska anglers

3.1 Survey and Sampling Design

The design of the 2005 Bristol Bay angler and lodge owners surveys followed the Dilman total design survey method (Dillman 2000). Table 13 details the methods employed in surveying the anglers and lodge owners.

Table 13: Bristol Bay Angler Survey and Sample Design

Population	***Subpopulation/ wave***	***Number of contacts***	***Survey method***	***Monetary incentive***
Licensed Alaska Anglers	Jan – July licenses	4 mail	Internet	932 of 1,400 (66%)
	Aug – Sept licenses	4 mail	Internet	1,000 of 1,000 (100%)
	Jan – July licenses	4 mail	Mail	none
Bristol Bay Lodge Owners	One sample of 46 lodges	2 mail 2 email	Mail	none
Bristol Bay Clients	One sample of 330 lodge clients	4 mail	Mail	none

A stratified sample of licensed anglers was drawn from a pool of 2005 Alaska sport-fishing licenses sold by four different groups of vendor locations in south-central Alaska: Bristol Bay, Anchorage, Matanuska/Susitna, and Kenai. The sampling was designed to increase the probability of sampling anglers who had fished in Bristol Bay in 2005, yet at the same time sampling the primary possible south-central Alaska license vendor locations for anglers likely to fish in Bristol Bay.

This sample was drawn in two stages. First a sample of 1,400 license-holders was drawn from the January-July license base. Because there is a lag in the development of the computer-based data base of license sales, a sample was drawn from this first pool of licenses as soon as available from Alaska Department of Fish and Game, in order to minimize potential recall bias. A second sample of 1,000 license holders from the license sale pool for August 1 to September 30 was drawn and surveyed subsequently. The stratified sampling design required that the survey results be weighted to reflect the entire license pool from which they were drawn.

The angler samples received four mail contacts asking potential respondents to participate in the 2005 Bristol Bay Angler Survey and directing them to a survey website at the University of Montana, Bureau of Business and Economic Research. Respondents were provided with unique passwords, giving them access to their survey. The mailings sent to potential respondents included: 1) initial contact letter, 2) reminder postcard, 3) 2nd reminder letter, and 4) 3rd reminder letter. To increase response rates and to test the

effect of an incentive, 932 (or two-thirds) of the 1,400 initial letters contained $2 in cash as a token of appreciation for participation in the survey. Based on preliminary analysis of the response to the incentive, all 1,000 anglers in the second wave mailing received the $2 incentive.

In addition to the sample of 2,400 licensed anglers asked to complete an internet survey, a smaller sample of 300 anglers from the January through July license pool received the same survey in a mail form. The purpose of this sub-sample was to test response rates across survey modes. This sub-sample also received four mail contacts, two of which included a printed survey instrument.

The lodge owner survey was sent to a sample of 46 Bristol Bay lodge owners. These lodges received an initial email notice of the mail survey, the mail survey packet, a reminder email notification, a second survey by mail, and a final email reminder. The lodge survey asked owners to supply detailed information on the operation of their lodges, including rates and occupancy for several years, capital expenditures in recent years, and detailed business expenses and payroll information for 2005 season. The data collected from the lodge owner sample was intended to provide a snapshot of the typical distribution of revenues from lodge operations within the Bristol Bay and Alaska economies.

The 2005 Bristol Bay lodge client survey was a sample of 330 anglers. This was a convenience sample (not a probability sample) in that a limited number of Bristol Bay lodges provided contact information for a sample of their client lists. This sub-sample also received four mail contacts including 1) an initial letter, 2) survey package, 3) reminder postcard, and 4) 2nd survey package. This survey provided additional information primarily on Kvichak River lodge client anglers.

3.1.1 Structure of Bristol Bay Angler Survey

The angler survey instrument was organized into four primary groupings of questions. Section I of the survey asked general questions about the angler's sport fishing level of experience and preferences in types of fishing and locations for fishing. Section II asked specifically about the number and location of 2005 Alaska fishing trips taken to Bristol Bay waters (mail surveys) and Bristol Bay plus other south central Alaska waters (internet survey). Section III narrowed the focus of the survey down to the most recent trip the respondent had taken to fish in south central Alaska. In this section respondents were asked detailed questions on the location, dates, cost and characteristics of this most recent Alaska fishing trip. In Section III anglers were also asked about fish species they targeted and caught on their trip, how they rated several aspects of their experience, and how the trip compared to other destinations they have fished in recent years. Section III also included a series of questions related to current policy issues on road building and development in Bristol Bay. The final section of the survey, Section IV, asked a series of questions on the demographic characteristics of the respondent.

3.1.2 Bristol Bay Angler Survey Sample Allocation Design

As noted above, the 2005 Bristol Bay Angler Survey was designed as a stratified sample of Alaska 2005 sportfish license holders. The strata were based on where anglers had purchased their licenses (specifically, four south central Alaska regions: Anchorage, the Kenai Peninsula, Matanuska/Susitna, and Bristol Bay (RST), and two different purchase periods: January-July and August-September). Some specific vendors within each location were excluded to increase the probability of sampling freshwater (not saltwater) anglers. The following series of tables (Table 14 through Table 19) provide detail on the size and distribution of the license population as well as that of the sample drawn for this survey. Additionally, information on the distribution of survey responses across the sample strata are supplied for both all survey respondents and for sub-samples of respondents supplying information on trips to the Bristol Bay area and the Kenai Peninsula.

Table 14 shows the distribution of the total population of 2005 sportfish licenses as supplied by Alaska Department of Fish and Game. The license pool was separated into two waves. Wave 1 included licenses sold between January 1 and July 31, 2005. Wave 2 included licenses sold between August 1 and September 30, 2005. Two waves were sampled in order to minimize recall bias among those respondents whose most recent trip might have been earlier in the fishing year.

Table 14. 2005 Actual ADF&G Sportfish License Sales

Wave 1 Actual License Pool	**2005 ADF&G Sportfish Licenses sold**			**Distribution of License sales across sample populations**		
SampleArea	**RESIDENCY**			**RESIDENCY**		
	NON	**RES**	**Total**	**NON**	**RES**	**Total**
Anchorage	32,050	54,624	86,674	15.1%	25.7%	40.7%
Kenai Peninsula	38,821	22,031	60,852	18.2%	10.4%	28.6%
MatSu/West Cook	8,851	18,908	27,759	4.2%	8.9%	13.0%
RST (Bristol Bay)	3,116	1,694	4,810	1.5%	0.8%	2.3%
Total	**82,838**	**97,257**	**180,095**	**38.9%**	**45.7%**	**84.6%**
Wave 2 Actual License Pool						
SampleArea	**RESIDENCY**			**RESIDENCY**		
	NON	**RES**	**Total**	**NON**	**RES**	**Total**
Anchorage	10,087	4,566	14,653	4.7%	2.1%	6.9%
Kenai Peninsula	10,414	1,485	11,899	4.9%	0.7%	5.6%
MatSu/West Cook	2,992	1,632	4,624	1.4%	0.8%	2.2%
RST (Bristol Bay)	1,251	257	1,508	0.6%	0.1%	0.7%
Total	**24,744**	**7,940**	**32,684**	**11.6%**	**3.7%**	**15.4%**

Overall, the license pools contained 180,095 anglers for the Wave 1 sample and 32,684 anglers in Wave 2. Table 14 also shows the proportional distribution of all licenses in the

pool across the 16 sample strata (2 waves x 2 residency classes x 4 sample areas). The sample distribution was designed to increase the probability of sampling Bristol Bay anglers, and to obtain approximately equal samples of nonresident anglers in wave 1 and wave 2.

Table 15 shows the actual distribution of randomly drawn licenses across the 16 sample strata. As in the previous table, this table also shows the proportional distribution of the license sample across the strata.

Table 15. Distribution of Sample of License Holders Drawn from ADF&G License Pool

Wave 1 Sample distribution	**Licenses sampled from total pool**			**Distribution of License sample across sample populations**		
SampleArea	**RESIDENCY**			**RESIDENCY**		
	NON	**RES**	**Total**	**NON**	**RES**	**Total**
Anchorage	83	164	247	3.5%	6.8%	10.3%
Kenai Peninsula	142	105	247	5.9%	4.4%	10.3%
MatSu/West Cook	71	176	247	3.0%	7.3%	10.3%
RST (Bristol Bay)	442	217	659	18.4%	9.0%	27.5%
Total	**738**	**662**	**1,400**	**30.8%**	**27.6%**	**58.3%**
Wave 2 Sample distribution						
SampleArea	**RESIDENCY**			**RESIDENCY**		
	NON	**RES**	**Total**	**NON**	**RES**	**Total**
Anchorage	116	59	175	4.8%	2.5%	7.3%
Kenai Peninsula	152	23	175	6.3%	1.0%	7.3%
MatSu/West Cook	108	67	175	4.5%	2.8%	7.3%
RST (Bristol Bay)	392	83	475	16.3%	3.5%	19.8%
Total	**768**	**232**	**1,000**	**32.0%**	**9.7%**	**41.7%**

Table 16 presents the ratios of the proportion of the entire sample in each strata to the proportion of the total license pool in each of the 16 strata. For comparison, a ratio of 1.0 in this table would indicate that the proportion of the sample in a stratum was exactly equal to the proportion of the total number of licenses in that stratum. Ratios of less than 1.0 indicate that the strata are under-sampled relative to the share of all licenses in those strata. Conversely, a ratio of over 1.0 indicates that a stratum is over-sampled relative to the entire population.

Table 16. Ratio of Sportfishing License Sample Sizes to Population Sizes

Wave 1	NON	RES
Anchorage	0.23	0.27
Kenai Peninsula	0.32	0.42
MatSu/West Cook	0.71	0.83
RST (Bristol Bay)	12.58	11.36
Wave 2	**NON**	**RES**
Anchorage	1.02	1.15
Kenai Peninsula	1.29	1.37
MatSu/West Cook	3.20	3.64
RST (Bristol Bay)	27.78	28.63

Note: a ratio of less than one indicates the sample strata is under-sampled relative to the population size. A sample of over one indicates the strata is over-sampled relative to the population size.

Table 16 shows that for Wave 1 the RST (Bristol Bay) license sales are significantly over-sampled relative to the population of license sales. In this first wave licenses from the remaining three strata were under-sampled relative to the license population. In Wave 2 the Bristol Bay strata are also significantly over-sampled relative to the pool. This over-sampling of the Bristol Bay license sales was included in the sample design in order to maximize the probability that information on 2005 fishing trips to the Bristol Bay area would be included in the survey responses, and to balance the number of nonresident anglers between waves. Within purchase location and time of purchase strata, residents and nonresidents were sampled as the same proportion as the license population for that strata.

Table 17 shows the distribution of internet survey responses across the 16 sample strata. While this table shows a distribution of responses that is relatively representative of the distribution of the sample across the strata, Table 18 shows that the pattern changes dramatically when only responses containing information on trips to the Bristol Bay are included. Table 18 shows that 95% of survey responses in our sample that contained information on a Bristol Bay 2005 fishing trip were from licenses sold in the Bristol Bay area.

While this was expected, and was the basis of the sample design which significantly over-sampled the Bristol Bay license sales, the degree to which Bristol Bay trips would be under-represented in the non-Bristol Bay license strata was unexpected. While 70% of respondents who bought their licenses in the Bristol Bay area reported information on a Bristol Bay fishing trip, only 3.7% of those buying licenses in the other three areas reported on Bristol Bay trips. The response proportions shown in Table 17 and Table 18 suggest that had the sample design been random across all four license areas rather than stratified with over-sampling of the Bristol Bay area, the survey could have expected to only receive information on 30 to 35 Bristol Bay angling trips rather than the 301 trips reported in the final survey responses. The sampling achieved the appropriate balance of

nonresident Bristol Bay respondents between the early summer and late summer license pools.

Table 17. Distribution of all Survey Responses to Internet Survey

Sample Area (License Purchase)	***Wave 1 (Jan.-July licenses)***		***Wave 2 (Aug. – Sept. licenses)***	
	Residents	**Nonresidents**	**Residents**	**Nonresidents**
Anchorage	43	25	10	43
Kenai	32	57	8	66
Matanuska/Susitna	35	32	15	44
RST (Bristol Bay)	55	180	13	185
Total	165	294	46	338

The distribution of Bristol Bay trip responses in Table 18 is so completely dominated by licenses sold in the Bristol Bay region that the decision was made to limit analysis of Bristol Bay trip characteristics to responses from this major strata. The small number of observations from other license sales areas were excluded to eliminate the possibility of a grossly disproportional impact associated with one or two observations contained in heavily weighted strata.

Table 18. Distribution of Survey Responses with Information on a Bristol Bay Fishing Trip

Sample Area (License Purchase)	***Wave 1 (Jan.-July licenses)***		***Wave 2 (Aug. – Sept. licenses)***		***Sum***
	Residents	**Nonresidents**	**Residents**	**Nonresidents**	
Anchorage	3	1	1	1	6
Kenai	1	1	1	2	5
Matanuska/Susitna	1	1	0	2	4
RST (Bristol Bay)	45	121	10	125	301
Total	50	124	12	130	316

The only other south-central Alaska fishing destination that was reasonably well represented in the current trip responses was Kenai Peninsula. Table 19 shows the distribution of survey responses including information on trips to Kenai Peninsula waters. Consistent with the pattern shown in Table 18, the large majority of these Kenai area trips were from licenses sold in either the Kenai region or the nearby Anchorage area.

Table 19. Distribution of Survey Responses with Information on a Kenai Area Fishing Trip

Sample Area	***Wave 1 (Jan.-July licenses)***		***Wave 2 (Aug. – Sept. licenses)***	
	Residents	**Nonresidents**	**Residents**	**Nonresidents**
Anchorage	11	8	2	16
Kenai	20	31	2	39
Matanuska/Susitna	2	3	3	3
RST (Bristol Bay)	2	2	0	2
Total	35	44	7	60

4.0 Survey Response Rates and Weighting

The response rates detailed in Table 20 are final rates for all populations. Table 20 shows a breakout of response rates by survey type. All survey results specific to Bristol Bay fishing were derived from the sample responses associated with licenses bought in the Bristol Bay area. Therefore, individual responses from each of 4 strata (2 waves x 2 residency classes) were weighted to reflect the actual distribution of licenses sold among these 4 strata.

Table 20: Bristol Bay Survey Response Rates

Population	***Sample Size***	***Un-deliverables***	***Completed surveys***	***Response Rate***
Angler (License Holder) Internet Survey	2,400	143	843	37.4%
Resident	886	62	211	25.6%
Nonresident	1,514	81	632	44.1%
License holders (mail)	300	14	103	36%
Lodge owners	46	2	14	32%
Lodge clients	330	13	126	39.7%

Note: an additional 6 mail survey responses were received from the internet survey sample.

The response rates shown in Table 20, while somewhat lower than those generally experienced by the authors in survey research conducted in other states, are consistent with response rates from previous economic surveys of ADF&G fishing license holders (Duffield, Merritt and Neher, 2002). The overall internet response rate for this survey of about 37% (excluding undeliverable surveys) is nearly identical to overall response rates from an ADF&G-sponsored survey of grayling fishing (37%) and an ADF&G-sponsored survey if salmon fishing (39%). Additionally, the difference between resident and non-resident response rates in the current internet survey is consistent with response rates from a third ADF&G-sponsored survey of attitudes related to Alaska Rod and Reel fishing. This survey had a response rate for Alaska residents of 25% to 31% (depending on Alaska region sampled). The nonresident response rate for the rod and reel survey was 46%.

4.1 Results of Survey Incentive Experiment

As noted above, the anglers invited to participate in the internet-based survey were randomly placed into either a group receiving a $2 cash incentive for participating, or a group receiving no incentive. These two treatments were included to 1) encourage increased participation by the 80% of anglers in our sample who received the incentive, and 2) to test the impact of the incentive on response rates. Table 21 shows the comparison of response rates between those anglers receiving the incentive and those not

receiving the incentive. For both the resident and non-resident samples the $2 incentive had a positive impact on final response rates. Given the response rates shown in Table 21 and associated sample sizes, the difference between the two treatments (incentive and no incentive) is statistically significant at the 99% level of confidence for both the resident and non-resident samples.

Table 21. Comparison of Response Rates between those Respondents Receiving an Incentive Payment, and those receiving No Incentive

Population	*Received no incentive*	*Received $2 incentive*	*Absolute change in Response Rate*
Residents	15.7% n=223	26.23% n=671	+10.53%
Non Residents	35.1% n=245	43.3% n=1,261	+8.2%

4.2 Sample Population and Non-response Weighting

One consequence of a stratified sampling plan with unequal sampling rates across strata is that it necessitates the weighting of individual responses to correct for over or under-sampling.

In addition to weighting so the sample reflected the actual population, responses were also weighted to correct for possible non-response bias. While the response rates to the survey were representative of rates from similar Alaska angling surveys, it is possible that non-respondents are significantly different in some characteristics from survey respondents. In order to test for and correct for any such non-response bias a comparison of respondents and the total sample of potential respondents was conducted using three variables available in the ADF&G database for all license holders: age, type of fishing license, and gender.

The differences between the survey respondents and the entire sample drawn are not large for the three variables examined. Respondents to the survey tended to be slightly older and more heavily dominated by males then did the entire license sample. However, only one of six comparisons of mean values for the three variables and 2 residency classes showed a statistically significant difference. Nonetheless, an analysis was undertaken to develop a respondent sample that was weighted to represent the same age, gender, and license type characteristics as the overall license sample. The approach used is based on methods developed by Kanninan, Chapman and Hanemann (1992).

As noted, information was available on three characteristics of the entire license sample: age, gender, and type of license purchased (length of license period). These three variables were transformed into dichotomous variables based on the individual

distributions of each variable for the entire sample. These three dichotomous variables were, in turn, combined into one variable with 8 levels (one for each of the 8 possible combinations of the three dichotomous variables). The number of observations at each of these levels was then compared between the survey respondents and the total license sample, and a set of 8 weights were computed to equalize the two. This process was undertaken for each population strata.

Table 22 details the impact of the non-response weighting procedure on each population strata. Comparison of the un-weighted respondents and the entire pool of 2,400 possible respondents showed only small differences. The only cells with differences between the entire pool and the survey respondents were the age variable for nonresident anglers. Nonresident respondents were significantly older on average than were the entire pool of nonresident anglers. Following the non-response weighting process, there were no statistically significant differences among the analysis variables.

Table 22. Nonresponse weighting results, by population strata

	Un-weighted respondents	*Entire sample*	*Weighted respondents*
Wave 1 -Nonresidents			
License type dummy	70.7%	66.7%	67.1%
Gender dummy	84.0%	82.8%	83.8%
Age	**50.39**	**47.88**	49.43
Sample size	294	738	294
Wave 1 – Residents			
License type dummy	97.6%	98.0%	99.0%
Gender dummy	67.9%	68.4%	66.7%
Age	40.88	39.40	39.30
Sample size	165	662	165
Wave 2 - Nonresidents			
License type dummy	69.2%	66.7%	67.7%
Gender dummy	81.1%	79.4%	80.5%
Age	**50.85**	**48.96**	49.44
Sample size	338	768	338
Wave 2 – Residents			
License type dummy	87.0%	90.1%	92.3%
Gender dummy	63.0%	62.5%	63.2%
Age	38.57	37.62	36.61
Sample size	46	232	46
Total sample size	843	2,400	843

Note: bolded entries indicate means are significantly different at the 95% level of confidence

5.0 Bristol Bay Sport Fishing

Section 5 of this report details the results from two surveys of Bristol Bay anglers: 1) results from the 843 anglers who responded to the Bristol Bay Region – 2005 angler internet survey administered by the University of Montana, Bureau of Business and Economic Research, and 2) the 126 responses from Bristol Bay remote lodge clients sampled using a repeat contact mail survey.

As noted in Section 4, these two surveys had overall 37% to 40% response rates. In general, nonresident anglers participated in the internet survey in higher proportions than did Alaska resident anglers (44% as compared to 26% response rates, respectively).

The following discussion of sport-fishing angler survey results is divided into two general sections. First is a detailed discussion of responses to the internet survey of a random sample of all licensed Alaska anglers. The second part contains a discussion of the results from the mail survey of 2005 Bristol Bay remote lodge clients. This survey sample provides an expanded view of angler and trip characteristics specific to trips to the Kvichak River, which for nonresident anglers is a primarily rainbow trout fishery destination.

The following discussion of the results from the 2005 Bristol Bay angler survey generally reflects the responses of those internet survey respondents who reported taking a fishing trip to the Bristol Bay Region in 2005, and answered questions about that trip to the Bristol Bay area. The exception to this presentation is in the case of estimation of the mean contribution to a Bristol Bay protection fund. In this case, all responses to the survey were included.

The results in this section are presented using several sub-sample breakouts. Comparisons of sub-samples are presented to highlight similarities as well as differences between sample groups. Primary sub-samples examined include nonresident anglers and Alaska residents, and non-local Alaska resident anglers. In some cases, nonresident anglers who reported staying at a remote Bristol Bay fishing lodge are highlighted for comparisons to other sub-samples. Some comparisons are also provided for fishing destinations, primarily the Kenai and Russian Rivers, on the Kenai Peninsula.

The analysis examines angler responses to a wide range of questions on their opinions, preferences, and experiences relating to fishing in the Bristol Bay area. While the pool of respondents for this survey was drawn from a large share of all south-central Alaska licensed anglers, only those anglers who reported taking a trip to fish the Bristol Bay area in 2005 were utilized in analysis of many questions relating specifically to Bristol Bay fishing. Because of this, the sample of Alaska resident responses is heavily dominated by responses from Alaskans living within the Bristol Bay region. A limitation of this study is that the sample under represents out-of-Bristol Bay Alaska residents.

5.1 Fishing Experience and Attitudes for Alaska Resident and Non-resident Anglers

The first section of the 2005 Bristol Bay angler survey asked respondents a series of questions pertaining to their fishing habits and preferences. Additionally, respondents were asked to rate the importance of certain fishing and site attributes in selecting where they sport-fished in Alaska. Table 23 shows results both for resident and nonresident Bristol Bay anglers (e.g. anglers whose "recent trip" was to Bristol Bay waters). Overall, about 85% of resident and non-resident respondents reported that they had been fishing for 10 years or more. Nonresidents were more likely to prefer fly fishing compared to residents (65% vs. 47%). About 28% of non-residents but only 5% of residents said that fishing was their favorite outdoor activity. Table 23 also shows a clear preference for stream fishing over lake fishing for nonresident anglers while local residents are more evenly divided in their preferences.

Table 23: Bristol Bay Angler Experience and Preferences

Question/statistic	**Population**	
	Non-residents	**Alaska Residents**
Percent who have fished for 10 years or more	85.0%	84.4%
Percent who prefer fly fishing	65.0%	46.5%
Percent who prefer stream fishing from bank or w/waders	64.7%	58.3%
Percent who prefer lake fishing	26.1%	59.4%
Percent who rate fishing as their favorite outdoor activity	28.0%	4.5%
Percent who rate their expertise as an angler as "advanced"	40.6%	34.0%
Sample Size	246	55

Table 24 reports summary results for residents and non-residents on the importance of different factors in their decisions of where to fish. Specifically, the questions asked:

> *"What factors are important to you in selecting where to sport fish in Alaska. For each characteristic below, please rate its importance from least important (1) to most important (5)."*

Both resident and non-resident anglers rated the same five attributes as their top five in selecting an angling area. These attributes are "natural beauty of the area", "being in an area with few other anglers", "being in a wilderness setting", "chance to catch wild fish", and "opportunities to view wildlife." Both resident and non-resident anglers rated being in an area with few other anglers as a very important site attribute (85% and 87% respectively). Consistent with this, strong majorities of both resident and nonresident anglers also said fishing in remote, off-the-road locations was an important fishing location attribute (64% and 70%, respectively).

Table 24: Bristol Bay Angler Ratings of Importance of Selected Angling and Area Attributes.

	Percent rating as "most important" (4 or 5)			
	Bristol Bay Anglers		**Kenai Peninsula Anglers**	
Fishing experience attribute	**Non-residents**	**Residents**	**Non-residents**	**Residents**
Fishing easily accessible site near a road	4.5%	9.4%	36.6%	45.7%
Fishing in remote, off-the-road locations	70.2%	64.2%	29.9%	26.0%
Harvesting fish	21.4%	41.3%	29.7%	38.8%
Catching and releasing large numbers of fish	63.0%	28.7%	40.1%	9.4%
Chance to catch large or trophy-sized fish	72.2%	40.6%	60.9%	32.8%
Natural beauty of the area	89.6%	82.8%	84.4%	89.5%
Catching wild stock rainbows	55.5%	48.3%	20.7%	22.1%
Being in an area with few other anglers	87.0%	85.4%	71.7%	50.5%
Being in a wilderness setting	84.4%	89.5%	70.1%	61.1%
Chance to catch wild fish	85.3%	83.2%	69.7%	80.8%
Opportunities to view wildlife	87.5%	75.2%	76.8%	66.5%
Sample size	238	54	101	41

Table 24 also shows a comparison of responses from anglers fishing both Bristol Bay and those whose most recent trip was to fish the Kenai Peninsula. Generally those anglers fishing the Kenai were less concerned with issues of angler crowding and fishing remote roadless areas than were Bristol Bay anglers. These findings are consistent with the general finding from Romberg (1999), that there are different market segments of Alaskan sportfishing, and that different types of waters attract different types of anglers.

5.2 Bristol Bay Area Trip Characteristics and Angler Attitudes

Those survey respondents who reported taking a fishing trip to the Bristol Bay area in 2005 were asked a series of questions about that trip. Table 265 and Figure 7 show how survey respondents described the type of Bristol Bay angling trip they took. For non-resident anglers the most common trip type was staying at a remote lodge and flying or boating with a guide (35.2%). For resident anglers, the most common types of Bristol Bay fishing trips were accessing the area with their own plane or boat (49.9%), driving to area by motor vehicle (11.3%), and "other" type of trips (24%). Those who reported driving to access Bristol Bay fisheries were primarily residents and nonresidents staying in the King Salmon and Dillingham area, where a few local roads exist and provide some access to nearby fisheries.

Table 25. Bristol Bay Angler Distribution across Trip Types, by Residency

Trip Type	*Non-residents (%)*	*Alaska Residents (%)*
Stayed at a remote lodge and flew or boated with a guide to fishing sites most days	35.2	-
Stayed at a tent or cabin camp and fished waters accessible from this base camp	23.7	7.8
Hired other lodging in an area community and either fished on own or contracted for travel on a daily basis	6.4	4.2
Floated a section of river with a guided party	3.9	2.8
Hired a drop-off service and fished and camped on our own	4.3	2.2
Accessed the area with my own airplane or boat	8.3	49.9
Drove to the area by motor vehicle	4.3	11.3
Other	14.0	24.0
Sample Size	246	55

Note: sample size for resident sample is not large enough to divide into local and non-local sub-samples

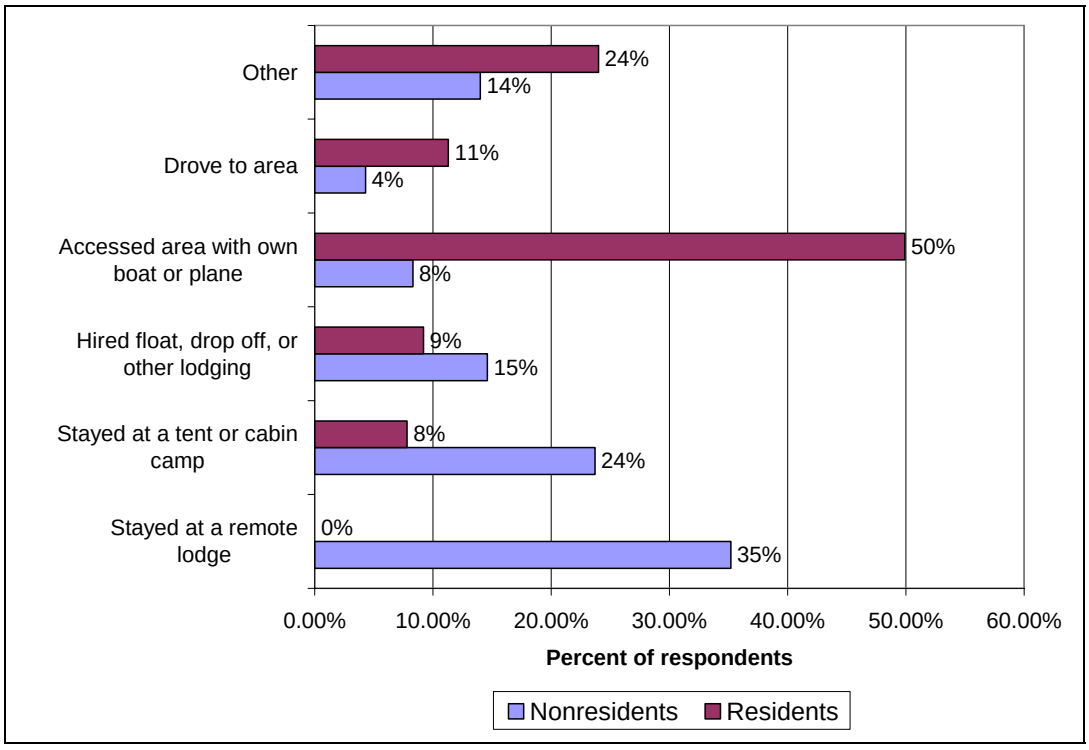


Figure 7. Comparison of Resident and Nonresident Bristol Bay Angler Trip Types

Respondents to the Bristol Bay survey were asked what the primary purpose of their trip to the Bristol Bay area was. While a majority of nonresidents (73%) reported fishing as their major purpose, only 30% of resident anglers reported fishing as the main purpose of their most recent Bristol Bay trip. Table 26 also shows that a much larger proportion of

non-residents (45%) than residents (11.4%) were on their first trip to their primary fishing destination.

Table 26: Bristol Bay Angler Trip Characteristics.

Statistic	*Nonresidents (sample size)*	*Residents*
Major purpose of trip was for fishing	72.7% (246)	29.5% (54)
Trip was first trip to primary destination	45.2% (245)	11.4% (48)

Survey respondents were asked what fish species they targeted on their most recent trip to Bristol Bay. Table 27 reports these results. Overall, king salmon and rainbow trout were the most frequently targeted species for both residents and non-residents. Among the two sub-populations, residents were most likely to say they would have taken their trip even if their primarily targeted species had not been available (67%). Conversely, 45% of non-resident anglers said they would have still made the trip absent their primarily targeted species. Overall, 28% of non-residents and 32% of residents reported catching a rainbow trout larger than 26 inches on their most recent Bristol Bay trip.

Anglers fishing the Kenai Peninsula more often targeted Sockeye, and were less likely to target, or catch large, rainbows.

Table 27: Bristol Bay Angler Survey, Targeted Species and Associated Trip Characteristics.

	Bristol Bay Anglers		*Kenai Anglers*	
Primary species targeted on trip / statistic	**Residents**	**Nonresidents**	**Residents**	**Nonresidents**
Rainbow Trout	31.3%	30.6%	12.2%	9.9%
King Salmon	29.8%	35.2%	14.6%	36.1%
Silver Salmon	16.5%	16.3%	25.3%	15.8%
Sockeye Salmon	0%	9.1%	45.4%	28.1%
Other Species	22.4%	8.8%	2.6%	10.1%
Would have still taken trip if primary species not available	66.9%	45.0%	55.6%	68.1%
% catching a rainbow larger than 26 inches	31.8%	28.4%	5.4%	10.6%
Sample size	48	235	38	94

Table 28 shows the same statistics presented in Table 27 for the subset of non-resident anglers who reported taking a trip to a remote fishing lodge in Bristol Bay. The primary difference between this subset of non-residents and all non-resident anglers is that remote

lodge clients are more likely to target rainbow trout and to have caught a rainbow over 26 inches.

Table 28. Bristol Bay Angler Survey, Targeted Species and Associated Trip Characteristics : Remote Lodge Sub-sample

Primary species targeted on trip / statistic	***Nonresident Remote Lodge Clients***
Rainbow Trout	38.9%
King Salmon	29.0%
Silver Salmon	22.6%
Sockeye Salmon	4.9%
Other Species	4.4%
Would have still taken trip if primary species not available	45.5%
% catching a rainbow larger than 26 inches	43.0%
Sample Size	103

Respondents to the Bristol Bay angler survey were presented with a series of statements regarding fishing conditions on their Bristol Bay area trip. They were asked to indicate their level of agreement or disagreement with each statement. *Table 29* shows the percent of residents and non-residents who either "agreed" or "strongly agreed" with each statement. Across all of the statements presented in the survey, majorities of both resident and non-resident respondents agreed with the positive statements about their fishing experience. The highest levels of agreement for both nonresidents and Alaska resident anglers were with the statements "there was a reasonable opportunity to catch fish", "there was minimal conflict with other anglers", and "fishing was in a wilderness setting."

Table 29: Bristol Bay Angler Rating of Selected Attributes of Fishing Trip

Statement	***% of respondents who either "agree" or "strongly agree"***	
	Nonresidents	**Local Residents**
Fishing conditions were un-crowded	87.2%	75.4%
There was a reasonable opportunity to catch fish	96.5%	93.0%
There was minimal conflict with other anglers	93.3%	90.7%
Fishing was in a wilderness setting	92.4%	95.0%
There was opportunity to catch trophy sized fish	81.4%	70.0%
There was opportunity to catch and release large # of fish	87.3%	76.6%
Sample Size	235	47

Table 30 and Figure 12 show the survey question results from *Table 29* for three specific subgroups: 1) non-resident Bristol Bay lodge clients, 2) all non-resident Bristol Bay anglers, and 3) all non-resident anglers whose most recent trip was to a Kenai Peninsula destination. This comparison shows a clear trend across several statements. In general Bristol Bay lodge client anglers felt their fishing experience was less crowded, in a more wilderness setting, and more productive in terms of number and size of fish caught than did both the sample of all Bristol Bay non-residents, and the Kenai Peninsula non-resident anglers.

Table 30. Angler Rating of Selected Attributes of Fishing Trip: Selected Subsamples.

Statement	***% of Nonresident respondents who either "agree" or "strongly agree"***		
	Bristol Bay Lodge clients	**All Bristol Bay Non-Res.**	**Kenai Non-Residents**
Fishing conditions were un-crowded	92.8%	87.2%	59.9%
There was a reasonable opportunity to catch fish	98.6%	96.5%	89.0%
There was minimal conflict with other anglers	97.4%	93.3%	89.7%
Fishing was in a wilderness setting	98.6%	92.4%	57.8%
There was opportunity to catch trophy sized fish	89.5%	81.4%	55.6%
There was opportunity to catch and release large # of fish	94.0%	87.3%	51.0%
Sample Size	102	235	93

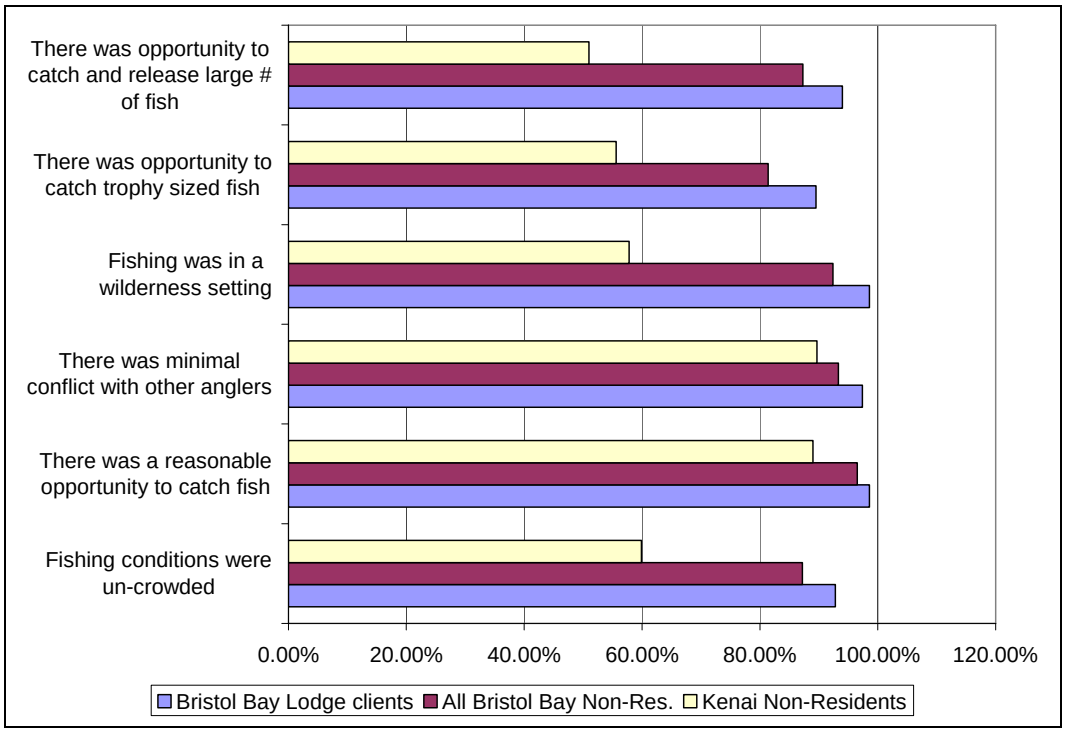


Figure 8. Bristol Bay and Kenai angler rating of selected fishing trip attributes.

The percent of Bristol Bay anglers who reported minimal conflict with other anglers shown in *Table 29* (between 91% and 93%) is confirmed by responses to a follow-up survey question that asked anglers to rate the level of crowding they experienced on their trip from 0 (not at all crowded) to 10 (extremely crowded). Table 31 shows that a significant percentage of both resident and non-resident anglers rated crowding conditions on their trip as very low. This table also shows the survey crowding rating for the sample of trips taken to the Kenai Peninsula by nonresident anglers. This group showed a lower percentage of respondents who rated the level of crowding on their Kenai fishing trip as between 0 and 2 on the 10-point scale.

Table 31: Bristol Bay Angler Rating of Angler Crowding on Trip.

Most recent trip crowding rating	***Bristol Bay Anglers***		***Kenai Anglers***	
	Nonresidents	**Residents**	**Nonresidents**	**Residents**
0 – not at all crowded	34.4%	30.9%	15.3%	9.7%
1	12.5%	16.5%	8.7%	0
2	16.5%	8.6%	7.9%	4.8%
3	10.5%	14.6%	9.4%	6.9%
4	8.7%	3.0%	9.4%	3.0%
5 – moderately crowded	10.8%	16.2%	27.3%	38.1%
6	2.7%	3.8%	2.9%	3.0%
7	2.5%	3.8%	14.9%	13.9%
8	0.9%	2.8%	2.5%	8.8%
9	0.7%	0	1.7%	11.9%
10 – extremely crowded	0	0	0	0
Sample Size	235	44	89	36

5.3 Bristol Bay Angler Expenditures and Trip Value

Respondents to the 2005 Bristol Bay angler survey were asked a series of questions relating to the amount of money they spent on their fishing trips. They were also asked a question designed to measure the net economic value (or willingness to pay) for their trip over and above what they actually spent. The following three tables detail average spending by resident and non-resident anglers associated with their Bristol Bay area trips.

Table 32 shows the average total expenditures per trip for resident and nonresident and resident angler trips to Bristol Bay. As a point of comparison, estimates are also shown for trips to Kenai Peninsula freshwater sites. As would generally be expected, Alaska resident anglers spend much less than non-resident anglers on their trips to Bristol Bay fisheries. The table also shows average total expenditures for fishing trips to Kenai Peninsula waters. These trips follow a similar pattern to the Bristol Bay trips--residents spend much less than nonresidents on their trips. Among nonresident anglers, almost twice as much is spent on average to trips to the Bristol Bay region ($3,969) compared to trips taken to the Kenai area ($2,243).

Table 32. Comparison of Reported Average Trip Spending across Populations and Area

Area	*Nonresidents (sample size)*	*Alaska residents*
Bristol Bay	$3,969 (203)	$393 (27)
Kenai	$2,243 (75)	$457 (20)

Table 33 breaks out average expenditures by impact region and type of fishing trip for the nonresident angler sample. Where money is spent on a trip determines local economic impacts. For instance, a given amount of money spent within the very small Bristol Bay economy has a much greater relative impact on this area than the same amount of money spent in, for instance, Anchorage. Table 33 shows that the largest per-trip spending is made by nonresident anglers who stay at a remote lodge with daily guiding services ($6,327/trip). This compares to the lowest spending levels per trip of about $1,300 for driving to the fishing site, accessing the area with own plane or boat, and hiring a drop-off service and fishing or camping on own.

The first two rows of Table 33 show that a large portion of Alaska trip costs for remote lodge or tent or cabin camp trips is associated with the cost of a sport-fishing package or tour.

Table 33. Nonresident trips to Bristol Bay waters, mean expenditure per trip estimates by trip type

Trip type	*Total spending*	*Bristol Bay spending*[a]	*Package sport-fishing trip spending*	*Sample size*
Stayed at a remote lodge and flew or boated with a guide to fishing sites most days	$6,327	$1,730	$5,543	92
Stayed at a tent or cabin camp and fished waters accessible from this base camp	$3,785	$1,235	$3,202	43
Hired other lodging in an area community and either fished on own or contracted for travel on a daily basis	$2,406	$1,655	$2,345	18
Floated a section of river with a guided party	$1,991	--	--	6
Hired a drop-off service and fished and camped on our own	$1,379	$1,042	--	10
Accessed the area with my own airplane or boat	$1,308	$1,175	0	9
Drove to the area by motor vehicle	$1,323	$967	--	5
Other	$2,033	$953	$2,205	23

[a] all spending in Bristol Bay except package sportfishing trip expenditures.
Note: cells with less then 5 observations are left blank. Category values are the average values for those respondents reporting an expense in that category. Bristol Bay spending and Package sport-fishing tour spending will not necessarily sum to Total spending due to varying sample sizes.

Table 34 details the distribution of Bristol Bay trip spending across expenditure categories. For non-residents visitors, the largest three spending categories within the Bristol Bay area were for commercial and air taxi service and for lodging or camping fees (totaling about 66% of all spending in Bristol Bay). For non-local Alaska residents the three largest categories of spending were "gas and other Alaska travel costs," camping fees, and commercial air travel (totaling about 58% of all Bristol Bay spending).

Table 34: Distribution of Trip Expenditures across Spending Categories, by Residency and Area

	Nonresidents		***non-local AK residents***
Expenditure category	**In Bristol Bay**	**In rest of AK**	**In Bristol Bay**
Commercial air travel	31.1%	51.9%	18.1%
Air taxi service	20.5%	1.3%	11.1%
Transportation by boat	0.0%	0.0%	0.0%
Boat or vehicle rental	5.3%	4.8%	7.5%
Gas or other travel costs in AK	4.1%	1.4%	16.3%
Lodging or camping fees	13.9%	11.9%	23.6%
food or beverages	9.2%	19.3%	16.7%
Guide fees	6.2%	0.6%	0.0%
Fishing supplies	4.1%	5.2%	6.7%
Other non-fish package tours	0.1%	0.7%	0.0%
Other	5.4%	2.9%	0.0%
Total	100.0%	100.0%	100.0%

5.3.1 Aggregate Direct Sport fishing Expenditures in Bristol Bay

One of the major goals of this study was to estimate annual levels of spending in the Bristol Bay area that are attributable to freshwater sport fishing. In order to derive this estimate two primary pieces of information were needed: 1) the number of angler trips per year to the region by Alaska residents and nonresidents, and 2) the average spending per trip by resident and nonresident anglers. A trip is defined here as a roundtrip visit from home, and return. Estimates of the number of anglers who fished in the Bristol Bay region in 2005 were derived by ADF&G staff (Table 35). The average number of trips per angler, estimated from responses to the Bristol Bay angler survey, are also shown in Table 35. In total an estimated 37,000 fishing trips are taken annually to Bristol Bay freshwater fisheries. These trips are split between 13,000 nonresident trips, 19,000 Bristol Bay resident trips, and 4,500 trips by Alaskans living outside of the Bristol Bay area.

Table 35. Estimated 2005 Bristol Bay area angler trips, by Angler Residency

Statistic	*Nonresidents*	*Out-of-area AK residents*	*BB Residents*
Annual Anglers fishing Bristol Bay waters	10,044	3,017	1,614
Average trips per angler for 2005 (std.err.)	1.29 (0.71)	1.47 (0.40)	12.07 (12.98)
Estimated total trips (std.err.)	12,966 (7,121)	4,450 (1,211)	19,488 (20,950)

Table 36 presents the aggregation of total angler expenditures within the Bristol Bay region. This table shows average and aggregate estimated expenditures for three angler groups: 1) nonresident anglers, 2) local-area resident anglers (those who live in the Bristol Bay area), and 3) non-local resident anglers (those Alaska residents living outside of the Bristol Bay region). This table also shows average and total annual spending by nonresident anglers for package sportfishing trips in the Bristol Bay region.

Overall, the large majority of angler spending in the region is attributable to nonresident anglers. Additionally, the majority of nonresident spending is due to the purchase of sportfishing packages such as accommodation and angling at one of the areas remote fishing lodges. Estimates of variability in the estimates were derived for average expenditure levels, and total visitation estimates. It is estimated that annually Bristol Bay anglers spend approximately $58 million within the Bristol Bay economy. Given the variability in the components of this estimate, the 95% confidence interval for Bristol Bay area spending by anglers from outside the area ranges from $0 to $123 million annually. The vast majority of this spending (approximately $45 million annually) is spent by nonresident anglers.

Table 36. Estimated Aggregate Spending Associated with Sportfishing in the Bristol Bay Region

	Nonresidents		*out-of-area AK residents*	*BB Residents*	*Total*
	All Non Residents	Remote Lodge Increment			
Mean expenditures in Bristol Bay region	$ 1,339	$4,277	$ 1,440	$ 339	
Estimated trips 2004	12,966	6,431	4,450	19,488	36,904
Total Bristol Bay direct expenditures	$ 17,360.898	$ 27,526,683	$ 6,407,597	$ 6,611,878	$ 57,907,057

Table 37 presents total estimated direct angler expenditures by residency, and location of spending. Again, among all direct spending related to Bristol Bay angling, the large majority is associated with nonresidents traveling to Alaska. Additionally, the large majority of this spending is reported to have occurred within the Bristol Bay economy.

Table 37. Bristol Bay Sportfishing: Aggregate in and out of Region and State Spending

Population	*In Bristol Bay Spending*		*In Alaska Spending*	
	Total spending in Bristol Bay	Total spending from outside Bristol Bay	Total in-state spending	Spending from outside Alaska
NONRESIDENT Base trip spending	$ 17,360,898	$ 17,360,898	$ 19,628,058	$ 19,628,058
NONRESIDENT Sportfish package spending	$ 27,526,683	$ 27,526,683	$ 27,526,683	$ 27,526,683
NONRESIDENT TOTAL	$ 44,887,582	$ 44,887,582	$ 47,154,741	$ 47,154,741
RESIDENTS				
OUT-OF-BB RESIDENT base trip spending	$ 6,407,597	$ 6,407,597	$ 6,407,597	$ -
BB RESIDENT base trip spending	$ 6,611,878	$ -	$ 6,611,878	$ -
ALASKA RESIDENT TOTAL	$ 13,019,475	$ 6,407,597	$ 13,019,475	$ -
TOTAL	**$ 57,907,057**	**$ 51,295,178**	**$ 60,174,216**	**$ 47,154,741**

5.3.2 Estimation of Net Willingness to Pay for Bristol Bay Fishing Trips

A measure of the net economic value of sport fishing trips is the amount anglers are willing to pay over and above the costs of their trips. This willingness to pay is also referred to as net economic benefit. There is a large economics literature on estimating sport fishing net economic benefits (Rosenberger and Loomis 2001). The method for estimating these benefits here is contingent valuation using the so called "payment card" question format.

Following questions on their trip expenditures, survey respondents were asked whether they felt their trip was worth more than the amount they actually spent. Those who answered "yes" were then asked, "What is the largest increase over and above your actual costs that you would have paid to be able to fish your primary destination?" Respondents were presented with a series of dollar amounts ranging from $10 to $2,000. Table 38

shows the percentage of both resident and nonresident Bristol Bay anglers who responded that they would have paid the various additional amounts to take their Bristol Bay fishing trip.

Table 38. Responses to Current Trip Net Economic Value Question

	NONRESIDENTS	***RESIDENTS***
	Percent	**Percent**
Willing to Pay More	**63.0%**	**73.3%**
$ 10	1.1%	0%
$ 25	0.3%	2.1%
$ 50	0.2%	3.6%
$ 100	6.2%	16.5%
$ 250	16.2%	20.5%
$ 500	15.9%	7.5%
$ 750	2.5%	3.6%
$ 1,000	9.1%	0%
$ 1,500	3.7%	0%
$ 2,000	2.3%	3.6%
Other amount	4.3%	15.7%
Sample Size	**204**	**38**

The estimates of willingness to pay models based on the Table 38 data were developed using a maximum likelihood interval approach (Welsh and Poe 1998). As noted, respondents were asked to choose the highest amount he or she was willing to pay from a list of possible amounts. It was inferred that the respondent's true willingness to pay was some amount located in the interval between the amount the respondent chose and the next highest amount presented. The SAS statistical procedure LIFEREG was used to estimate the parametric model of willingness to pay based on the underlying payment card responses.

Table 39 shows the estimated parametric willingness to pay for trips to Bristol Bay fisheries. Nonresident anglers state their trip was worth approximately $450 more, on average, than they actually paid. Resident Bristol Bay anglers stated they were willing on average to pay an additional $320 for their most recent trip. These estimates are similar to other estimates for Alaska sport fishing (Duffield et al. 2002; Jones and Stokes 1987).

Table 39: Estimated Mean Willingness to Pay for Anglers' Recent Trip to Bristol Bay

Statistic	*Non-residents*	*Residents*
Estimated mean willingness to pay in addition to trip costs for those willing to pay more	$722.18	$437.05
Percent of respondents willing to pay more for their trip	63.0%	73.3%
Net willingness to pay for Bristol Bay fishing trips for all anglers	$454.90	$320.45
Sample Size	204	38

The net economic value per trip estimates shown in Table 39 were calculated from the results of a bivariate statistical model of the payment card response data using a variant of survival analysis to examine censored interval data. The chi-square test of significance for the key parameters from these models show the estimated coefficients to be statistically significant.

As a check on the bivariate willingness to pay modeling results shown above, a multivariate model of the payment card data was also done. This model included a number of explanatory variables in addition to the different payment levels. Table 40 shows the results of a multivariate model of current trip willingness to pay for nonresidents fishing in the Bristol Bay area. The model's explanatory variables are all statistically significant at least at the 90% level of confidence, and most variables are significant at the 99% level. The model was specified with a normal distribution.

The signs of the explanatory variables in the following multivariate model of willingness to pay are generally consistent with *a priori* expectations. The sign on the income variable is positive, indicating that as income rises, so does willingness to pay. Other variables with positive coefficients are variables indicating 1) the angler caught a rainbow trout over 26 inches on their trip, 2) the angler's trip was un-crowded, 3) the angler rates fishing as their favorite outdoor activity, 4) the angler prefers fly-fishing when fishing in Alaska, and 5) the main purpose of the respondent's most recent trip was for fishing. The remaining variables had negative coefficients, indicating that a "yes" response for those bivariate variables is associated with a decrease in willingness to pay for the angler's most recent Alaska fishing trip. These results indicate the pattern of responses is consistent with what would be predicted by economic theory.

Table 40. Multivariate explanatory model of willingness to pay for nonresident Bristol Bay fishing trips

Parameter	*Estimate*	*Chi-Square*
Intercept	-297.6	21.34***
Income ($1,000)	0.47	3.09*
Lodge client (1=yes, 0=no)	-404.7	62.62***
Caught large rainbow (1=yes, 0=no)	220.3	19.97***
Targeted rainbows (1=yes, 0=no)	-254.4	28.14***
Fishing uncrowded (1=yes, 0=no)	412.8	78.53***
Advanced angler)1=yes, 0=no)	-90.7	4.83**
Fishing favorite activity (1=yes, 0=no)	190.5	17.82***
Prefers flyfishing (1=yes, 0=no)	249.1	28.39***
First trip to area (1=yes, 0=no)	-235.4	30.98***
Main purpose of trip fishing (1=yes, 0=no)	349.2	44.43***
Scale parameter	791.9	--
Sample size	167	

Note: * = significant at 90% level of confidence; ** = 95%; * = 99%.**

5.4 Package Fishing Trip Characteristics

Section 4 detailed estimated total annual angler spending associated with Bristol Bay angling. A large majority of this estimated spending is made by nonresident anglers (approximately 80%). Additionally, nearly half of all estimated annual Bristol Bay freshwater angler expenditures is spent on nonresident purchases of sportfishing package trips. Because of the relative importance of this sector, this section focuses on that substantial market segment of the Bristol Bay sport fishing sector.

Figure 9 presents information on the sub-sample of non-resident trips to Bristol Bay that include a stay at a remote lodge that provided guided fly-out or boat fishing services. Figure 9 shows the distribution of nights spent at the lodge. The most common trip length was seven nights (37%), followed by six nights (24%) and greater than seven nights (14%). A total of 75% of nonresident lodge stays were at least six nights long.

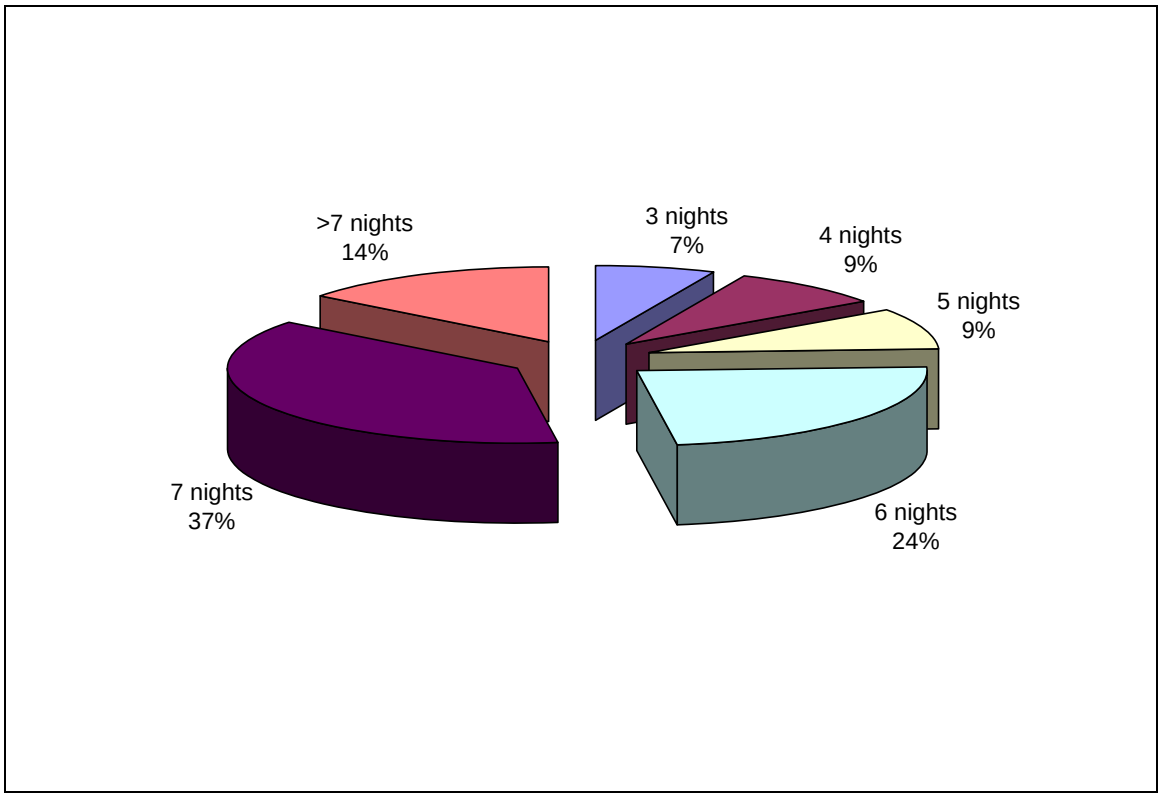


Figure 9. Distribution of Trip Length, Bristol Bay Package Fishing Trips

Respondents who had purchased a "package" sportfishing trip to Bristol Bay were asked what services were included in their package price. Figure 10 details the percentage of respondents who indicated each type of service that was included in their package price.

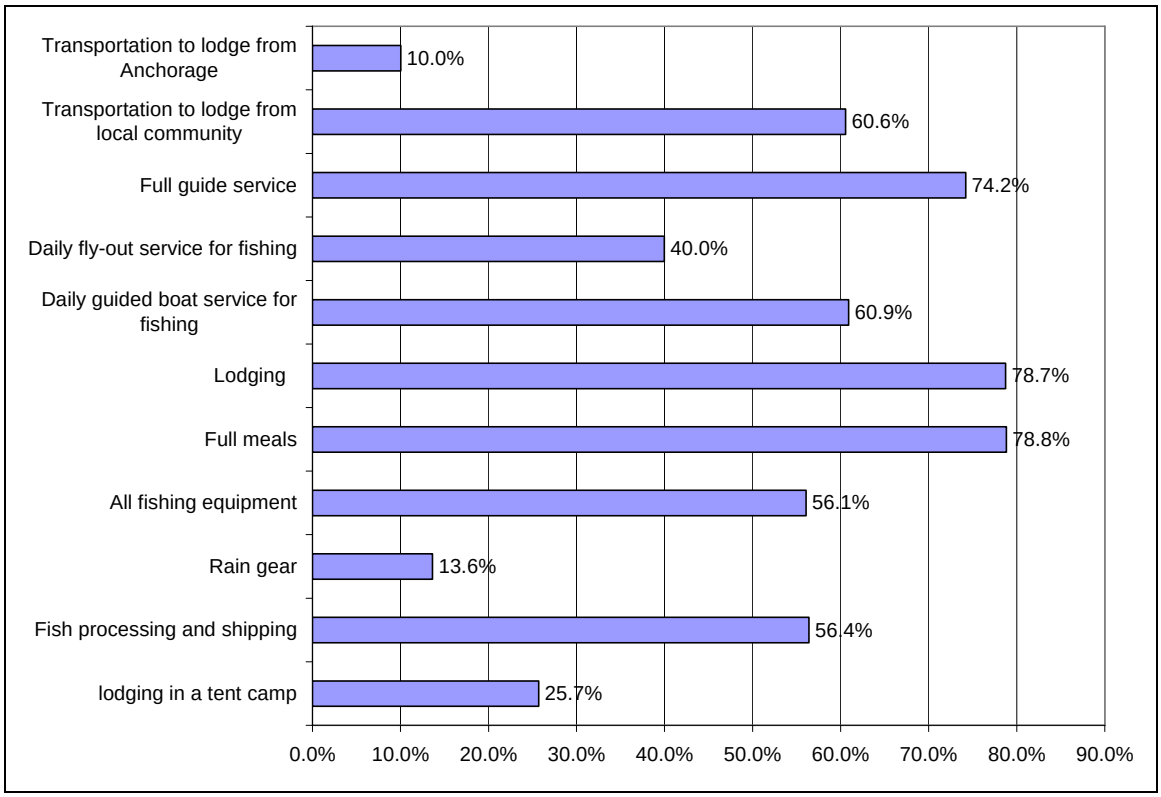


Figure 10. Bristol Bay Package Fishing Trips, Services Provided

5.4.1 Estimated Explanatory Model of Sportfishing Package Expenditures

In order to further examine which of the sportfishing package services listed by survey respondents were most important in determining the price of the fishing package, a multivariate model regressing price on a series of services offered was constructed. The estimated model (linear specification) is shown in Table 41. Consistent with expectations, the most significant variable in the model was the use of daily fly-out service from the lodge for fishing. Package tours including daily fly-out service on average cost $3,005 more than those not offering this service. Additionally, those packages supplying all fishing equipment were significantly more expensive than those not supplying this equipment. Finally, the model predicts that the package price increases by $465 dollars for every additional night's stay included in the package.

Table 41. Explanatory model of reported sportfishing package trip prices: nonresident Bristol Bay anglers

Parameter / Statistic	*Coefficient*	*Standard Error*	*T-statistic*
Intercept	-228	1,612	-0.14
Daily fly-out services	3,005	721	4.17***
All fishing equipment	1,221	725	1.68*
Number of nights	465	258	1.80**
Adjusted R-square		0.357	
Sample Size		75	

Note: * = significant at 90% level of confidence; ** = 95%; *** = 99%.

5.5 Bristol Bay Development Issues and Resource Values

Table 29 and Table 30, above, indicate that anglers experience the Bristol Bay area as an uncrowded, wilderness setting, with seasonally good fishing for large rainbows. Questions in the survey on crowding were followed by a set of policy questions directly addressing potential development within the area that could impact access (and thus crowding and size and abundance of rainbows) and the pristine, undeveloped nature of the region.

Respondents were first asked the following question:

> *Fishing in the Bristol Bay region is currently generally characterized by a wilderness setting, relatively un-crowded fishing, and good opportunities to catch large rainbow trout. Suppose that good road access was developed from Anchorage to Bristol Bay by ferry from Homer across Cook Inlet and then along a corridor including the Newhalen River, Lake Illiamna, the Kvichak River, and the lower Nushagak River to Dillingham, King Salmon, and Aleknagik. How do you anticipate this would affect your future sportfishing, if at all?*

Figure 11 shows responses to this question about the impact of hypothetical Bristol Bay road access for survey respondents who reported fishing a Bristol Bay water. The largest category of respondents (both resident and non-resident) indicated a road would not impact their sport fishing. Conversely, the smallest category of responses for both samples indicated they would fish more often in the Bristol Bay area, given road access. However, the final 2 categories of responses combined indicate that 45.4% of non-residents and 30.5% of residents feel that the road access would cause them to either stop fishing in the Bristol Bay area (and fish other areas of Alaska) or stop fishing in Alaska entirely.

In contrast to these responses of anglers who had recently fished Bristol Bay waters, those survey respondents who reported taking their most recent trip to a Southcentral Alaska water outside of Bristol Bay (for example, the Kenai R.) seemed more favorable

to fishing Bristol Bay waters were road access improved. While nonresident anglers in this group were still on balance less likely to fish in Bristol Bay with improved road access (12% would take more trips and 29.4% would take fewer trips), Alaska resident anglers were much more favorable to improved access. Among this group of resident anglers who reported fishing streams outside of Bristol Bay, 50.4% said they would take more trips to Bristol Bay with improved road access while 13.5% said they would take fewer trips.

Interpretation of the long run implications of possible Bristol Bay road development for use and demand is complex. Improved access would tend to increase congestion on Bristol Bay waters and impact the current high quality of the fishing experience. Determining the net impact of any such changes on angler use and expenditures would require further research.

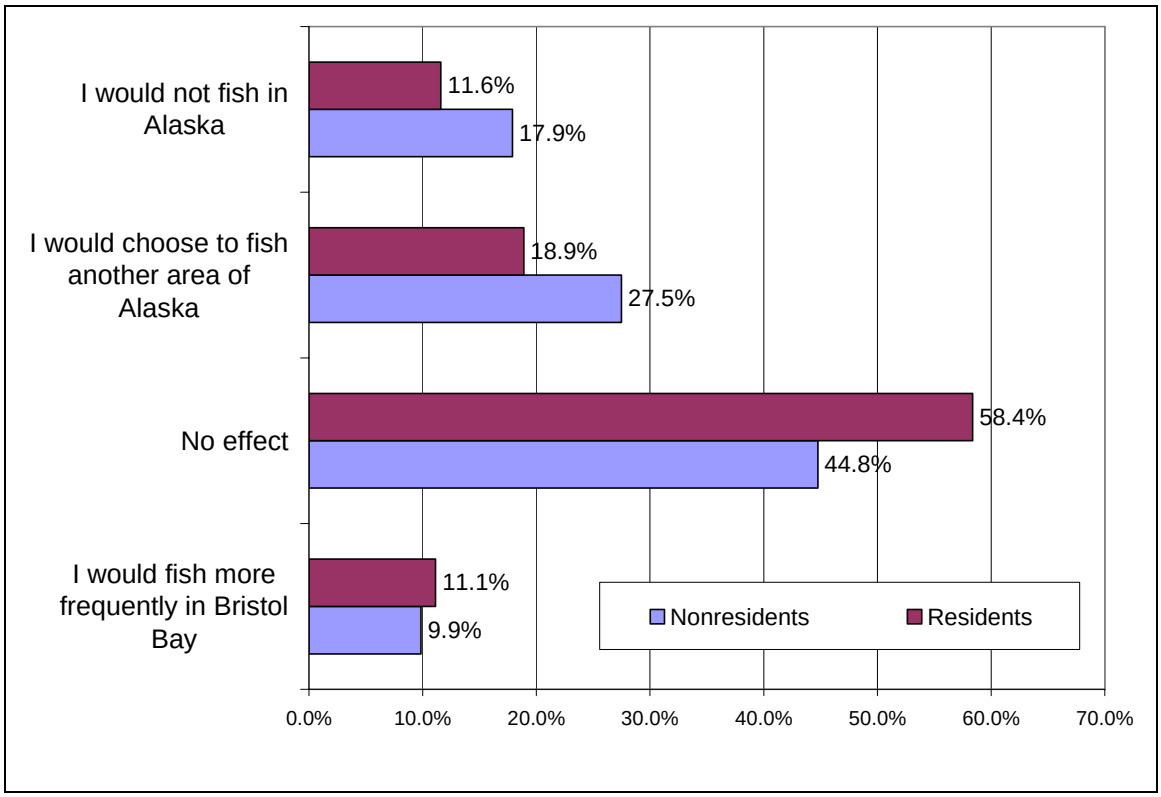


Figure 11. Bristol Bay Angler Responses to Impact of Bristol Bay Road Access on Sportfishing.

Figure 12 shows the percentage of resident and non-resident anglers who reported fishing Bristol Bay waters who favor, oppose, or were not sure of their position on the development of future possible road access to Bristol Bay (as outlined in the question above). Non-resident anglers show a very strong opposition to road access with 68.6% opposing, 14.8% favoring, and 16.5% not sure. Alaska resident anglers are more divided, but still primarily in opposition to road access with 57.2% opposing, 34.8% favoring, and 8.0% not sure.

Again, those anglers who reported fishing waters outside of Bristol Bay were more supportive of road development than those anglers who most recently fished Bristol Bay waters. Among nonresident anglers who reported fishing a South-central Alaska water outside of Bristol Bay, a plurality still opposed the road (24.3% favor, 43.4% oppose, 32.3% not sure). Among residents, however, a majority (52.3%) favored road development while 26.9% opposed it and 20.2% were not sure.

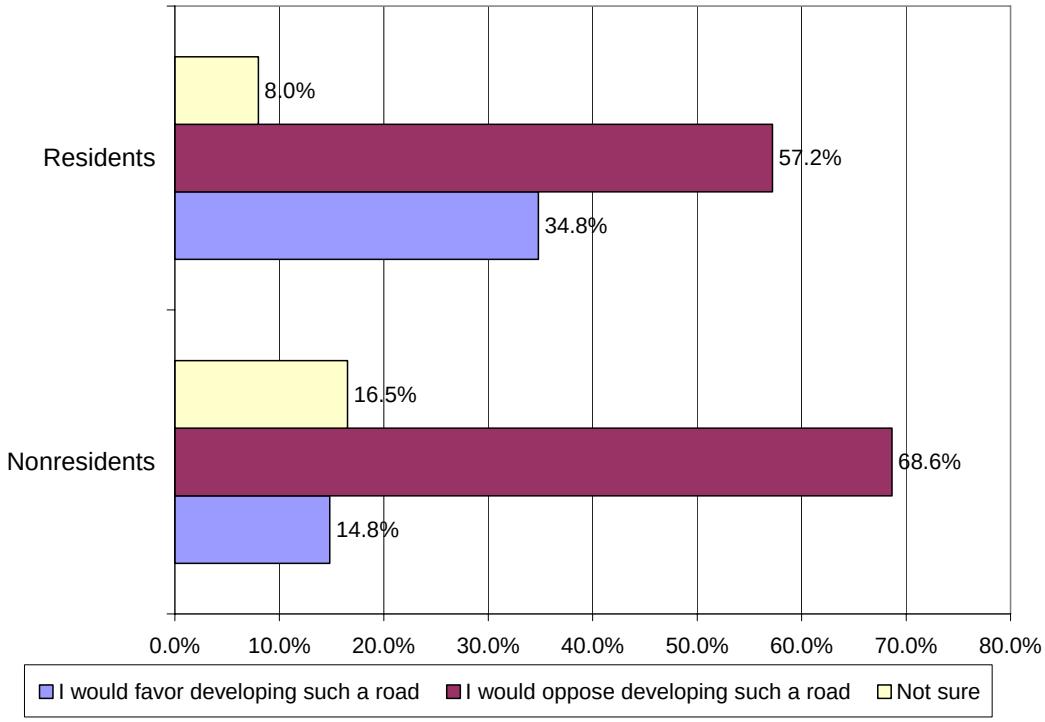


Figure 12. Bristol Bay Angler Support and Opposition to Bristol Bay Road Access

Table 42 presents the information contained in the preceding figures and adds the results for the sub-sample of nonresident Bristol Bay anglers who stayed at remote lodges on their recent trip. This last group of lodge clients is more likely than the entire group of nonresident anglers to both oppose road development in the region, and to say they would fish other areas in the event of the proposed development. Table 42 also includes sample sizes and estimated 95% confidence intervals for the estimates. The sample of Alaska residents who fished Bristol Bay is relatively small, and this is reflected in the relatively larger confidence interval around the estimates.

Table 42. Comparison of responses to Bristol Bay road development policy questions: Bristol Bay angler residents, non-residents, and non-resident lodge clients

Question/statistic	*Alaska Residents (95% C.I.)*	*Nonresidents (95% C.I.)*	*Nonresident lodge clients (95% C.I.)*
% who would not fish Bristol Bay area if good road access were developed in the area	30.5% (+/- 13.0%)	45.4% (+/- 6.4%)	58.8% (+/- 9.6%)
% who oppose developing road access in Bristol Bay area	57.2% (+/- 14.0%)	68.6% (+/- 5.9%)	76.8% (+/- 8.2%)
Sample Size	48	234	101

5.6 Bristol Bay Angler Survey Demographic Characteristics

A final section of the 2005 Bristol Bay angler survey asked respondents a series of demographic questions. Table 43 and Table 44 show selected statistics from this section of the survey. The survey indicates that most Bristol Bay anglers are males, at 90% for non-residents and 71% for residents. Survey responses indicated that nonresidents on average had higher incomes and were more likely to be college graduates, compared to residents. Overall, 20% of non-residents but only 4% of residents reported incomes over $200,000. Differences between resident and non-resident anglers were also seen in level of respondent education. Proportionally, twice as many non-residents as residents reported they had at least a college degree (66.4% v. 32.7%).

Table 43: Socioeconomic Characteristics of Bristol Bay Anglers, by Residency.

Statistic	*Non-residents*	*Residents*
Median Age	49	42
Percent Male	89.5%	70.6%
Percent college graduates	66.4%	32.7%
Percent employed full time	63.1%	77.3%

Table 44. Bristol Bay Angler Household Income Levels, by Residency

Household Income	*Non-residents*	*Residents*
Less than $24,999	9.5%	4.5%
$25,000 to $49,999	17.2%	19.6%
$50,000 to $74,999	15.9%	24.6%
$75,000 to $99,999	12.1%	22.3%
$100,000 to $124,999	10.6%	10.5%
$125,000 to $149,999	6.6%	12.5%
$150,000 to $199,000	8.3%	2.1%
$200,000 to $299,999	7.4%	1.2%
Over $300,000	12.5%	2.7%

5.7 Results of Mail Survey of Bristol Bay Remote Lodge Clients.

As noted in Section 3, above, one population surveyed for this study was 2005 clients of remote Bristol Bay lodges. This sample was largely a convenience sample, rather than a probability sample. Bristol Bay lodges were asked to randomly sample their 2005 client lists and provide that sample to the survey researchers. In actuality, the sample drawn consisted of a census of clients from one area lodge and random samples from 3 others. The resulting sample primarily included responses from anglers who had fished the Kvichak River, a largely rainbow trout fishery located downstream of the proposed area of mine development. As such, these survey responses highlight both similarities and some key differences between angling on the Kvichak and in other areas of Bristol Bay.

Table 45 presents a comparison of responses from two groups of 2005 Bristol Bay anglers who stayed at remote area lodges on their trips. The first group in the table is the sub-sample of internet survey respondents who reported both fishing Bristol Bay waters on their most recent trip, and reported staying at a remote area fishing lodge on that trip. The second is respondents to the mail survey of 2005 remote lodge clients.

A comparison of the responses from the two independent lodge client samples shows a significant degree of agreement across a wide range of survey question responses. Lodge clients from the two samples spent similar amounts of money on their trips and were demographically similar. The largest differences between the 2 groups shown in **Table 45** are in regard to the percentage of respondents targeting rainbow trout on their recent trip, the percent who reported catching a rainbow 26 inches long or longer, and the percentage saying they would still have made their trip if their primarily targeted species had not been available. Additionally, smaller differences were also seen in the percent of respondents who said they would reduce their trips to Bristol Bay if road access to the area were improved, and the percent who oppose development of road access in the region.

Table 45. Comparison of Lodge Mail and Lodge Internet Sample Responses for Selected Survey Questions

Survey question/statistic	*Internet responses from sample of licensed anglers who visited remote lodges*	*Mail responses from Bristol Bay Remote Lodge Clients*
(A) Demographic Comparisons		
Median age	55	57
% employed full time	60.4%	60.0%
% male	86.7%	98.4%
% with over $200,000 household income	38.4%	47.0%
(B) Expenditure Comparisons		
Average amount spent on package fishing tour	$5,543	$6,134
Average amount spent in Bristol Bay (besides package tour cost)	$1,729	$1,550
Average amount spent in rest of Alaska (besides package tour cost)	$529	$917
% saying that the trip was worth more than they had to pay for it	54.8%	54.5%
(C) Trip Characteristic Comparisons		
% agreeing that fishing conditions were un-crowded	92.8%	91.6%
% who primarily targeted rainbow trout	**38.9%**	**72.3%**
% who caught a rainbow over 26 inches	**43.0%**	**75.4%**
% who would have still made the trip if their primarily targeted species had not been available	**45.5%**	**29.7%**
(D) Response to Policy Questions Comparisons		
% who would reduce trips to Bristol Bay if improved road access were to be built	58.2%	66.1%
% who oppose development of road access	76.4%	88.0%

These specific differences across the two samples are consistent with what might be expected due to the composition of trips in the samples. Table 46 shows that while the responses from Bristol Bay lodge clients taken from the pool of 2005 fishing license holders show a distribution of trips across a number of major Bristol Bay drainages, the remote lodge client sample supplied by lodge owners is heavily dominated by anglers who took their trip to the Kvichak River drainage. This river is a renowned rainbow trout fishery (Gunn 2006), and the Kvichak is also located downstream of potential mine and road development in the region. It is logical, then that respondents within this heavily Kvichak River sample would be more likely to both target rainbows and catch large rainbows, and to have strong opinions on future development in the region.

Table 46. Comparison of Drainages/waters Fished: Internet vs. Mail Lodge Client Samples

Drainage/water	*Internet Lodge Client Sample*	*Mail Lodge Client Sample*
Naknek River Drainage	16.6%	0.9%
Nushagak-Mulchatna Drainage	23.3%	7.4%
Kvichak-Lake Iliamna	**37.6%**	**90.7%**
Other Bristol Bay	22.5%	0.9%
Kvichak River (specifically)	**12.0%**	**88.0%**

5.7.1 Bristol Bay Conservation Trust Fund Contribution Responses

The mail and web surveys of Bristol Bay lodge clients included a series of questions asking respondents how much they would be willing to contribute to a conservation trust fund designed to protect the area in its current pristine, primarily unroaded condition. The text of this question is as follows:

> There is the potential for significant future extractive resource development and roading in the Bristol Bay area. For example, **a large mine** has been proposed in the headwaters of the Nushagak and Kvichak Rivers near Lake Iliamna, and **a road** has been proposed linking Anchorage and Bristol Bay.
>
> Suppose that you had an opportunity to support a fund whose aim was to keep the main Bristol Bay drainages in their current relatively pristine and un-roaded condition. Assume that the successful development of such a fund would actually result in the protection of Bristol Bay from roading and extractive resource development.
>
> **As this survey is part of a research project, we are not asking you to make a donation. Nonetheless, we would like you to answer the following question as you would a solicitation for an actual donation. If you were asked today. how much would you be willing to donate, if anything, to keep the Bristol Bay region in its current relatively pristine and unroaded condition?** (Please check one)
>
> □ $25 □ $50 □ $100 □ $250 □ $500 □ $1000 □ $2000 $____ other
>
> □ I would choose to not make a donation at this time

A cash and contingent valuation experiment was undertaken to measure willingness to pay into this trust fund. The "payment card" format used in the question tends to be conservative and understates the true referendum values recommended by Arrow et al. (1993). Web survey participants in response to the contingent valuation question indicated an average willingness to pay of $19.62 for Alaska residents and $37.04 for nonresidents. For a sub-sample of nonresident Bristol Bay anglers who stayed at remote lodges, the average willingness to pay was $156.50 per respondent. In general

the literature indicates these willingness to pay estimates are likely conservative for not mentioning a referendum, and for use of the "payment card" rather than a dichotomous choice format.

A small cash experiment was also conducted using just the nonresident lodge client anglers. This-subsample was asked to make an actual contribution to the trust fund for protection of the Bristol Bay area. Average contributions to this survey were $20.63. These results are not consistent with the literature in that the average cash donation is a small fraction of the contingent valuation response (Champ and Bishop 2006). This result may be due to "free riding" or the respondent unfamiliarity with the trust fund and its sponsors.

6.0 Commercial Fisheries

6.1 Introduction

This chapter provides an overview of the commercial fisheries sector in Bristol Bay. The focus is on identifying total earnings in the harvesting and processing sectors, and on providing the historical context for these estimates. Since commercial fishing is the largest commercial sector in the Bristol Bay economy, this data is an essential input for the regional economic modeling reported below. Information is also summarized on costs, and on the residence of commercial fishing permit holders and others employed in this sector.

This chapter draws on a number of recent studies including: the most recent annual fishery management report for Bristol Bay (Alaska Department of Fish and Game, 2005), the Bristol Bay Salmon Drift Gillnet Fishery Optimum Number Report (Commercial Fisheries Entry Commission, 2004), Projections of Future Bristol Bay Salmon Prices (Knapp 2004), and data available on the websites of the management agencies.

6.2 Overview of the Bristol Bay Fishery

The Bristol Bay commercial fisheries management area encompasses all coastal and inland waters east of a line from Cape Menshikof to Cape Newhenham (Figure 1). This area includes eight major river systems: Naknek, Kvichak, Egegik, Ugashik, Wood, Nushagak, Igushik and Togiak. Collectively these rivers support the largest commercial sockeye salmon fishery in the world (ADF&G, 2005). This is an interesting and unique fishery, both because of its scale and significance to the local economy, but also because it is one of the very few major commercial fisheries in the world that has been managed on a sustainable basis.

The five species of pacific salmon found in Bristol Bay are the focus of the major commericial fisheries. Sockeye salmon are the primary species harvested both in terms of pounds of fish and value. Annual commercial catches between 1984 and 2003 averaged nearly 24 million sockeye salmon, 69,000 Chinook, 971,000 chum, 133,000 coho, and 593,000 (even year only) pink salmon (ADF&G, 2005). Prices for sockeye salmon are typically higher than for other salmon species, making the Bristol Bay fishery the most valuable of Alaska's salmon fisheries (CFEC, 2004). This is also the largest Alaska fishery in terms of the number of permit holders. In 2004, there were 1,857 potentially active entry permits in the drift gillnet fishery and 992 in the set gillnet fishery (CFEC, 2004). There is also a herring roe on kelp fishery. The focus in this chapter is on the salmon fishery, particularly sockeye, since this fishery is dependent on the same freshwater ecosystems as the sport and subsistence fisheries.

The fishery is organized into five major districts (Figure 13) including Togiak, Nushagak, Naknek-Kvichak, Eggegik, and Ugashik. Management is focused on discrete stocks with harvests directed at terminal areas at the mouths of the major river systems (ADF&G, 2005). The stocks are managed to achieve an escapement goal based on maximum sustained yield. The returning salmon are closely monitored and counted and the openings are adjusted on a daily basis to achieve desired escapement. Having the fisheries near the mouths of the rivers controls the harvest on each stock, which is a good strategy for protection of the discrete stocks and their genetic resources. The trade-off is that the fishery is more congested and less orderly, and the harvest is necessarily more of a short pulse fishery, with most activity in June and early July. This has implications for the economic value of the fish harvested, both through effects on the timing of supply, but also on the quality of the fish.

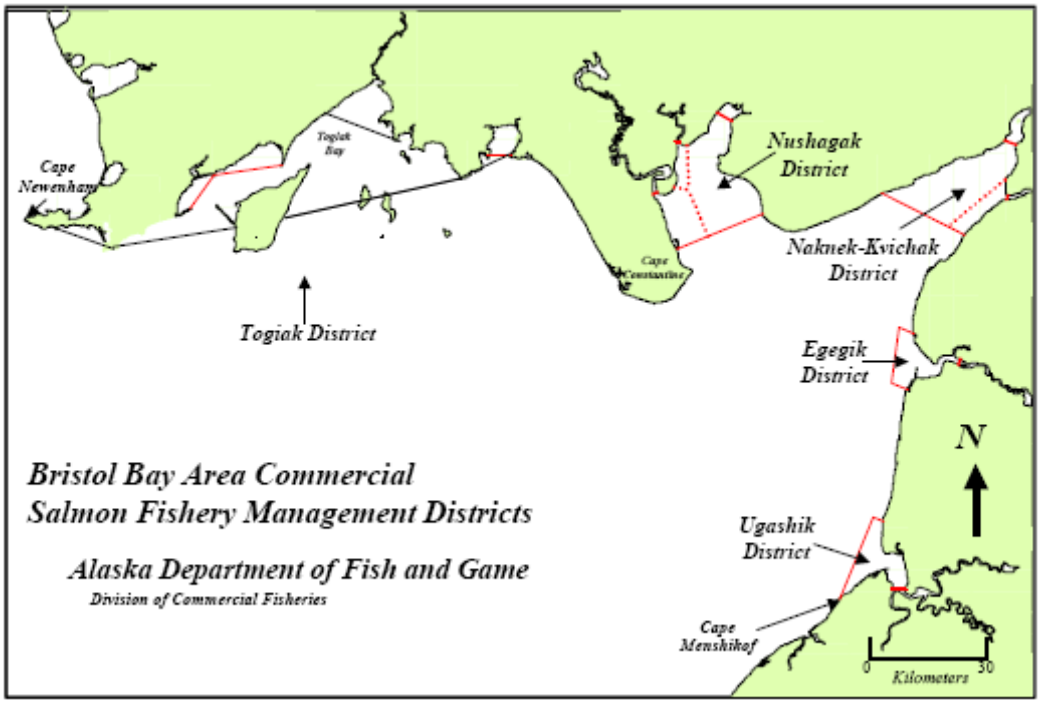


Figure 13. Bristol Bay Area Commercial Salmon Fishery Management Districts (ADFG 2005)

The most lucrative market for salmon is as high quality fresh fillets or whole fish. For example, Copper River kings and sockeye are available early in the season and are relatively close to the U.S. domestic market. These fish can go for up to $10 per pound wholesale in recent years. The Bristol Bay harvest comes on when there is already a glut in the market and prices may only average 50 cents a pound. Most Bristol Bay salmon are canned or frozen, as detailed below.

An interesting aspect of this fishery is that the compressed timing of the harvesting activity makes commercial fishing a good fit with subsistence in the overall Bristol Bay cash-subsistence economy. As detailed below, many commercial fishing permit holders and crew members, as well as some employees in the processing sector, are residents of

Bristol Bay's dominantly-native Alaskan villages. In 2004, there were 952 resident commercial fishing permit holders in the Bristol Bay study area, as well as 920 crew members. This is a significant share of the area's total adult population. An ADF&G summary of subsistence activity in Bristol Bay (Wright, Morris, and Schroeder 1985) noted that as of the mid-1980's traditional patterns of hunting, fishing, and gathering activities had for the most part been retained, along with accommodations to participate in the commercial fishery and other cash-generating activities. In the abstract to this 1985 paper, the authors characterize the commercial salmon fishery as "a preferred source of cash income because of its many similarities to traditional hunting and fishing, and because it is a short, intense venture that causes little disruption in the traditional round of seasonal activities while offering the potential for earning sufficient income for an entire year." Commercial fishing is a form of self employment requiring many of the same skills, and allowing nearly the same freedom of choice as traditional subsistence hunting and fishing. (Wright, Morris, Schroeder 1985; p. 89).

In 2002, Bristol Bay commercial salmon fishing accounted for about 19% of all Alaska salmon harvest, by weight, and nearly 32% of all Alaska salmon harvest by earnings (Table 47). Harvest by set gillnet accounts for approximately 18% of Bristol Bay commercial harvest while drift gillnet harvest accounts for 82% of salmon harvest. Among all 5 species of salmon, sockeye account for over 98% of the *ex vessel* value of salmon harvests in the Bristol Bay region (
Table 48).

Table 47. Bristol Bay and Alaska Commercial Fishery Permits, Harvest, and Gross Earnings (2002)

Sector	*# permit holders*	*# permits*	*Pounds*	*Gross earnings*
Bristol Bay Salmon				
Drift gillnet	1,862	1,447	135,549,944	$77,243,936
Set gillnet	988	829	30,032,259	$17,327,819
All Bristol Salmon	2,850	2,276	165,582,203	$94,571,755
All Alaska Salmon	10,594	7,508	872,577,336	$293,147,368
All Alaska fisheries	14,318	13,463	3,842,853,863	$990,099,365

Source: derived from ADFG (2005)

Table 48. Bristol Bay Salmon Harvest and Ex Vessel Value

Species	*Total Catch (lbs)*	*Mean Weight (lbs)*	*Mean Price ($/lb)*	*Ex-vessel Value ($)*
Sockeye	148,394,331	5.77	$0.50	$ 74,197,166
Chinook	1,707,696	15.35	$0.38	$ 648,924
Chum	4,932,731	6.57	$0.09	$ 443,946
Pink	212,527	4.07	$0.05	$ 10,626
Coho	473,380	6.84	$0.34	$ 160,949
Total	155,720,665			$ 75,461,611

Source: derived from CFEC website data

In the following pages, Figure 14 through Figure 21 and Table 49 present time series data on harvest and *ex vessel* values for Bristol Bay salmon fishing. These graphs and tables illustrate the extreme variability in both harvest levels and prices paid to commercial fishermen over several decades.

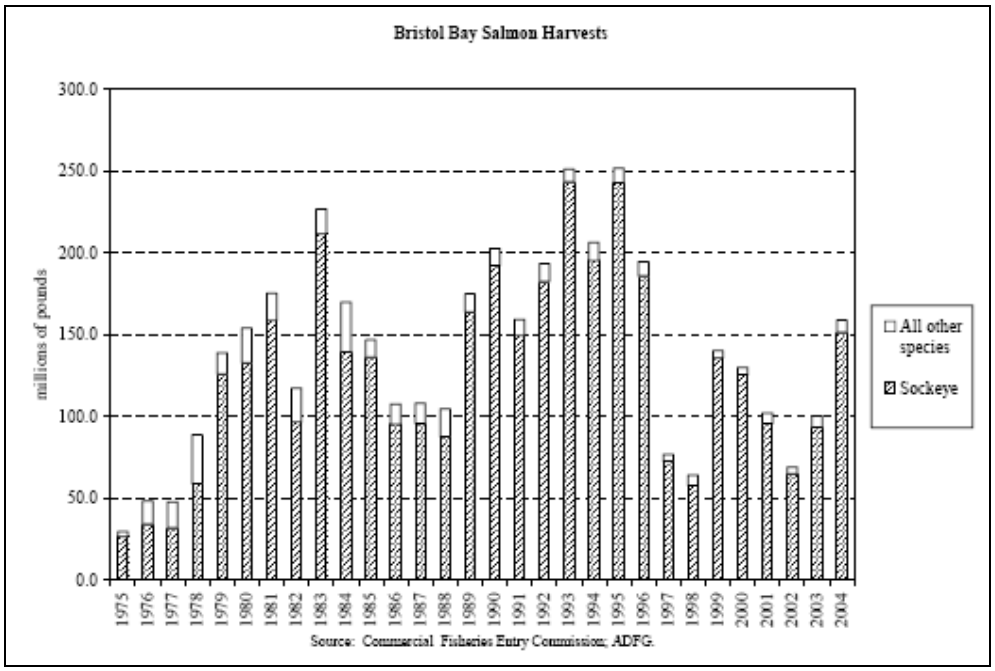


Figure 14. Time Series of Bristol Bay Salmon Harvest, pounds (Source: Knapp 2004).

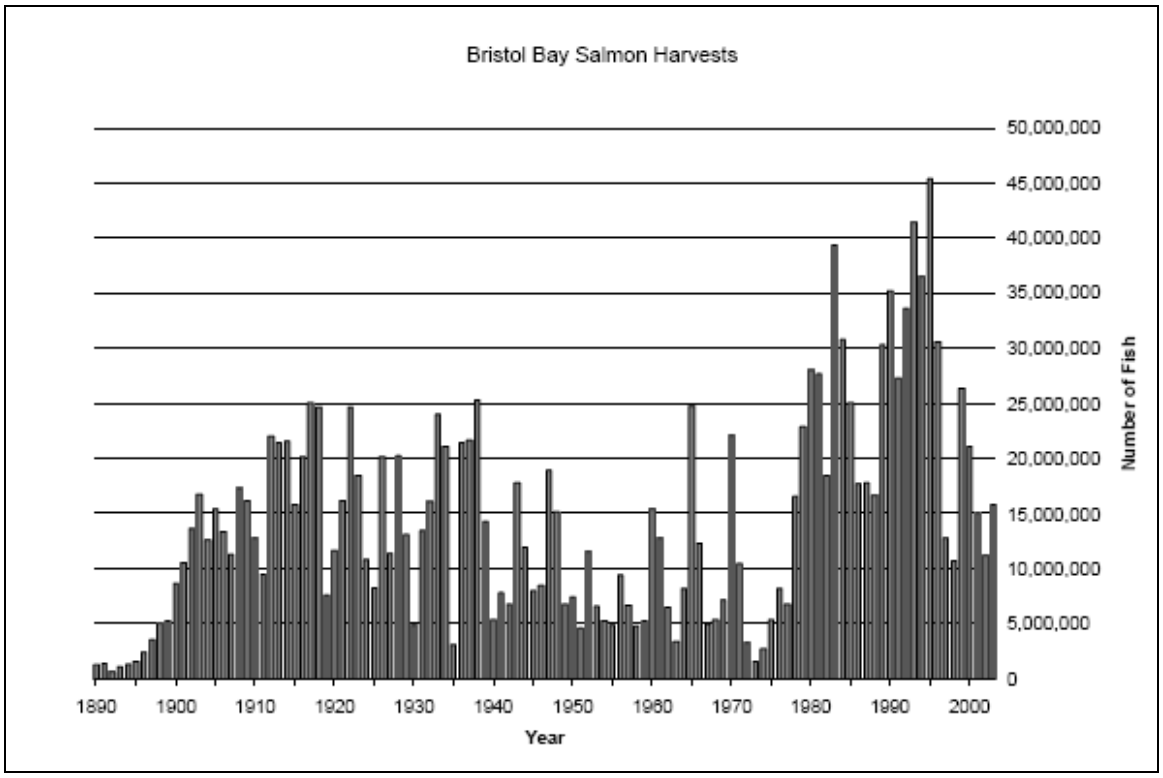


Figure 15. Time Series of Bristol Bay Salmon Harvest, Number of Fish (Source: Knapp 2004).

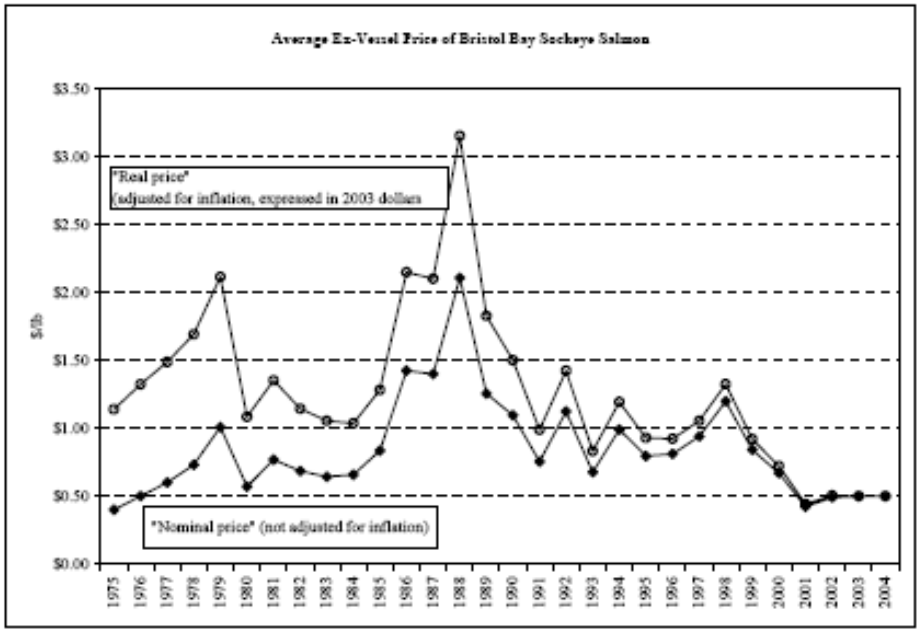


Figure 16. Time Series, Ex Vessel Price of Bristol Bay Sockeye Salmon (Source: Knapp 2004).

Table 49. Time Series Average Annual Ex Vessel Prices for Bristol Bay Salmon: Real and Nominal

	Sockeye		Chum		Coho		Chinook		Pink	
Year	Nominal Price	Real Price	Nominal Price	Real Price	Nominal Price	Real Price	Nominal Price	Real Price	Nominal Price	Real Price
1975	0.40	1.14	0.30	0.85	0.38	1.09	0.40	1.14	0.28	0.80
1976	0.50	1.32	0.32	0.85	0.42	1.11	0.49	1.30	0.31	0.82
1977	0.60	1.49	0.40	0.99	0.60	1.48	0.75	1.86	0.36	0.89
1978	0.73	1.69	0.40	0.93	0.77	1.79	0.72	1.67	0.33	0.76
1979	1.01	2.12	0.51	1.06	0.98	2.06	1.02	2.14	0.36	0.75
1980	0.57	1.08	0.34	0.65	0.56	1.06	1.01	1.92	0.25	0.48
1981	0.77	1.35	0.41	0.71	0.70	1.23	1.21	2.12	0.30	0.52
1982	0.69	1.14	0.35	0.59	0.75	1.25	1.22	2.04	0.22	0.37
1983	0.64	1.05	0.32	0.52	0.45	0.74	0.70	1.15	0.20	0.32
1984	0.66	1.04	0.30	0.48	0.76	1.20	1.03	1.63	0.23	0.36
1985	0.83	1.28	0.32	0.49	0.73	1.12	0.96	1.48	0.22	0.33
1986	1.42	2.15	0.31	0.47	0.68	1.02	1.00	1.51	0.15	0.22
1987	1.40	2.10	0.30	0.45	0.84	1.26	1.17	1.76	0.40	0.59
1988	2.10	3.15	0.47	0.70	1.38	2.06	1.11	1.66	0.35	0.53
1989	1.25	1.82	0.26	0.37	0.72	1.05	0.84	1.22	0.22	0.31
1990	1.09	1.50	0.27	0.37	0.78	1.06	0.93	1.28	0.32	0.44
1991	0.75	0.99	0.23	0.29	0.57	0.75	0.68	0.90	0.16	0.21
1992	1.12	1.42	0.27	0.34	0.60	0.76	0.94	1.19	0.14	0.18
1993	0.68	0.83	0.22	0.27	0.51	0.63	0.76	0.94	0.13	0.16
1994	0.99	1.20	0.22	0.26	0.66	0.80	0.64	0.77	0.12	0.15
1995	0.80	0.93	0.20	0.24	0.42	0.49	0.66	0.77	0.14	0.16
1996	0.81	0.92	0.11	0.12	0.31	0.35	0.51	0.58	0.05	0.06
1997	0.94	1.05	0.10	0.11	0.49	0.55	0.51	0.57	0.07	0.07
1998	1.21	1.34	0.09	0.10	0.44	0.48	0.62	0.69	0.08	0.09
1999	0.84	0.92	0.10	0.11	0.35	0.38	0.53	0.58	0.09	0.10
2000	0.67	0.72	0.09	0.09	0.35	0.37	0.46	0.49	0.08	0.08
2001	0.42	0.44	0.11	0.12	0.32	0.34	0.31	0.32	0.09	0.09
2002	0.49	0.50	0.09	0.09	0.31	0.32	0.33	0.34	0.06	0.06
2003	0.50	0.50	0.09	0.09	0.29	0.29	0.29	0.29	0.03	0.03

Note: Real prices were calculated using the Anchorage consumer price index.

Source: Knapp (2004).

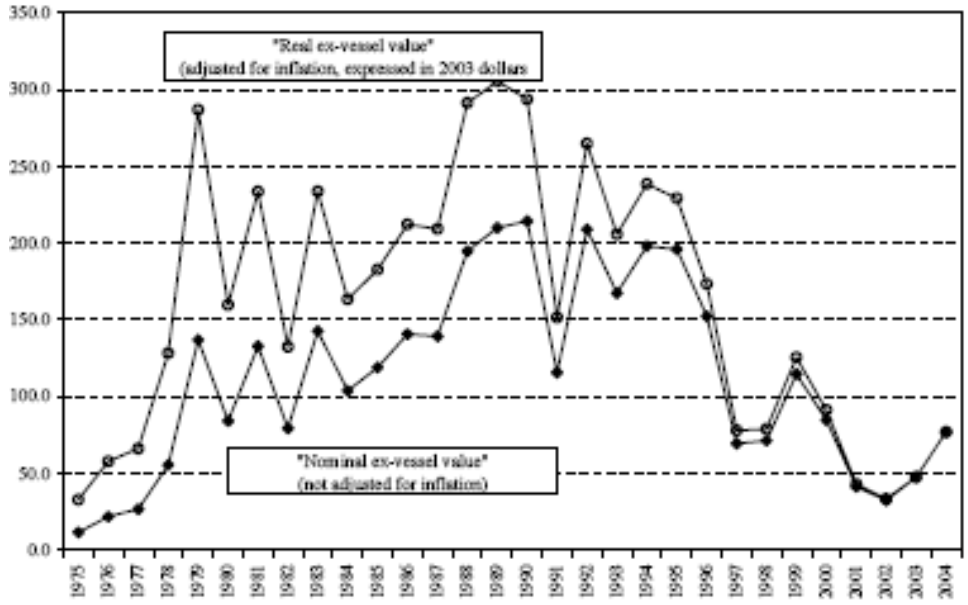


Figure 17. Time Series, Real and Nominal Ex Vessel Value. (Source: Knapp 2004)

Table 50. 2004 and 2005 Bristol Bay Harvest and Earnings

	# Permits fished	*Pounds*	*Gross earnings*	*Derived $/lb.*
2004				
Drift gillnet	1,411	131,219,518	$ 65,669,641	
Set gillnet	795	23,995,687	$ 11,663,522	
Total	2,206	155,215,205	$ 77,333,163	$ 0.50
2005				
Drift gillnet	1,447	135,549,944	$ 77,243,936	
Set gillnet	829	30,032,259	$ 17,327,819	
Total	2,276	165,582,203	$ 94,571,755	$ 0.57

Derived from CFEC Website data.

Table 51. 1999-2003 Bristol Bay Drift Gillnet Earnings, Costs, and Net Returns.

Year	1999	2000	2001	2002	2003
Number of Permits Fished	1,847	1,823	1,566	1,184	1,424
Average lbs. per permit	61,480	57,408	51,491	45,751	55,099
Sockeye ex-vessel price $/lb	$0.84	$0.67	$0.42	$0.49	$0.50
Average permit value	$89,700	$80,500	$34,700	$19,700	$29,300
Avg. gross earnings per permit	**$50,296**	**$37,527**	**$20,699**	**$21,482**	**$25,989**
Minus Average Expenses					
Food	$1,434	$1,531	$1,280	$894	$1,214
Fuel, oil, & lubricants	$1,718	$1,637	$1,362	$1,496	$1,670
Crew shares (excluding skipper)	$10,692	$7,867	$4,144	$4,323	$5,317
Maintenance (routine & unexpected)	$2,392	$2,695	$2,133	$1,876	$2,541
Nets (hanging, repair, and web)	$1,809	$1,896	$1,349	$1,322	$1,629
Miscellaneous gear & supplies	$1,269	$1,100	$841	$683	$880
Raw fish tax	$1,771	$1,217	$617	$852	$748
Transportation	$1,890	$2,149	$1,872	$1,705	$1,922
Moorage, storage, and haul-out	$1,318	$1,301	$1,254	$1,275	$1,320
Insurance (P&I, hull, lay-up)	$2,266	$2,166	$2,016	$2,076	$2,161
Administrative services	$626	$744	$619	$573	$669
Annual permit fee	$460	$490	$387	$236	$120
Annual vessel license fee	$48	$48	$47	$47	$47
Property Tax	$522	$471	$461	$275	$405
Depreciation	$1,694	$1,609	$1,386	$1,356	$1,238
Avg. Returns to Labor, Management, and Investment	**$20,486**	**$10,706**	**$929**	**$2,492**	**$4,107**
Minus Average Opportunity Costs					
Skipper Opportunity Cost	$5,674	$5,726	$5,043	$5,480	$6,019
Vessel Opportunity Cost	$6,132	$6,867	$3,719	$1,428	$1,907
Average Profits per permit	**$8,680**	**-$1,887**	**-$7,832**	**-$4,415**	**-$3,819**

Source: CFEC (2004).

Table 52 through Table 54 present the composition and trends of Bristol Bay salmon fishing permit ownership and harvest. The trend in Bristol Bay commercial salmon permit ownership between 1995 and 2004 is a slight movement from Alaska resident ownership of permits to nonresident ownership. The trend toward nonresident ownership is consistent for both drift and set gillnet permits.

Table 52. Bristol Bay Region Fishing Permits and Crew Members, 2005

	Permit Holders	*Crew Members*	*Permits fished*
(A) Census Area			
Bristol Bay Borough	187	175	
Dillingham Census Area	650	608	
Lake & Penn. Borough	115	137	
Total for Bristol Bay Residents	**952**	**920**	
(B) Total Permits by Alaskan Residency			
Drift gill net			
Alaska Residents	900		700
Nonresidents	959		747
Set gill net			
Alaska Residents	697		571
Nonresidents	291		258
Total Alaska Residents	1,597		1,271
Total Nonresidents	1,250		1,005

Source: Derived from CFEC website data

Table 53. Distribution of Commercial Fishing Permit Holders by Residency and 2005 Harvest and Earnings

Residence	*Permits*	*Permits fished*	*Total pounds*	*Estimated gross earnings*
(1) Bristol Bay Borough				
Drift gill net	60	52	4,833,791	$ 2,814,821
Set gill net	116	112	4,413,494	$ 2,566,112
Subtotal	176	164	9,247,285	$ 5,380,933
(2) Dillingham C.A.				
Drift gill net	283	233	14,582,744	$ 7,638,519
Set gill net	205	155	4,678,691	$ 2,523,764
Subtotal	488	388	19,261,435	$ 10,162,283
(3) Lake & Penn. Borough				
Drift gill net	68	56	3,740,545	$ 1,912,675
Set gill net	48	34	777,362	$ 387,096
Subtotal	116	90	4,517,907	$ 2,299,771
(4) Total Bristol Bay	780	642	33,026,627	$ 17,842,987
(5) Alaska Total				
Drift gill net	902	700	55,209,565	$ 30,872,061
Set gill net	697	571	20,072,497	$ 11,487,014
Subtotal	1,599	1,271	75,282,062	$ 42,359,075
(6) Non-Bristol Bay resident	819	629	42,255,435	$ 24,516,088
(7) Nonresident				
Drift gill net	960	747	80,234,379	$ 46,371,874
Set gill net	291	258	9,959,762	$ 5,840,805
Subtotal	1,251	1,005	90,194,141	$ 52,212,679
(8) Total				
Drift gill net	1,862	1,447	135,443,944	$ 77,243,935
Set gill net	988	829	30,032,259	$ 17,327,819
Subtotal	2,850	2,276	165,476,203	$ 94,571,754

Source: Derived from CFEC website data

Table 54. Comparison of 1995 and 2004 Permit Ownership

Method/Residency	*1995*		*2004*	
	Number	Percent	Number	Percent
Drift Gillnet				
Resident	910	50.2%	900	48.4%
Nonresident	903	49.8%	959	51.6%
	1813		1859	
Set Gillnet				
Resident	758	75.0%	697	70.5%
Nonresident	253	25.0%	291	29.5%
	1011		988	
Total				
Resident	1668	59.1%	1597	56.1%
Nonresident	1156	40.9%	1250	43.9%
	2824		2847	

Source: Derived from CFEC website data

Table 55 and Table 56 (from the Commercial Fish Entry Commission website www.cfec.state.ak.us), detail recent trends in Bristol Bay salmon fishing permits, harvest, earnings, and average permit price. These tables show that market permit prices have dropped significantly in recent years off of highs seen in the early 1990's for both drift and set gillnet permits.

Table 55. Time Series, Bristol Bay Drift Gillnet Basic Information Table

WWWBITP-A State of Alaska 2006-04-21
Commercial Fisheries Entry Commission
Basic Information Table
S 03T SALMON, DRIFT GILLNET, BRISTOL BAY

Year		Residency	Permanent Permits Renewed	Interim Permits Issued	Total Permits Issued/ Renewed	Total Permits Fished	Total Pounds	Average Pounds	Total Gross Earnings	Average Gross Earnings	Average Permit Price
2005	*	Resident	900	2	902	700	55,209,565	78,871	$30,872,061	$44,103	
		Nonresident	959	1	960	747	80,340,379	107,551	$46,371,874	$62,077	
		Year Totals	1,859	3	1,862	1,447	135,549,944	93,677	$77,243,936	$53,382	$51,200
2004		Resident	908	3	911	678	53,693,514	79,194	$26,402,325	$38,941	
		Nonresident	949	0	949	733	77,526,004	105,765	$39,267,316	$53,571	
		Year Totals	1,857	3	1,860	1,411	131,219,518	92,998	$65,669,641	$46,541	$37,000
2003		Resident	923	6	929	697	34,749,009	49,855	$16,613,775	$23,836	
		Nonresident	938	1	939	727	43,712,491	60,127	$21,385,643	$29,416	
		Year Totals	1,861	7	1,868	1,424	78,461,500	55,099	$37,999,418	$26,685	$29,300
2002		Resident	943	13	956	587	21,222,461	36,154	$9,722,293	$16,563	
		Nonresident	920	3	923	597	32,941,957	55,179	$15,710,124	$26,315	
		Year Totals	1,863	16	1,879	1,184	54,164,418	45,747	$25,432,417	$21,480	$19,700
2001		Resident	935	19	954	791	34,952,452	44,188	$13,672,961	$17,286	
		Nonresident	926	5	931	775	45,682,324	58,945	$18,741,854	$24,183	
		Year Totals	1,861	24	1,885	1,566	80,634,776	51,491	$32,414,815	$20,699	$34,700
2000		Resident	916	30	946	896	47,755,267	53,298	$30,804,817	$34,380	
		Nonresident	942	8	950	927	56,900,121	61,381	$37,607,521	$40,569	
		Year Totals	1,858	38	1,896	1,823	104,655,388	57,408	$68,412,338	$37,527	$80,500
1999		Resident	901	41	942	907	52,023,153	57,357	$42,292,171	$46,629	
		Nonresident	949	12	961	940	61,530,424	65,458	$50,603,777	$53,834	
		Year Totals	1,850	53	1,903	1,847	113,553,577	61,480	$92,895,948	$50,296	$89,700
1998		Resident	918	49	967	933	24,793,504	26,574	$26,824,602	$28,751	
		Nonresident	926	12	938	925	26,174,001	28,296	$30,378,343	$32,841	
		Year Totals	1,844	61	1,905	1,858	50,967,505	27,431	$57,202,946	$30,787	$99,500
1997		Resident	912	56	968	943	29,172,310	30,936	$25,937,929	$27,506	
		Nonresident	920	15	935	932	33,414,608	35,853	$30,753,137	$32,997	
		Year Totals	1,832	71	1,903	1,875	62,586,918	33,380	$56,691,067	$30,235	$153,800
1996		Resident	907	58	965	956	75,865,588	79,357	$58,297,093	$60,980	
		Nonresident	914	14	928	928	90,755,987	97,797	$72,315,102	$77,926	
		Year Totals	1,821	72	1,893	1,884	166,621,575	88,440	$130,612,195	$69,327	$171,800
1995		Resident	910	62	972	966	96,920,668	100,332	$74,515,323	$77,138	
		Nonresident	903	13	916	916	121,081,051	132,185	$95,514,076	$104,273	
		Year Totals	1,813	75	1,888	1,882	218,001,719	115,835	$170,029,398	$90,345	$195,000
1994		Resident	918	64	982	963	80,658,405	83,757	$76,096,992	$79,021	
		Nonresident	892	14	906	902	100,582,552	111,511	$98,472,908	$109,172	
		Year Totals	1,810	78	1,888	1,865	181,240,957	97,180	$174,569,899	$93,603	$165,700
1993		Resident	918	69	987	975	103,711,446	106,371	$68,437,885	$70,193	
		Nonresident	887	16	903	900	114,429,840	127,144	$76,938,013	$85,487	
		Year Totals	1,805	85	1,890	1,875	218,141,286	116,342	$145,375,898	$77,534	$199,600
1992		Resident	935	73	1,008	1,002	78,496,299	78,340	$83,336,175	$83,170	
		Nonresident	862	15	877	877	89,415,053	101,956	$98,880,837	$112,749	
		Year Totals	1,797	88	1,885	1,879	167,911,352	89,362	$182,217,012	$96,976	$193,500
1991		Resident	951	78	1,029	1,019	67,230,487	65,977	$48,048,820	$47,153	
		Nonresident	842	14	856	854	69,547,738	81,438	$51,181,588	$59,932	

Source: CFEC website

Table 56. Time Series, Bristol Bay Set Gillnet Basic Information Table

WWWBITP-A State of Alaska 2006-04-21
Commercial Fisheries Entry Commission
Basic Information Table
S 04T SALMON, SET GILLNET, BRISTOL BAY

Year		Residency	Permanent Permits Renewed	Interim Permits Issued	Total Permits Issued/ Renewed	Total Permits Fished	Total Pounds	Average Pounds	Total Gross Earnings	Average Gross Earnings	Average Permit Price
2005	*	Resident	697	0	697	571	20,072,497	35,153	$11,487,014	$20,117	
		Nonresident	291	0	291	258	9,959,762	38,604	$5,840,805	$22,639	
		Year Totals	988	0	988	829	30,032,259	36,227	$17,327,819	$20,902	$15,100
2004		Resident	701	1	702	541	14,978,530	27,687	$7,233,045	$13,370	
		Nonresident	287	0	287	254	9,017,157	35,501	$4,430,477	$17,443	
		Year Totals	988	1	989	795	23,995,687	30,183	$11,663,522	$14,671	$14,700
2003		Resident	712	1	713	531	15,097,184	28,432	$7,418,731	$13,971	
		Nonresident	287	0	287	230	6,078,944	26,430	$2,997,778	$13,034	
		Year Totals	999	1	1,000	761	21,176,128	27,827	$10,416,508	$13,688	$12,600
2002		Resident	725	2	727	477	9,196,739	19,280	$4,329,654	$9,077	
		Nonresident	279	0	279	203	4,712,904	23,216	$2,266,945	$11,167	
		Year Totals	1,004	2	1,006	680	13,909,643	20,455	$6,596,599	$9,701	$11,900
2001		Resident	728	2	730	596	15,684,265	26,316	$6,373,300	$10,693	
		Nonresident	280	0	280	238	5,117,989	21,504	$2,117,802	$8,898	
		Year Totals	1,008	2	1,010	834	20,802,254	24,943	$8,491,102	$10,181	$25,300
2000		Resident	735	6	741	670	17,656,984	26,354	$11,384,654	$16,992	
		Nonresident	272	0	272	251	6,983,598	27,823	$4,595,486	$18,309	
		Year Totals	1,007	6	1,013	921	24,640,582	26,754	$15,980,140	$17,351	$32,400
1999		Resident	749	5	754	684	18,643,524	27,257	$15,124,273	$22,112	
		Nonresident	259	1	260	241	7,756,043	32,183	$6,396,839	$26,543	
		Year Totals	1,008	6	1,014	925	26,399,567	28,540	$21,521,112	$23,266	$31,300
1998		Resident	748	6	754	660	8,733,618	13,233	$9,734,294	$14,749	
		Nonresident	261	0	261	241	3,728,727	15,472	$4,378,426	$18,168	
		Year Totals	1,009	6	1,015	901	12,462,345	13,832	$14,112,720	$15,663	$30,400
1997		Resident	750	7	757	685	9,159,469	13,371	$8,218,755	$11,998	
		Nonresident	262	0	262	236	4,469,856	18,940	$4,093,604	$17,346	
		Year Totals	1,012	7	1,019	921	13,629,325	14,798	$12,312,359	$13,368	$39,000
1996		Resident	755	6	761	708	20,364,600	28,764	$15,693,869	$22,166	
		Nonresident	256	0	256	233	7,147,327	30,675	$5,679,538	$24,376	
		Year Totals	1,011	6	1,017	941	27,511,927	29,237	$21,373,407	$22,714	$41,100
1995		Resident	758	8	766	728	24,343,741	33,439	$18,773,036	$25,787	
		Nonresident	253	0	253	239	9,126,351	38,186	$7,170,148	$30,001	
		Year Totals	1,011	8	1,019	967	33,470,092	34,612	$25,943,184	$26,829	$42,200
1994		Resident	757	7	764	700	17,901,793	25,574	$16,494,186	$23,563	
		Nonresident	255	0	255	239	6,817,516	28,525	$6,494,975	$27,176	
		Year Totals	1,012	7	1,019	939	24,719,309	26,325	$22,989,161	$24,483	$37,800
1993		Resident	760	9	769	722	22,895,472	31,711	$15,234,434	$21,100	
		Nonresident	254	0	254	243	9,731,634	40,048	$6,513,826	$26,806	
		Year Totals	1,014	9	1,023	965	32,627,106	33,810	$21,748,260	$22,537	$49,100
1992		Resident	767	8	775	727	17,868,082	24,578	$18,567,037	$25,539	
		Nonresident	250	2	252	241	7,363,788	30,555	$7,871,830	$32,663	
		Year Totals	1,017	10	1,027	968	25,231,870	26,066	$26,438,867	$27,313	$49,800
1991		Resident	767	9	776	715	16,532,201	23,122	$11,971,994	$16,744	
		Nonresident	245	4	249	235	5,881,825	25,029	$4,337,474	$18,457	

Source: CFEC website

Table 57 shows a listing of commercial salmon processors and buyers operating in the Bristol Bay region in 2004 (ADFG 2004). Production of salmon (processing, freezing, and canning) is a value added industry in the area. This production value is highly dependent on the harvest levels and associated harvest value (Figure 18). The composition of the salmon processing industry in the Bristol Bay region is also dependent on end-buyer demand for salmon.

Table 57. Commercial Salmon Processors and Buyers Operating in Bristol Bay, 2004

	Name of Operator/Buyer[a]	Base of Operations	District[b]	Method[c]	Export
1	Alaska Family Seafoods	Dillingham, AK	N	EF,F	AIR
2	Alaska General Seafoods	Kenmore, WA	GD,K,E,U	C,EF,F	AIR
3	Aleutian Maid Processors, LLC	Egegik, AK	E	F	SEA,AIR
4	Alpine Cove, LLC	Kodiak, AK	E,N,U	F	SEA
5	Alyce C. Todd	Montello, WI	N,U	F	SEA,AIR
6	Anthony Wood	King Salmon, AK	K	F	SEA
7	Banacon Inc.	Dillingham, AK	N	EF	AIR
8	Barbara J.Hill	Naknek, AK	K	EF	N/A
9	Baywatch Seafoods, LLC	Woodinville, WA	K,E,U,N,T	EF,F	SEA,AIR
10	Coffee Point Seafoods of WA, LLC	S. Seattle, WA	E	F	SEA
11	CSP Seafoods	Wasilla, AK	T	[d]	[d]
12	Dancing Salmon Company, LLC	Dillingham, AK	N	F,S	AIR
13	Diamond Lodge	King Salmon, AK	K	EF,F,S	AIR
14	Fisherman's Express, LLC	Anchorage, AK	N	F	AIR
15	Friedman Family Fisheries, Inc.	Baltimore, MD	N	F	SEA,AIR
16	Great Ruby Fish Company	Anchorage, AK	K	EF,F	AIR
17	Icicle Seafoods, Inc.	Seattle, WA	GD,K,E,U,N	C,F	SEA
18	Interior Alaska Fish Processors, Inc.	Fairbanks, AK	N	EF	AIR
19	Kim J. Hubert	Eagle River, AK	T	EF	N/A
20	Lady Marion Seafoods	Anchorage, AK	GD,E	EF,F	AIR
21	Libby Bro. Wild Alaskan Harvest	Anchorage, AK	N	EF,F	AIR
22	Leader Creek Fisheries, LLC	Seattle, WA	GD,K,E,U,N	EF,F	SEA,AIR
23	NorQuest Seafoods, Inc.	Seattle, WA	GD,K,E,U,N	F	SEA
24	Ocean Beauty Seafoods, Inc.	Seattle, WA	GD,K,E,U,N	C,EF,F	SEA,AIR
25	Pacman Fisheries/Bristol Gold, LLC	Naknek, AK	K	S,F	AIR
26	Pederson Point	Seattle, WA	K,E,U	F	SEA
27	Peter Pan Seafoods, Inc.	Seattle, WA	GD,K,E,U,N	C,EF,F	SEA,AIR
28	Snopac Products, Inc.	Seattle, WA	GD,K,E,U	F	SEA
29	Togiak Fisheries	Seattle, WA	T	F	SEA
30	Trident Seafoods	Seattle, WA	GD,K,E,U,N	C,F	SEA,AIR
31	Ugashik Wild Salmon	Ugashik, AK	U	C,EF	AIR
32	Westwind Seafoods, LLC	Seattle,WA	N,T	F	SEA
33	Wild Alaskan Seafood Co., LLC	Spokane, WA	N	F	SEA
34	Woodbine Alaska Fish Company	Rio Vista, CA	E,U,T	C,F	AIR
35	Yard Arm Knot Fisheries, LLC	Seattle, WA	GD,K,E,U	C,F	SEA

Canning=8; Freezing= 29; Fresh=15; Curing=3; Air Export=21; Sea Export=19

[a] Indicates operators with a processing facility in a district or operators from other areas buying fish and/or providing support service for fishers in districts away from the facility.

[b] GD=General District; K=Naknek-Kvichak; E=Egegik; U=Ugashik; N=Nushagak; T=Togiak.

[c] Type of processing: C=canned; EF=export fresh; F=frozen; S=cured.

[d] Registered but did not operate.

Source: ADF&G (2005)

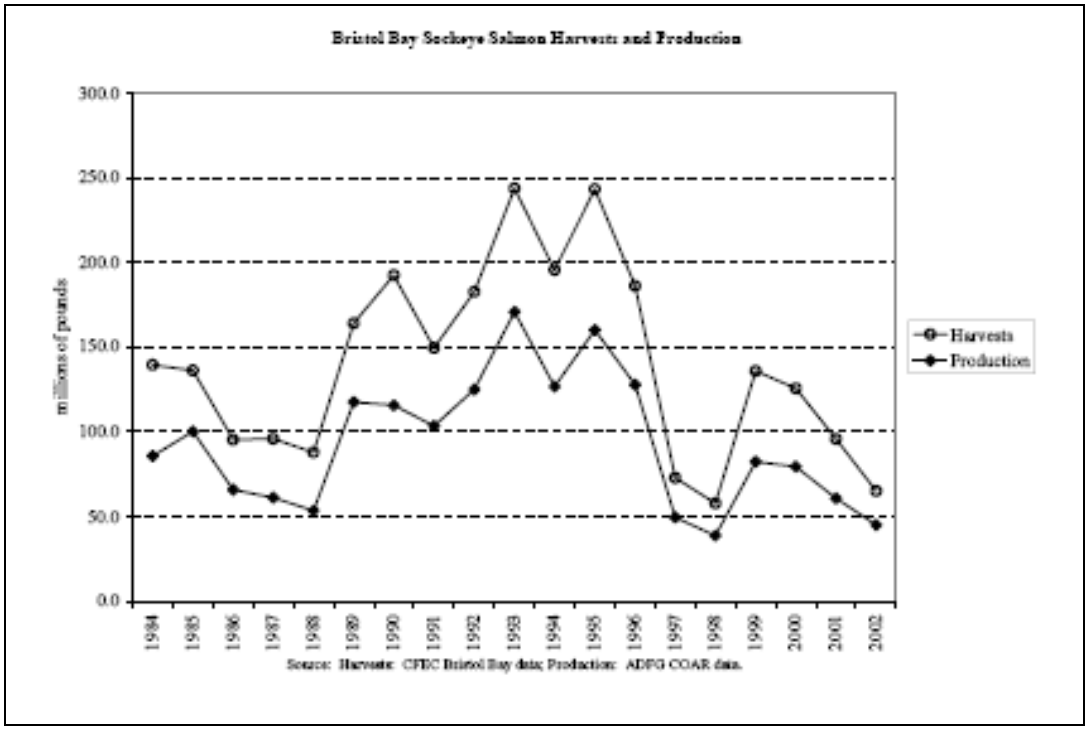
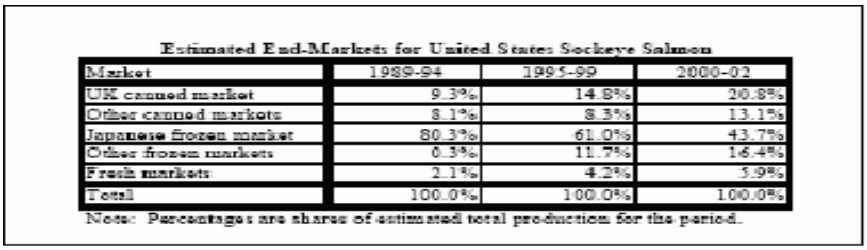


Figure 18. Time Series, Bristol Bay Sockeye Salmon Harvest and Production. (Source: Knapp 2004)

Table 58 shows that over the past 15 years the demand for U.S. sockeye salmon has changed dramatically. During the 1989-1994 period 80% of demand was for frozen sockeye for the Japanese market. By 2002 this market segment had dropped to 44% of demand for U.S. sockeye production. Between 1994 and 2002 other markets including markets for canned salmon, and other markets for frozen fish had replaced the Japanese frozen sockeye market.

Table 58. Changes in Estimated End-markets for United States Sockeye Salmon (Source: Knapp 2004)



Estimated End-Markets for United States Sockeye Salmon

Market	1989-94	1995-99	2000-02
UK canned market	9.3%	14.8%	20.8%
Other canned markets	8.1%	8.3%	13.1%
Japanese frozen market	80.3%	61.0%	43.7%
Other frozen markets	0.3%	11.7%	16.4%
Fresh markets	2.1%	4.2%	5.9%
Total	100.0%	100.0%	100.0%

Note: Percentages are shares of estimated total production for the period.

Table 59 through Table 61 detail the final accounting of current and recent total Bristol Bay salmon processing output. Table 60 shows that in 2005 the total earnings from Bristol Bay salmon processing was $225 million. The total earnings from salmon harvest in 2005 were approximately $95 million. Table 61 shows the net weight, price, and wholesale value by end product for 2002-2005. Figure 19 shows the historical distribution for 1984-2002 by end product (frozen vs. canned). Clearly, both harvest and processing play important roles in the Bristol Bay economy, with one industry closely tied to and dependent on the other for economic success.

Table 59. 2005 Bristol Bay Salmon Fishery Processing and Gross Earnings

	Count	*Price per unit*	*Gross Earnings (2005$)*
Sockey			
Tall Cans (cases)	237,369	$ 90.06	$ 21,377,452
Halves (cases)	906,843	$ 59.25	$ 53,730,448
Fresh Headed & Gutted (lbs)	2,342,212	$ 2.65	$ 6,206,862
Frozen Headed & Gutted (lbs)	57,132,488	$ 2.05	$ 117,121,600
Frozen and fresh Fillet (lbs)	2,239,781	$ 3.90	$ 8,735,146
Roe (lbs)	3,609,918	$ 3.55	$ 12,815,209
Subtotal	66,468,611		219,986,717
Chinook			
Fresh Headed & Gutted (lbs)	315,414	$ 4.36	$ 1,375,205
Frozen Headed & Gutted (lbs)	493,726	$ 2.57	$ 1,268,876
Roe (lbs)	35,243	$ 3.86	$ 136,038
Subtotal	844,383		2,780,119
Chum			
Frozen Headed & Gutted (lbs)	4087138	$ 0.72	$ 2,942,739
Total			$ 225,709,575

Source: Personal Communication, Alaska Department of Revenue, 2006.

Table 60. Comparison of Bristol Bay Harvest and Processing Total Earnings (2005)

sector	*Pounds*	*Earnings*
Harvest	165,582,203	$ 94,571,755
Processing	114,665,676	$ 225,709,575

Table 61. 2003-2005 Total Bristol Bay Fishery Salmon Production Value, by End-product Type

Year	*Type*	*Net Weight*	*Wholesale Value*	*$/pound*
2002	Canned	22,097,595	55,275,886	$2.50
2002	Fresh	212,571	327,357	$1.54
2002	Frozen	22,686,595	39,698,079	$1.75
2002	Other	Confidential	Confidential	Confidential
2003	Canned	21,936,035	51,488,596	$2.35
2003	Fresh	1,129,280	1,531,488	$1.36
2003	Frozen	34,296,062	55,823,648	$1.63
2003	Other	1,575,092	7,086,321	$4.50
2004	Canned	31,080,841	68,610,956	$2.21
2004	Fresh	6,404,391	8,054,856	$1.26
2004	Frozen	54,471,049	95,680,315	$1.76
2004	Other	1,451,444	4,815,510	$3.32
2005	Canned	30,567,479	75,107,900	$2.46
2005	Fresh	2,342,212	6,206,862	$2.65
2005	Frozen[1]	59,372,269	125,856,746	$2.12
2005	Other	3,609,918	12,815,209	$3.55

[1] indicates "frozen and fresh fillets". Fresh excludes "fresh filets" for 2005 data from Alaska Department of Revenue.

Source: Knapp (2004) and Alaska Department Of Revenue.

Figure 20 shows historical real prices per round pound for 1984 to 2004 for three different related markets for sockeye salmon: Bristol Bay ex vessel, Bristol Bay frozen production price, and Japan August wholesale price. The price differences are indicative of markups, and show how the relative shares of total value received by harvesters and processors has changed over time, and in response to rising or falling market price conditions.

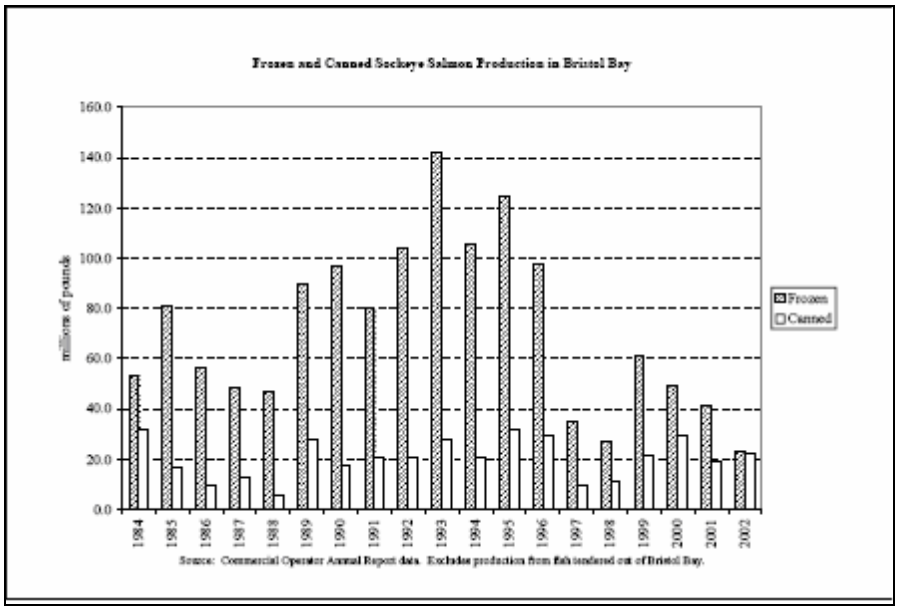


Figure 19. Time Series, Frozen and Canned Production of Bristol Bay Sockeye Salmon (Source: Knapp 2004)

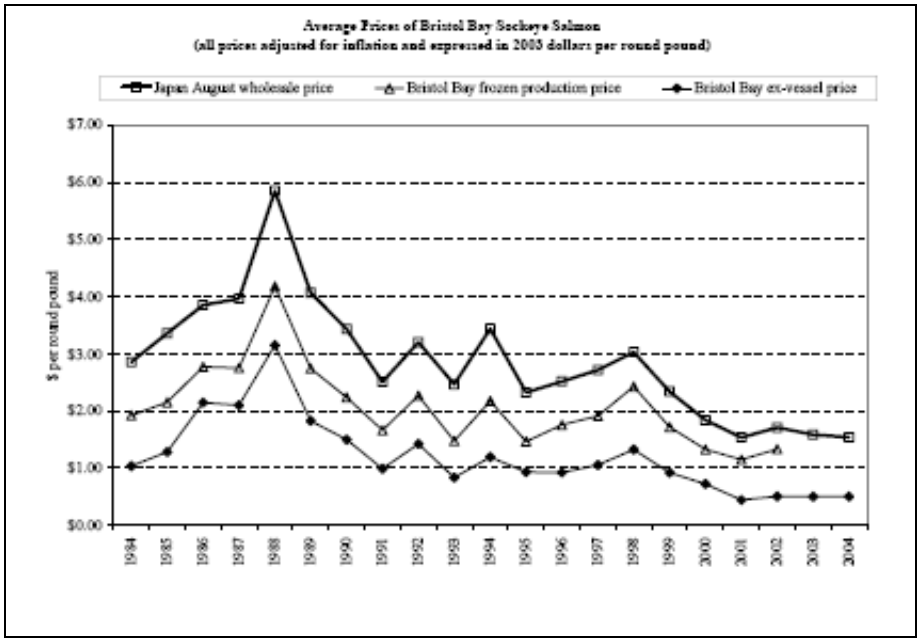


Figure 20. Time Series, Average Prices of Bristol Bay Sockeye Salmon. (Source: Knapp 2004)

7.0 Subsistence Harvest

The subsistence harvest within the Bristol Bay region generates regional economic impacts when Alaskan households spend money on subsistence-related supplies. Goldsmith (1998) estimated that Alaskan Native households that use Bristol Bay wildlife refuges for subsistence harvesting spend an average of $2,300 per year on subsistence-related equipment to aid in their harvesting activities. Additionally, Goldsmith estimated that Non-Native households spend $600 annually for this purpose. Correcting for inflation from 1998 to 2005 implies annual spending for subsistence harvest of about $2,780 for Native households and $725 for Non-Native households.

Figure 21 shows the general distribution of subsistence harvest by Bristol Bay residents. Overall, salmon make up the largest share of all harvest (on a basis of usable pounds), and accounts for over one-half of all harvest. Another nearly one third of harvest come from land mammals (31%), and non-salmon fish comprise another 10% of harvest.

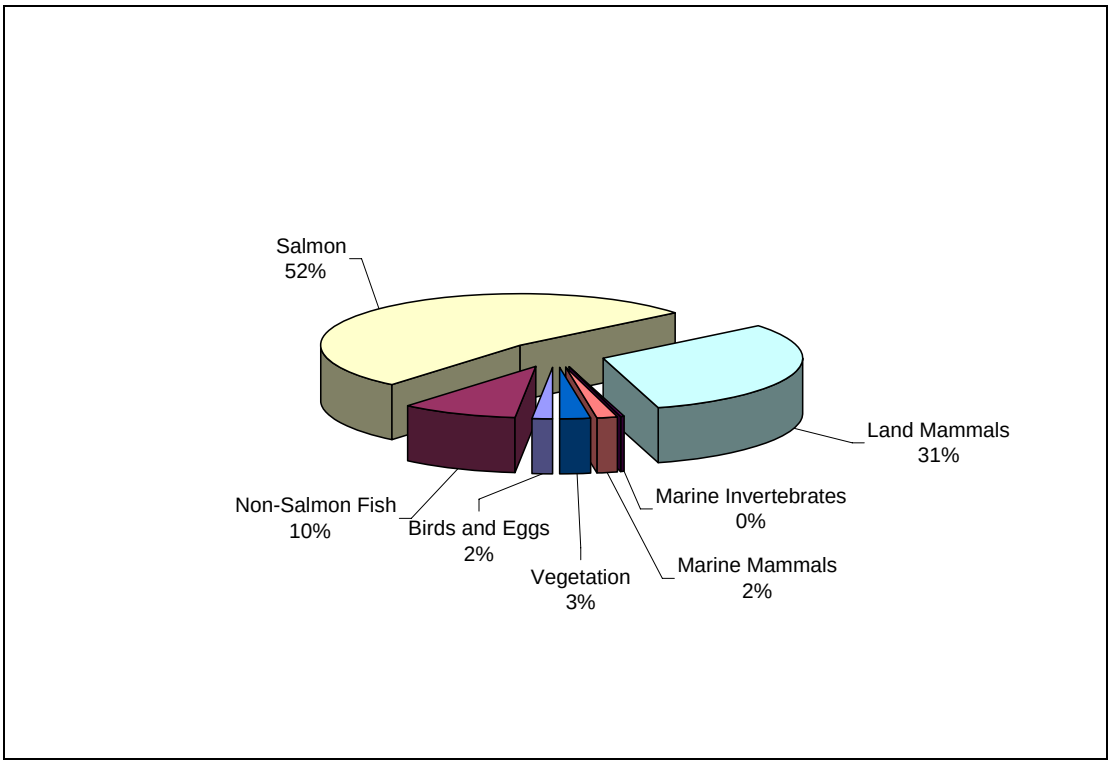


Figure 21. Distribution of Bristol Bay Subsistence Harvest

Table 62 shows average per capita and total estimated community subsistence harvest for the Bristol Bay communities. In total, individuals in these Bristol Bay communities harvest about 2.4 million pounds of subsistence harvest per year for an average of 315 pounds per person annually. Table 63 and Table 64 detail Bristol Bay area subsistence harvest by salmon species and location.

Table 62. ADF&G Division of Subsistence Average Per Capita Subsistence Harvest for Bristol Bay Communities

Bristol Bay Area Community /year of harvest data	Population (2000 census)	Per Capita Harvest	Total Annual Harvest	% Native Population
Aleknagik 1989	221	379	54,079	81.9%
Clark's Point 1989	75	363	20,325	90.7%
Dillingham 1984	2,466	242	494,486	52.6%
Egegik 1984	116	384	37,450	57.8%
Ekwok 1987	130	797	85,260	91.5%
Igiugig 1992	53	725	33,915	71.7%
Iliamna 2004	102	508	51,816	50.0%
King Salmon 1983	442	220	81,261	29.0%
Kokhanok 1992	174	1,013	175,639	86.8%
Koliganek 1987	182	830	154,705	87.4%
Levelock 1992	122	884	97,677	89.3%
Manokotak 1985	399	384	118,337	94.7%
Naknek 1983	678	188	72,110	45.3%
New Stuyahok 1987	471	700	247,494	92.8%
Newhalen 2004	160	692	110,720	85.0%
Nondalton 2004	221	358	79,118	89.1%
Pedro Bay 2004	50	306	15,300	40.0%
Pilot Point 1987	100	384	24,783	86.0%
Port Alsworth 2004	104	133	13,832	4.8%
Port Heiden 1987	119	408	41,985	65.6%
South Naknek 1992	137	297	39,893	83.9%
Ugashik 1987	11	814	8,144	72.7%
Togiak City	809	--	--	86.3%
Portage Creek	36	--	--	86.1%
Twin Hills	69	--	--	84.1%
Total communities	7,447	--	--	--
Unincorporated areas	164	--	--	--
Total (interpolated to include unincorporated areas)	7,611	315	2,397,970	69.6%

Table 63. Historical Subsistence Harvest for Bristol Bay, Alaska. (Knapp et al. 2004)

	PERMITS		ESTIMATED SALMON HARVEST					
YEAR	ISSUED	RETURNED	CHINOOK	SOCKEYE	COHO	CHUM	PINK	TOTAL
1983	829	674	13,268	143,639	7,477	11,646	1,073	177,104
1984	882	698	11,537	168,803	16,035	13,009	8,228	217,612
1985	1,015	808	9,737	142,755	8,122	5,776	825	167,215
1986	930	723	14,893	129,487	11,005	11,268	7,458	174,112
1987	996	866	14,424	135,782	8,854	8,161	673	167,894
1988	938	835	11,848	125,556	7,333	9,575	7,341	161,652
1989	955	831	9,678	125,243	12,069	7,283	801	155,074
1990	1,042	870	13,462	128,343	8,389	9,224	4,455	163,874
1991	1,194	1,045	15,245	137,837	14,024	6,574	572	174,251
1992	1,203	1,028	16,425	133,605	10,722	10,661	5,325	176,739
1993	1,206	1,005	20,527	134,050	8,915	6,539	1,051	171,082
1994	1,193	1,019	18,873	120,782	9,279	6,144	2,708	157,787
1995	1,119	990	15,921	107,717	7,423	4,566	691	136,319
1996	1,110	928	18,072	107,737	7,519	5,813	2,434	141,575
1997	1,166	1,051	19,074	118,250	6,196	2,962	674	147,156
1998	1,234	1,155	15,621	113,289	8,126	3,869	2,424	143,330
1999	1,219	1,157	13,009	122,281	6,143	3,653	420	145,506
2000	1,219	1,109	11,547	92,050	7,991	4,637	2,599	118,824
2001	1,226	1,137	14,412	92,041	8,406	4,158	839	119,856
2002	1,093	994	12,936	81,088	6,565	6,658	2,341	109,587
2003	1,182	1,058	21,231	95,690	7,816	5,868	1,062	131,667
1999-2003 Average	1,188	1,091	14,627	96,630	7,384	4,995	1,452	125,088
1994-2003 Average	1,176	1,060	16,070	105,093	7,546	4,833	1,619	135,161
All Years Average	1,093	951	14,845	121,715	8,972	7,050	2,571	155,153

SOURCE: Alaska Department of Fish and Game, Division of Subsistence, Alaska Subsistence Fisheries Database, Version 3.4.

Table 64. Bristol Bay Subsistence Salmon Harvests by Location, 2003. (Knapp et al. 2004)

Area and River System	Permits Issued [1]	Estimated Number of Salmon Harvested [2]					
		Sockeye	Chinook	Chum	Pink	Coho	Total
NAKNEK-KVICHAK DISTRICT	489	61,443	1,221	259	198	812	63,934
Naknek River [3]	316	22,948	1,080	233	195	672	25,129
Kvichak River/Iliamna Lake:	175	38,495	142	26	3	140	38,805
Alagnak (Branch) River	1	48	0	0	0	0	48
Igiugig	8	1,053	1	0	0	1	1,055
Iliamna Lake	38	7,049	0	0	0	0	7,049
Kijik	1	80	0	0	0	0	80
Kokhanok	29	9,990	89	16	3	73	10,170
Kvichak River	7	755	0	0	0	0	755
Lake Clark: General	33	2,949	0	0	0	0	2,949
Levelock	7	629	52	10	0	66	757
Newhalen River	27	7,934	0	0	0	0	7,934
Nondalton Village	6	1,938	0	0	0	0	1,938
Pedro Bay	10	2,144	0	0	0	0	2,144
Port Alsworth	4	464	0	0	0	0	464
Six Mile Lake	15	3,463	0	0	0	0	3,463
Naknek or Kvichak Unspecified	0	0	0	0	0	0	0
EGEGIK DISTRICT [4]	62	3,240	84	32	10	297	3,663
UGASHIK DISTRICT [5]	23	1,113	31	30	0	392	1,567
NUSHAGAK DISTRICT	527	25,491	18,686	5,064	403	5,432	55,076
Wood River [6]	138	3,979	3,311	268	5	463	8,026
Lower Nushagak River [7]	36	975	2,120	343	5	120	3,564
Upper Nushagak River [8]	80	6,363	4,448	3,210	232	1,310	15,563
Dillingham Beaches [9]	244	8,451	7,778	987	84	2,956	20,255
Nushagak Bay Commercial [10]	56	1,665	672	210	68	539	3,155
Igushik/Snake River	30	3,882	357	45	9	44	4,337
Nushagak, Site Unspecified	2	176	0	0	0	0	176
TOGIAK DISTRICT [11]	92	4,403	1,208	483	451	883	7,428
TOTAL BRISTOL BAY	1,182	95,690	21,231	5,868	1,062	7,816	131,667

[1] Sum of sites may exceed district totals, and sum of districts may exceed area total, because permittees may use more than one site.
[2] Harvests are extrapolated for all permits issued, based on those returned and on the area fished as recorded on the permit. Due to rounding, the sum of columns and rows may not equal the estimated total. Of 1,182 permits issued for the management area, 1,058 were returned (89.5%).
[3] Includes Mile 5 North, Naknek River General, Powerline-North, North and South Savonoski, South Naknek Beach, and Telephone Point-North.
[4] Includes Egegik river and beach.
[5] Includes Pilot Point and Ugashik.
[6] Includes Dragnet, Aleknagik, Muklung River, Red Bluff, and Upper and Lower Wood River General.
[7] Includes Black Point, Grassy Island, and Lewis Point.
[8] Includes Ekwok, Kokwok River, New Stuyahok, Koliganek, Mulchatna River, and Portage Creek.
[9] Includes Bradford Point, City Dock, Kanakanak, Scandinavia, Skinner, Snag Point, and Squaw Creek.
[10] Includes Clark's Point, Ekuk, Etolin Point, Nushagak Point, Protection Point, and Queen's Slough.
[11] Includes Togiak village and Togiak River.

In 2000 the US Census reported an estimated 2,290 Native and 1,129 non-native households in the Bristol Bay Region (Bristol Bay Borough, Lake and Peninsula Borough, and Dillingham). Based on the Goldsmith (1998) estimate of direct expenditures related to subsistence harvest, this implies an annual direct subsistence-related expenditure of approximately $7.2 million in the Bristol Bay region (Table 65).

Table 65. Estimated Total Annual Bristol Bay Area Subsistence-Related Expenditures

Area	*Population 2004*	*Percent Alaska native*	*Number of households*	*Number of Native Households*	*Number of non-native Households*
Bristol Bay Borough	1,103	43.7%	490	214	276
Dillingham Census Area	4,924	70.1%	2,341	1,641	700
Lake & Penninsula Borough	1,584	73.5%	588	432	156
Total Bristol Bay Region	7,611	67.0%	3,419	2,290	1,129
Annual Spending/ household				$2,780	$725
Total Estimated Subsistence Spending				$6,366,487	$ 818,450
Total				$ 7,184,937	

8.0 Sport Hunting

In addition to sport fishing, sport hunting also plays a significant (but smaller) role in the local economy of the Bristol Bay region. While not a large share of the economy, sport hunting in the Bristol Bay area offers high quality hunting opportunities for highly valued species. Bristol Bay sport hunting provides hunting opportunities for caribou, moose, and brown bear, among other species. Table 66 shows reported hunter numbers for the most recently reported representative years for several species hunted in the region.

Table 66. ADF&G Reported Big Game Hunting in Bristol Bay and Alaska Peninsula Game Management Units

Most recent Big Game Hunting Estimates from ADF&G Wildlife Management Reports (Number of hunters)

	Alaska Peninsula (GMU 9)		Bristol Bay (GMU 17)		
	Non-local Residents	NR	Non-local Residents	NR	
Moose	146	184	140	294	All hunters 2002
Caribou	23	0	1115	1439	All hunters 2003-04
Brown bear	90	319	24	74	most recent available 5-year average
	259	**503**	**1279**	**1807**	

The caribou estimate for GMU 17 is for the Mulchatna herd and extends beyond the GMU 17 borders

Shaded cells include both non-local residents and local residents

Sources: Alaska Wildlife Harvest Summary (2003-04); ASDF&G Species-specific Wildlife Management Reports

Table 67 outlines the estimation of total annual expenditures for big game hunting within the Bristol Bay region. These estimates are based on an assumption of one trip per hunter per year for a species, and utilizes estimates of hunter expenditures per trip developed by Miller and McCollum (1994) adjusted to 2005 price levels.

Table 67. Estimated annual big game hunting expenditures for Bristol Bay region

Statistic	***Nonresidents***	***Non-local residents***
Estimated trips	2,310	1,538
Expenditure per trip	$4,706	$972
Total estimated direct expenditure	$10,870,860	$1,494,936
Total	**$12,365,796**	

In total, it is estimated that Bristol Bay area big game hunters living outside of the area spend about $12.4 million per year in direct hunting-related expenditures. The expenditure estimate

above may include some caribou hunting of the Mulchatna herd outside of the closely defined Bristol Bay region game management units.

9.0 Wildlife Viewing / Tourism

Many of the sport fishing and sport hunting visitors to the Bristol Bay region also engage in other activities while there such as kayaking, canoeing, wildlife viewing or bird watching. However an estimated 10,000 visitors to the region come expressly to view wildlife or engage in other non-consumptive outdoor recreation activities.

The Bristol Bay region has a number of nationally recognized special management areas for wildlife. These include Katmai and Lake Clark National Parks, the Togiak and Becherof National Wildlife Refuges, and Wood-Tikchick State Park. The most accessible and popular destination for visitors interested in non-consumptive recreation activities is Katmai National Park, and in particular Brooks Camp on Naknek Lake which is world famous as a site for bear viewing. The camp accommodates both day and overnite visitors who are there to view the bears, as well as sport fishermen.

Information on the number of non-consumptive use visitors, their itineraries and activities while in the region, and their expenditures is extremely limited. Unlike sport fishing and sport hunting, no license is required for these other activities so there is no consistent and comprehensive record documenting these trips.

In particular, the visitation numbers collected by the park service in Katmai cannot be used as a guide to the number of non-consumptive recreational visitors to the region because they include sport fishermen as well as large numbers of visitors to the eastern portion of the park where the waters flow into Shelikof Strait and Cook Inlet.

Our estimate of non-consumptive recreational visitation is based on adjusted visitation data collected for Brooks Camp (available through 1999). Our estimate assumes that Brooks Camp receives most of the non-consumptive visits to the region and that about 1/3 of total visitors to Brooks Camp engage in sport fishing while in the region. Based on these assumptions, there are approximately 1,000 non-local Alaska residents and 9,000 nonresidents who visit the Bristol Bay region for wildlife viewing/tourism (and not to fish). Total expenditure for this group is estimated to be $17,138,290, using expenditure data from McCollum and Miller (1994). This is an approximate estimate based on limited and outdated information, and is an area for further research.

10.0 Economic Significance

Economic significance is a measure of the number of jobs and the amount of income within a region that can be attributed to particular activities. It is the answer to the question of how may jobs, or what share of all the jobs, in a region exist due to that activity. In this section we report on the economic significance of the commercial salmon industry, recreational, and subsistence activities that occur in the Bristol Bay region. We show results for the local region and for the rest of Alaska. Economic effects occurring outside the state are not included. We also describe the overall structure of the economy of the Bristol Bay region.

10.1 Summary

We estimate that 5,490 annual average jobs in Alaska in 2005 were attributable to the wild salmon ecosystem in the Bristol Bay region. Slightly over 1/3 of these jobs were filled by non-residents. About equal shares of the jobs taken by Alaska residents went to residents of the Bristol Bay region and the rest of the state. At the peak of the summer season, there were 13,248 jobs in Alaska associated with the commercial salmon harvest (including processing) and providing services to recreational visitors and subsistence harvesters.

$161 million in payroll was associated with these jobs. $103 million of this payroll went to Alaska residents, with more than half going to Alaskans living in other locations outside the Bristol Bay region. $58 million in payroll was collected by non-residents working seasonally in the commercial fishery or the recreation industry.

Table 68. Economic Significance of Bristol Bay Ecosystems

	TOTAL	*RESIDENTS*			*NON-RESIDENTS*
		TOTAL	*LOCAL*	*NON-LOCAL*	
DIRECT JOBS					
PEAK	13,248	4,513	2,161	2,352	8,735
ANNUAL AVG	3,230	1,120	528	592	2,110
MULTIPLIER JOBS	2,260	2,260	1,057	1,204	
TOTAL JOBS (ANN AVG)	5,490	3,380	1,585	1,795	2,110
DIRECT WAGES ($000)	$88,028	$30,349	$14,061	$16,288	$57,680
MULTIPLIER		$73,005	$32,750	$40,256	
TOTAL	$161,033	$103,354	$46,811	$56,544	$57,680

SOURCE: ISER.

NOTE: All direct jobs are in Bristol Bay region.
Multiplier jobs divided between Bristol Bay and Southcentral Alaska.
Multiplier jobs are all taken by residents of region where they occur.
Peak and annual average direct wages are equal.
This summary excludes subsistence and ecosystem management.

10.2 Regional Economic Overview

The economy of the Bristol Bay region depends on three main types of activities—publicly funded services (government plus non-profits), activities associated with the commercial exploitation of the natural resources of the region (commercial fishing and recreation), and subsistence. Public services and exploitation of natural resources are BASIC activities that bring money into the economy and provide the impetus for a modest level of support (NON-BASIC) activities—local businesses that sell goods and services to the commercial fishing sector, recreational service providers, government (including non-profits), and subsistence participants. Subsistence is a non-market activity but it does have an economic dimension. Residents commit significant economic resources to participate in subsistence and the products of subsistence activity have considerable economic value. Recently mining exploration has been an additional small source of basic employment.

Annual average employment in the region (the sum of the Bristol Bay Borough, Lake and Peninsula Borough, and Dillingham labor market areas) provides one way to measure the relative importance of government and resource exploitation to the regional economy. Of total basic jobs in 2004, 2,098 were directly dependent on government spending (federal, state, and local). Resource exploitation (commercial fishing and recreation) accounted for 4,013, or 64 percent of the total.

NON-BASIC jobs depend on the money that comes into the economy from BASIC activity. We have not assigned any particular percent of these NON-BASIC jobs to dependence on government or resource exploitation, and to do so would be difficult. The difficulty stems primarily from the fact that the number of government jobs is stable throughout the year, while resource exploitation jobs have an extremely seasonal pattern. The more stable government jobs, and payroll, are likely to support more NON-BASIC jobs in the region than their share of BASIC jobs.

One indicator of the importance of government money in the regional economy is the amount of federal spending in the region. In 2004 $141 million in federal spending flowed into the three labor market areas of this region.

Table 69. Employment in the Bristol Bay Region, 2004

	ANNUAL AVERAGE	*SUMMER*	*WINTER*	*SWING (SUMMER MINUS WINTER)*
TOTAL JOBS BY PLACE OF WORK	7,691	16,631	3,640	12,991
BASIC	6,251	15,028	2,304	12,724
Fish Harvesting	2,552	7,657	0	7,657
Fish Processing	1,150	4,193	200	3,993
Recreation	311	933	0	933
Government + Health	2,098	1,795	2,104	-309
Mining	150	450	0	450
NON-BASIC	1,440	1,603	1,336	267
Construction	64	80	56	24
Trade/Transport/Leisure	642	765	580	185
Finance	127	118	116	2
Other Wage and Salary	180	213	157	56
Non-Basic Self Employed	427	427	427	0
JOBS BY PLACE OF RESIDENCE				
Local Resident	4,233	5,741	3,640	2,101
All Non Local	3,458	10,890	0	10,890

Source: ISER.

Table 70. Federal Spending in the Bristol Bay Region 2004 ($000)

	Bristol Bay	*Dillingham*	*Lake & Pen*	*Total*
TOTAL	$38,812	$78,596	$23,351	$140,759
Retirement	$4,734	$10,667	$2,890	$18,291
Other direct to individuals	$1,142	$1,599	$2,573	$5,314
Direct to others	$146	$8,760	$1,732	$10,638
Grants	$24,704	$52,976	$3,843	$81,523
Medical Asst	$19,813	$25,867	$0	$45,680
Impact Aid	$2,669	$4,259	$0	$6,928
Other	$2,222	$22,850	$3,843	$28,915
Procurement	$4,676	$1,645	$10,703	$17,024
Wages	$3,410	$2,948	$1,610	$7,968

Source: US Department of Commerce, Consolidated Federal Funds Report.

The extreme seasonality of the market based economy is reflected in contrasting snapshots of employment in the region taken in the summer (July) and in the winter (January) of 2004, as well as the change or "swing" between the seasons. In the summer total employment peaked at 16,631, while in the winter it was 3,640. (These figures are derived from Alaska Department of Labor wage and salary employment data and US Department of Commerce self employment numbers. They have been augmented with independent information on the number of commercial fish harvesters, recreation industry workers, and mining exploration employees that are not reflected in the official statistics.) The "swing" between the seasons was 12,991. This is the increase in jobs in the summer over the winter.

The employment data shows that all the "swing" occurs in the jobs in the commercial fishery, the recreation sector, and mining. The number of government jobs actually falls, primarily due to schools closed for the summer. In both the winter and summer the number of NON BASIC jobs is modest, concentrated mostly in transportation, retail trade, and leisure services. In January there were 1,336 such jobs, increasing 267 to peak at 1,603 in July.

We assume that the winter jobs are taken by the 7,485 residents who live in the Bristol Bay region throughout the year (ADOL, 2005). But during the summer most of the "swing" jobs are taken by non-local residents—either Alaskans from other regions or workers from outside the state who come to Alaska for the summer to work in commercial fishing, recreation, or mining jobs.

One measure of the residency of workers in the region is reported each year by the Alaska Department of Revenue. For 2002 they found in a count of private sector wage and salary workers in the region that 33 percent were local residents, 16 percent were from elsewhere in Alaska, and 51 percent were from outside the state. Statewide seafood processing and visitor related businesses had some of the highest rates of non-resident employment of all sectors.

Table 71. Residence of Workers in the Bristol Bay Region, 2002

	LOCAL	*OTHER AK*	*OUTSIDE*	*TOTAL*
BRISTOL BAY				
State Govt	24	13	11	48
Local Govt	119	19	11	149
Private	322	306	1,308	1,936
Sum	465	338	1,330	2,133
DILLINGHAM				
State Govt	81	27	4	112
Local Govt	920	90	72	1,082
Private	1,036	295	385	1,716
Sum	2,037	412	461	2,910
LAKE AND PEN				
State Govt	6	6	2	14
Local Govt	514	130	60	704
Private	122	145	622	889
Sum	642	281	684	1,607
TOTAL PRIVATE	**1,480**	746	2,315	4,541
SHARE	33%	16%	51%	100%

Source: Alaska Department of Labor, Alaska Economic Trends, February 2004.

Note: This is a count of workers and not of FTE jobs or annual average jobs

Personal income in the region, measured for residents, was $229 million in 2004, or $30,105 per capita. Net earnings from labor was $159 million, or 69 percent of total personal income.

Table 72. Personal Income in the Bristol Bay Region, 2004 (000$)

		Bristol Bay	*Dillingham*	*Lake & Pen*	*Total*
	Wages	$46,766	$79,794	$17,628	$144,188
+	Supplements to wages	$14,995	$22,093	$5,764	$42,852
+	Proprietor income	$9,409	$16,595	$2,465	$28,469
=	Earnings by place of work	$71,170	$118,482	$25,857	$215,509
+	Contributions for government social insurance	-$7,286	-$10,880	-$2,628	-$20,794
+	Residence adjustment	-$30,875	-$3,794	-$736	-$35,405
=	Net earnings by place of residence	$33,009	$103,808	$22,493	$159,310
+	Dividends	$5,995	$14,650	$4,939	$25,584
+	Transfers	$8,782	$26,484	$9,059	$44,325
=	Personal Income	$47,786	$144,942	$36,491	$229,219
Population		1,093	4,938	1,583	7,614
Per Capita Income		$43.720	$29.352	$23.052	$30.105

Source: US Department of Commerce.

10.3 Commercial Fisheries

The commercial salmon fishery generates the largest share of the jobs and income associated with commercial resource exploitation in the Bristol Bay region, although the amount varies considerably from year to year with the size and value of the harvest. In 2005 the harvest was 166 million pounds with an ex vessel value of $95 million. After processing the wholesale value of the 115 million pounds of product was $226 million.

An estimated 1,485 local residents were joined by 6,167 seasonal workers from outside the region to participate in the harvest. About 4,000 non-local processing workers also came for the season. At the peak of the season 12,484 workers were directly employed in harvesting and processing the catch. Of these 4,177 were Alaska residents and 8,308 were from outside the state.

Spending in the region and the rest of the state by these workers—both residents and non-residents—as well as instate purchases by the harvesters and processors for fuel, supplies, equipment, and services, generated additional jobs in other sectors of the economy through the multiplier process. (We did not estimate employment associated with management of the fishery.) We estimate that 1,263 annual average jobs were created through this process, 651

locally and 612 in the rest of the state, in trade, services, finance and other support industries. (Jobs created outside the state are not included in these estimates.)

The 12,484 jobs during the summer peak is equivalent to 2,975 average annual jobs directly attributable to the commercial fishery. Adding the 1,263 jobs generated within Alaska by the multiplier results in total annual average jobs in Alaska attributable to the commercial fishery of 4,239.

Table 73. Economic Significance of Commercial Fishing—Harvest and Processing

	TOTAL	*RESIDENTS*			*NON-RESIDENTS*
		TOTAL	LOCAL	NON-LOCAL	
DIRECT JOBS					
PEAK	12,484	4,177	2,088	2,088	8,308
ANNUAL AVG	2,975	1,008	504	504	1,968
MULTIPLIER JOBS	1,263	1,263	651	612	
TOTAL JOBS (ANN AVG)	4,239	2,271	1,155	1,116	1,968
DIRECT WAGES ($000)	$79,119	$26,427	$13,213	$13,213	$52,693
MULTIPLIER	$41,371	$41,371	$21,341	$20,029	
TOTAL	$120,490	$67,797	$34,555	$33,243	$52,693

SOURCE: ISER.
NOTE: All direct jobs are in Bristol Bay region.
Multiplier jobs divided between Bristol Bay and Southcentral Alaska.
Multiplier jobs are all taken by residents of region where they occur.
Peak and annual average direct wages are equal.

A similar analysis results in an estimate of an annual payroll associated with the commercial fishery of $120 million.

10.4 Recreation: Total

In 2005 an estimated 50,752 recreational visitors to the Bristol Bay region spent about $91 million on trip related expenditures in Alaska. Non-residents comprised nearly half of the total number of recreational visitors, 24,276 (48%), and accounted for the majority of spending at $75 million (82%). Alaskans from outside the Bristol Bay region made 6,988 trips and local residents made 19,488 trips. Alaskans from outside the region spent $10 million on their trips and local residents spent the smallest amount, $7 million.

Most trips and spending were related to sport fishing, although both hunting and non-consumptive use trips (wildlife viewing, kayaking, bird watching, mountain climbing, hiking,

etc.) were also popular and accounted for significant spending. Many recreational visitors combined sport fishing with some non-consumptive use activities as well. We include those visitors in the sport fish category for this analysis.

The figures in the table include only expenditures directly related to trips--transportation, food, lodging, guiding services, supplies, licenses, etc. They exclude equipment purchases such as fishing rods, hunting rifles, boats, and kayaks that may have been purchased during the trip but that can be used for subsequent recreational or other kinds of trips. For most non-residents, all in-state travel expenditures are included, based on the assumption that the primary reason for the travel to Alaska is the visit to the Bristol Bay region. The expenditures related to travel to Alaska for non-residents are not included in the figures in the table, but we do include them in the economic significance calculations.

A portion of the non-resident visitor expenditures related to trips to the Bristol Bay region are made outside the region. We assume all these expenditures take place in South Central Alaska as the entry and exit point for non-residents.

Table 74 Recreational Trips and Expenditures in the Bristol Bay Region, 2005

	LOCAL RESIDENT	*NON-LOCAL RESIDENT*	*NON-RESIDENT*	*TOTAL*
TRIPS	**19,488**	**6,988**	**24,276**	**50,752**
SPORT FISH	19,488	4,450	12,966	36,904
SPORT HUNTING	0	1,538	2,310	3,848
WILDLIFE VIEWING/ TOURISM	0	1,000	9,000	10,000
SPENDING PER TRIP				
SPORT FISH	$339	$1,440	$3,637	$2,421
SPORT HUNTING		$1,440	$4,706	$3,401
WILDLIFE VIEWING/ TOURISM		$970	$1,796	$1,714
TOTAL SPENDING (000$)	**$6,606.4**	**$9,582.4**	**$75,246.7**	**$91,435.6**
SPORT FISH	$6,606.4	$6,397.7	$48,207.6	$61,211.8
SPORT HUNTING		$2,214.7	$10,870.9	$13,085.6
WILDLIFE VIEWING/ TOURISM		$970.0	$16,168.3	$17,138.3

SOURCE: ISER.

Some visitors combine fishing with passive use activities. These visitors are included here in sportfishing.

Cost of travel to Alaska for non-residents not shown

Most recreational visits occur during the summer months creating a peak in economic activity that largely coincides with the peak created by the commercial fishery. The

recreational visitors outnumber workers in the commercial fishery, but their average length of stay in the region is much shorter. And unlike the workers in the commercial fishery, their presence is not directly counted as part of the employment in the region. The economic impact of these recreational visitors occurs primarily through their local purchases of goods and services and is captured in our calculations in the multiplier effect. The direct jobs, 1,570 at the peak, and 523 when converted to annual average jobs, are the workers that are clearly identifiable as providing services to recreational visitors, mostly guides and lodge employees. The workers in other sectors like transportation, lodging, food services, and retail trade, who are directly serving the visitor industry, are included in the multiplier numbers in this analysis. This definitional difference explains why the "multiplier" appears to be so much higher for recreational activity compared to commercial fishing. As with the commercial fishery (particularly processing), only a small portion of these jobs are filled by local residents. More than half are taken by non-residents.

Recreational visitor spending creates a large number of jobs indirectly (multiplier jobs), particularly in the transportation, accommodation, and trade sectors of the economy. A large share of these jobs are located outside the Bristol Bay region in South Central Alaska where most of the goods and services originate that are purchased by businesses and households in the Bristol Bay region. The jobs in these industries are much more likely to be filled by Alaska residents who live where they work, and they are also more likely to be year-round rather than seasonal jobs as well.

Total jobs (annual average) in Alaska traceable to recreational visits to the Bristol Bay region were 1,252 in 2005. Only 430 of those jobs were taken by local residents. The largest share was taken by other Alaskans, either because they moved into the region to fill a job during the summer season, or because the job attributable to recreation in the Bristol Bay region was located in South Central Alaska. A smaller share of total jobs, all within the Bristol Bay region, was taken by non-residents. (Some of the indirect jobs in transportation, trade, and accommodations were undoubtedly filled by non-residents rather than residents. We have no data at this time to quantify the number. The data for calculating the resident vs. non resident split of jobs in the recreation sector is sketchy. Limited aggregate data by industry is available, and some specific data on the residency of workers in certain segments of the recreation sector such as lodges and guiding services is available from limited surveys. For this reason the total employment and payroll numbers are more robust than their distribution by residence of the job holder. When making comparisons about worker residence between different types of activities, it is important to keep this limitation in mind.)

Because many of the goods and services consumed in Alaska are produced outside the state, the effects of recreational spending (similar to commercial fishing spending) spill over to the rest of the US. The share of the economic effects that occurs outside the state of Alaska is not included in this analysis.

Table 75. Economic Significance of All Recreational Trips

	TOTAL	*RESIDENTS*			*NON-RESIDENTS*
		TOTAL	**LOCAL**	**NON-LOCAL**	
DIRECT JOBS					
PEAK	764	336	73	264	427
ANNUAL AVG	255	112	24	88	142
MULTIPLIER JOBS	997	997	406	591	
TOTAL JOBS (ANN AVG)	1,252	1,109	430	679	142
DIRECT WAGES ($000)	$8,909	$3,922	$848	$3,075	$4,987
MULTIPLIER	$29,927	$29,927	$10,884	$19,044	
TOTAL	$38,836	$33,849	$11,731	$22,118	$4,987

SOURCE: ISER.
NOTE: All direct jobs are in Bristol Bay region.
Multiplier jobs divided between Bristol Bay and Southcentral Alaska.
Multiplier jobs are all taken by residents of region where they occur.
Peak and annual average direct wages are equal.

The total payroll paid in Alaska that is traceable to recreational expenditures in the Bristol Bay region is $39 million.

10.5 Recreation: Sport Fishing

Most of the expenditures for recreation in the Bristol Bay region are related to sport fishing, either as the only, or as the primary, activity of the visitor. $48 million of the $61 million total sport fishing expenditures are made by the one-third of sport fishermen who are non-residents (12,966). Non-residents are the more likely to stay at a lodge and employ the services of a guide. Alaska residents from outside the region made 4,450 trips and had expenditures of $6 million. Local residents made 19,488 trips and had spending of $7 million. We include local resident sport fishing trip spending in the calculation of economic significance to present a complete picture of the importance of sport fishing, even though this spending by local residents is not new money that comes into the economy. (In the absence of sport fishing opportunities locally, some of this spending could possibly shift outside the region.)

Table 76. Economic Significance of Sport Fishing

	TOTAL	*RESIDENTS*			*NON-RESIDENTS*
		TOTAL	**LOCAL**	**NON-LOCAL**	
DIRECT JOBS					
PEAK	657	288	62	226	369
ANNUAL AVG	219	96	21	75	123
MULTIPLIER JOBS	627	627	267	360	
TOTAL JOBS (ANN AVG)	846	723	288	435	123
DIRECT WAGES ($000)	$7,666	$3,363	$723	$2,639	$4,303
MULTIPLIER	$19,308	$19,308	$7,456	$11,852	
TOTAL	$26,974	$22,671	$8,180	$14,491	$4,303

SOURCE: ISER.
NOTE: All direct jobs are in Bristol Bay region.
Multiplier jobs divided between Bristol Bay and Southcentral Alaska.
Multiplier jobs are all taken by residents of region where they occur.
Peak and annual average direct wages are equal.

Total jobs associated with the sport fishery were 846. The total payroll paid in Alaska that is traceable to sportfishing expenditures in the Bristol Bay region was $27 million.

10.6 Recreation: Sport Hunting

Sport hunting accounts for a smaller share of total recreational visits but spending by hunters is still significant. All of the trips we include in this analysis originate outside the Bristol Bay region, either elsewhere in Alaska or outside the state. These trips from outside the region are involve more travel costs and are more likely to use guiding services and other commercial facilities. Of the 167 total annual average jobs in Alaska attributable to sport hunting, most are taken by residents of the state with the majority outside the local region.

Table 77. Economic Significance of Sport Hunting

	TOTAL	*RESIDENTS*		*NON-RESIDENTS*
	TOTAL	*LOCAL*	*NON-LOCAL*	
DIRECT JOBS				
PEAK	14	6	1	5	7
ANNUAL AVG	5	2	0	2	2
MULTIPLIER JOBS	163	163	60	103	
TOTAL JOBS (ANN AVG)	167	165	60	105	2
DIRECT WAGES ($000)	$158	$71	$16	$55	$87
MULTIPLIER	$4,857	$4,857	$1,521	$3,337	
TOTAL	$5,016	$4,929	$1,536	$3,392	$87

SOURCE: ISER.
NOTE: All direct jobs are in Bristol Bay region.
Multiplier jobs divided between Bristol Bay and Southcentral Alaska.
Multiplier jobs are all taken by residents of region where they occur.
Peak and annual average direct wages are equal.

The total payroll paid in Alaska that is traceable to sport hunting expenditures in the Bristol Bay region is $5 million.

10.7 Recreation: Wildlife Viewing and Other Non-consumptive Uses

Although the majority of recreational visitors come to the Bristol Bay region to fish or hunt, many engage in other activities, and neither fish nor hunt. Most of these visitors come for wildlife viewing, and in particularly to see the bears. The number of these visitors, their activities while in the region, and their expenditures are all difficult to trace because unlike sportfishing or hunting, no license is generally required for these activities. No consistent and comprehensive administrative mechanism currently exists to determine overall visitation in the region for these purposes. Some limited information is collected on visits to specific sites, but this does not capture information about activities or expenditures.

One recent study has estimated that Western Alaska receives 30,000 non-resident overnight visitors in a tourist season, with most coming to fish (McDowell, 2006). Using this information as a general guideline together with limited visitor information from the National Parks in the region as well as an earlier study of the National Wildlife Refuges in western Alaska (Goldsmith et al., 1998), we estimate that about 9,000 trips were made into the region for recreational purposes that did not include either fishing or hunting. Most of these

involved an at least one overnight in the region, but a portion were day trips from Anchorage for bear viewing. To be consistent with the expenditure data for sport fishing and hunting, we assume that the visit to the Bristol Bay region was the primary reason for their visit to Alaska for visitors who overnight in the region. For these visitors we include all their instate expenditures in the calculation of the economic significance of this activity. For visitors who do not overnight in the region, we include only the expenditures related to this "side trip" and exclude both their other instate expenditures and their expenditures to travel to Alaska.

We estimate 239 annual average jobs associated visits involving only non-consumptive wildlife viewing/tourism use to the Bristol Bay region and a payroll of $7 million.

Table 78. Economic Significance of Non-consumptive Recreational Use Visits

	TOTAL	*RESIDENTS*			*NON-RESIDENTS*
		TOTAL	*LOCAL*	*NON-LOCAL*	
DIRECT JOBS					
PEAK	93	42	9	33	51
ANNUAL AVG	31	14	3	11	17
MULTIPLIER JOBS	208	208	79	128	
TOTAL JOBS (ANN AVG)	239	222	82	139	17
DIRECT WAGES ($000)	$1,085	$488	$108	$380	$597
MULTIPLIER	$5,762	$5,762	$1,907	$3,855	
TOTAL	$6,847	$6,250	$2,015	$4,235	$597

SOURCE: ISER.
NOTE: All direct jobs are in Bristol Bay region.
Multiplier jobs divided between Bristol Bay and Southcentral Alaska.
Multiplier jobs are all taken by residents of region where they occur.
Peak and annual average direct wages are equal.

10.8 Subsistence

Subsistence is an important component of the regional economy dependent on the wild salmon ecosystem, but it is not part of the market economy. Consequently there is no direct measure of the labor effort (like employment) in pursuit of subsistence resources, and there is no market measure of the return to that labor (payroll). However we can quantify the link that exists between subsistence and the market economy based on the purchases of supplies and equipment that households make in support of their subsistence activities. Typically these purchases include boats, snowmachines, fuel, nets, traps, rifles, and a broad range of other items, some used exclusively for subsistence, and others used not only for subsistence, but for other purposes as well.

Information on the level of these purchases by households engaged in subsistence is nearly non-existent. We rely on a survey conducted by the North Slope Borough for an estimate of these expenditures, recognizing not only differences in the circumstances between these different parts of the state, but also how difficult it is to determine what household expenditures can appropriately be attributed to subsistence rather than other activities.

For simplicity we assume that every Native household in the region practices subsistence in one form or another, although not necessarily every year, and that none of the non-Native households practice subsistence.

Because of these very simple assumptions, our estimate of the economic significance of subsistence (significance here narrowly defined to mean only jobs and payroll in businesses that provide the supplies and equipment used in subsistence) is merely a rough approximation. It is quite small in comparison to commercial fishing and recreation spending, both in terms of market jobs and payroll generated. A large share of the jobs created by spending on inputs to subsistence related activities are in urban Alaska, a reflection of the limited capacity of the businesses in the communities within the region to supply the goods and services that residents purchase.

Table 79. Economic Significance of Subsistence

	TOTAL	*RESIDENTS*			*NON-RESIDENTS*
		TOTAL	*LOCAL*	*NON-LOCAL*	
DIRECT JOBS					
PEAK	0	0	0	0	0
ANNUAL AVG	0	0	0	0	0
MULTIPLIER JOBS	49	49	14	34	
TOTAL JOBS (ANN AVG)	49	49	14	34	0
DIRECT WAGES ($000)	$0	$0	$0	$0	$0
MULTIPLIER		$1,707	$525	$1,183	
TOTAL	$1,707	$1,707	$525	$1,183	$0

SOURCE: ISER.
NOTE: All direct jobs are in Bristol Bay region.
Multiplier jobs divided between Bristol Bay and Southcentral Alaska.
Multiplier jobs are all taken by residents of region where they occur.
Peak and annual average direct wages are equal.

11.0 Net Economic Values

As noted in Section 1, the second general accounting framework under which ecosystem services can be measured is the Net Economic Value framework. Net economic value is the value of a resource or activity that is over and above regular expenditures associated with engaging in a activity or visiting a resource area.

11.1 Commercial Fisheries

In addition to the regional economic impact of commercial fish harvest in the Bristol Bay, the commercial fishery has a net economic value related to the expected differences over time between the ex vessel revenues and the costs of participating in this fishery. One method for approximating this value is to look at the market prices for commercial fishing permits in the Bristol Bay. These market prices reflect the value that commercial operators place on their right to fish the region. There were 1,860 salmon drift net permits in the fishery in 2005, and the average market value for permits that changed hands was $64,300, implying a total value to the fishery of $119,600,000 in 2005. Historically, these permits have been much more valuable, on the order of $250,000 each in the late 1980's. The decreased value of permits reflects in part the effect on farmed salmon on the market price for Bristol Bay salmon, which has dropped from over $2.00 per pound to around $0.50 per pound. Table 80 presents an approximation of total commercial permit values for Bristol Bay.

Table 80. Current Bristol Bay Salmon Fishing Permit Numbers and sale prices, 2005

Permit type	***Number of permits***	***Current market value***	***Total estimated value***
Salmon (Drift net)	1860	$64,300	119,600,000
Salmon (Set net)	988	$14,700	14,500,000
Total			134,100,000
Implied annual value (at 7% real discount rate)			$9,387,000
(at 14% real discount rate)			$18,774,000

Including salmon set nets, and based on current permit sales prices and numbers for salmon fishing permits in Bristol Bay, we estimate that the current net economic value of commercial salmon fishing in the Bay is approximately $134 million, or an implied annualized value of between $9.4 million using a real 7% amortization rate into perpetuity and $18.8 million using a 14% discount rate.

11.2 Subsistence Harvest

The Alaska Department of Fish and Wildlife, Division of Subsistence reports that most rural families in Alaska depend on subsistence fishing and hunting. ADF&G surveys of rural communities find that from 92% to 100% of sampled households used fish, 79% to 92% used wildlife, 75% to 98% harvested fish, and 48% to 70% harvested wildlife. Because subsistence foods are widely shared, most residents of rural communities make use of subsistence foods during the course of the year. The subsistence food harvest in rural areas constitutes about 2% of the fish and game harvested annually in Alaska. Commercial fisheries harvest about 97% of the statewide harvest, while sport fishing and hunting take about 1%. Though relatively small in the statewide picture, subsistence fishing and hunting provide a major part of the food supply of rural Alaska (Subsistence in Alaska, a 2000 Update http://www.subsistence.adfg.state.ak.us/download/subupd00.pdf).

The Alaskan subsistence harvest is not traditionally valued in the marketplace. Duffield (1997) estimated the value per pound of Alaskan subsistence harvest though use of a cross-sectional hedonic model of community-specific harvest per capita and community per capita income levels. This model estimated the value of a pound of subsistence harvest (willingness to pay) at $32.46. Adjusting this value to current (2005) values using Alaska statewide trends in per capita income yields an estimate of $59.68 per pound in terms of current income and dollars. These models have not been estimated with current data. For this reason, a range of values is employed in this analysis utilizing the original $32.46 per pound as a low-end estimate and the inflation adjusted $59.68 per pound as a high-end estimate.

Table 81 shows the accounting of ADF&G Division of Subsistence estimates of total annual subsistence harvest in most communities in Bristol Bay. This total has been adjusted to include population in the region not included in the ADF&G subsistence harvest estimates. In total, we estimate that about 2.4 million usable pounds of subsistence harvest per year occur in the Bristol Bay region. Valued at an estimated range of $32.46 to $59.68 per pound, this harvest results in an estimated net economic value annually of subsistence harvest of between $78 and $143 million.

Table 81. Estimated Net Economic Annual Value of Bristol Bay Area Subsistence Harvest

community name/statistic	*Usable pounds of harvest*
Aleknagik 1989	54,079
Clark's Point 1989	20,325
Dillingham 1984	494,486
Egegik 1984	37,450
Ekwok 1987	85,260
Igiugig 1992	33,915
Iliamna 1991	51,816
King Salmon 1983	81,261
Kokhanok 1992	175,639
Koliganek 1987	154,705
Levelock 1992	97,677
Manokotak 1985	118,337
Naknek 1983	72,110
New Stuyahok 1987	247,494
Newhalen 1991	110,720
Nondalton 1983	79,118
Pedro Bay 1996	15,300
Pilot Point 1987	24,783
Port Alsworth 1983	13,832
Port Heiden 1987	41,985
South Naknek 1992	39,893
Ugashik 1987	8,144
Total ADF&G Pounds Harvest	2,058,329
Population adjustment	1.165
Total usable pounds	2,397,970
Value per pound	$32.46 to $59.68
Total annual subsistence value	$77.8 million to $143.1 million

11.3 Sport Fishing Net Economic Value

In addition to the direct expenditures that Bristol Bay area anglers make each year (reported in Section 4), there is substantial net economic value attached to the trips these anglers take to the region. The 2005 Bristol Bay angler survey asked respondents a series of questions relating to what they spent on their fishing trip, and how much, if any, more they would have been willing to spend to have the same experience. Respondents were presented with a set of amounts ranging from $0 to $2,000, and asked to mark the greatest additional increase in spending they would have made to take the same trip. Table 82 shows the mean willingness to pay estimate for the two groups. The net economic value from the survey data was estimated using an interval estimation model.

Based on an estimated annual use level of 12,966 trips for nonresidents, and 23,938 trips for Alaska residents, we estimate that the annual net economic value of fishing trips in the Bristol Bay region is approximately $13.6 million.

Table 82. Estimated Willingness to Pay for Sportfishing Fishing in the Bristol Bay Region

	Residents	***Nonresidents***
Estimated mean net willingness to pay	$ 320.45	$ 454.90
Estimated number of trips/year	23,938	12,966
Total estimated Net Economic Value	$7,670,932	$5,898,233
Total annual value	$13,569,165	

11.4 Sport Hunting Net Economic Value

As in the case of sport fishing, there is additional value associated with sport hunting, above what is actually spent on the activity. Table 83 details the estimation of annual net economic value of big game hunting in the Bristol Bay region. Table 83 utilizes ADF&G estimates of hunter numbers in the game management units associated with the Bristol Bay area, and on estimates of net willingness to pay per trip for hunting (from Miller and McCollum 1994, adjusted to current, 2005 dollars). It is estimated that nonresident net economic value of Bristol Bay hunting is approximately $1.4 million annually. The annual net economic value of big game hunting in the Bristol Bay region for Alaska residents is estimated at about $360,000. Therefore the total estimated net economic value of big game hunting in this region is $1.8 million.

Table 83. Estimated annual big game hunting net economic value for Bristol Bay region

Species / Statistic	*Nonresidents*			*Non-local residents*		
	trips	Value/ trip	NEV	Trips	Value/ trip	NEV
Moose	478	$529	$283,000	286	$244	$70,000
Caribou	1439	$583	$839,000	1138	$228	$260,000
Brown bear	393	$817	$321,000	114	$280	$32,000
Total			$1,443,000			$362,000

11.5 Wildlife Viewing and Tourism Net Economic Value

The 1991 study by McCollum and Miller estimated the net economic value of wildlife watching trips in Alaska. These values adjusted to current dollars results in an estimated value per trip of $181. Using the 10,000 visitor trips to the region we estimate an annual net economic value of wildlife watching of about $1.8 million.

11.6 Existence Value

A major unknown is the total value for existence and bequest (also called passive use values). Goldsmith et al. (1998) estimated the existence and bequest value for the federal wildlife refuges in Bristol Bay at $2.3 to $4.6 billion per year (1997 dollars).

There is considerable uncertainty in these estimates, as indicated by the large range of values. Goldsmith's estimates for the federal wildlife refuges are based on the economics literature concerning what resident household populations in various areas (Alberta, Colorado) (Adamowicz et al. 1991; Walsh et al. 1984; Walsh et al. 1985) are willing to pay to protect substantial tracts of wilderness. Similar literature related to rare and endangered fisheries, including salmon, could also be appealed to here. It is possible that from a national perspective that the Bristol Bay wild salmon ecosystems and the associated economic and cultural uses are sufficiently unique and important to be valued as highly as wilderness in other regions of the U.S.

Goldsmith et al's (1998) estimates assume that a significant share of U.S. households (91 million such households) would be willing to pay on the order of $25 to $50 per year to protect the natural environment of the Bristol Bay federal wildlife refuges. The number of such households is based on a willingness to pay study (the specific methodology used was contingent valuation) conducted by the State of Alaska Trustees in the Exxon Valdez oil spill case (Carson et al. 1992). The findings of this study were the basis for the $1 billion settlement between the State and Exxon in this case. These methods are somewhat controversial among economists, but when certain guidelines are followed, such studies are recommended for use in natural resource damage regulations (for example, see Ward and Duffield 1992). They have also been upheld in court (Ohio v. United States Department of Interior, 880 F.2d 432-474 (D.C. Cir. 1989) and specifically endorsed by a NOAA-appointed blue ribbon panel (led by several Nobel laureates in economics) (Arrow et al. 1993).

Goldsmith's estimates for just the federal refuges may be indicative of the range of passive use values for the unprotected portions of the study area. However, there are several caveats to this interpretation. First, Goldsmith et al. estimates are not based on any actual surveys to calculate the contingent value specific to the resource at issue in Bristol Bay. Rather, they are based on inferences from other studies (benefits transfer method). Second, these other studies date from the 1980's and early 1990's and the implications of new literature and methods have not been examined. Additionally, the assumptions used to make the benefits transfer for the wildlife refuges may not be appropriate for the Bristol Bay study area.

11.7 Total Net Economic Value and Present Value and Inter-temporal Issues

Table 84 shows the estimated annual net economic value associated with direct use of the natural resource services provided by the Bristol Bay ecosystem. Commercial salmon fishery net economic values are derived by annualizing permit values, which are exchanged in an open market and reported by the Commercial Fish Entry Commission. These are on the order of $51,200 for a drift gillnet permit in 2005 in total, but have been as high as $200,000 as recently as 1993. Subsistence harvests are valued based on the willingness-to-pay revealed through tradeoffs of income and harvest in choice of residence location (Duffield 1997).

Table 84: Summary of Bristol Bay Ecosystem Services, Net Economic Value per Year (Million 2005 $)

Ecosystem Service	Low estimate, net economic value per year	High estimate, net economic value per year
Commercial salmon fishery	$9.4	$18.8
Subsistence harvest	$77.8	$143.1
Sport fisheries	$13.5	$13.5
Sport Hunting	$1.8	$1.8
Wildlife viewing / tourism	$1.8	$1.8
Total Direct Use Value	$104.30	$179.00
Existence and Bequest Value	Not estimated	Not estimated

Sportfisheries net economic values are based on original data collected for purposes of this study, as reported below. These estimates are consistent with values from the extensive economic literature on the value of sportfishing trips. Sport hunting and wildlife viewing values are based on studies conducted about fifteen years ago in Alaska, and which need to be updated. Direct use values total from $104 million to $179 million.

These are annual net economic values. Since these are values for renewable resource services that in principle should be available in perpetuity, it is of interest to also consider their present value (e.g. total discounted value of their use into the foreseeable future). Recent literature (EPA 2000; Weitzman 2001) provides some guidance on the use of social discount rates for long term (intergenerational) economic comparisons. Rates as low as 0.5% have been recommended by EPA (2000). Weitzman, based on an extensive survey of members of the American Economic Association, suggests a declining rate schedule, which may be on the order of 4 percent (real) in the near term and declining to near zero in the long term. He suggests a constant rate of 1.75% as an equivalent to his rate schedule. Applying this

parameter to the net economic values shown in Table 76 implies a net present value of $6.0 billion to $10.2 billion for the measured uses.

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Attachment A: Angler Survey Instrument

Bristol Bay Region

2005 Angler Survey

Bureau of Business and Economic Research
University of Montana

The purpose of this survey is to obtain information about angler use of the Bristol Bay Area. We anticipate that this information could have a significant impact on future management of these fisheries.

We are particularly interested in your use of wild stocks of rainbow trout and salmon, so several questions will be directed towards these species. We very much appreciate your participation in this survey, and hope you enjoy answering our questions and reflecting on your recent fishing experience.

Section I. General questions about your sport fishing.

1. How many years have you been sport fishing?
_____ years

2. About how many days per year do you spend sportfishing?
_____days

3. How many days have you sportfished in Alaska so far in 2005?
_____days fished in Alaska in 2005

4. How many separate trips from home did you take for the primary purpose of fishing Alaska freshwater sites so far this year?
_____ number of separate trips from home

5. Please check the types of fishing you most prefer when fishing in Alaska (check all that apply):

- ☐ fly fishing
- ☐ lure fishing
- ☐ bait fishing
- ☐ stream fishing from a bank or with waders
- ☐ stream fishing from a boat
- ☐ lake fishing from a shore or boat
- ☐ salt water fishing from shore or boat
- ☐ other (please specify)_____

6. How would you rate fishing as compared to your other outdoor recreation activities? (please check one)

- ☐ It's my favorite outdoor recreation activity
- ☐ It's one of my favorite outdoor recreation activities
- ☐ It's just one of several outdoor recreation activities that I do
- ☐ I prefer other outdoor recreation activities

7. Are you a member of a fishing club or an organization that supports fishery conservation?

☐ Yes ☐ No

8. How would you rate your expertise as an angler? (please check one)

☐ Beginner ☐ Intermediate ☐ Advanced ☐ Don't know

9. What factors are important to you in selecting where to sport fish in Alaska. For each characteristic below, please rate its importance (circle the number) from least important (1) to most important (5).

Fishing Experience	Importance				
	least				most
Fishing easily accessible site near a road	1	2	3	4	5
Fishing in remote, off-the-road locations	1	2	3	4	5
Harvesting fish	1	2	3	4	5
Catching and releasing large numbers of fish	1	2	3	4	5
Chance to catch large or trophy-sized fish	1	2	3	4	5
Natural beauty of the area	1	2	3	4	5
Catching wild stock rainbows	1	2	3	4	5
Being in an area with few other anglers	1	2	3	4	5
Being in a wilderness setting	1	2	3	4	5
Chance to catch wild fish	1	2	3	4	5
Opportunities to view wildlife	1	2	3	4	5

II. Where you have fished in Bristol Bay and Southcentral Alaska so far in 2005

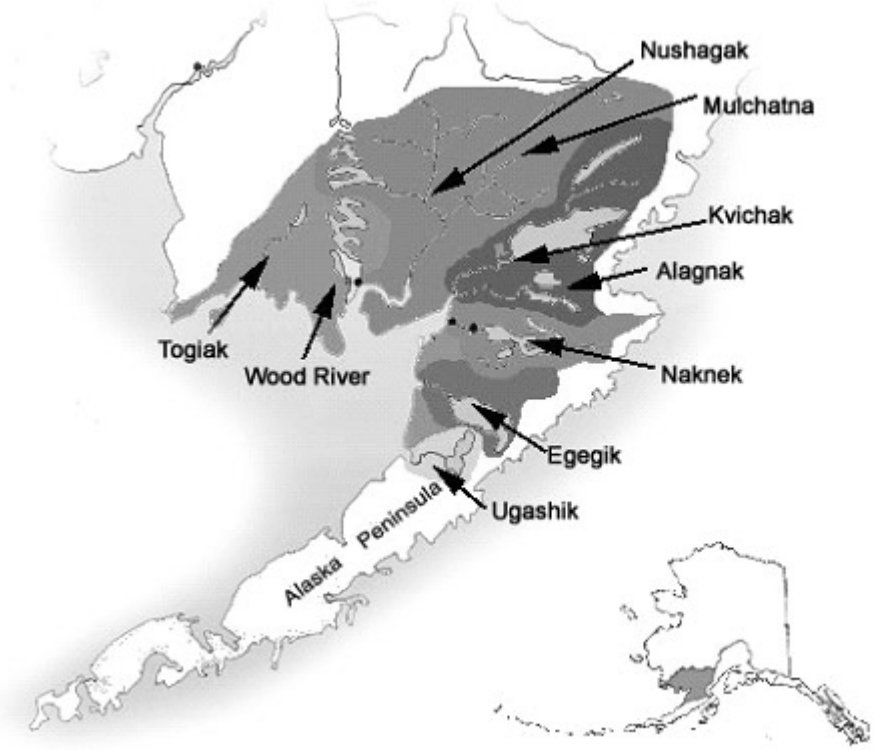
10. With reference to the map on the next page highlighting the Bristol Bay area, did you fish any freshwater sites in the Bristol Bay area in 2005?

□ Yes □ No **(If "NO" please skip to Question 39)**

(IF YES) How many separate trips from home did you make to fish one or more specific sites in the Bristol Bay area so far in 2005?

_____ number of separate trips from home

BRISTOL BAY REGION



11. Which of the following specific Bristol Bay area freshwater fishing sites did you visit so far in 2005? Please check **yes** for each site and indicate how many days you fished, for at least part of a day, on each specific water you fished. (See map)

Fishing Site	**"Yes" fished this year**	**Days fished on each water**
Area A. **Naknek River Drainage**		
Naknek River	___	_____
Brooks River	___	_____
Brooks Lake	___	_____
Other Freshwater(please list)		
_____	___	_____
Area B. **Nushagak-Mulchatna Drainage**		
Nushagak River	___	_____
Wood River Lakes System	___	_____
Mulchatna River	___	_____
Other Freshwater (please list)		
_____	___	_____
Area C. Kvichak-Lake Iliamna		
Alagnak (Branch) River	___	_____
Newhalen River	___	_____
Kvichak River	___	_____
Talarik Creek	___	_____
Lake Clark Drainage	___	_____
Other Freshwater (please list)		
_____	___	_____
Area D. Other Bristol Bay		
Togiak River	___	____
Egegik River	___	____
King Salmon River	___	____
Ugashik River	___	____
Other Freshwater (please list)		
_____	___	____

Section III. In this section, we would like to ask you about your most recent fishing trip to the Bristol Bay area.

The rest of the questions in this section are about this <u>most recent fishing trip</u> from home to Bristol Bay.

12. What specific fishing site (river, lake, or drainage) did you spend most of your time at on this recent trip?

_____ name of fishing site

13. What was the approximate date of your most recent fishing trip to this specific fishing site? (please circle all the days of your most recent trip)

June						
S	M	T	W	T	F	S
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30		

July						
S	M	T	W	T	F	S
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30
31						

August						
S	M	T	W	T	F	S
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30	31			

September						
S	M	T	W	T	F	S
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	

13a. If your trip was not in June through September, please indicate the beginning and end dates for your trip. _____ (Begin date) _____ (End date)

14. What was the major purpose of your trip to Alaska? (check one).

- 9 To fish
- 9 To hunt
- 9 For business
- 9 For general vacation
- 9 To visit friends and relatives
- 9 Other (please specify) _____

15. On your most recent trip to Bristol Bay how many days were spent:

In total? (e.g. round trip from home)	_____days
In the Bristol Bay area?	_____days
In Anchorage?	_____days
In the rest of Alaska?	_____days
Traveling to and from Alaska?	_____days

16. If you spent time in the rest of Alaska, what were your primary other destinations?

_____

17. Was this trip your first fishing trip ever to the Bristol Bay?

9 Yes 9 No

↓

If NO, how many years have you been fishing this area? _____ years

18. What kind of fishing trip were you on? (please check one)

9 Stayed at a remote lodge and flew or boated with a guide to fishing sites most days
9 Stayed at a tent or cabin camp and fished waters accessible from this base camp
9 Hired other lodging in the area and contracted for fly-out or boat-out travel on a daily basis
9 Hired other lodging in an area community and fished on own
9 Floated a section of river with a guided party
9 Hired a drop-off service and fished and camped on our own
9 Accessed the area with my own airplane or boat
9 Other:(please describe)_____

19. If you stayed at a remote lodge or camp, how many nights were you there?

_____ number of nights stayed at remote lodge or camp

20. What was the actual physical location of the remote lodge or camp?

_____nearest river, lake, drainage, or community

21. What was the name of the remote lodge or camp where you stayed?

_____ name of lodge or camp

Questions about your Trip Expenditures

22. If you were not already living in Alaska this past fishing season, which of the following modes of transportation did you use to come to Alaska? (Please check as many as apply).

□ Commercial airplane	□ Cruise ship	□ Car, truck, RV
□ Private airplane	□ Private boat/Ferry	□ Other

23. If you were not already living in Alaska this past fishing season, how much did you spend on transportation to and from Alaska on this recent trip? $_____

24. If you purchased a "packaged" sportfishing trip to the Bristol Bay area, what was the total price per person of the package? (Please enter the dollar amounts you paid for yourself below on this recent trip).

Package base price	$_____
Miscellaneous rental or services	$_____
Gratuity to staff	$_____

Total spent at remote sportfish lodge or camp: $_____

25. If you purchased a "packaged" sportfishing trip to the Bristol Bay area, what services were included in the base price at the remote lodge where you stayed? (check all that apply)

□ Transportation to the lodge from Anchorage
□ Transportation to the lodge from a local community (community?):_____
□ Full guide services
□ Daily flyout service to specific fishing sites
□ Other level of flyout service to specific fishing sites (# of days _____)
□ Daily guided boat access to specific fishing sites
□ Lodging
□ Full meals
□ All fishing equipment
□ Flies or other terminal tackle
□ Rain gear
□ Fish processing and shipping
□ Lodging in a full service lodge
□ Lodging in cabins
□ Lodging in a tent camp
□ Other (please list):_____

26. Please fill out the following table, listing all of your expenses which were **Not included in the price of a package sportfishing trip** . The expenditures should be only those spent **while in Alaska**. Approximately how much did you spend on:

Expenditures not included in the price of your package sportfishing trip	**Spent in Bristol Bay**	**Spent in rest of Alaska**
Commercial air travel	$	$
Air taxi service	$	$
Transportation by boat	$	$
Boat or vehicle rental	$	$
Gasoline or other travel costs within Alaska (not rentals)	$	$
Lodging or camping fees	$	$
Food and beverages	$	$
Guide fees	$	$
Fishing supplies (tackle, clothing, etc.)	$	$
Other non-fishing package tours (list) _____	$	$
Other (please specify) _____	$	$

27. Counting yourself, how many people were included on this total cost?

_____ people

28. What is the total of all costs you incurred on the trip that are specifically attributable to travel to, and time spent, at your primary fishing destination area? (For example, this might include a package sportfishing trip, airfare or other expenses incurred specifically to include fishing in your trip itinerary)

$_____

The costs of visiting and recreating on Alaska's rivers and lakes change over time. For example, gas prices and other travel costs rise and fall

29. Was this trip to fish your primary destination area **worth more to you than what you actually spent** (for example, on a package sportfishing trip plus airfare or other expenses incurred specifically to include fishing in your trip itinerary)?

9 Yes 9 No

If YES, what is the largest increase over and above your actual costs that you would have paid to be able to fish your primary destination area? (please choose one)

□ $10 □ $250 □ $1,500
□ $ 25 □ $500 □ $2,000
□ $50 □ $750 □ Other $_____
□ $100 □ $1,000

30. What is the most important reason for your answer to Question 29?

_____
_____
_____

31. On a scale of 1 to 5 where 1 means "very uncertain" and 5 means "very certain," how certain are you that you would actually be willing to pay the additional costs you indicated in Question 29, to have included fishing at your primary destination in you trip itinerary? (please circle one number)

1 2 3 4 5
very uncertain very certain

Questions about Your Fishing Experience

32. What was the **primary species of fish** you intended to catch on this trip? (**check one**)

9 Rainbow Trout 9 Chum
9 King Salmon 9 Arctic Char
9 Silver Salmon 9 Steelhead
9 Sockeye Salmon 9 Arctic Grayling
9 Other_____ 9 No specific species was targeted

33. Would you still have chosen to make this trip if, for some reason, the primary species of fish you intended to catch on this trip was unavailable?

□ Yes □ No □ Don't know

34. Which of the following fish were you trying to catch on this trip? For each type of fish you targeted, please check the box that shows your evaluation of the quality of fishing for that type of fish.

Species	Targeted?			Excellent	Good	Fair	Poor
	Yes	No					
Rainbow Trout			Fishing was:				
King Salmon			Fishing was:				
Silver Salmon			Fishing was:				
Sockeye Salmon			Fishing was:				
Chum Salmon			Fishing was:				
Arctic Char			Fishing was:				
Steelhead			Fishing was:				
Arctic Grayling			Fishing was:				
Other			Fishing was:				

35. Did you catch any rainbow trout larger than 26 inches?

9 No 9 Yes

36. For each item below, please check the box that shows how strongly you agree or disagree with the following statements about the fishing you experienced on your recent trip.

Statement	Strongly Agree	Agree	Not Sure	Disagree	Strongly Disagree
Fishing conditions were un-crowded					
There was a reasonable opportunity to catch fish					
There was minimal conflict with other anglers					
Fishing was in a wilderness setting					
There was opportunity to catch trophy-sized fish					
There was opportunity to catch and release large numbers of fish					

37. In general, how crowded were your primary fisheries on this trip? (circle one number)

1 2 3 4 5 6 7 8 9 10

---

not at all crowded **moderately crowded** **extremely crowded**

Questions about Other Areas You Fish

38. Please list the states, provinces, or countries where you have taken sport fishing trips in the last three years that you believe are roughly comparable to your recent trip to Bristol Bay. Please include information on the specific water fished and your target species.

Year	State/Prov./ Country	Name of Water	Target Species
2005			
2004			
2003			

39. How did these trips compare to your recent fishing trip to Bristol Bay? (please circle a category below for each year)

Year	Poorer than Bristol Bay	About the Same	Better than Bristol Bay
2005	□	□	□
2004	□	□	□
2003	□	□	□

Questions about Management-related Issues

40. Fishing in the Bristol Bay region is currently generally characterized by a **wilderness setting, relatively un-crowded fishing, and good opportunities to catch large rainbow trout**. Thinking back on your recent 2005 fishing trip to Alaska, suppose that **good road access** was developed from **Anchorage to Bristol Bay** by ferry from Homer across Cook Inlet and then along a corridor including the Newhalen River, Lake Illiamna, the Kvichak River, and the lower Nushagak River to Dillingham, King Salmon and Alekngik. How do you anticipate this would **affect your future sport fishing**, if at all? (Please mark one box)

9 I would fish more frequently in Bristol Bay: _____ number of additional trips per year
9 No effect
9 I would choose to fish another area in Alaska (please list):_____
9 I would not fish in Alaska

41. Would you generally favor or oppose developing good road access from Anchorage to Bristol Bay (including a ferry from Homer across Cook Inlet). Such a road would connect from a ferry terminal on Cook Inlet and then on to Lake Illiamna and on to King Salmon, Dillingham and Aleknagik. (Please check one)

9 I would favor developing such a road
9 I would oppose developing such a road
9 Not sure

42. In various parts of the country, **funds have been set up** to conserve natural resources and wildlife habitat. The Nature Conservancy, Rocky Mountain Elk Foundation, and Trout Unlimited are examples of the types of groups that can do this. **How familiar are you** with these kinds of efforts?

□ Never heard of them □ Know a fair amount about them
□ I have heard of them □ I know a great deal about them

43. There is the potential for significant future extractive resource development and roading in the Bristol Bay area. For example, **a large mine** has been proposed in the headwaters of the Nushagak and Kvichak Rivers near Lake Iliamna, and **a road** has been proposed linking Anchorage and Bristol Bay.

Suppose that you had an opportunity to support a fund whose aim was to **keep the main Bristol Bay drainages in their current relatively pristine and un-roaded condition**. Assume that the successful development of such a fund **would actually result in the protection of Bristol Bay from roading and extractive resource development.**

As this survey is part of a research project, we are not asking you to make a donation. Nonetheless, we would like you to answer the following question as you would a solicitation for an actual donation. Hypothetically, **if your were asked today, how much would you be willing to donate, if anything, to keep the Bristol Bay region in its current relatively pristine and unroaded condition?** (Please check one)

□ $10 □ $25 □ $50 □ $100 □ $250 □ $500 □ $1000 $____ other

□ I would choose to not make a donation at this time

44. Could you please comment on the **main reason** you **would or would not support** such a fund?_____

45. On a scale of 1 to 5 where 1 means "very uncertain" and 5 means "very certain," how certain are you that you would pay the amount you checked in Question 42 to protect Bristol Bay from roading and extractive resource development? (please circle one number)

1 2 3 4 5
very uncertain very certain

IV. These last few questions will help us to compare respondents to the general population.

46. Where do you live? City: _____ State: _____ Zip: _____

Country (if not U.S.) _____-_____

47. How old were you on your last birthday? _____

48. Are you: 9 male 9 female

49. What is the highest level of formal education you have completed? (Circle one)

9 Some grade school
9 Finished grade school
9 Some high school
9 Finished high school
9 Some college
9 Finished college
9 Some postgraduate work
9 Finished postgraduate

50. During the fishing season this year, you were:

9 Employed full time
9 Employed part time
9 Unemployed
9 Retired
9 Homemaker
9 Student
9 Other: _____

51. Please check your household's expected income before taxes for 2005:

9 Less than $24,999
9 $25,000 to $49,999
9 $50,000 to $74,999
9 $75,000 to $99,999
9 $100,000 to $124,999
9 $100,000 to $149,999
9 $150,000 to $199,999
9 $200,000 to $299,999
9 $over $300,000

Thanks for your time and assistance!

Is there anything else you'd like to tell us about your trip or how you feel your primary fishing destination area should be managed in the future?