United Cook Inlet Drift Association

43961 K-Beach Road, Suite E • Soldotna, Alaska 99669 • (907) 260-9436 • fax (907) 260-9438
• info@ucida.org •

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Addressee: Alaska Board of Fisheries
PO Box 115526
Juneau, AK 99811

RE: Cook Inlet Observer Program

Dear Board of Fisheries Members,

This document records some 9,000 salmon fishing locations in Upper Cook Inlet. These observations were determined by a two-year National Marine Fisheries Service sponsored Observer Program. Figures 8 – 13 record the drift gillnet fishing locations that were recorded during this two-year study.

Sincerely,

Roland Maw, PhD
UCIDA Executive Director

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Incidental Catch and Interactions of Marine Mammals and Birds in the Cook Inlet Salmon Driftnet and Setnet Fisheries, 1999-2000

Bryan F.J. Manly
Western EcoSystems Technology Inc.
2003 Central Avenue, Cheyenne, Wyoming 82001
bmanly@west-inc.com

Table of Contents

Summary

- The Marine Mammal Protection Act is reviewed in terms of the use of the Potential Biological Removal (PBR) of a stock, and the two tier analysis for allocating fisheries to Categories I, II or III are defined. The application of the process to Alaskan fisheries is also summarized, and the Alaska Marine Mammal Observer Program (AMMOP) is described.

- The Cook Inlet setnet and driftnet fisheries were observed in 1999 and 2000, partly because in 1999 the status of the Cook Inlet beluga whale was being reviewed under the Marine Mammal Protection Act and the Endangered Species Act because of declining numbers. These fisheries are described, with information about potential interactions with marine mammals and birds.

- The method for determining the appropriate amount of observer coverage of the fisheries is described, and how the actual effort related to the planned effort.

- The calculation of ratio estimates of total incidental take numbers of marine mammals and birds is decribed.

- During the 1999 season the Upper Cook Inlet driftnet fishery had a total of 5709 permit-days (one permit fished for one day) of fishing. All or part of 100 of these permit-days were observed. Two harbor porpoises were observed to be entangled in nets, but both were released alive, without serious injuries. Five marine birds were also observed to be entangled, with three released dead and two released alive, without serious injuries. In the same fishery in 2000 there were a total of 3889 permit-days of fishing, with all or part of 141 of these observed. Two harbor porpoises and a minke whale were observed to be entangled in nets. One of the harbor porpoises was apparently dead when it was released, but the other porpoise and the whale were released alive, without serious injuries. One marine bird was observed to be entangled in nets and it was released alive, without serious injuries.

- In the Upper Cook Inlet setnet fishery in 1999 there were a total of 5455 permit-days of fishing. All or part of 399 of these permits-days were observed. Two marine birds were observed to be entangled in nets, with one released alive, without serious injuries and one released dead. In the same fishery in 2000 there was a total of 3239 permit-days, with all or part of 269 permit-days observed. One harbor seal was observed entangled in a net, and was released alive, without serious injuries. Two marine birds were also observed to be entangled, and these were both released dead.

- In the Lower Cook Inlet setnet fishery in 1999 there was an estimated total of 968 permit-days of fishing, of which all or part of 28 permit-days were observed. One harbor porpoise was observed entangled in a net and was released alive, without serious injuries. Two marine birds were also observed entangled in nets, and both

were released alive, without serious injuries. In the same fishery in 2000 there is an estimated total of 1045 permit-days of fishing, with 34 of these observed. In this case no entanglements of marine mammals or birds were observed.

- Using a regression method, the total estimated fishing effort for the Upper Cook Inlet driftnet fishery is estimated at 51,586.9 permit hours in 1999. Using this total fishing effort with incidental take rates per hour estimated from the observer data, the total incidental take for the fishery is estimated at 183 common murres (released alive, without serious injuries) with a standard error (SE) of 257, 122 gulls (released alive, without serious injuries) with a SE of 211, and 122 harbor porpoises (released alive, without serious injuries)with a SE of 202. The large SE values for these and other estimates of incidental take means that the estimates should be treated with some reservations. Similar methods applied to the 2000 data for the same fishery give an estimated 28,870.9 permit hours of fishing, with total estimated incidental take of 31 common murres (released alive, without serious injuries) with a SE of 55, 31 live harbor porpoises (released alive, without serious injuries) with a SE of 59, 31 harbor porpoises (released dead) with a SE of 55, and 31 minke whales (released alive, without serious injuries) with a SE of 56.

- For the Upper Cook Inlet setnet fishery in 1999 it was assumed that the observed mean fishing time of 8.14 hours was an accurate estimate of the mean fishing time of a permit holder for a fishing open period. This gives a total fishing effort of 44,104.4 permit hours. Using this total effort and the incidental take rates per hour estimated from the observer data, the estimated total incidental take for the fishery was estimated as 89 gulls (released alive, without serious injuries) with a SE of 89, and 89 common loons (released dead) with a SE of 89. Applying similar methods with the 2000 data gave a mean fishing time for an open period of 7.97 hours, and a total fishing effort of 25,823.8 permit hours. The estimated total incidental take was 37 marbled murrelets (released dead) with a SE of 37, 39 white-winged scoters (released dead) with a SE of 37, and 37 harbor seals (released alive) with a SE of 37. The large SE values with all of the incidental take estimates means that the estimates should be treated with some reservations.

- For the Lower Cook Inlet setnet fishery it was necessary to assume that the permits were fished whenever the fishery was open. In 1999 this gives a total fishing effort of 23,232 permit hours. Combined with the estimated rates of incidental take per hour from the observer data, this leads to the total incidental take for the fishery being estimated as 628 white-winged scoters (released alive) with a SE of 664, 628 common loons (released alive) with a SE of 665, and 628 harbor porpoises (released alive) with a SE of 624. In 2000 the total fishing effort was assessed at 25,080 hours, with no incidental take observed, so that the estimated total incidental take was zero. The observer coverage for this fishery was very low, which has led to the very large SEs for the estimated incidental take in 1999. These incidental take estimates should therefore be treated with even more reservation than the estimates for the other fisheries.

- Marine mammal and bird sightings near nets are summarized, wit maps showing the locations of sightings.

- A graphical analysis of factors that may influence incidental take rates is presented, although the small number of observed takes means that the results are indicative only of factors that may be important.

- No interactions with beluga whales were observed in the Cook Inlet fisheries in 1999 and 2000. The only marine mammal incidental take of importance was of one dead harbor porpoise in the Upper Cook Inlet driftnet fishery in 2000. The level of observer coverage is not sufficient to get a reasonably good estimate of the annual serious injury and mortality rate for this species in the fishery. The best estimate is 5.9% of the PBR, but the true rate may be as high as 27.6% of the PBR. Based on the best estimate, the Upper Cook Inlet driftnet fishery has been retained as a Category II fishery.

- No marine mammal or serious injuries were observed in the setnet fisheries. On this basis the Upper Cook Inlet and Lower Cook Inlet setnet fisheries have been changed from Category II to Category III fisheries.

1. The Marine Mammal Protection Act and the Observer Program

The Marine Mammal Protection Act directs the Secretary of Commerce to monitor marine mammal mortality and serious injury occurring incidentally to commercial fishing, and to monitor the progress of commercial fisheries in reducing incidental takes to insignificant levels approaching a zero mortality rate goal (ZMRG). The National Marine Fishery Service (NMFS) currently uses a value of 10% of the stock's potential biological removal (PBR, Wade and Angliss, 1997) as a criterion to evaluate whether the incidental take of a stock is at an insignificant level approaching the ZMRG.

The PBR is defined to be

$$(N_{min})(0.5\ r_{max})(F_R),$$

where N_{min} is the minimum estimate of the population size for the stock, r_{max} is the maximum yearly rate of increase of the stock, and F_R is a recovery factor between 0.1 and 1.0. The PBR is considered to be the maximum number of animals (not including natural mortality) that may be removed from a stock while still allowing that stock to reach its optimum sustainable population size.

Under the Marine Mammal Protection Act, the NMFS classifies each U.S. commercial fishery (state and federal) in one of three categories, based on the level of incidental serious injury and mortality of marine mammals that occurs in the fishery. Each fishery is classified through a two-tiered analysis which assesses the potential impact of fisheries on each marine mammal stock by comparing serious injury and mortality levels to the stock's PBR.

The Tier 1 analysis proceeds as follows. For each marine mammal stock, serious injuries and mortalities from all commercial U.S. fisheries are totaled. If the total is less than or equal to 10% of the PBR of that stock, then all fisheries interacting with this stock are placed in Category III. This process is repeated for each stock. A fishery remains in Category III unless it interacts with a stock for which the serious injury or mortality rate exceeds 10% of the PBR. All fisheries that interact with a stock for which the serious injury or mortality rate exceeds 10% of the PBR are subject to a Tier 2 analysis. Fisheries with no serious injuries or mortalities to any marine mammal stock are placed in Category III.

If a Tier 2 analysis is required then this proceeds as follows. For each fishery, the annual mortality and serious injury for each marine mammal stock is evaluated relative to the PBR of that stock. The fishery is categorized as Category I if the serious injury and mortality exceeds 50% of the PBR, as Category II if the serious injury and mortality is greater than 1% and less than 50% of the PBR, and as Category III if the serious injury and mortality is less than or equal to 1% of the PBR.

The NMFS relies on observer data in the analyses, but also evaluates other factors such as fishing techniques, the gear, the methods used to deter marine mammals, the seasons and the areas fished.

The Alaska Scientific Review Group was set up in 1994 to review the science used as the basis for marine mammal management. This group reviews stock assessment reports on the marine mammals in the regions and advises the NMFS on the status and trends in each population, and on the research and management needs to reduce incidental fisheries mortality if this is necessary.

In Alaska logbook programs were used from 1990 to 1993, and fisher self-reporting programs from 1995 to 2001 in an attempt to estimate the fishing related mortality of marine mammals. However, this was unsuccessful as logbook data were found to under-estimate mortality rates in comparison to more reliable observer data (Credle *et al.*, 1994), and there were almost no self-reports of injuries or mortalities. As a result, the Alaska SRG directed the NMFS not to use self-reporting data for producing estimates of fishing related mortality (Alaska Scientific Review Group, 1998), leading to many Alaskan fisheries being categorized as II or III using a combination of data five to ten years old, stranding reports, and their similarity to other fisheries.

The Alaska Marine Mammal Observer Program

The Alaska Marine Mammal Observer Program (AMMOP) was set up in 1990 to:

(a) obtain reliable estimates of the level of incidental serious injury and mortality of marine mammals during fishing operations;

(b) determine the reliability of reports submitted by vessel owners and operators;

(c) identify changes in fishing methods or technology that may increase or decrease incidental serious injury and mortality;

(d) collect biological samples that may otherwise be unobtainable for scientific studies; and

(e) record data on incidental take and discard levels of all species.

Although the collection of data on the incidental injury and mortality of marine birds during fishing operations is not part of these goals, the collection of such data is fully supported and considered to be an important secondary benefit from the program.

As part of this program, the NMFS is currently placing observers in Alaskan fisheries on a rotational basis, to gather data to monitor the level and nature of incidental mortalities and serious injuries. These data are also used to place Alaska federal and state

commercial fisheries into the appropriate List of Fisheries category, as required under the Marine Mammal Protection Act. There are currently no Category I fisheries (frequent serious injuries and mortalities) in Alaska, and Category II fisheries (occasional serious injuries and mortalities) have priority for observer coverage. Category III fisheries are not required to accommodate observers and therefore unlikely to be covered by the AMMOP.

The AMMOP began observer coverage in 1991 and 1992 on the Prince William Sound setnet and driftnet fisheries, and the Aleutian Peninsula driftnet fisheries. It continued with the Cook Inlet salmon setnet and driftnet fisheries in 1999 and 2000, and covered the Kodiak Island setnet fishery in 2002. This report covers the 1999 and 2000 surveys of the Cook Inlet salmon setnet and driftnet fisheries.

Part of the reason for observing the Cook Inlet fisheries was the review of the status of beluga whales taking place in 1999 under the Marine Mammal Protection Act and the Endangered Species Act because of declining stock numbers. There was therefore interest in obtaining data on the interaction of the fisheries with beluga whales.

The Role of Observers

The NMFS specifically required the hiring of experienced observers for the first year of the Cook Inlet observer program because of the need for high quality data and the provision of useful information for the further development of the program. It was considered that their presentation of the program to the fishing community was of the utmost importance because most of the fishers had never before had to cooperate with any kind of observer program and might have had little understanding of the implications of the Marine Mammal Protection Act on their fishery or of the impact of their fishery on marine mammal stocks. The ability of the observer to understand and present the program in a professional and clear manner to the fishing community was therefore considered to be critical to the success of the program and future programs.

The observer's duties involved the collection and recording of accurate and precise data in the field. These data included information on fishing gear deployment and operations, marine mammal and bird presences, interactions and entanglements in the fishing gear, the deterrents used against marine mammals, fish catch information, species identification of birds, mammals, and fish, environmental conditions and other elements covered in the *Observer Manual*. In addition, observers collected biological specimens and/or tissue of marine mammals, birds, and some fish, worked cooperatively and professionally with fishers, provided information to the industry regarding the program, conducted data reviews and editing, entered data into computers, and attended debriefing meetings. All data and biological specimen collection were required to be made in accordance with instructions provided in the *Observer Manual*. Appendix A provides copies of the forms used for recording data in 2000.

Lead observers acted as field coordinators and primary debriefers of observers. The lead observers were the main field staff responsible for implementing the observer program in their districts. They were the contact people who cooperated with the NMFS in addressing sampling, data, and deployment issues and provided reports as needed. The lead observers were responsible for the oversight and tracking of debriefing, final data reviews, data editing and data entry. In addition, lead observers were required to organize open meetings with the fishing community to provide updates and consider suggestions and concerns. Whenever possible lead observers participated as field observers in the collection of data.

It was required that debriefings for observers occurred at least once a week, and preferably after every opener (i.e., a period when a fishery is open). The debriefings consisted of (1) a preliminary interview reviewing sampling methods, answering questions, and discussing observer concerns; (2) a preliminary data review; (3) correction by the observer of any data errors noted; and (4) a review and correction of any errors in data turned in by the observer in a previous debriefing, including data entered on a computer after an audit had been run. Any changes to data made by an observer or others were required to be made using a colored pencil, with the identity of the person making the corrections noted on the data form so that questions could be directed at them later if necessary.

When at sea, observers were required to maintain a high standard of conduct as prescribed by the NMFS, with a professional, objective demeanor at all times. They were not permitted to have a direct, financial or political interest in any organization that might be aided by the performance or nonperformance of their duties. Observers received a NMFS certificate acknowledging their successful completion of the observer training program, and to maintain this certificate they had to have satisfactory work standards while deployed, maintain prescribed standards of conduct, not violate the conflict of interest guidelines, and successfully complete additional certification training when required.

2. The Cook Inlet Salmon Setnet and Driftnet Fisheries

Figure 1 shows the location of the Cook Inlet setnet and driftnet salmon fisheries. There are three Alaska Department of Fish and Game (ADFG) fishing districts, with setnet fishing in the Northern District, setnet and driftnet fishing in the Central District, and setnet fishing in the Southern District. The Northern and Central Districts are also called the Upper Cook Inlet fisheries, while the Southern District is called the Lower Cook Inlet fishery. These fisheries were the only ones observed under the Marine Mammal Protection Act in Cook Inlet in 1999 and 2000. A subsistence setnet fishery also exists in the area, but is not required to be observed under the AMMOP.

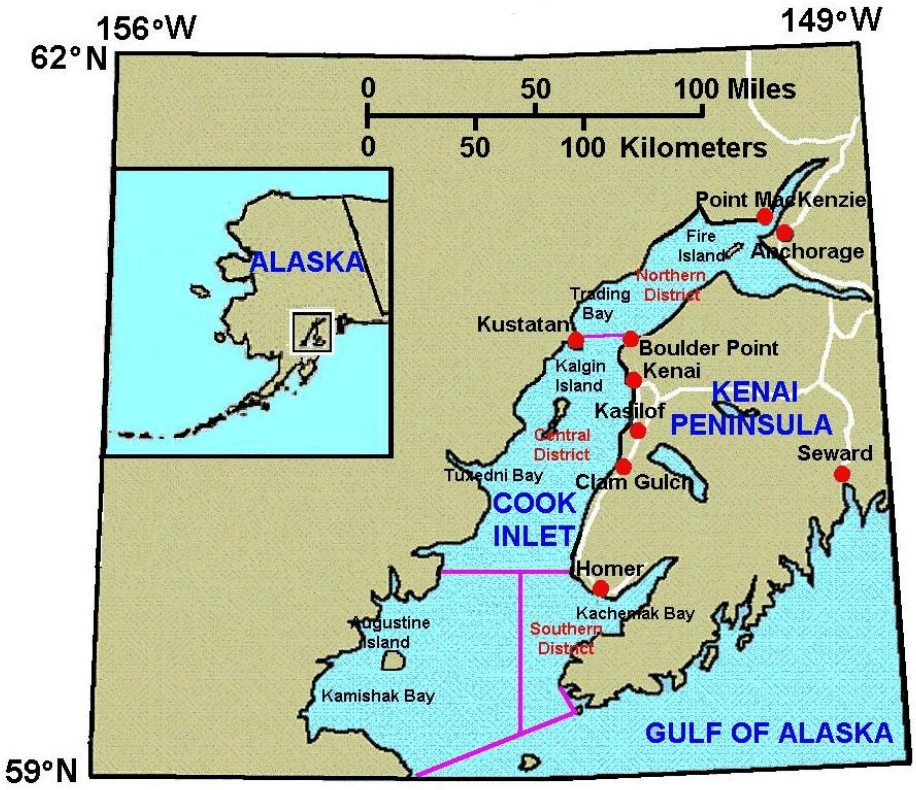


Figure 1 The location of the Cook Inlet salmon setnet and driftnet fisheries. Setnet fishing takes place in the Northern, Central and Southern Districts, while driftnet fishing only takes place in the Central District. There is no fishing around Kamishak Bay and Augustine Island in the southwest.

The salmon gillnet fisheries are the primary commercial fisheries in the Upper Cook Inlet. Other commercial fisheries in the Inlet include purse seining for pink and chum salmon, and herring and razor clam fishing, with the purse seining being the most important commercial fishery in the Lower Cook Inlet. The area is also important for recreational fishing and many sport fishers come to Cook Inlet area during the summer to fish for salmon. Their primary destination is the Kenai River and the main fish of interest is king salmon.

ADFG is the agency responsible for the management of the gillnet fisheries. The agency divides Cook Inlet into the Upper Cook Inlet and Lower Cook Inlet commercial salmon management areas. There are two management area offices, one in Kenai-Soldotna for the Upper Cook Inlet and one in Homer for the Lower Cook Inlet. ADFG regulates the fisheries as three management units, which are the Upper Cook Inlet driftnet fishery, the Upper Cook Inlet setnet fishery, and the Lower Cook Inlet setnet fishery. For management purposes, the Upper Cook Inlet Districts are divided further into subdistricts, as shown in Figure 2, with a further division into the statistical areas that are shown in Figure 3. Similarly, the Lower Cook Inlet setnet fishery is divided into subdistricts

with corresponding statistical areas, as shown in Figure 4. In the Marine Mammal Protection Act categorization of these fisheries, the Upper and Lower Cook Inlet setnet fisheries are jointly referred to as the Cook Inlet setnet fishery.

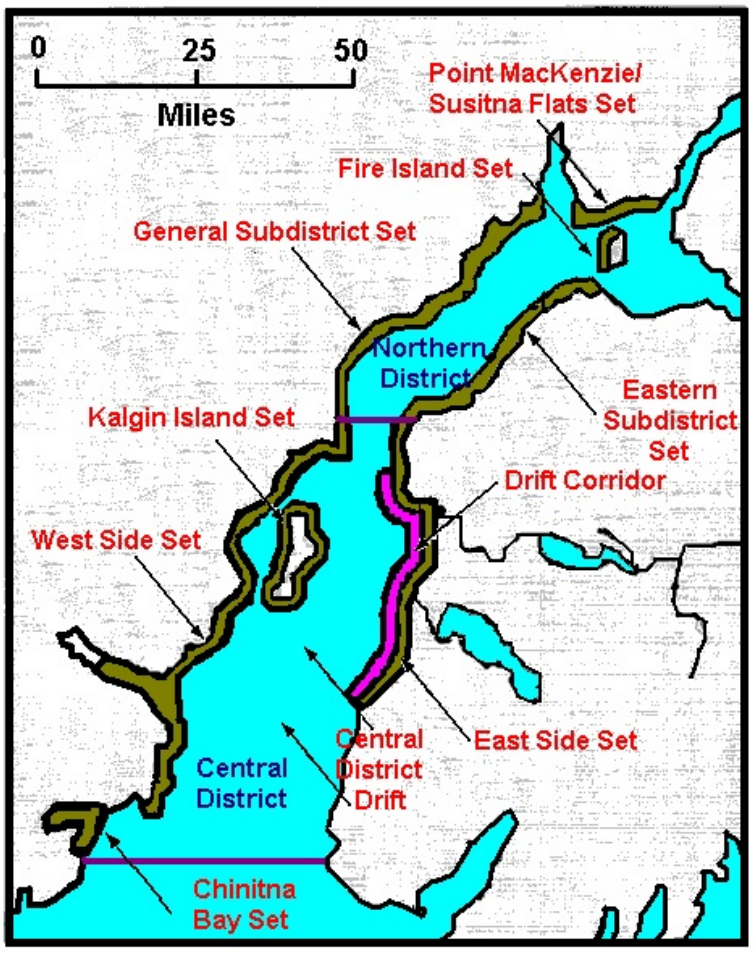


Figure 2 Fishing subdistricts names in the Upper Cook Inlet. There is setnet fishing in the Northern and Central Districts, and driftnet fishing in the Central District only in the drift corridor and in the middle waters.

The fisheries are limited entry, state-managed, inshore, salmon gillnet fisheries. Fishing occurs each year within state waters, primarily from June to the end of September. Fishing opener schedules are laid out by district in the ADFG Commercial Fishing Regulations for Cook Inlet. In the Upper Cook Inlet notices of fishing openers are posted weekly and announced on regular radio channels some time before each opener. There are usually two regular openers a week of 12 hours each, but these are sometimes extended by Emergency Order during the last few hours of the opener. The fishing effort can change dramatically at any time because of alterations in management policy, the salmon run strength, the price, and strikes within the industry. By contrast, there is little active management during the fishing season in the Lower Cook Inlet.

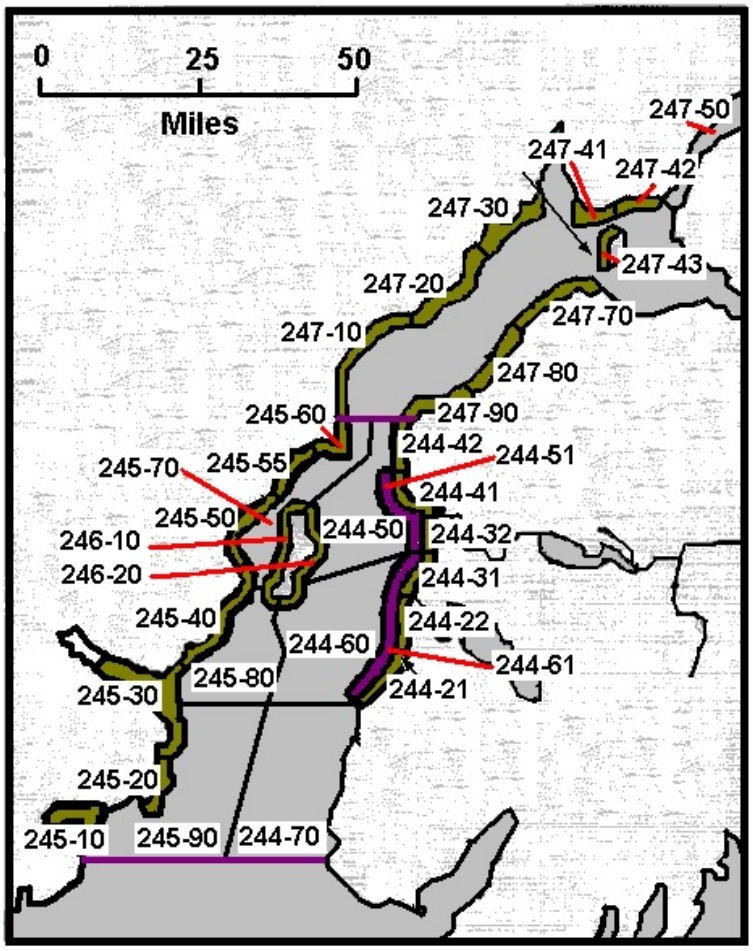


Figure 3 Statistical area codes for the Upper Cook Inlet setnet and driftnet fisheries, 1999-2000. The statistical areas starting with 247 are all setnet fisheries in the Northern District. The statistical areas starting 246, 245 and 244 are in the Central District. Setnet and driftnet fishing occurs in area 245-10, and driftnet fishing occurs in areas 244-50, 244-60, 244-70, 244-51, 244-61, 245-70, 245-80, and 245-90. The areas 244-51 and 244-61 form the Drift Gillnet Corridor, which is also labeled 244-55.

The Setnet Fishery

The Cook Inlet commercial setnet fishery usually begins early in June and runs through until September or October. Typically the Northern and Central District setnet fishery is open for two 12 hour periods each week during daylight hours, but there are often extensions. The Southern District usually fishes two 48 hour periods per week, with one subdistrict having this period extended after July 4. The majority of the effort occurs in the Northern District and the upper part of the Central District. Fishing effort in the Northern District generally peaks between late June and mid-August, while the fishing effort in the Central District peaks from July to mid-August. The fishery had approximately 740 active permit holders in 1999 and 2000.

Setnets are stationary surface-hanging multifilament nets that are staked, anchored, or otherwise fixed in place. Nets can be up to 35 fathoms (210 feet) in length, but a permit holder is allowed to fish three or four nets providing that the total length does not exceed 105 fathoms. The nets are usually set perpendicular to the shore in the path of salmon moving along rivers or the ocean shoreline. Most nets are attached to the shore but in some areas nets are anchored and set offshore. Small skiffs are used to collect fish picked from the net and to reach offshore sites. Nets can be picked in sections allowing them to effectively be fished for the entire period. Nets may be picked continuously or according to the tides, catch, and stamina of the crew. The crew may take shifts tending the nets with usually one to three crew per shift. Some sites are located in remote areas far from roads or accommodations, and are often reachable only by boat, aircraft, or all-terrain vehicles. Most fish are delivered to shore-based processors by land vehicles, aircraft or tenders. Permit holders often live near the setnet site for the season, many in a small cabins or wall tents.

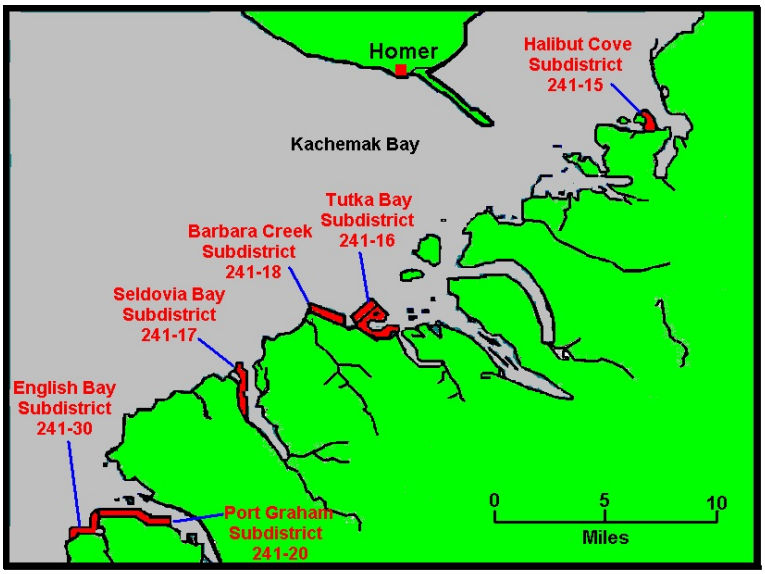


Figure 4 The subdistricts for the Lower Cook Inlet setnet fishery 1999-2000, with the corresponding statistical area numbers.

The Driftnet Fishery

The driftnet fishery usually runs from June 25 until August 9. Currently driftnet fishing only occurs in the entire Central District areas for the two regular 12 hour openers on Mondays and Thursdays, with all extra fishing restricted to the drift corridor that is shown on Figure 2. Also, according to the fishery management plan, three regular periods during the season must also be restricted to the drift corridor, although these restrictions can be relaxed for two of these three periods under conditions that are related to sockeye salmon abundance and achieving escapement goals for other species. The fishery had approximately 585 permit holders in 1999 and 2000.

Between openers the driftnet fleet primarily anchors in the mouth of the Kenai River, near the mouth of the Anchor River, or in the ports of Kasilof, Ninilchik, and Homer. The fishing effort peaks in mid to late July while the fleet fishes for sockeye. The productive driftnet fishing season is relatively short in Cook Inlet and many boats also fish other areas before and after the salmon driftnet season. Driftnet fishing accounts for approximately 60% of the average annual salmon harvest for the region.

The driftnet vessels deploy and retrieve a gillnet from either the stern or bow of the vessel. The net is usually 150 fathoms long, although sometimes shorter than this. Primarily stern picking is used although there are bow pickers in the fleet. The net is suspended from floats and stays attached to the vessel as it soaks. The duration of sets can vary from 20 minutes to four or more hours, depending on fishing conditions and other variables, with between four and 20 sets per day. In general, fishing only occurs during daylight hours, and on long openers fishing is stopped from about 11 pm until early the next morning.

Because driftnet openers are short, fishers will often deliver their catch to fish processors in local ports, although sometimes there are tenders on the fishing grounds to collect the fish. Vessels range in size from 25 - 40 feet, with two to four bunks, a head, and a small galley, to accommodate crews of one to two fishermen for the entire opener.

Potential Marine Mammal Interactions

The Cook Inlet set and drift gillnet fisheries were originally placed into Category II (occasional serious injury or mortality of marine mammals) under the Marine Mammal Protection Act, based on a logbook reporting program in operation during 1991-93. As noted above, the AMMOP was conducted in Cook Inlet in 1999 and 2000 partly because the status of the Cook Inlet stock of beluga whales (*Delphinapterus leucas*) was in the process of being reviewed under both the Marine Mammal Protection Act and the Endangered Species Act because of the declining numbers.

Apart from beluga whales, the marine mammal stocks that had been documented to interact with the Cook Inlet fisheries are the Gulf of Alaska stock of the harbor porpoise (*Phocoena phocoena*), the Alaska stock of Dall's porpoise (*Phocoenoides dalli*), the western United States stock of the Steller sea lion (*Eumetopias jubatus*), and the Gulf of Alaska stock of the harbor seal (*Phoca vitulina richardsi*) (Federal Register, 2006).

A Minke whale (*Balaenoptera acutorostrata*) was observed to be entangled in nets in the Upper Cook Inlet driftnet fishery in 2000. Mike whales are not listed as depleted under the Marine Mammal Protection Act, or as threatened or endangered under the Endangered Species Act, and there have been no other incidental takes of minke whales in this fishery. Minke whales are common off the coast of Alaska, with minimal mortalities related to human activities. Therefore, it is not considered to be a strategic stock. Currently there is no estimate available of the population size, and no PBR has been calculated.

The estimate of the population size of the Cook Inlet beluga whales from a 2004 aerial survey is 366, with a coefficient of variation (CV = standard error/estimated population size) of 0.20. Using a minimum population size of N_{min} = 310, a maximum yearly rate of increase of R_{max} = 0.04, and a recovery factor of F_R = 0.3, the NMFS has determined that the PBR for this species should be 326 x 0.5 x 0.04 x 0.3 = 1.86 (NMFS, 2006a). Currently the stock is listed as depleted under the Marine Mammal Protection Act. There has been a recent announcement of a reduction in the estimated population size to 278 (NMFS, 2006b).

The latest estimate of the population size for the Gulf of Alaska stock of harbor porpoise is 30,506, with a CV of 0.214, from aerial surveys in 1998. For this stock the parameters used for the PBR are N_{min} = 25,536, R_{max} = 0.04, and F_R = 0.5, so that the PBR is 25,536 x 0.5 x 0.04 x 0.5 = 255 (Angliss and Outlaw, 2005, p. 137). At present there is no reliable information about trends in abundance for the stock, which is therefore considered to have an unknown population status under the Marine Mammal Protection Act.

The currently used population size estimate for the Alaska stock of Dall's porpoise is 83,400, with a CV of 0.097. This is based on vessel surveys from 1987 to 1993, with a correction for vessel attraction behavior. More recent survey results will soon be used to produce a new estimate. For this stock N_{min} = 76,874, R_{max} = 0.04, and F_R = 1.0, so that the PBR is currently 76,874 x 0.5 x 0.04 x 1.0 = 1537 (Angliss and Outlaw, 2005, p. 146). The stock is not listed as depleted under the Marine Mammal Protection Act.

A minimum population size estimate for the western U.S. stock of Steller sea lions based on aerial surveys of non-pups in 2004 and counts of pups at rookeries and haul out sites from 2004 to 2005 is 38,988. Using this value for N_{min}, R_{max} = 0.12, and F_R = 0.1, the PBR is 38,513 x 0.5 x 0.12 x 0.1 = 234 (NMFS, 2006c). The stock is listed as endangered under the Endangered Species Act and depleted under the Marine Mammal Protection Act.

The estimated population size of the Gulf of Alaska stock of the harbor seal is 45,975 with a CV of 0.04. Based on N_{min} = 44,453, R_{max} = 0.12, and F_R = 0.5, the PBR is currently 44,453 x 0.5 x 0.12 x 0.5 = 1,334 (NMFS, 2006d). The stock is not listed as depleted under the Marine Mammal Protection Act.

Potential Marine Bird Interactions

Potential marine bird interactions are of concern in the setnet and driftnet fisheries, because of the high numbers of marine birds in Cook Inlet in the summer, perhaps as high as two to three million birds. Densities of up to 300 birds/km^2 have been reported. In particular, there is very high primary productivity around Kachemak Bay on the eastern side of Lower Cook Inlet, leading to high concentrations of birds. The concern with marine birds is also related to a regime change in the oceanic conditions in the early 1980's that reduced the availability of food for some bird species, plus the effects of the Exxon Valdez

oil spill in 1989, which had many adverse effects on the availability of food (Agler *et al*., 1995, 1998; Speckman, 2002).

Yearly surveys for the years 1995 to 1999 in the Lower Cook Inlet showed short-tailed shearwaters (*Puffinus tenuirostris*) to be the most commonly sighted species (48.2% of records). Other species of in the order of their frequency of sightings were tufted puffins (*Fratercula cirrhata*, 13.6%), black-legged kittiwakes (*Rissa tridactyla*, 9.3%), common murres (*Uria aalge*, 8.0%), *Brachyramphus* murrelets (6.2%), phalaropes (mainly red-necked phalaropes, *Phalaropus lobatus*, 3.0%), fork-tailed storm-petrels (*Oceanodroma furcata*, 2.7%), northern fulmars (*Fulmarus glacialis*, 2.3%), glaucous-winged gulls (*Larus glaucescens*, 1.8%), horned puffins (*Fratercula corniculata*, 1.3%), and pigeon guillemots (*Cepphus columba*, 1.1%). The remaining 2.5% sightings were of a number of species each contributing less than 1% of to the total (Speckman, 2002).

3. Fishing Effort and Observer Coverage

The method used to determine the observer effort for the Cook Inlet setnet and driftnet fisheries in 1999 and 2000 identified the minimum number of fishing days that need to be observed to ensure that if no mortalities or serious injuries are observed for a marine mammal stock of concern then there is 95% confidence that the actual level of mortality or serious injury is not greater than the PBR level for that stock (Wade, 1999). The calculations were made for this purpose using the harbor porpoise because this species is thought to interact with all the Alaskan gillnet fisheries at detectable rates.

When the Cook Inlet observer program for 1999 and 2000 was being planned in 1998 the yearly PBR for the harbor porpoise was 71 (Hill and DeMaster , 1999, p. 99). It was changed to 166 in 2000 (Ferrero *et al*., 2000, p. 99) and to 255 in 2003 (Angliss and Lodge, 2004, p. 111). Based on the PBR of 71 and past fishing effort data collected by the ADFG, it was determined that it required 600 observed fishing days for the setnet fishery to ensure a probability of 0.95 of observing some harbor porpoise incidental take if the total incidental take of this species is equal to the PBR of 71. Similarly, for the driftnet fishery it was determined that it required 360 observed fishing days to ensure a probability of 0.95 of observing some harbor porpoise incidental take if the total incidental take of the species is equal to the PBR of 71.

These target numbers of observed fishing days apply if the fisheries are sampled for one year. If sampling is spread out over two years then the total fishing effort and the PBR are doubled but this has almost no effect on the probabilities of observing some incidental take of harbor porpoise during the two years. For this reason the target level of coverage was 300 fishing days per year for the Cook Inlet setnet fishery and 180 fishing days for the Cook Inlet driftnet fishery. This required the assumption that the conditions in the fishery with regard to fishing effort and incidental take were stable over the two sampled years.

The target coverage levels were not adhered to. In 1999 there were 427 observed permit-days in the setnet fishery (399 in Upper Cook Inlet and 28 in Lower Cook Inlet), and 100 observed permit-days in the driftnet fishery. The target permit-days were therefore exceeded in the setnet fishery at the expense of the target days in the driftnet fishery. This was due to logistic difficulties in sampling enough driftnet days through the season, for example because of difficulty in getting observers on boats. In 2000 there were 303 observed permit-days in the setnet fishery (269 in Upper Cook Inlet and 34 in Lower Cook Inlet), and 141 sampled permit-days in the driftnet fishery. This was on target for the setnet fishery, but still short of the target for the driftnet fishery.

Table 1 shows the open periods for the Upper Cook Inlet driftnet fishery in 1999 and 2000, and the potential fishing effort in terms of permit-hours (the number of permits operating times the open hours available). Because of the large number of districts, only a summary of the open periods in the Upper Cook Inlet setnet fishery in 1999 and 2000 is provided in Table 2, with fuller data provided in Appendix C. Table 3 provides a summary of the open periods for the same two years in the Lower Cook Inlet setnet fishery.

The potential fishing efforts that are shown in Tables 1 to 3 are not the actual fishing effort that took place, as the individual fishers did not necessarily fish for the entire open periods. Allowances for this factor are discussed in the following sections on the estimation of incidental take numbers for the entire fisheries.

4. Ratio Estimation of Total Incidental Take Numbers

For the estimation of the total marine bird and mammal incidental take numbers, the Upper Cook Inlet driftnet fishery, the Upper Cook Inlet setnet fishery, and the Lower Cook Inlet setnet fishery are treated separately. The method used in each case is ratio estimation, as described in detail by Cochran (1977, Chapter 6). Estimates are needed separately for animals entangled in nets but released alive (without serious injuries), and those released either dead or seriously injured. It is the second group that is most important for management purposes.

The principle behind ratio estimation is quite simple. For each of n sample units (here a permit observed for one day) there is a measure of sampling effort X (here the observed fishing time in hours), and the value of a variable of interest Y (here the number of birds or mammals of a certain type caught in the net or nets). The incidental take per hour is then estimated by

$$r = \bar{y} / \bar{x}, \qquad (1)$$

where $\bar{y}$ is the mean of Y and $\bar{x}$ is the mean of X over the n sample units.

Table 1. The potential driftnet effort in 1999 and 2000 based on the maximum number of permits being fished on each open day. Except as noted in 2000, All fishing areas are as shown in Figure 3 (statistical areas 244-50 to 244-70 and 245-70 to 245-90). The potential fishing effort is equal to the number of permits times the open hours.

			Statistical Area Open Hours			Total	Potential
Year	Date	Permits	All	244-61	244-55	Hours	Effort
1999	28-Jun	225	12			12	2700
	01-Jul	361	12			12	4332
	03-Jul	84		15		15	1260
	05-Jul	421	12			12	5052
	08-Jul	407	12	4		16	6512
	09-Jul	112		10		10	1120
	11-Jul	189		13		13	2457
	12-Jul	256			12	12	3072
	15-Jul	475	12			12	5700
	19-Jul	477	12			12	5724
	22-Jul	444			12	12	5328
	27-Jul	356		3	14	17	6052
	28-Jul	47		6		6	282
	29-Jul	431	12		3	15	6465
	30-Jul	130		9	7	16	2080
	31-Jul	153		17		17	2601
	01-Aug	188			18	18	3384
	02-Aug	348	12		5	17	5916
	03-Aug	94			17	17	1598
	04-Aug	137			17	17	2329
	05-Aug	256	12		2	14	3584
	09-Aug	118	12			12	1416
	Totals	5709	120	77	107	304	78964
2000	26-Jun	194	12			12	2328
	29-Jun	262	12			12	3144
	03-Jul	414	12			12	4968
	06-Jul	458	12			12	5496
	10-Jul	262			12	12	3144
	12-Jul	132		13		13	1716
	13-Jul	477	12		4	16	7632
	15-Jul	304		13		13	3952
	16-Jul	87		7		7	609
	17-Jul *	431	12		4	16	6896
	18-Jul	144			9	9	1296
	20-Jul	474	12			12	5688
	31-Jul *	161	12			12	1932
	03-Aug *	59	12			12	708
	07-Aug *	30	12			12	360
	Totals	3889	120	33	29	182	49869

*Fishing was restricted to the statistical areas on the west side of the Central District on these days.

Table 2. Potential setnet effort in the Upper Cook Inlet fishery for 1999 and 2000 based on the total hours that different statistical areas were open[1].

	Potential Fishing Effort	
Statistical Area[2]	1999	2000
244-21	16780	6696
244-22	15162	6255
244-31	15850	6705
244-32	8872	2212
244-41	6688	2103
244-42	3644	1165
245-10	84	0
245-20	702	0
245-30	4637	7366
245-40	448	36
245-50	360	312
245-55	480	564
245-60	192	60
246-10	2088	1884
246-20	492	396
247-10	276	568
247-20	2784	2404
247-30	1200	1208
247-41	480	508
247-42	444	848
247-43	360	500
247-70	1668	1680
247-80	960	528
247-90	720	968
Total	85371	44966

[1]The potential fishing effort is the product of the number of permits operating and the number of hours the area was open, summed over all openings.
[2]The statistical areas are shown in Figure 3.

Table 3. Potential setnet fishing effort in the Lower Cook Inlet in terms of the permits times the number of open hours in 1999 and 2000. The statistical areas are shown in Figure 4.

	Statistical Area						
	241-15	241-16	241-17	241-18	241-20	241-30	Total
Permits in 1999	5	6	7	5	0	0	
Potential effort in the Week Starting on the Sunday Shown in 1999							
30-May	72	72	72	72	0	0	
6-Jun	96	96	96	96	0	0	
13-Jun	96	96	96	96	0	0	
20-Jun	96	96	96	96	0	0	
27-Jun	96	96	96	96	0	0	
4-Jul	120	96	96	96	0	0	
11-Jul	120	96	96	96	0	0	
18-Jul	120	96	96	96	0	0	
25-Jul	120	96	96	96	0	0	
1-Aug	120	96	96	96	0	0	
8-Aug*	48	48	48	48	0	0	
Total Hours	1104	984	984	984	0	0	
Total Permit Hours	5520	5904	6888	4920	0	0	23232
Permits in 2000	5	5	4	6	2	3	
Potential Effort in the Week Starting on the Sunday Shown in 2000							
28-May	48	48	48	48	48	48	
04-Jun	96	96	96	96	96	96	
11-Jun	96	96	96	96	96	96	
18-Jun	96	96	96	96	0	0	
25-Jun	96	96	96	96	0	0	
02-Jul	120	96	96	96	0	0	
09-Jul	120	96	96	96	0	0	
16-Jul	120	96	96	96	0	0	
23-Jul	120	96	96	96	0	0	
30-Jul	120	96	96	96	0	0	
06-Aug	120	96	96	96	0	0	
13-Aug	120	96	96	96	0	0	
20-Aug*	48	48	48	48	0	0	
Total Hours	1320	1152	1152	1152	240	240	
Permit Hours	6600	5760	4608	6912	480	720	25080

*Although the fishery season remained open until 30 September by regulation, fishing did not continue that long. In 1999 the last delivery of fish was on 11 August, and in 2000 the last delivery was on 23 August. The hours shown for these last fishing weeks reflect this curtailment of the fishing effort by the fishers themselves.

Providing that the sampling fraction n/N is small, where N is the total number of possible sample units, the variance of r can be estimated by

$$\mathrm{Var}(r) = \left[\sum_{i=1}^{n} (y_i - r\,x_i)^2 / (n - 1) \right] / (n\bar{x}^2), \qquad (2)$$

where x_i is the observed fishing hours and y_i is the observed incidental take on the ith sample unit. The standard error of r is then estimated by $SE(r) = \sqrt{\mathrm{Var}(r)}$.

To estimate the total incidental take of the bird or mammal being considered, the catch per hour is multiplied by the estimated total amount of effort E for the fishery (here the total fishing time for all of the permits). Thus the estimated total incidental take is

$$B = r \cdot E. \qquad (3)$$

If E has an estimated variance of Var(E) and an estimated standard error of $SE(E) = \sqrt{\mathrm{Var}(E)}$ then Goodman's (1960) equation for the estimated variance of B becomes

$$\mathrm{Var}(B) = r^2\mathrm{Var}(E) + E^2\mathrm{Var}(r) - \mathrm{Var}(E).\mathrm{Var}(r). \qquad (4)$$

This estimator assumes that the sampling errors in E and r are uncorrelated, which will be reasonable providing that different data are used for the estimation of E and r. The estimated standard error of B is then $SE(B) = \sqrt{\mathrm{Var}(B)}$. However, if the total effort is known either exactly or with a negligible error then the standard error of B can be estimated by the simple equation

$$SE(B) = SE(r).E. \qquad (5)$$

In using the above equations with the Cook Inlet data it is not assumed that all of the effort on a sampled permit was always observed during the sample day. Instead, the observed effort is based on the hours covered, irrespective of whether this was or was not the total hours fished on the permit. However, it is assumed that all incidental take on the permit was recorded during the observed period. In particular, if there were several nets with a setnet permit it is assumed that all picks were observed with these nets during the observed hours.

The Upper Cook Inlet Driftnet Fishery

There were n = 100 permit-days sampled in the Upper Cook Inlet driftnet fishery in 1999. The observed incidental take was of the common murre (*Uria aalge*, three released dead), gulls (two released alive, without serious injuries), and harbor porpoises (two released alive, without serious injuries). The mean observed fishing time for a permit was 8.44 hours, with a total of 844.3 hours observed.

The statistical fishing area codes were generally not recorded in 1999, and the level of incidental take was very low overall. For these reasons the total estimated incidental take has been calculated for the whole of the driftnet fishery, rather than for the individual statistical areas. On this basis, for the common murre the mean sample effort per permit was $\bar{x} = 8.44$ hours, and the mean incidental take per permit was $\bar{y} = 0.030$. This leads to an estimate from equation (1) of

$$r_{COMU} = 0.030/8.44 = 0.0036$$

individual birds caught in the nets per fishing hour. From equation (2) it is also found that

$$SE(r_{COMU}) = 0.0050.$$

Carrying out similar calculations for gulls and harbor porpoises leads to the estimates $r_{gull} = 0.0024$ gulls per hour with $SE(r_{gull}) = 0.0041$, and $r_{HAPO} = 0.0024$ porpoises per hour with $SE(r_{HAPO}) = 0.0039$.

The total potential driftnet fishing effort for all areas for the whole of 1999 is shown in Table 1 to be 78,964 hours. However, the actual fishing effort was lower than this because permits were not generally fished for entire open periods. For example, with the 12 hour open periods the mean fishing time for the observed permits was only about nine hours. Furthermore, inspection of the data suggests that the actual fishing time varied with the length of the open period and also with the time within the fishing season.

To examine the effect of the time in the season and the length in hours of the open period, the data on the total fishing time from the 100 observed sample units were used as the dependent variable in a multiple regression relating this time to the day in the season and the length of the opener. The form of regression equation used for this purpose was

$$FT = \beta_0 + \beta_1(DS) + \beta_2(DS^2) + \beta3(OT) + \beta_4(OT^2) + \beta5(DS.OT) + \varepsilon, \qquad (6)$$

where FT is the fishing time in hours, DS is the day in the season relative to 1 June, OT is the open time in hours, the β values are constants to be estimated, and ε represents the random element in an observed fishing time.

The fitted equation only accounted for 16.9% of the variation in FT, but this is very highly significant ($F = 5.02$ with 5 and 94 df, $p < 0.001$). Table 4 shows the estimated coefficients, with their standard errors and significance levels. Although the coefficients of OT and OT^2 are not significant at the 5% level, the coefficient of the product term is significant. Therefore the terms for OT have been left in the equation.

Table 4. The estimated regression equation relating the actual fishing time to the day in the season and the hours of opening, for the driftnet fishery in 1999.

Parameter	Estimate	Standard Error	T-Value	P-Value
Constant	1.23920	17.28500	-	-
DS	-0.00093	0.13654	-0.01	0.995
DS^2	-0.00320	0.00112	-2.87	0.005
OT	1.20257	2.48328	0.48	0.629
OT^2	-0.07392	0.09065	-0.82	0.417
DS.OT	0.02003	0.00890	2.25	0.027

Using the fitted equation, the fishing mean fishing time per permit, and hence the total fishing time for all permits can be estimated, as shown in Table 5. The mean fishing times per day estimated from the regression all appear reasonable except for the six hour open period on 6 July, where the mean fishing time is estimated as only 1.94 hours from the regression equation. As there were no observations on this day, the figure of 1.94 represents an extrapolation of the observer results that are available, and a value of 6.00 hours has been used instead. This estimated total fishing effort is then E = 51,586.6 hours, which is about 65% of the potential effort from the open hours of the fishery. The observers covered a total of 844.3 hours of fishing. This represents a coverage rate of 1.6% of the estimated total fishing effort.

Bootstrap resampling (Manly, 1997) was used to estimate the variance of E. To this end the residuals from the fitted regression equation(6) were randomly resampled with replacement and added to the predicted values from the equation. This then produced a bootstrap set of data which was used to refit the regression equation and then recalculate the values in Table 5. This process was repeated 5000 times to produce 5000 bootstrap estimates of the total effort. The variance of these estimates was 1,224,784.9, which is then the bootstrap value for the standard deviation of E for use in equation (4). The standard deviation of E is then estimated as 1106.7, indicating a small relative error in the estimation of E, with a CV of 0.021. For all bootstrap sets of data the mean fishing hours on 28 July was set equal to 6.00, as it was for the real data. The calculations were carried out using Resampling Stats for Excel (Blank, 2004).

Using equation (4) and the results presented above, it is now possible to estimate the standard error associated with the estimates of total incidental take. The estimates and their standard errors are provided in Table 6. As only two or three animals were observed for the incidental take of different species, the estimated variances and standard errors of the incidental take rates per hour are not very reliable. Consequently, the standard errors and CVs shown in Table 6 should only be viewed as rough approximations for the true values.

Table 5. Estimation of the total number of hours of driftnet fishing in 1999 based on the regression model of Table 4, which related the actual mean fishing hours for a permit to the day in the season and the number of open hours on that day.

Date	Day in Season	Permits	Open Hours	Permit Hours	Mean Fishing Hours[1]	Total Fishing Hours
28-Jun	28	225	12	2700	9.22	2074.2
01-Jul	31	361	12	4332	9.37	3382.7
03-Jul	33	84	15	1260	9.04	759.6
05-Jul	35	421	12	5052	9.48	3992.3
08-Jul	38	407	16	6512	9.08	3693.7
09-Jul	39	112	10	1120	8.78	983.1
11-Jul	41	189	13	2457	9.63	1821.0
12-Jul	42	256	12	3072	9.43	2414.8
15-Jul	45	475	12	5700	9.32	4424.9
19-Jul	49	477	12	5724	9.07	4326.1
22-Jul	52	444	12	5328	8.82	3914.9
27-Jul	57	356	17	6052	9.27	3300.8
28-Jul	58	47	6	282	6.00[2]	282.0
29-Jul	59	431	15	6465	9.17	3952.6
30-Jul	60	130	16	2080	9.20	1196.3
31-Jul	61	153	17	2601	9.12	1395.2
01-Aug	62	188	18	3384	8.92	1677.3
02-Aug	63	348	17	5916	9.00	3133.4
03-Aug	64	94	17	1598	8.94	840.1
04-Aug	65	137	17	2329	8.86	1214.3
05-Aug	66	256	14	3584	8.08	2069.7
09-Aug	70	118	12	1416	6.10	719.3
Totals		5709	304	78964		51568.6

[1]As estimated from the fitted regression model.
[2]An unrealistic estimate of 1.94 hours was replaced by the open hours.

Table 6. Estimated total incidental take from the Upper Cook Inlet driftnet fishery in 1999, together with standard errors (SE), coefficients of variation (CV) and whether the animals are released alive (without serious injuries) or dead.

Species	Incidental take	SE	CV
Common Murre (Dead)	182.6	257.8	1.41
Gulls (Alive)	121.7	211.4	1.73
Harbor Porpoises (Alive)	121.7	201.1	1.65

There were n = 141 permits sampled in the Upper Cook Inlet driftnet fishery in 2000. The observed incidental take was of one common murre (released alive, without serious injuries), two harbor porpoises (one released alive without serious injuries, and one that may have been dead), and a minke whale (released alive, without serious injuries). The mean observed fishing time was 7.41 hours, with a total of 1044.7 hours observed.

Information on the statistical areas where fishing took place was recorded in 2000. However, because of the low levels of observed incidental take the total estimated take has only been calculated for the whole of the driftnet fishery, rather than for the individual statistical areas. On this basis, for the common murre the mean sample effort per sample unit is $\bar{x}$ = 7.41 hours, and the mean incidental take per sample unit is $\bar{y}$ = 0.007. This leads to an estimate from equation (1) of

$$r_{COMU} = 0.007/7.41 = 0.0010$$

individual birds caught in the nets per fishing hour. From equation (2) it is also found that

$$SE(r_{COMU}) = 0.0017.$$

Carrying out similar calculations for live harbor porpoises, dead harbor porpoises, and minke whales leads to the exactly the same incidental take rate per hour for each of these types of incidental take. The estimated standard error of the incidental take rate is also 0.0017 except for live harbor porpoises, in which case the estimated standard error is 0.0018.

The total potential driftnet fishing effort for all areas for the whole of 2000 is shown in Table 1 to be 49,869 hours. However, as was the case in 1999, the actual fishing effort was lower than this because permits were not fished for entire open periods.

To examine the effect of the time in the season and the length in hours of the open period, the data on the total fishing time from the 141 observed sample units were used as the dependent variable (FT) in a multiple regression relating this time to the day in the season and the length of the opener, in the same was as way done for 1999. The fitted equation only accounted for 8.6% of the variation in FT, but this was highly significant ($F = 3.62$ with 5 and 135 df, $p = 0.004$). However, the coefficients of DS, DS^2 and DS.OT were not significant. These terms were therefore removed to produce a reduced equation in which all the coefficients are significant. This equation accounts for 9.2% of the variation in the data and is very highly significant ($F = 5.75$ with 3 and 137 df, $p < 0.001$). Table 7 shows the estimated coefficients, with their standard errors and significance levels.

Using the fitted equation, the fishing mean fishing time per permit, and hence the total fishing time for all permits can be estimated, as shown in Table 8. The mean fishing times per day estimated from the regression were all apparently reasonable except for the days with seven and nine hour openings. There were no observations on these days, so that the regression estimates are extrapolations outside the range of the data used to estimate the equation. The regression estimates of the mean number of fishing hours is 42.17 hours for the seven hour opener, and 23.11 hours for the nine hour opener. Both values are clearly absurd. These values were therefore replaced by the open times.

Table 7. The estimated regression equation relating the actual driftnet fishing time to the day in the season and the hours of opening, for 2000.

Parameter	Estimate	Standard Error	T-Value	P-Value
Constant	162.7630	70.81380	-	-
DS	-0.06814	0.02256	-3.02	0.003
OT	-22.46900	10.33540	-2.17	0.031
OT^2	0.81283	0.36899	2.20	0.029

With these adjustments, the estimated total fishing effort is E = 28,870.9 hours, which is about 65% of the potential effort from the open hours of the fishery, and close to the percentage for 1999. The observers covered a total of 1044.7 hours of fishing. This represents a coverage rate of 3.6% of the estimated total fishing effort.

Table 8. Estimation of the total number of hours driftnet fishing in 2000 based on the regression model of Table 7, which related the actual mean fishing hours for a permit to the day in the season and the number of open hours on that day.

Date	Day in Season	Permits	Open Hours	Permit Hours	Mean Fishing Hours[1]	Total Fishing Hours
26-Jun	26	194	12	2328	8.41	1631.7
29-Jun	29	262	12	3144	8.21	2150.0
03-Jul	33	414	12	4968	7.93	3284.5
06-Jul	36	458	12	5496	7.73	3540.0
10-Jul	40	262	12	3144	7.46	1953.7
12-Jul	42	132	13	1716	5.17	682.7
13-Jul	43	477	16	7632	8.41	4013.0
15-Jul	45	304	13	3952	4.97	1510.2
16-Jul	46	87	7	609	7.00[2]	609.0
17-Jul	47	431	16	6896	8.14	3508.5
18-Jul	48	144	9	1296	9.00[2]	1296.0
20-Jul	50	474	12	5688	6.78	3211.5
31-Jul	61	161	12	1932	6.03	970.1
03-Aug	64	59	12	708	5.82	343.5
07-Aug	68	30	12	360	5.55	166.5
Totals		3889	182	49869		28870.9

[1]As estimated from the regression model, except as indicated.
[2]The mean fishing times for openings of less than 12 hours were set equal to the open hours because the fitted regression model gave impossible extrapolated values.

Bootstrapping was used to estimate the variance associated with the estimate E, using the same approach as was used for the 1999 data. This resulted in an estimated variance of Var(E) = 612,462.8 and hence an estimated standard error of SE(E) = 782.6. The

relative error in estimating E should therefore be small, with the estimated CV being only 0.027.

Using equations (4) the estimates and their standard errors shown in Table 9 were calculated. As only one animal was observed for the incidental take of different types of animals, the estimated variances and standard errors of the incidental take rates per hour are not very reliable. Consequently, the standard errors and CVs shown in Table 9 should be viewed as being only rough approximations for the true values.

Figure 5 shows the approximate locations where incidental take took place for the driftnet fishery. Overall the most common incidental take was the common murre. The colony locations are shown on the figure for this bird species.

Table 9. Estimated total incidental take from the Upper Cook Inlet driftnet fishery in 2000, together with standard errors (SE), coefficients of variation (CV) and whether the animals are released alive (without serious injuries) or dead.

Species	Incidental take	SE	CV
Common Murre (Alive)	31.2	55.0	1.76
Harbor Porpoises (Alive)	31.2	59.1	1.90
Harbor Porpoises (Dead)	31.2	55.1	1.77
Minke Whales (Alive)	31.2	55.8	1.79

The Upper Cook Inlet Setnet Fishery

There were 399 permit-days sampled in the Upper Cook Inlet setnet fishery in 1999. As statistical areas were generally not recorded, the assignment to areas was based on whether or not observations were recorded as being above latitude 59°46'N, which divides the Upper and Lower Cook Inlet fisheries. In some cases the latitude was not recorded but could be determined from the information on other records for the same sampled permit. There were four cases where it was not possible to determine whether the permit was in the Upper or Lower Cook Inlet fishery.

The incidental take observed in 1999 was of one gull (released alive, without serious injuries), and one common loon (released dead). For the calculation of the total incidental take of these species it was necessary to take into account the fact that a setnet permit will generally involve more than one net, and the observers recorded the information on one net at a time. To allow for this, the observer effort for a haul was calculated as the time observed divided by the total number of nets for the permit. For example, if a permit had three nets and one of these was observed for six hours then this was regarded as equivalent to observing the whole permit for 6/3 = 2 hours. On this basis the total observer effort was 499.9 permit hours, with an average of $\bar{x}$ = 1.25 hours per sampled permit.

For gulls and the common loon the average incidental take per sampled unit was $\bar{y}$ = 1/399 = 0.0025. Using equation (1) the incidental take per permit hour is therefore estimated as 0.0020 for both birds. Also, applying equation (2) gives an estimated standard error of 0.0020 for each bird.

From Table 2 the potential fishing effort in the Upper Cook Inlet setnet fishery was 85,371 permit hours in 1999. However, the observer data indicates that the actual fishing effort is less than this because typically whole open periods are not fished by the permit holders. There were 131 sampled permits where the observers were recorded as present for all of the hauls, and where the times of the start of the first set and the end of the last haul were recorded. These sampled permits have a mean fishing time of 8.14 hours.

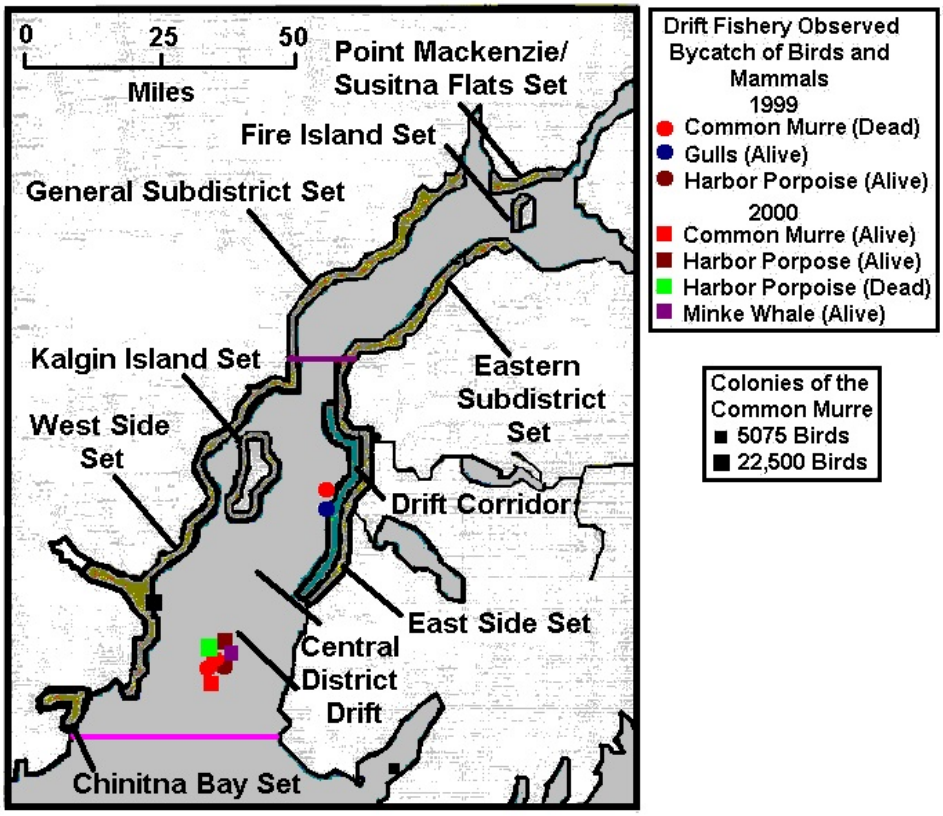


Figure 5. Approximate locations where incidental take occurred with the driftnet fishery, with the location of the two common murre colonies in Cook Inlet also indicated.

A regression of the fishing times in hours (FT) against the day in the season (DS) and the maximum opening time on that day (OT), with square and product terms as in equation (6) was fitted to the data. This accounted for only 3.7% of the variation in the data, and was not quite significant at the 5% level ($F = 1.99$ with 5 and 125 df, $p = 0.084$). Furthermore, when applied to fishing days that were not observed the equation predicted some negative fishing times. For this reason the equation was not used to estimate the

total fishing effort. Instead it was assumed that the observed mean fishing time of 8.14 hours represents the typical fishing time for an opener. The total fishing effort can be calculated as 8.14 x 5455 = 44,410.4 permit hours, where 5455 is the total number of permit-days for the fishery in 1999 (Appendix C). On this basis the observer coverage was 1.1% of the entire fishery.

The estimated standard error associated with the observed mean fishing time of 8.14 hours is 0.32. The standard error for the estimated total permit hours is therefore 0.32 x 5455 = 1,729.2. The CV for the estimated total effort of 44,410.4 is then 0.039.

Using equations (3) and (4) the total incidental take of gulls in the Upper Cook Inlet setnet fishery is therefore estimated as B = 44,410.4 x 0.00020 = 88.8, with a standard error of 88.8, and the total incidental take of common loons is also estimated as 88.8 with a standard error of 88.8. As was the case for the incidental take estimates presented before, the standard errors are not reliable as they are based on only one individual captured for each type of bird. These estimates are summarized in Table 10.

Table 10. Estimated total incidental take from the Upper Cook Inlet setnet fishery in 1999, together with standard errors (SE), percentage coefficients of variation (CV) and whether the animals are released alive, without serious injuries or dead.

Species	Incidental take	SE	CV
Gull (alive)	88.8	88.8	100
Common Loon (Dead)	88.8	89.2	104

There were 269 permit-days sampled in the Upper Cook Inlet in 2000. In this year the statistical areas where fishing took place were recorded, although in some cases these did not correspond to listed open periods. However, because of the low level of incidental take, estimates of the total take have only been calculated for the entire fishery. The incidental take observed was of one marbled murrelet (released dead), one white-winged scoter (released dead), and one harbor seal (released alive, without serious injuries). There was also one gull with an unknown species that was found in a net and classified as "previously dead". This gull is assumed to have died before entering the net, and is therefore not included in the incidental take. The white-winged scoter was classified as "fresh dead, cause unknown" although it was found entangled in the net. In this case it is assumed that in fact the death was due to the entanglement.

As was the case for 1999, the observer effort was calculated taking into account the fact that a setnet permit will generally involve more than one net, and the observers recorded the information on one net at a time. Therefore, the observer effort for a haul was calculated as the time observed divided by the total number of nets for the permit. On this basis the total observer effort was 780.7 permit hours, with an average of $\bar{x}$ = 2.59 hours per sampled permit.

Because there was one individual observed for all three types of incidental take, the average incidental take per sampled unit was $\bar{y}$ = 1/269 = 0.0037. Using equation (1) the incidental take per permit hour is therefore estimated as 0.0014 for all types of incidental take. Also, applying equations (2) and (3) gives an estimated standard error of 0.0014 for each of these estimates.

From Table 2 the potential fishing effort in the Upper Cook Inlet setnet fishery was 44,966 permit hours in 2000. However, as was the case in 1999, the observer data indicates that the actual fishing effort is less than this because typically whole open periods are not fished by the permit holders. There were 104 sampled permits where the an observer was recorded as being present for all of the hauls, and where the times of the start of the first set and the end of the last haul were recorded. These sampled permits have a mean fishing time of 7.97 hours, with a range of individual times from 0.98 to 15.38 hours. The standard error associated with the mean is 0.32.

A regression of the fishing times in hours (FT) against the day in the season (DS) and the time on that day (OT), with square and product terms as in equation (6) was fitted to the data. This accounted for 24.9% of the variation in the data, and was very highly significant ($F = 7.83$ with 5 and 98 df, $p < 0.001$). However, as was the case with the similar regression equation fitted to the 1999 data, the equation did not produce sensible mean fishing times when it was applied to conditions that were not observed. In particular, it predicted fishing times longer than the open period for some 23 and 24 hour open periods in statistical area 245-30. For this reason the equation was not used to estimate the total fishing effort. Instead it was assumed that the observed mean fishing time of 7.97 hours represent the typical fishing time for an opener throughout the season. The total fishing effort can then be calculated as 7.97 x 3239 = 25,823.8 permit hours with a standard error of 0.32 x 3239 = 1047.0, where 3239 is the total number of permit-days for the fishery in 1999 (Appendix C). On this basis the observer coverage of 780.7 hours was 2.7% of the entire fishery.

Using equations (2) to (4) the total incidental take of marbled murrelets in the Upper Cook Inlet setnet fishery is therefore estimated as B = 25,823.8 x 0.0014 = 37.1, with a standard error of 37.2. Because there was one capture of each type of incidental take, the estimates and standard errors are the same in all cases, as shown in Table 11. As was the case for the incidental take estimates presented before, the standard errors are not reliable as they are based on only one individual captured for each type of incidental take.

Figure 6 shows the approximate locations where incidental take took place for the Upper Cook Inlet setnet fishery in 1999 and 2000.

Table 11. Estimated total incidental take from the Upper Cook Inlet setnet fishery in 2000, together with standard errors (SE), percentage coefficients of variation (CV) and whether the animals are released alive (without serious injuries) or dead.

Species	Incidental take	SE	CV
Marbled Murrelet (Dead)	37.1	37.2	1.00
White-winged Scoter (Dead)	37.1	37.2	1.00
Harbor Seal (Alive)	37.1	37.2	1.00

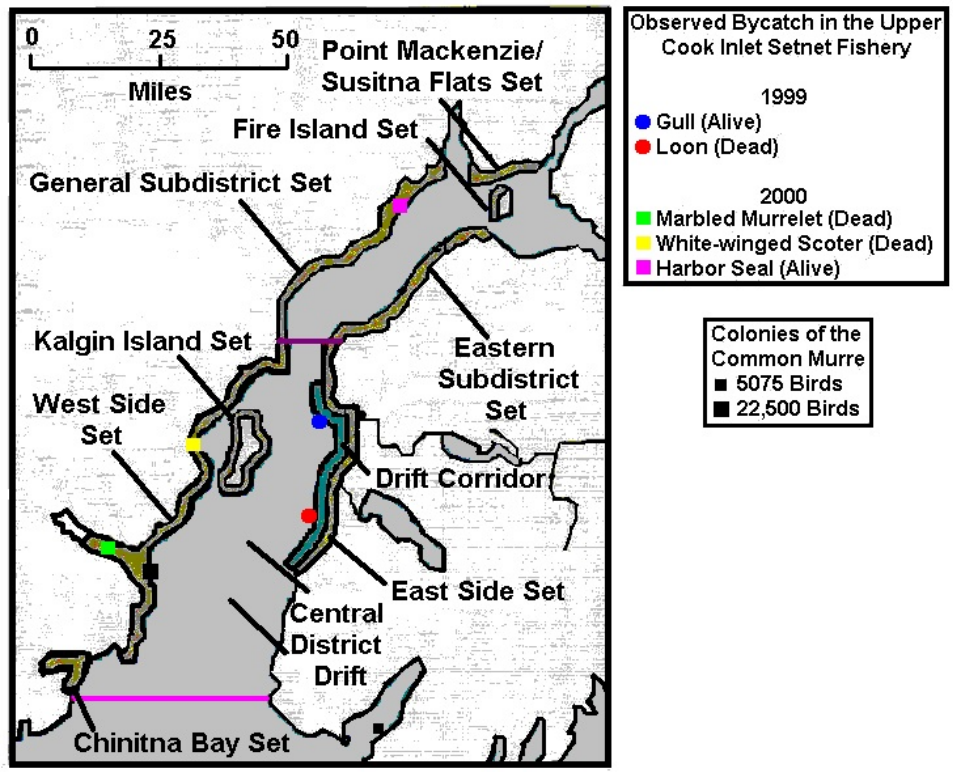


Figure 6. Approximate locations where incidental take occurred in the Upper Cook Inlet Setnet Fisheries in 1999 and 2000.

The Lower Cook Inlet Setnet Fishery

There were 28 permits sampled in the Lower Cook Inlet setnet fishery in 1999. As the fishing statistical areas were generally not recorded, the assignment of observations to this fishery was based on the latitude being below 59°46'N, which divides the Upper and Lower Cook Inlet fisheries. As noted above, in some cases the latitude was not recorded but could be determined from the information on other records for the same sampled permit. There were four cases where it was not possible to determine whether the permit was in the Upper or Lower Cook Inlet fishery.

The incidental take observed in 1999 was of one white-winged scoter (*Melanitta fusca*, released alive, without serious injuries), one common loon (*Gavia immer*, released alive, without serious injuries), and one harbor porpoise (released alive, without serious injuries).

As has been done for the Upper Cook Inlet setnet fishery, the observer effort is expressed as permit hours, where this is the time that an observer was watching a net, divided by the total nets used by the permit. On this basis the total observer coverage was of 37.0 net hours, with an average of $\bar{x}$ = 1.32 hours per permit.

For all three types of incidental take, the average incidental take per sampled unit was $\bar{y}$ = 1/28 = 0.027. Using equation (1) the incidental take per permit hour is therefore estimated as r = 0.0357 in each case. Also, applying equation (2) gives an estimated standard error of 0.0286 for the white-winged scoter and the common loon, and 0.0268 for the harbor porpoises.

From Table 2 the potential fishing effort in the Lower Cook Inlet setnet fishery was 23,232 permit hours in 1999. As the open periods were generally for 48 hours and the observers were apparently never present for the entire time with any of the permits, it must be assumed that the nets were fishing for the entire open periods, and use the 23,232 hours as the value for the total fishing effort. This may lead to some over-estimation because some of the permits may not have been fished at the start and end of the season.

Using the assumed total effort with equations (4) and (5) gives the total incidental take of white-winged scoters, common loons and harbor porpoises all estimated to be B = 23,232 x 0.00357 = 627.9, with the standard errors that are shown in Table 12. The standard errors were calculated using equation (5) as the assumed total fishing effort is known without error. The approximate locations of the incidental take are shown in Figure 7

Table 12. Estimated total incidental take from the Lower Cook Inlet setnet fishery in 1999, together with standard errors (SE), percentage coefficients of variation (CV) and whether the animals are released alive, without serious injuries or dead.

Species	Incidental take	SE	CV
White-winged scoter (Alive)	627.9	663.6	1.06
Common Loon (Alive)	627.9	664.7	1.06
Harbor Porpoise (Alive)	627.9	623.5	0.99

The observer coverage of 37 hours is 0.16% of the total assumed fishing effort of 23,232 permit hours. Given this very low level, and the low incidental take observed, the estimates and standard errors shown in Table 12 need to be treated with some reservations.

There were 34 permits sampled in the Lower Cook Inlet setnet fishery in 2000, based on the recorded fishing statistical areas. These permits were observed for an average of 2.48 permit hours, taking into account the number of nets being fished, with a total observation time of 84.4 hours. From Table 3, the total number of permit hours available for fishing was 25,080. Assuming that this was the total fishing effort that actually occurred, the observer coverage was therefore 0.34%. No incidental take of marine birds or mammals was observed in 2000 in this fishery, which is not surprising given the low level of observer cover.

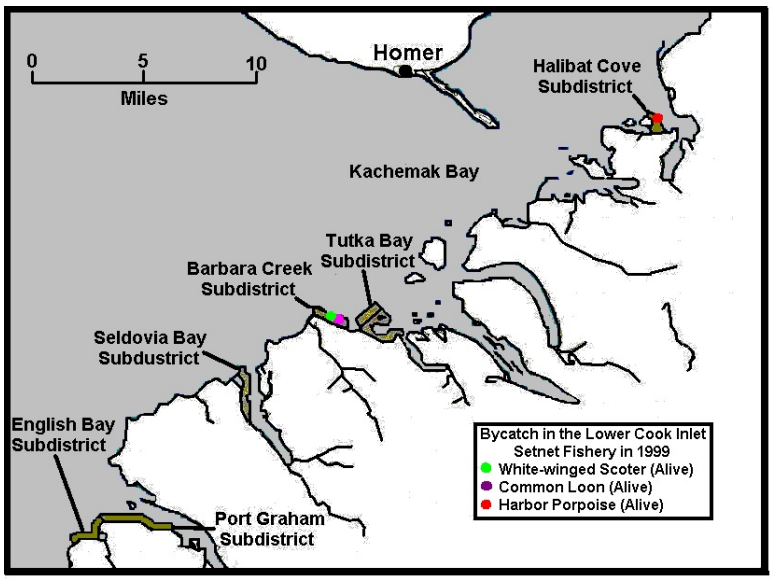


Figure 7. Approximate locations where incidental take was taken in the Lower Cook Inlet setnet fishery in 1999.

5. Mammal and Bird Sightings Near Nets

In 1999 detailed records of sightings of marine birds and mammals from 10 to 300m from nets were not kept. Animals closer than 10m to nets were considered to be encounters with the nets, which were recorded. The main encounters of birds were with gulls (almost all with an unknown species), black legged kittiwakes, shearwaters (all with unidentified species), murres (mainly common murres, but five with unidentified species), horned puffins, loons (mainly common loons), murrelets (marbled murrelets, Kittlitz's murrelets or unidentified), and terns (all with unidentified species). The locations of these encounters are shown on Figure 8, where an absence indicates a location where an observer watched a net without observing the bird group in question, while a presence indicates that at least one bird from that group was observed. There were a few other bird encounters not shown in these figures that involved either unidentified birds or the sighting of a species only on one occasion by the observers. For example, there is only one record of a pigeon guillemot being seen within 10m of a net.

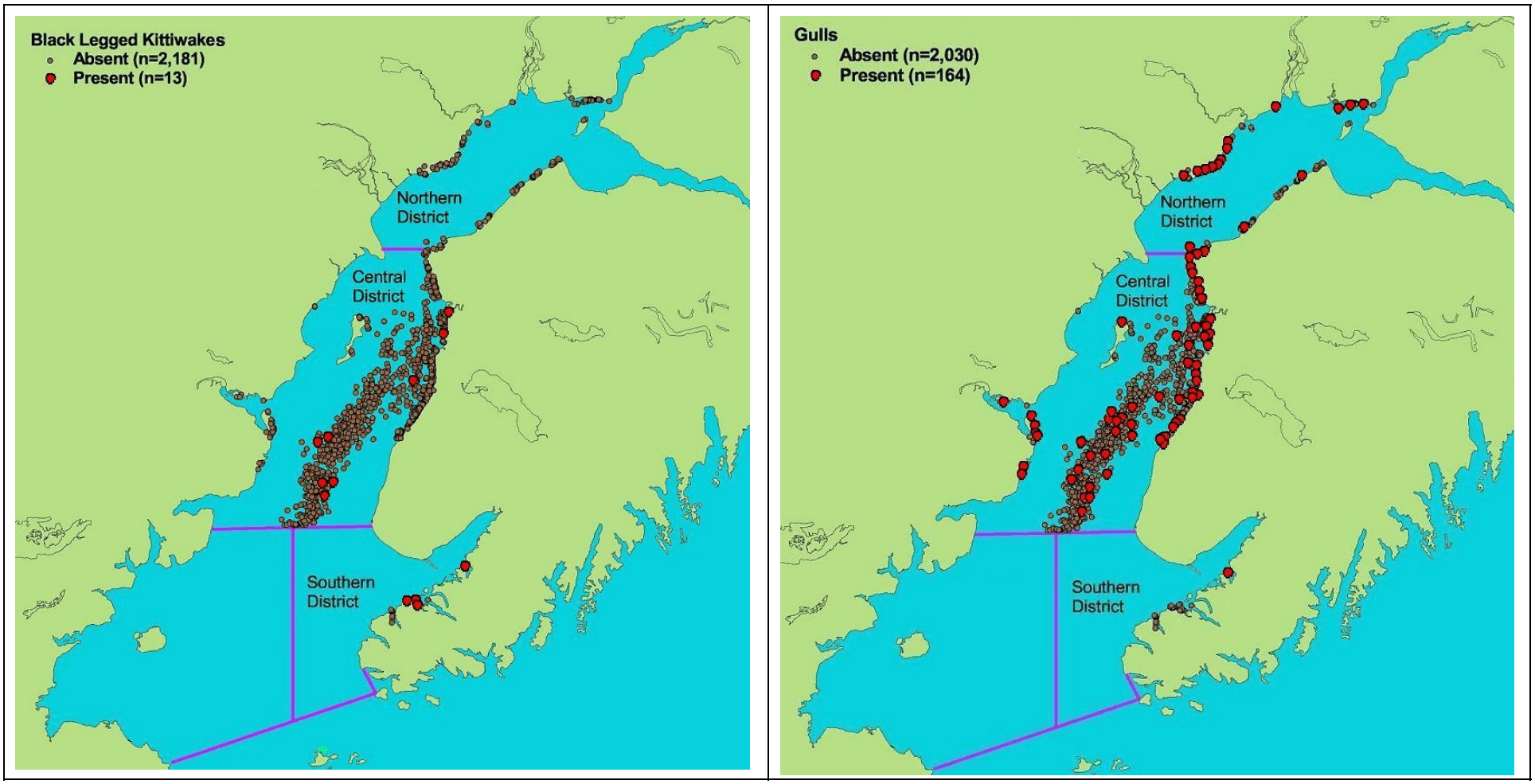
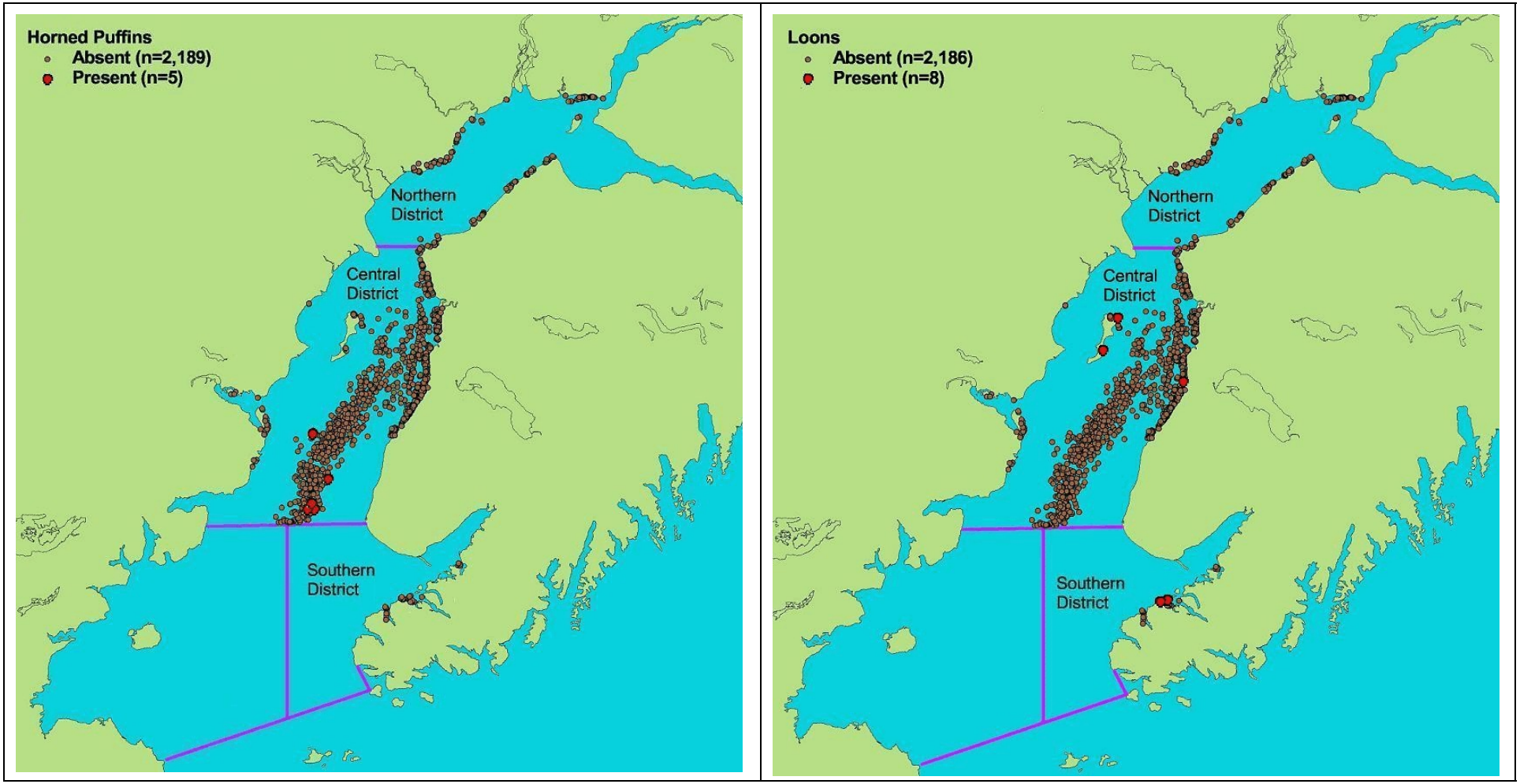


Figure 8 Sightings of birds closer that 10m to nets in 1999. The positions of all hauls are shown, and present means one or more bird sightings.



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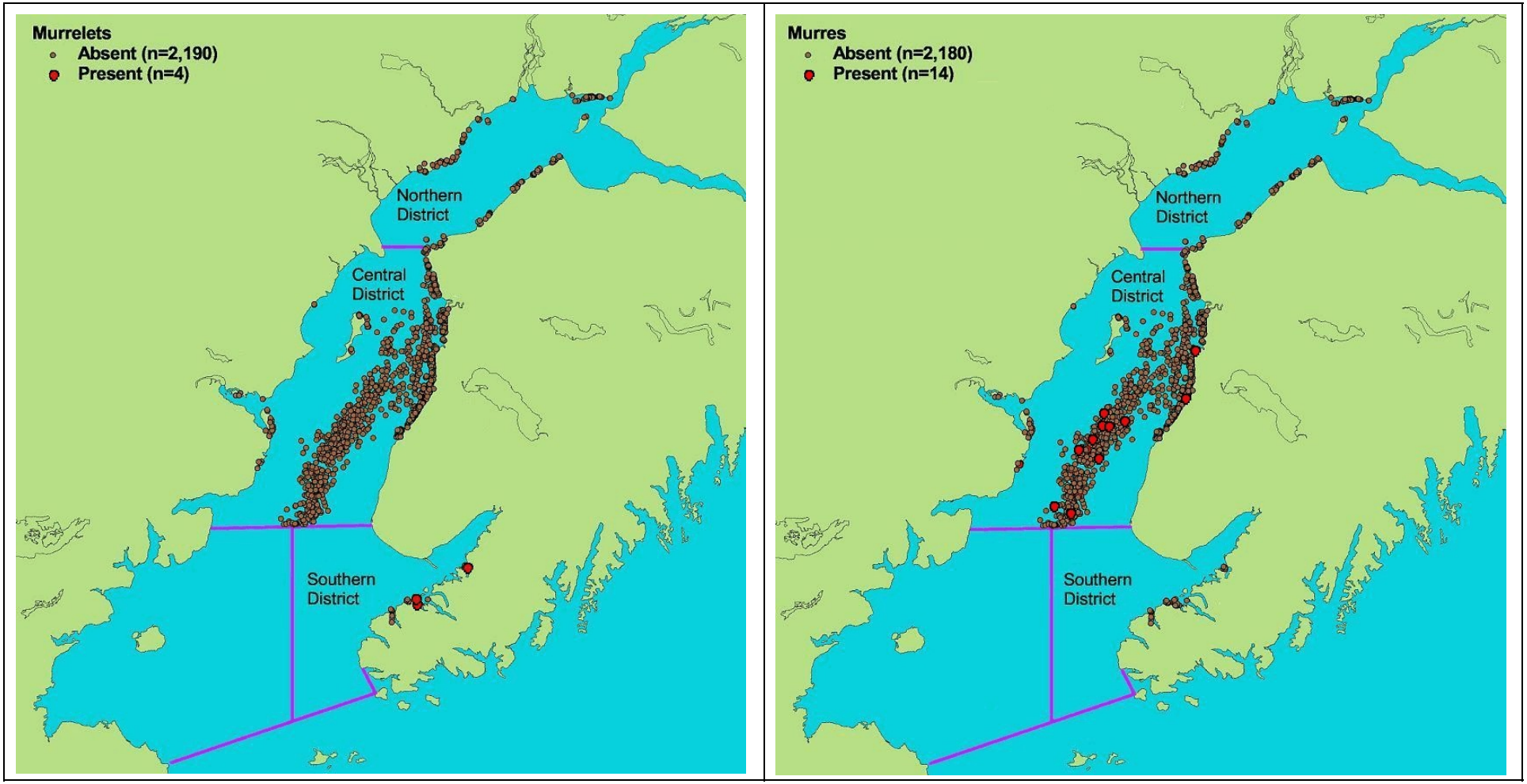

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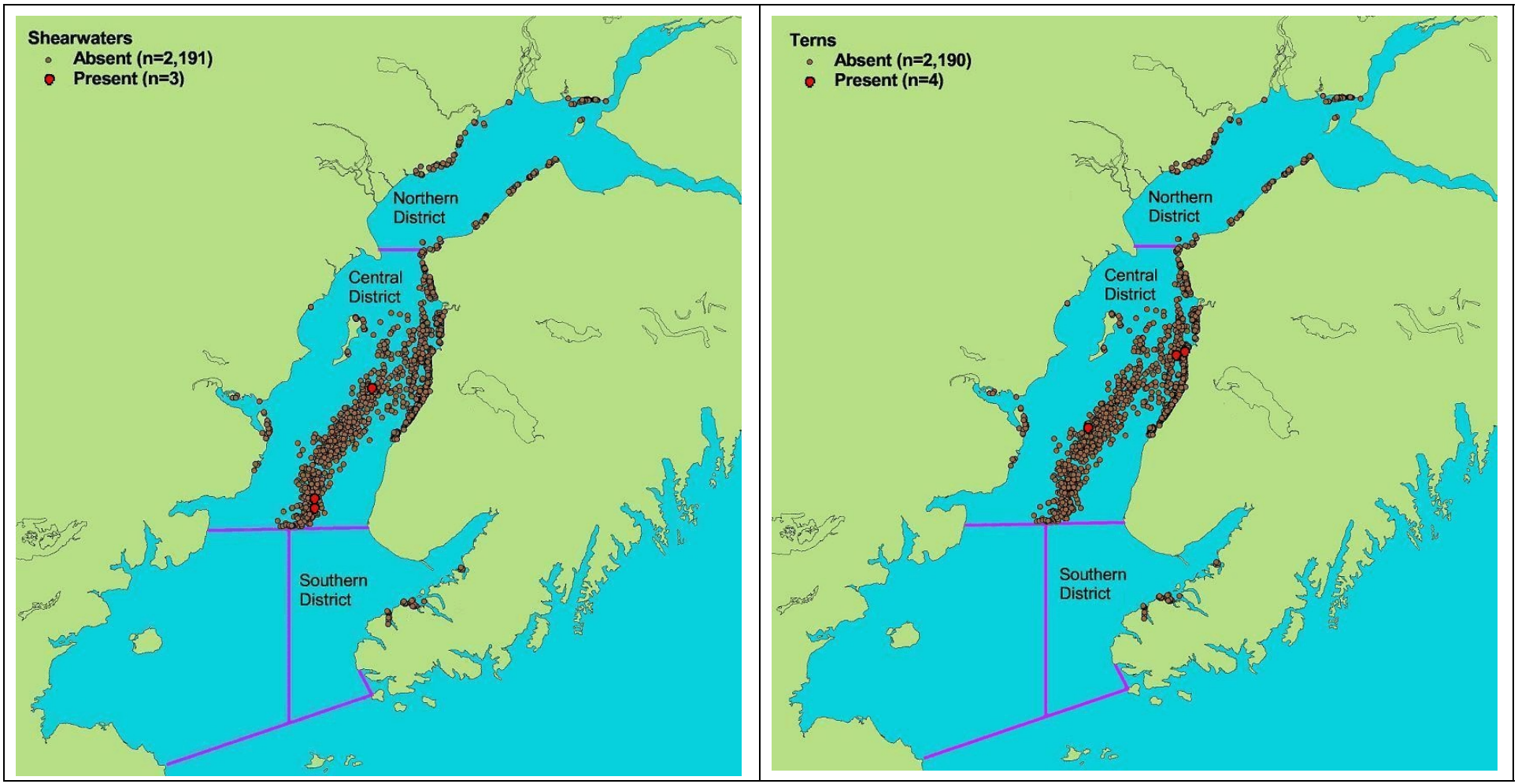

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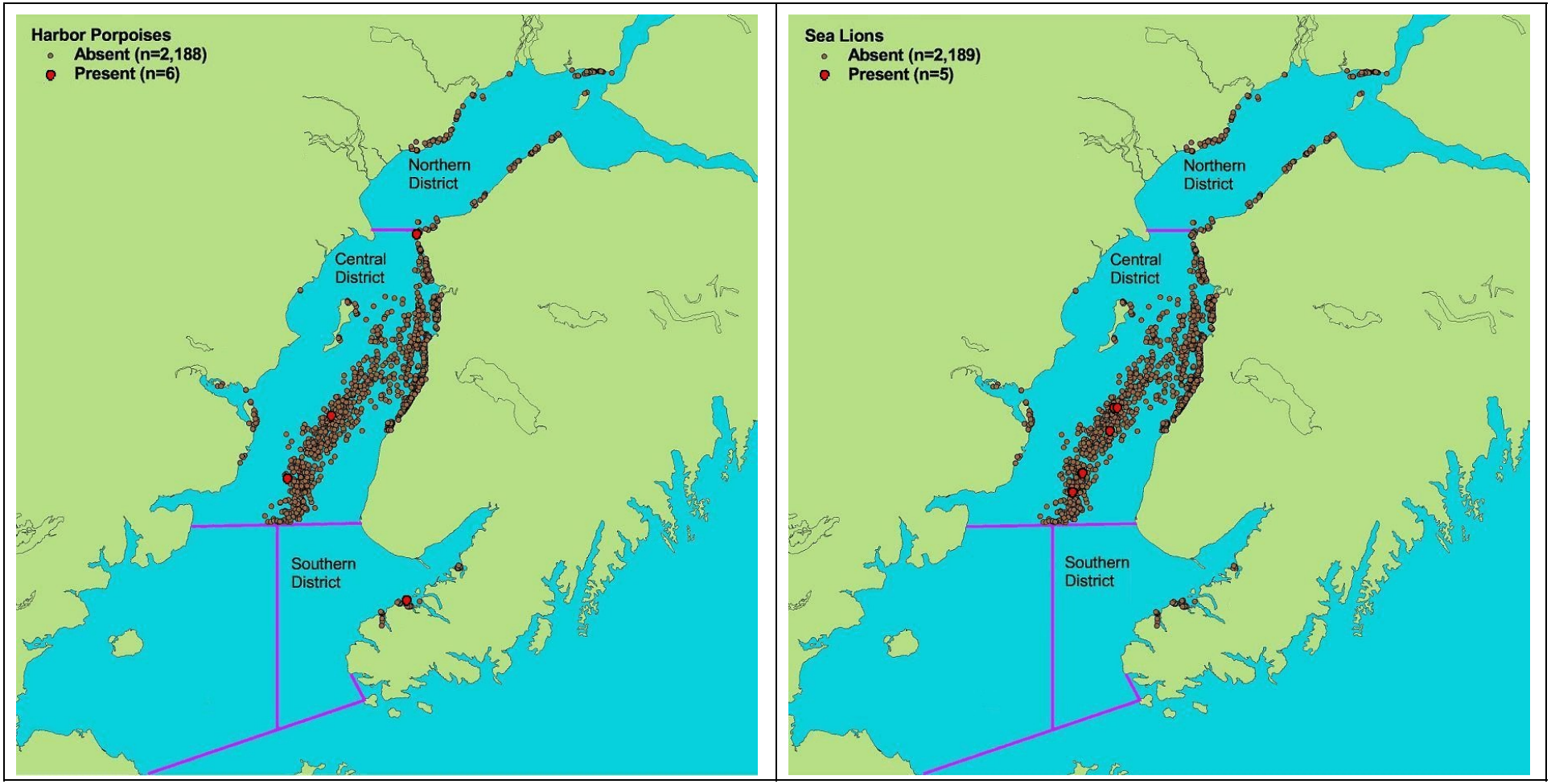


Figure 9 Sightings marine mammals closer than 10m to nets in 1999. The positions of all hauls are shown, and present means one or more animal sightings.

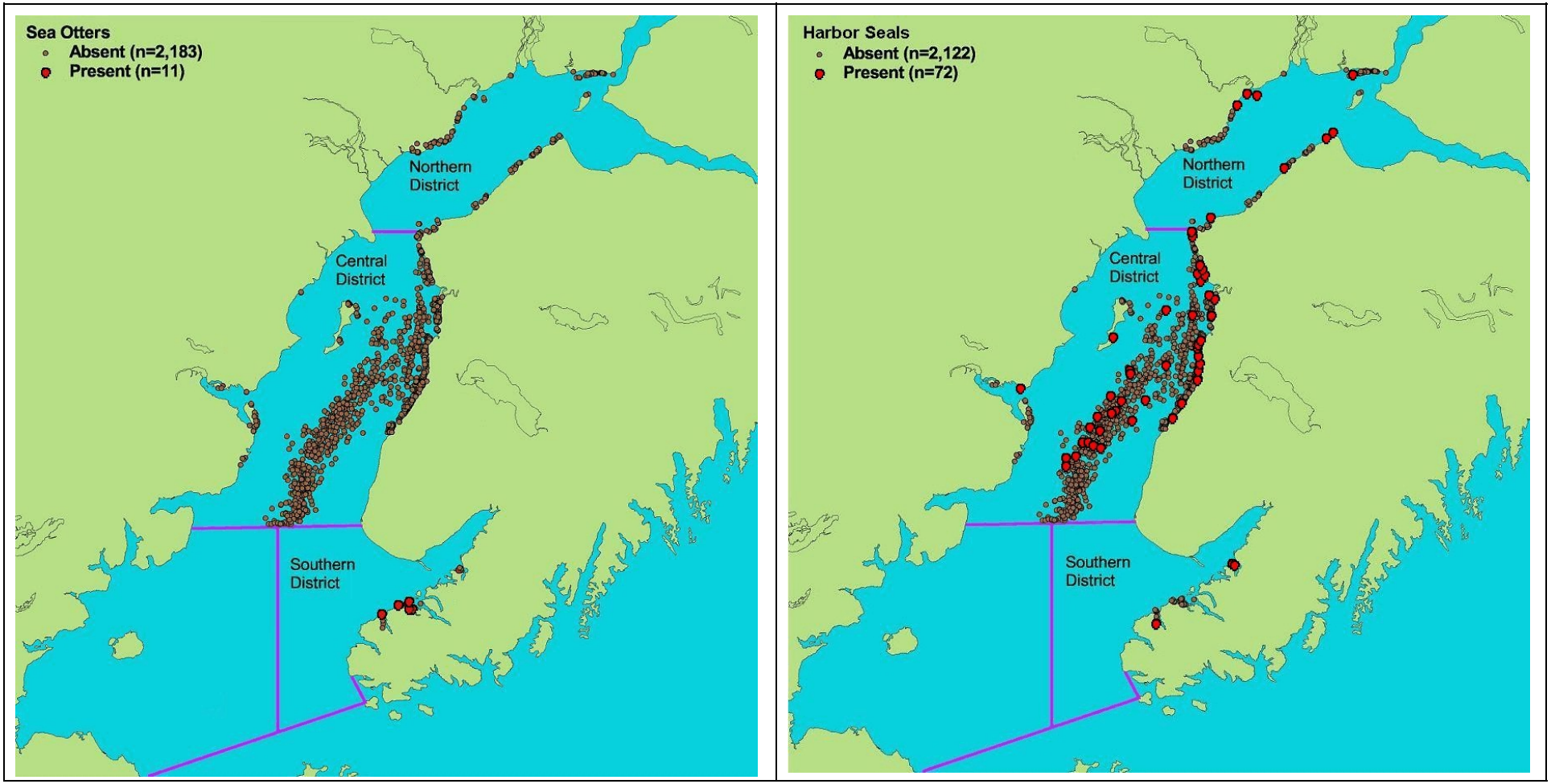


Figure 9, continued.

Most marine mammals seen within 10m of nets were seals (mainly harbor seals, but also two northern fur seals), but sea lions (four Steller sea lions and one California sea lion), sea otters, and harbor porpoises were also recorded. Figure 9 shows the locations of these encounters. In four cases there were records of encounters with a cetacean, a phocid, a pinniped, and a large whale, all with unidentified species.

In 2000 records were kept of sightings of birds and mammals from 10 to 300m from nets, and also closer than 10m. Figure 10 shows the locations of the bird sightings from 10 to 300m from nets. The most common sightings were of gulls (mostly with unknown species), murres (mostly with unknown species), pigeon guillemots, loons (half common loons, two Pacific loons, and the remainder of unknown species), terns (mostly with unknown species, but with about one third Arctic terns), puffins (mainly horned puffins), black legged kittiwakes, marbled murrelets, northern fulmars, marbled murrelets, scoters (white winged scoters, surf scoters or of unknown species), cormorants (with unknown species), harlequin ducks, and shearwaters (with one identified as a sooty shearwater). There were also 352 sightings of unknown marine birds or shorebirds and a few bird species seen on only one occasion.

Figure 11 shows the location of the marine mammal sightings in 2000 from 10 to 300m from nets. Most sightings were of harbor seals, with fewer otters (sea otters, except for one river otter), porpoises (mainly harbor porpoises, but with a few sightings of Dall's porpoises), and Steller sea lions. One Minke whale was also seen between 10 and 300m from a net in the statistical area 24470 in the Central District (Figure 3). There were seven sightings of cetaceans, otariids, and pinnipeds with unknown species.

Figure 12 shows the locations of the bird sightings closer than 10m to nets in 2000. The most common sightings this close were of gulls (mostly of unknown species), murres (mostly of unknown species, but with 24 common murres and two thickbilled murres), loons (about half with unknown species, but with 7 common loons and one Pacific loon), terns (mainly Arctic terns, but three with unknown species), guillemonts (mostly pigeon guillemonts, but with seven of unknown species), black-legged kittiwakes, marbled murrelets, northern fulmars, and cormorants (with unknown species). A few other bird species were either seen only once or were not well identified. On one occasion 17 horned puffins were seen within 10m of a net in statistical area 24590 in the Central District.

Figure 13 shows the marine mammal sightings closer than 10m to the nets in 2000. As was the case with the more distant sightings, most were of harbor seals, with fewer otters (all except one a sea otter), harbor porpoises and Steller sea lions. There were also four sightings of unknown pinnipeds or otariids.

Appendix B provides the observer's comments on interactions between nets and marine mammals and birds.

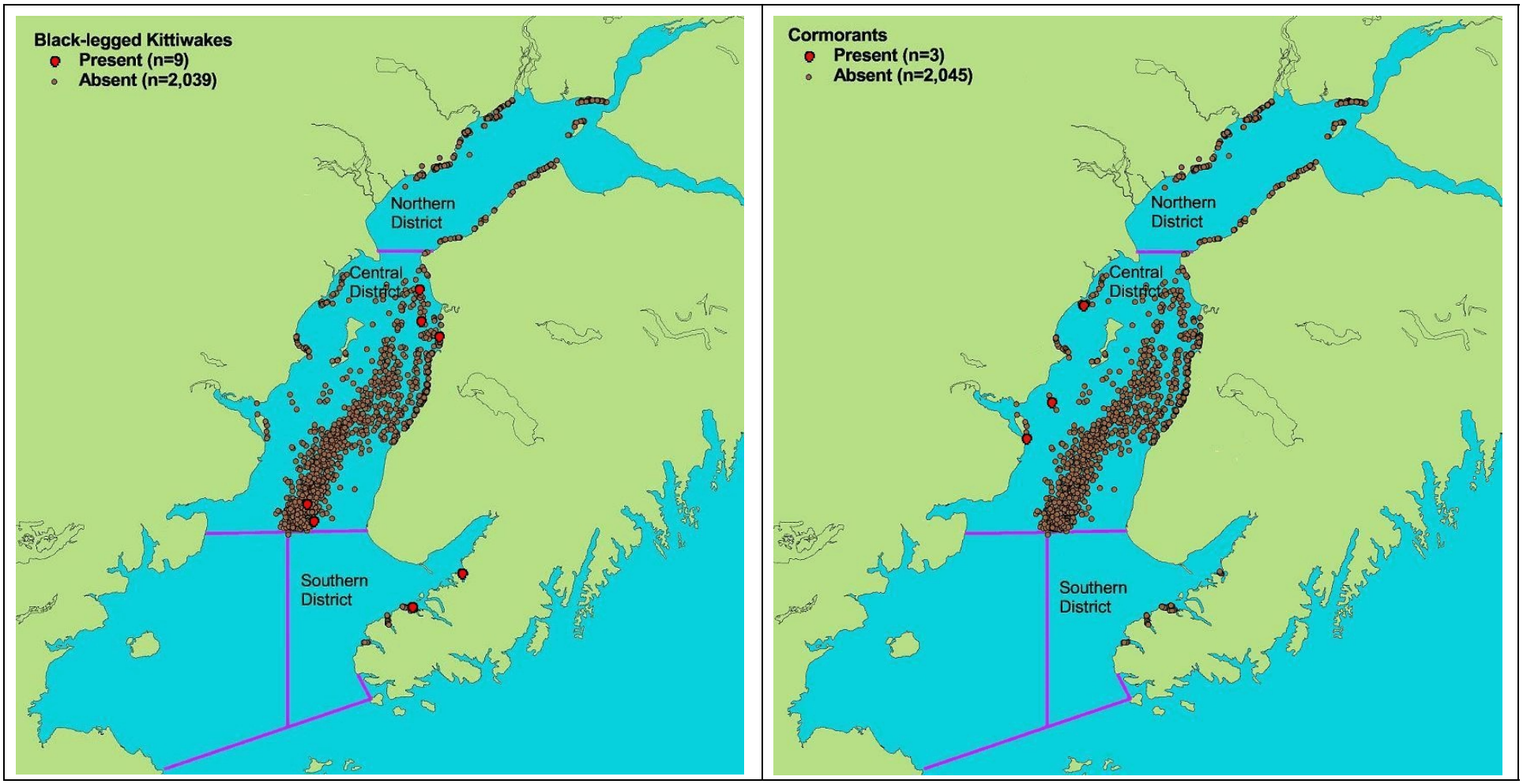
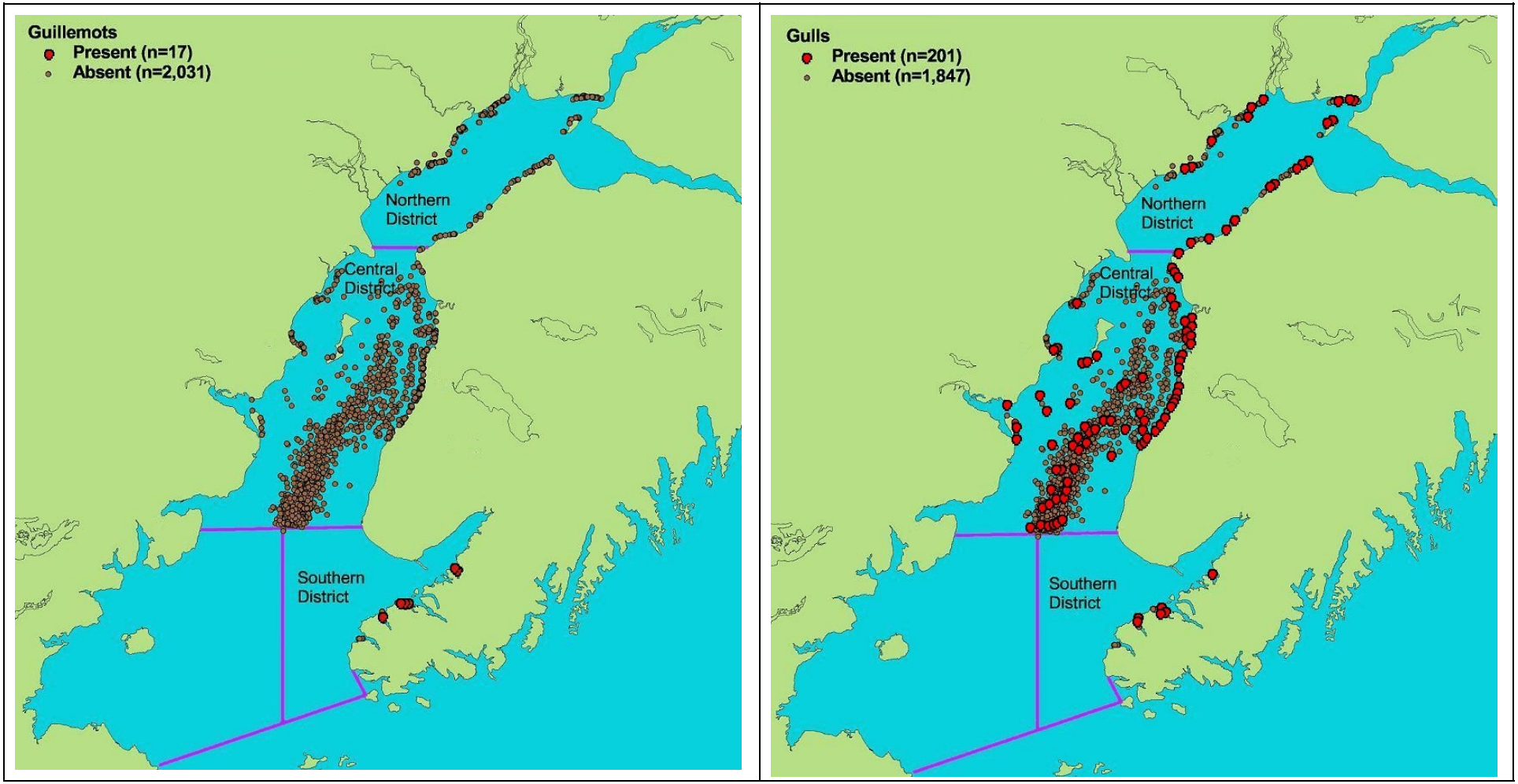


Figure 10 Sightings of birds from 10 to 300m from nets in 2000. The positions of all hauls are shown, and present means one or more bird sightings.



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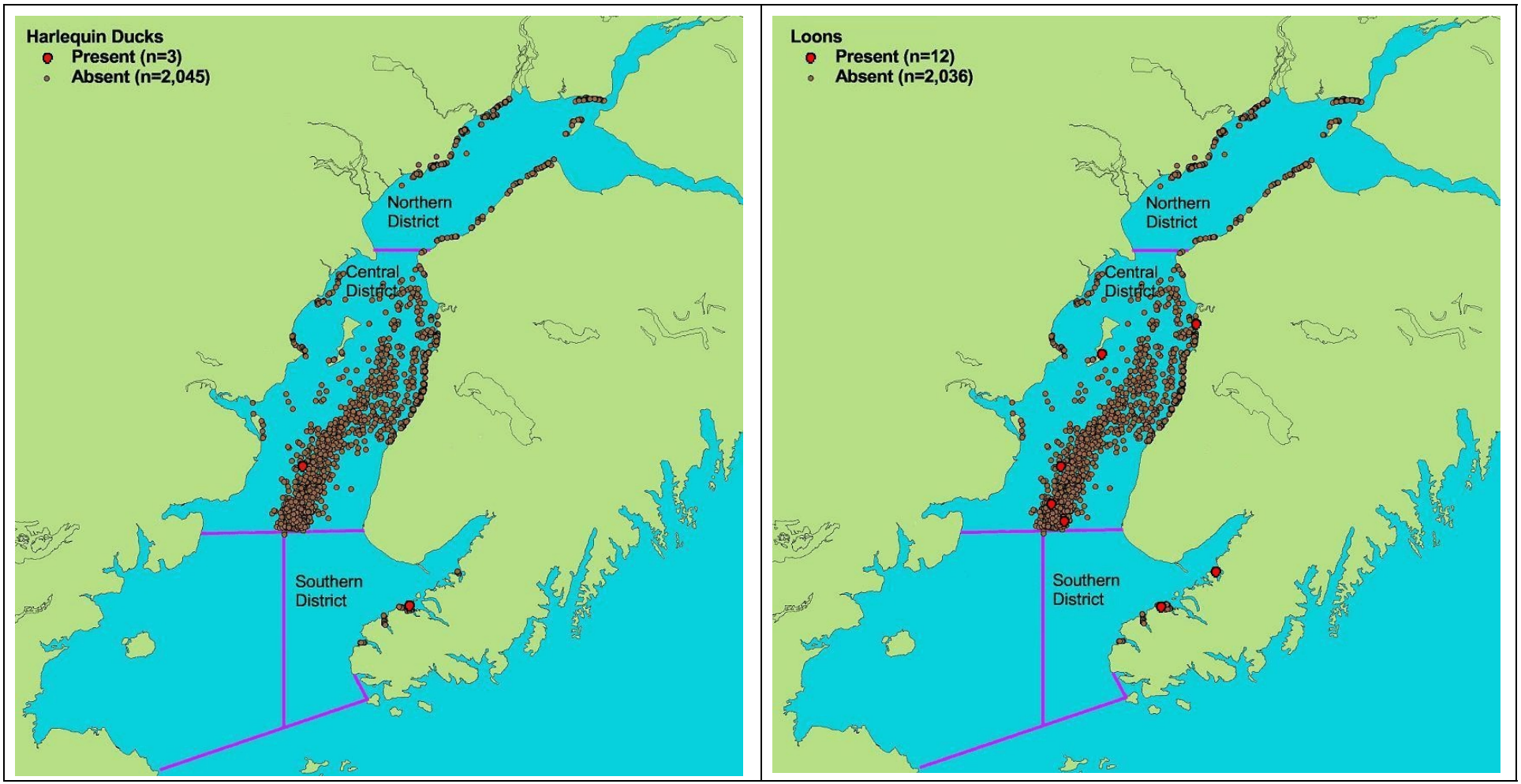

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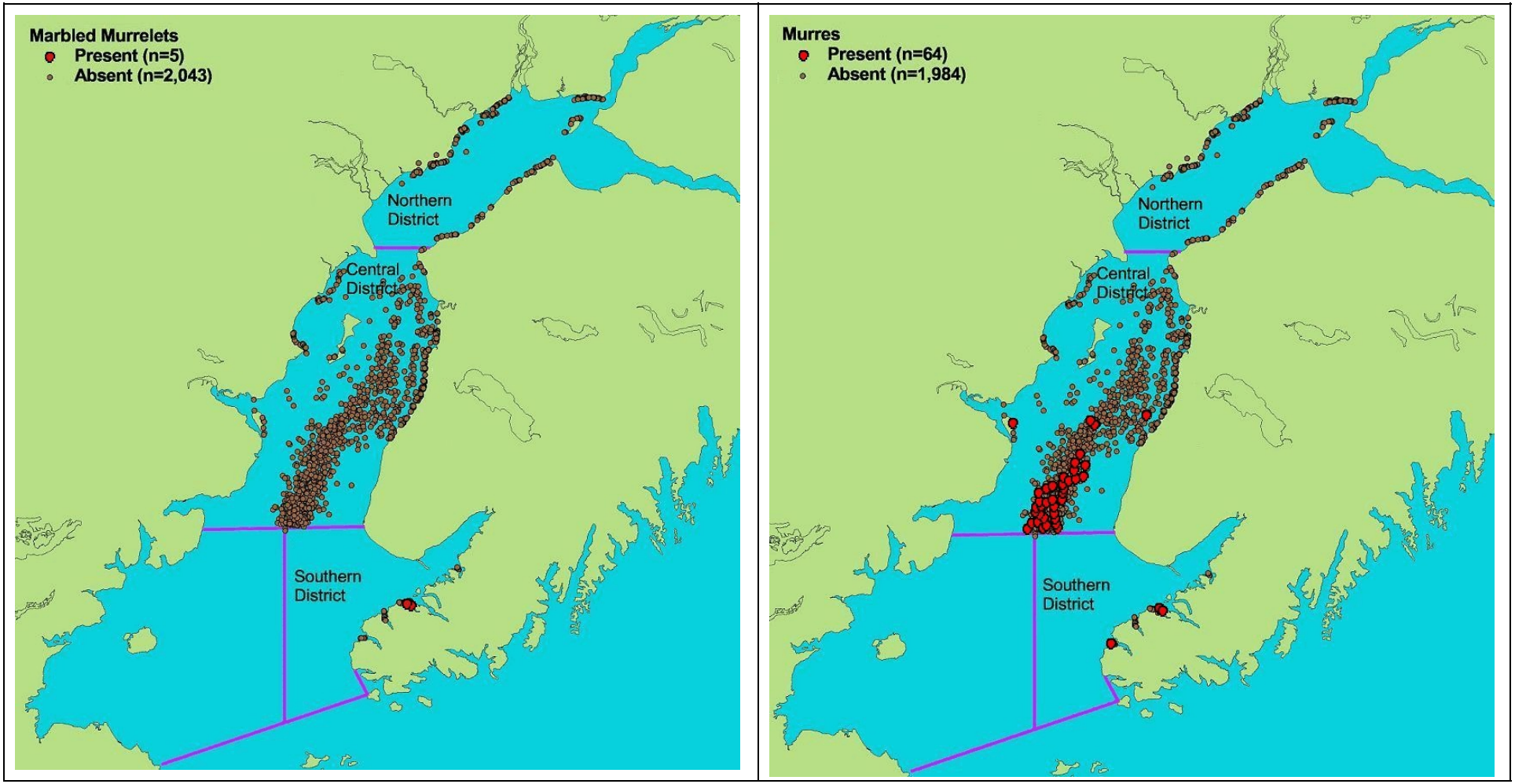

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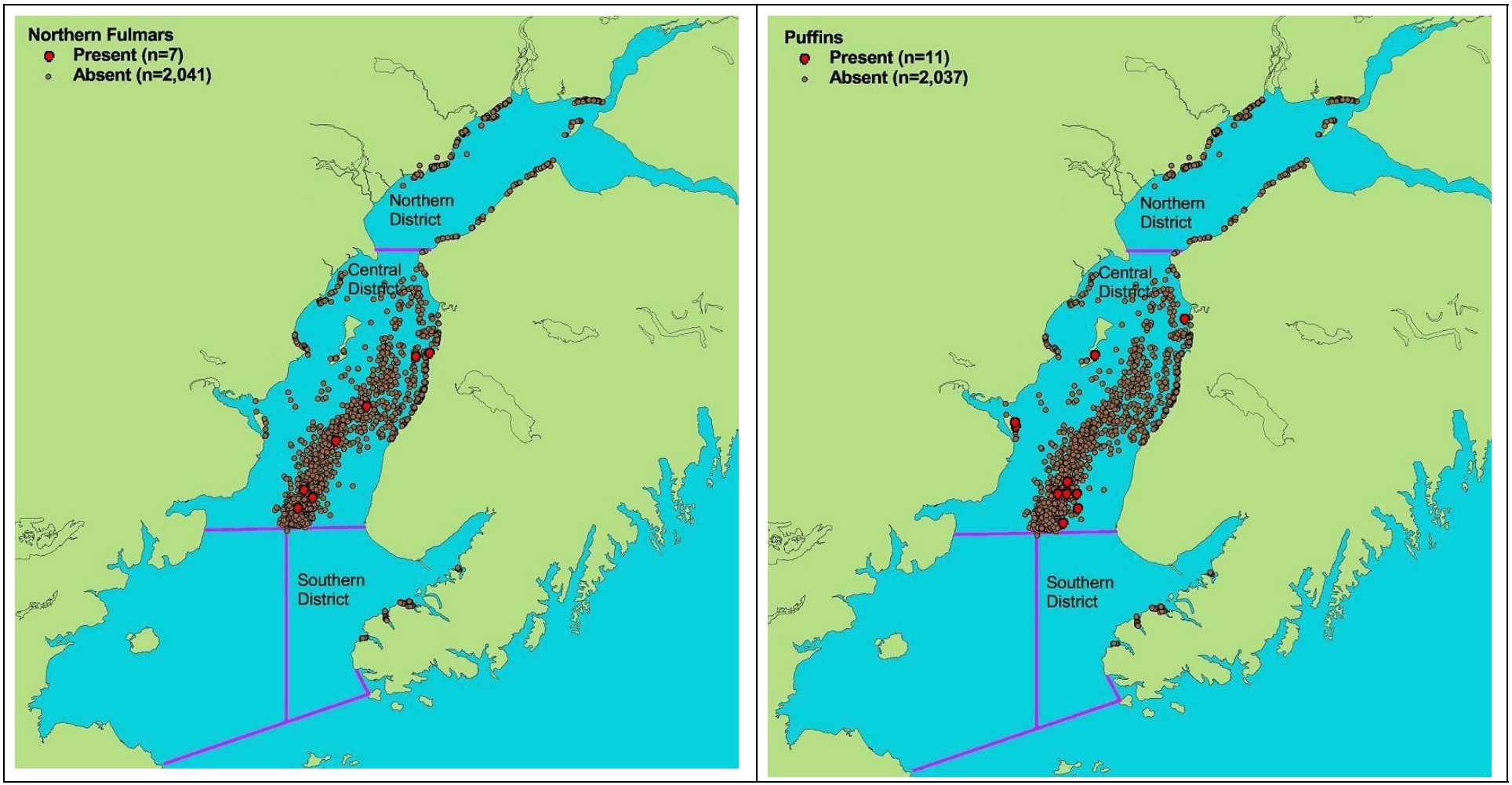

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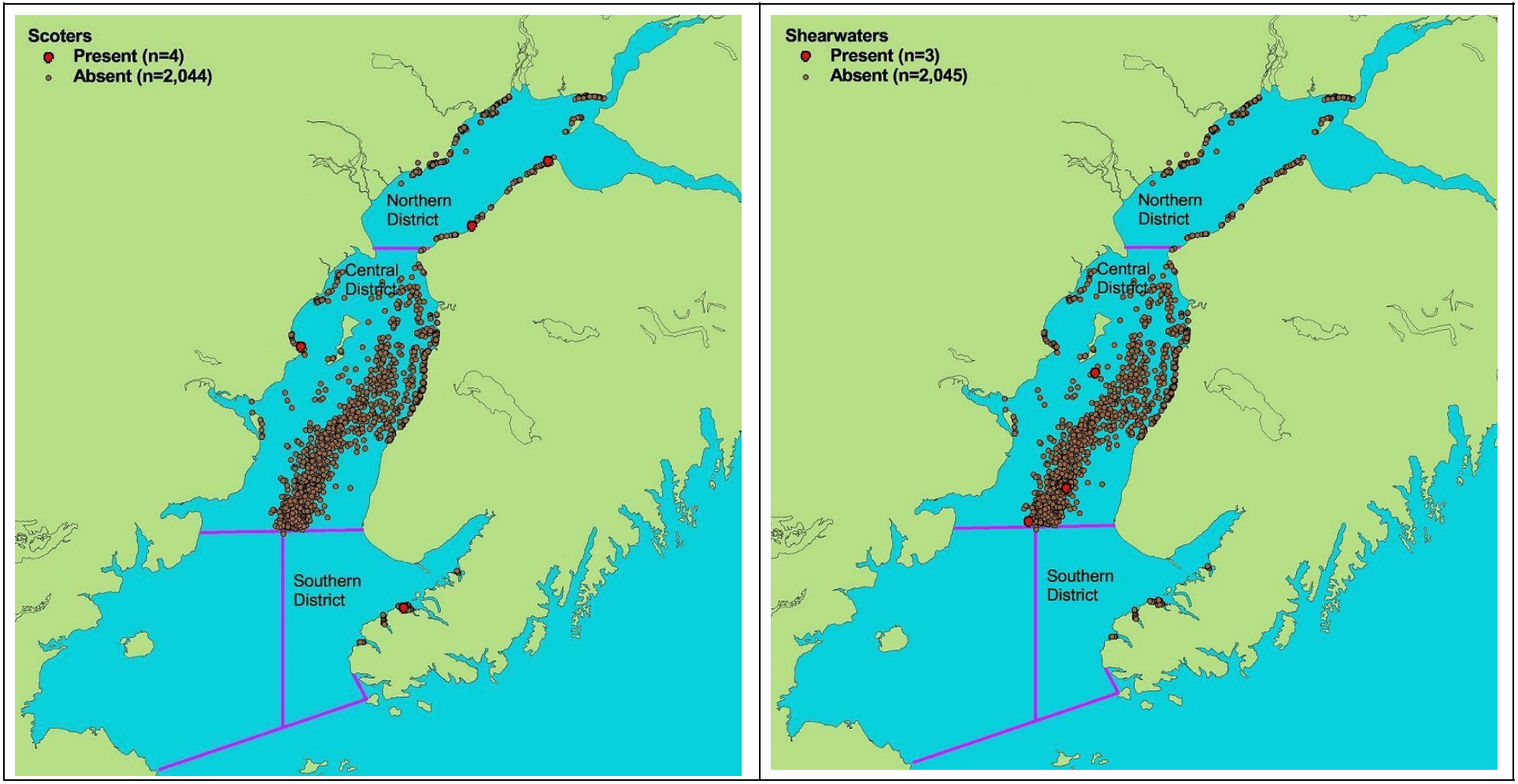

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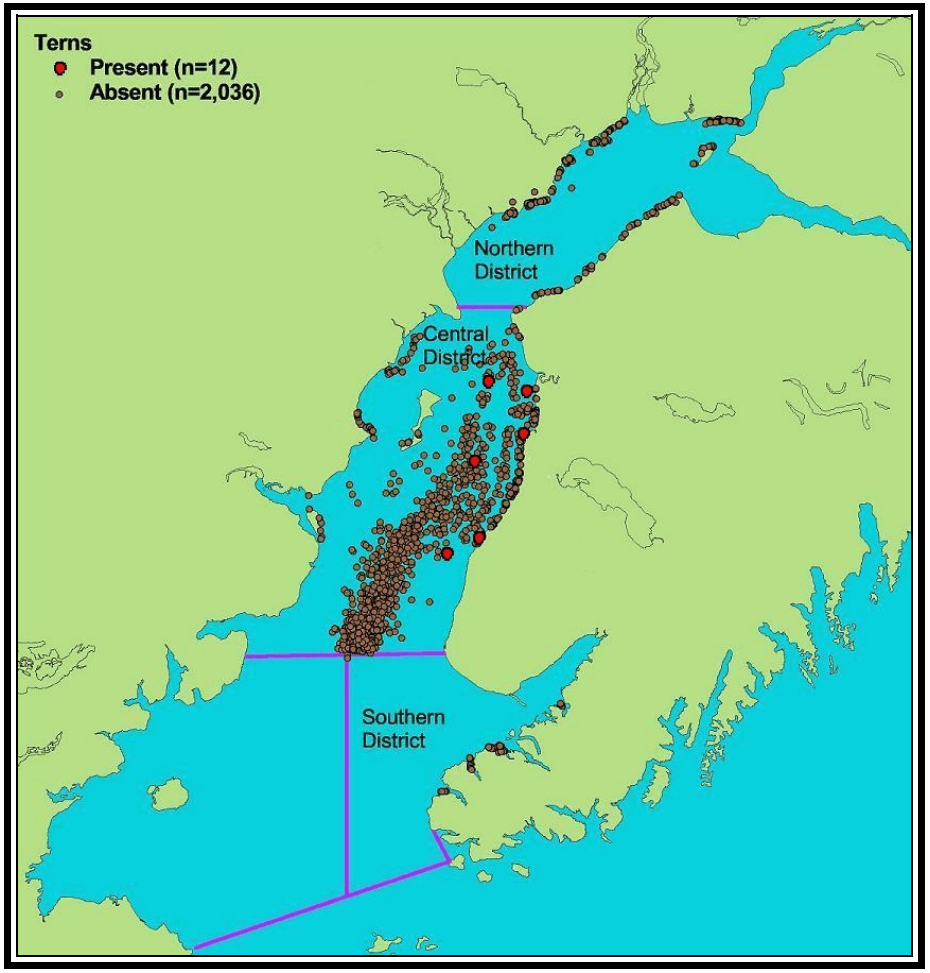

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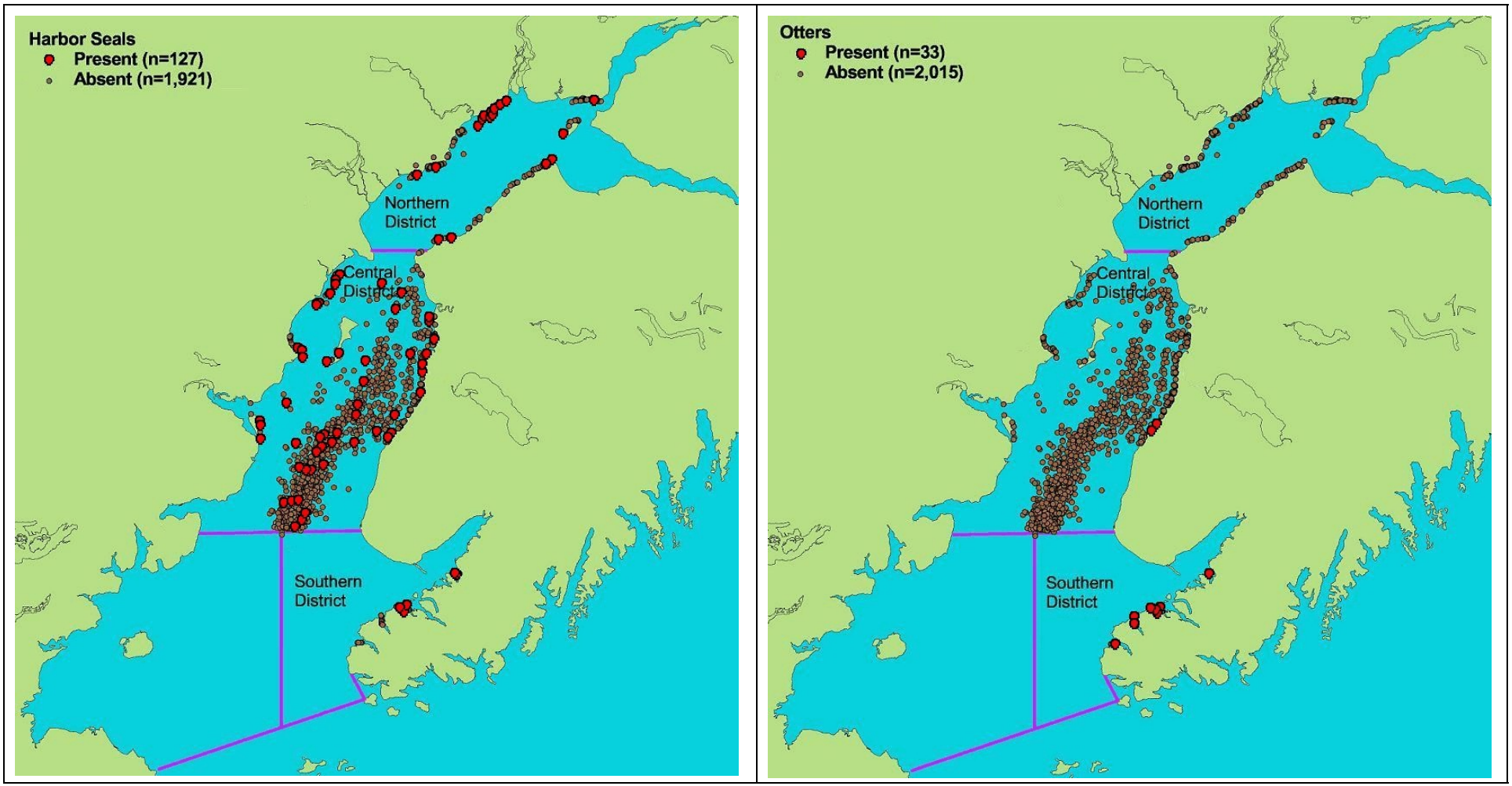
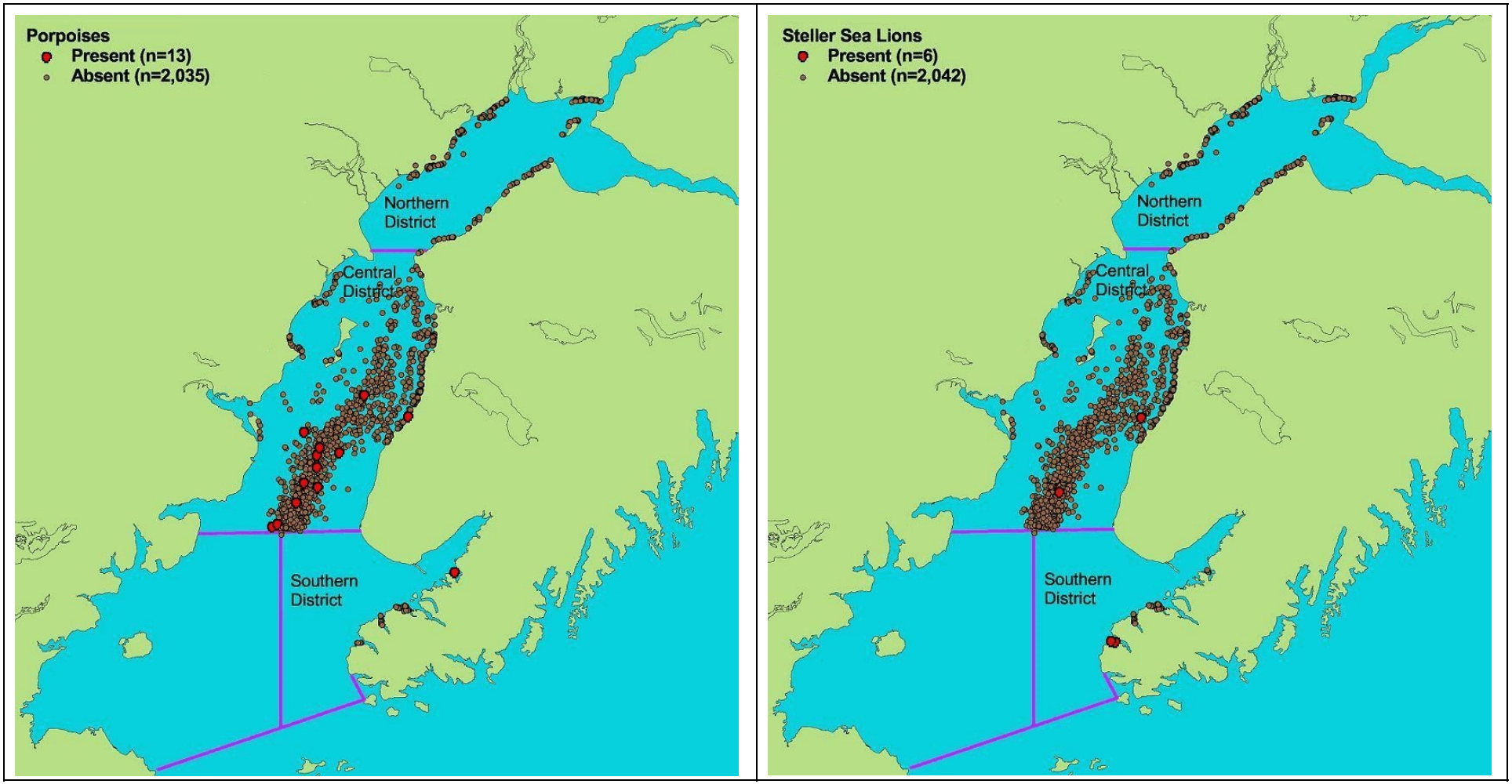


Figure 11 Sightings of marine mammals from 10 to 300m from nets in 2000. The positions of all hauls are shown and present means one or more animal sightings.



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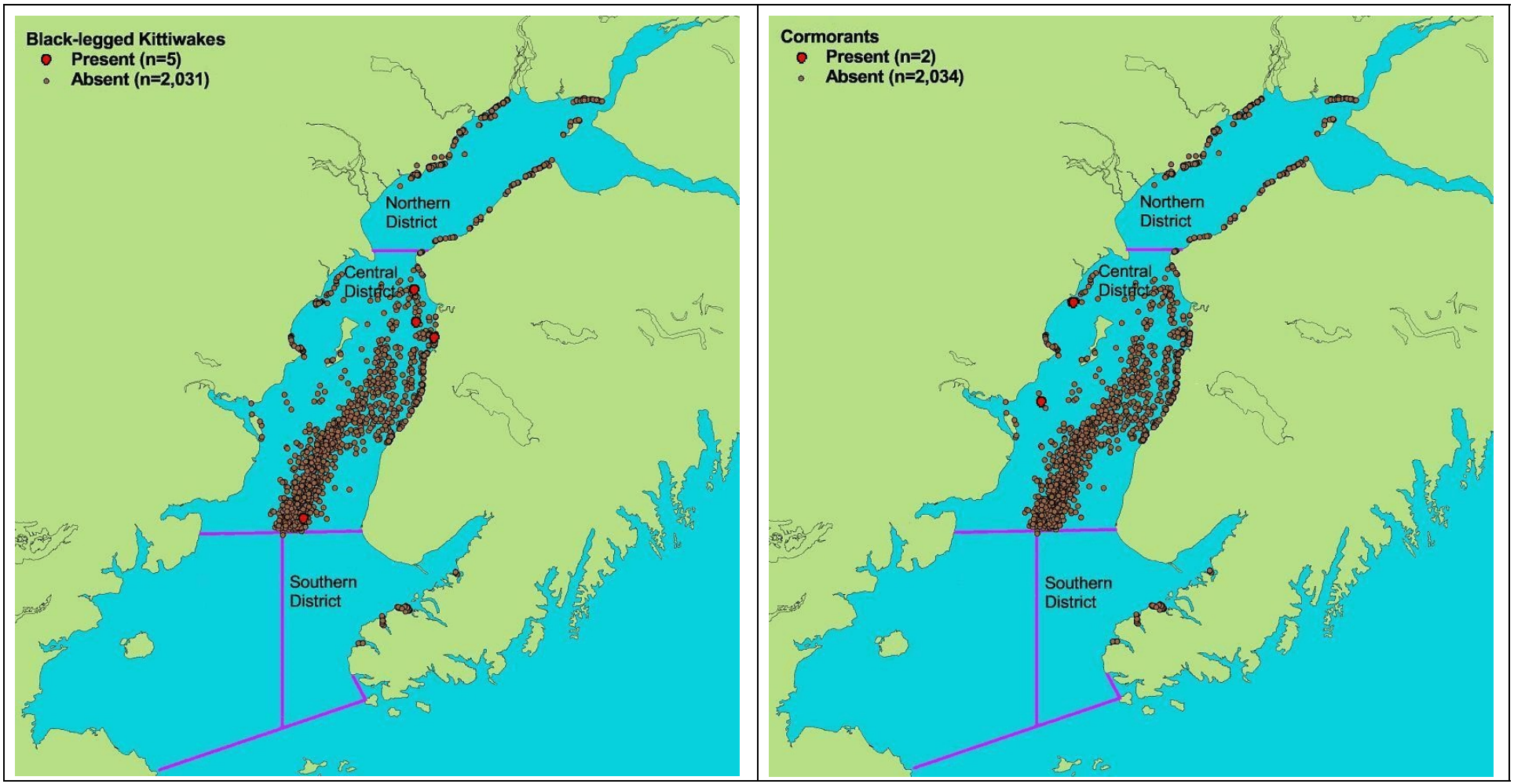
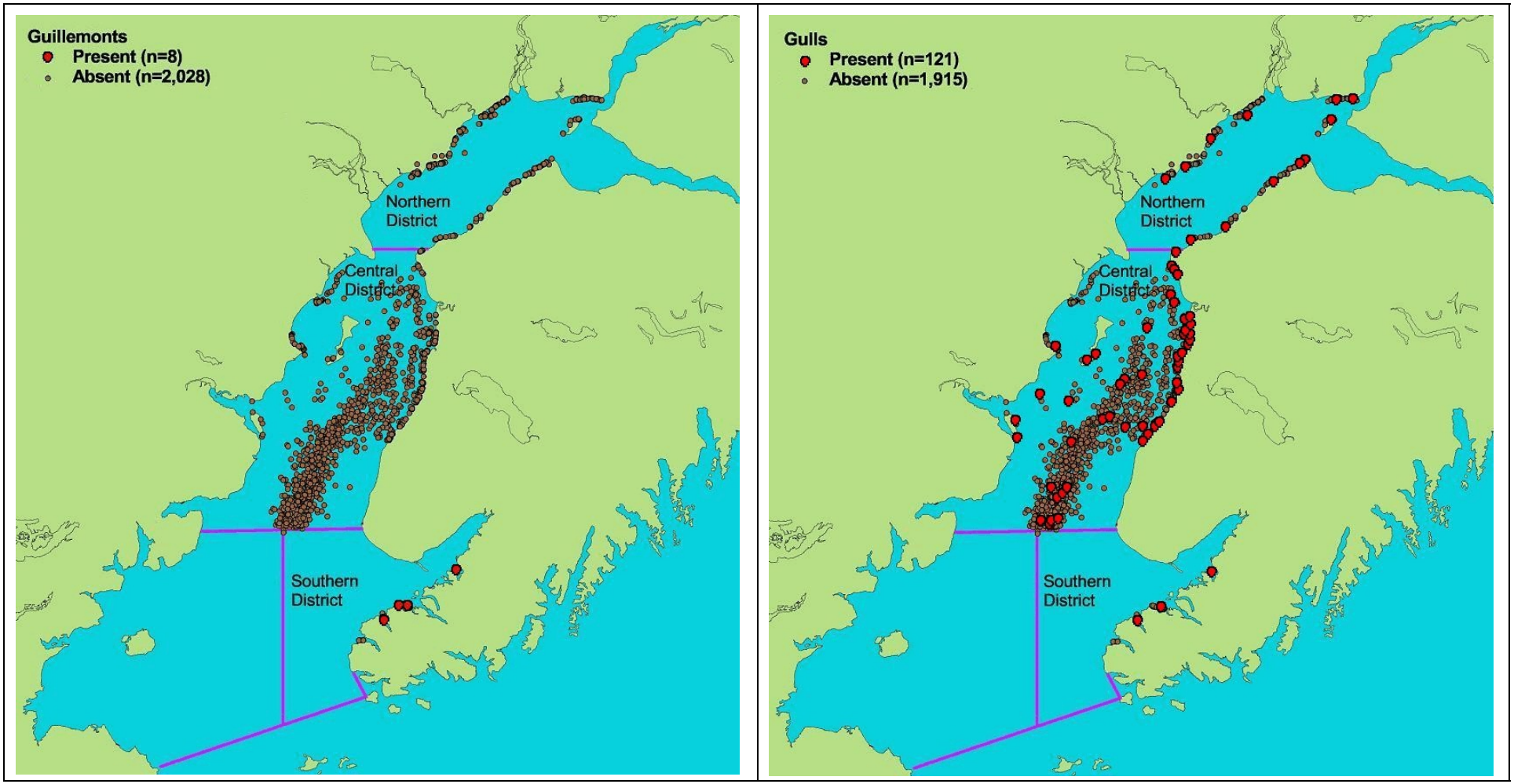


Figure 12 Sightings of marine birds closer than 10m to nets in 2000. The positions of all hauls are shown, and present means one or more bird sightings.



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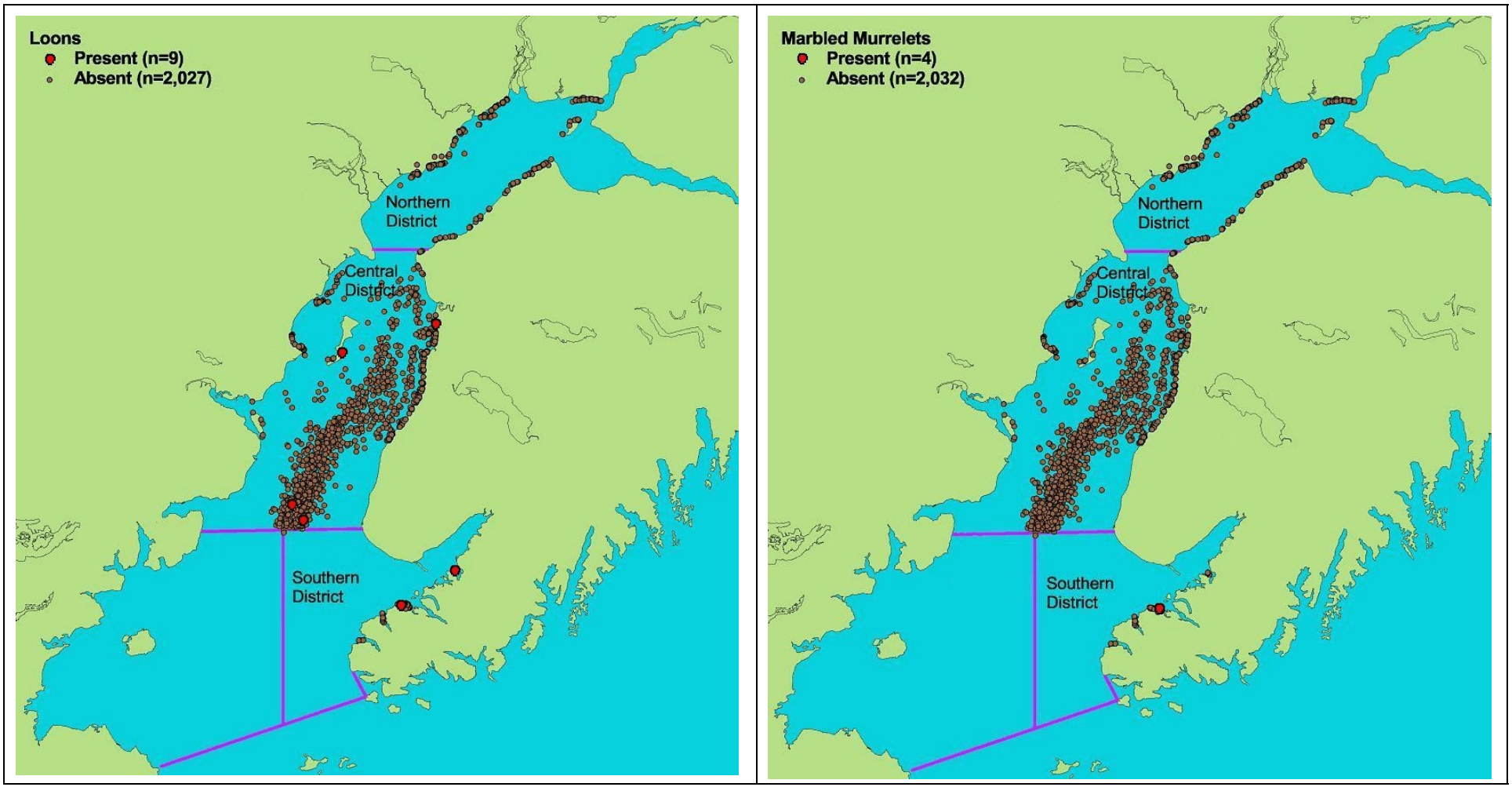

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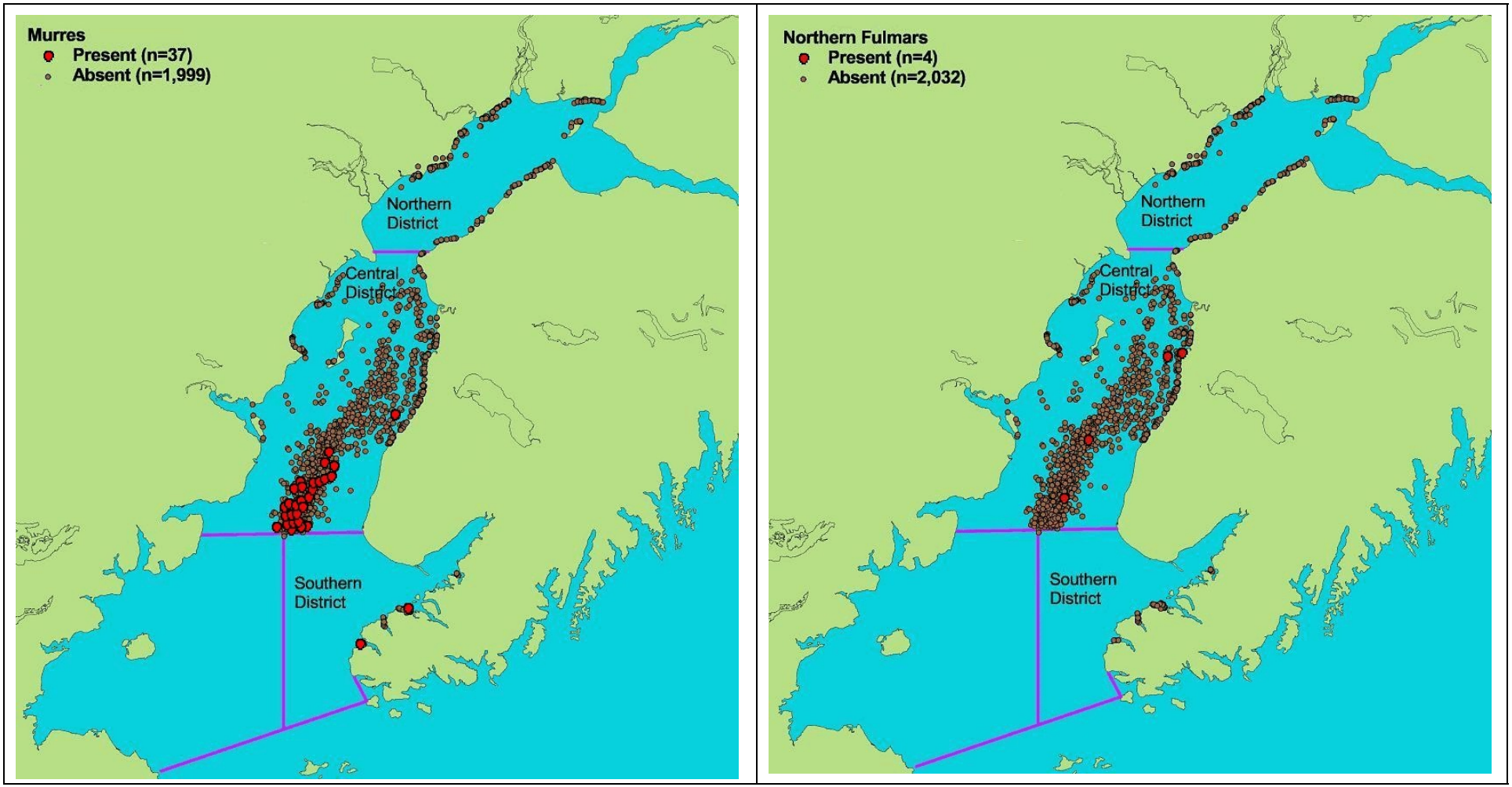

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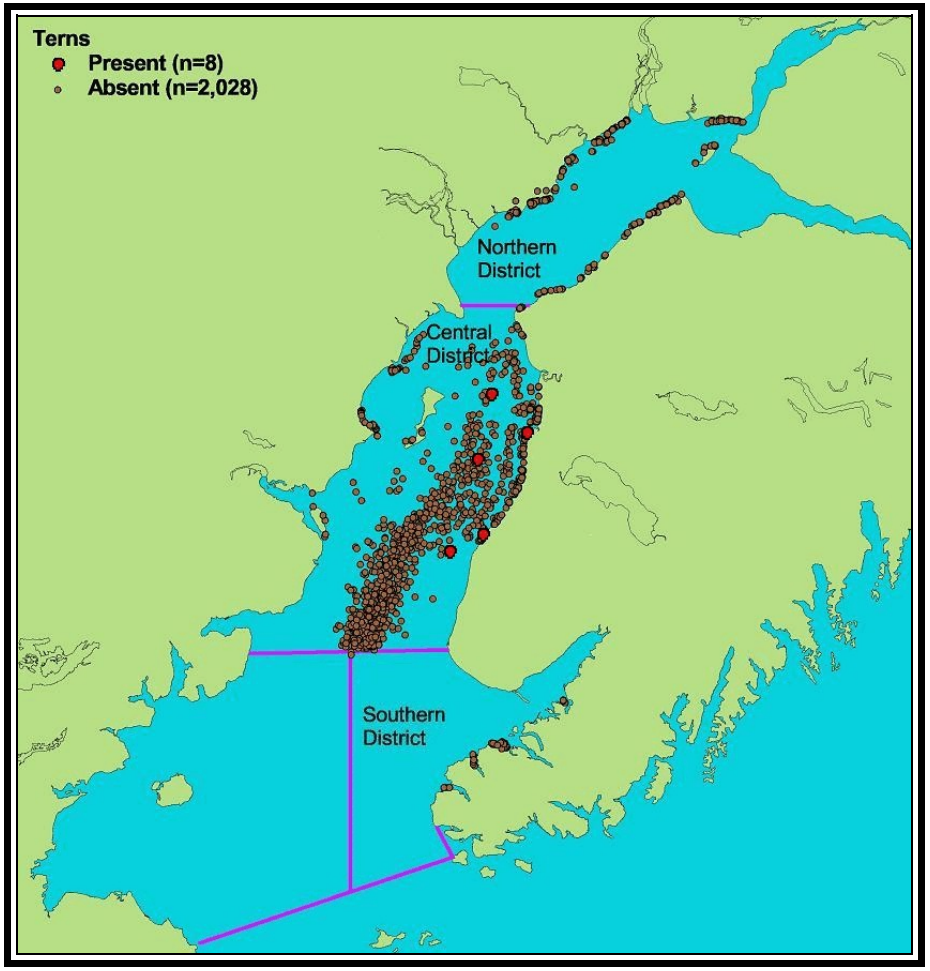

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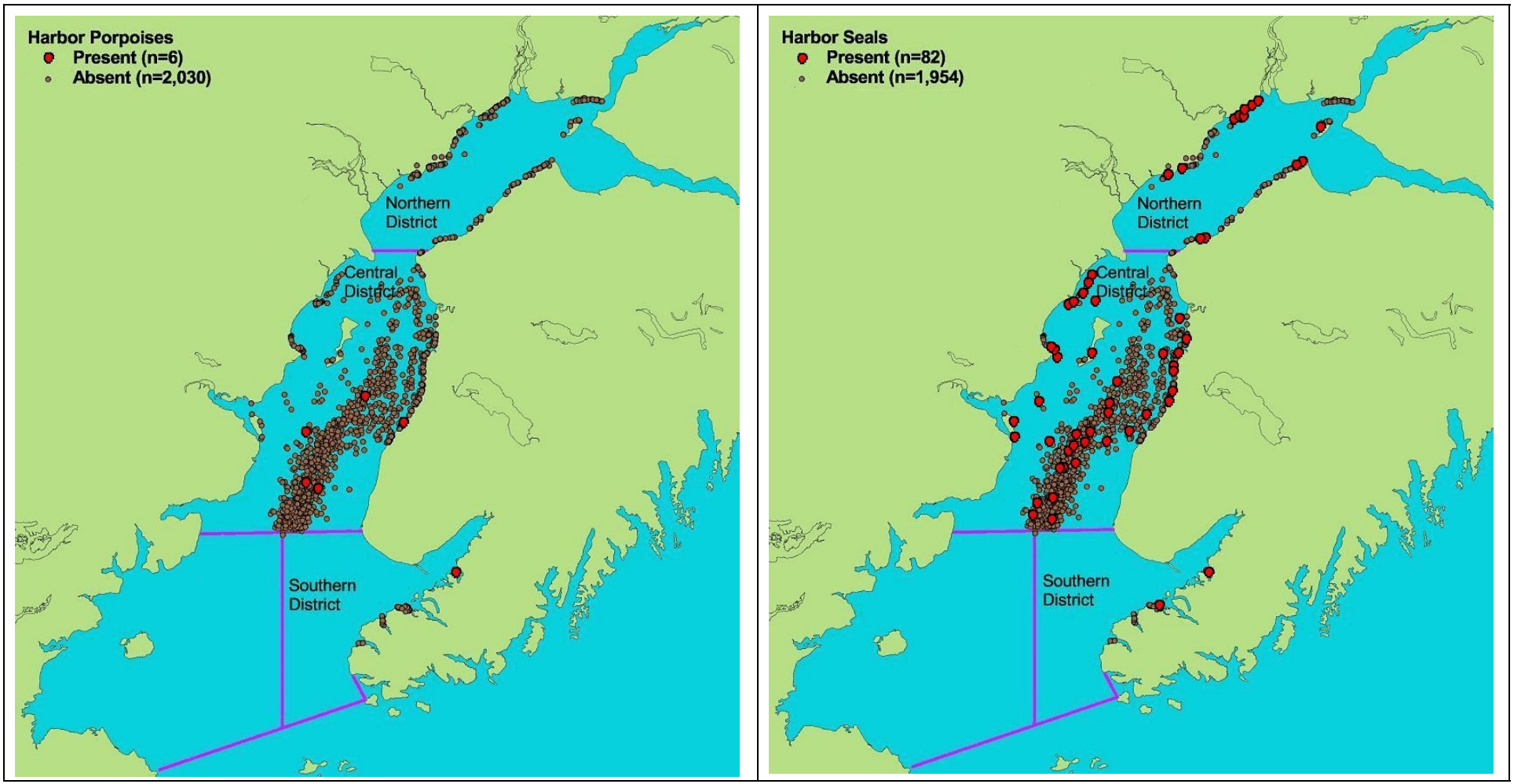


Figure 13 Sightings of marine mammals closer than 10m from nets in 2000. The positions of all hauls are shown, and present means one or more bird sightings.

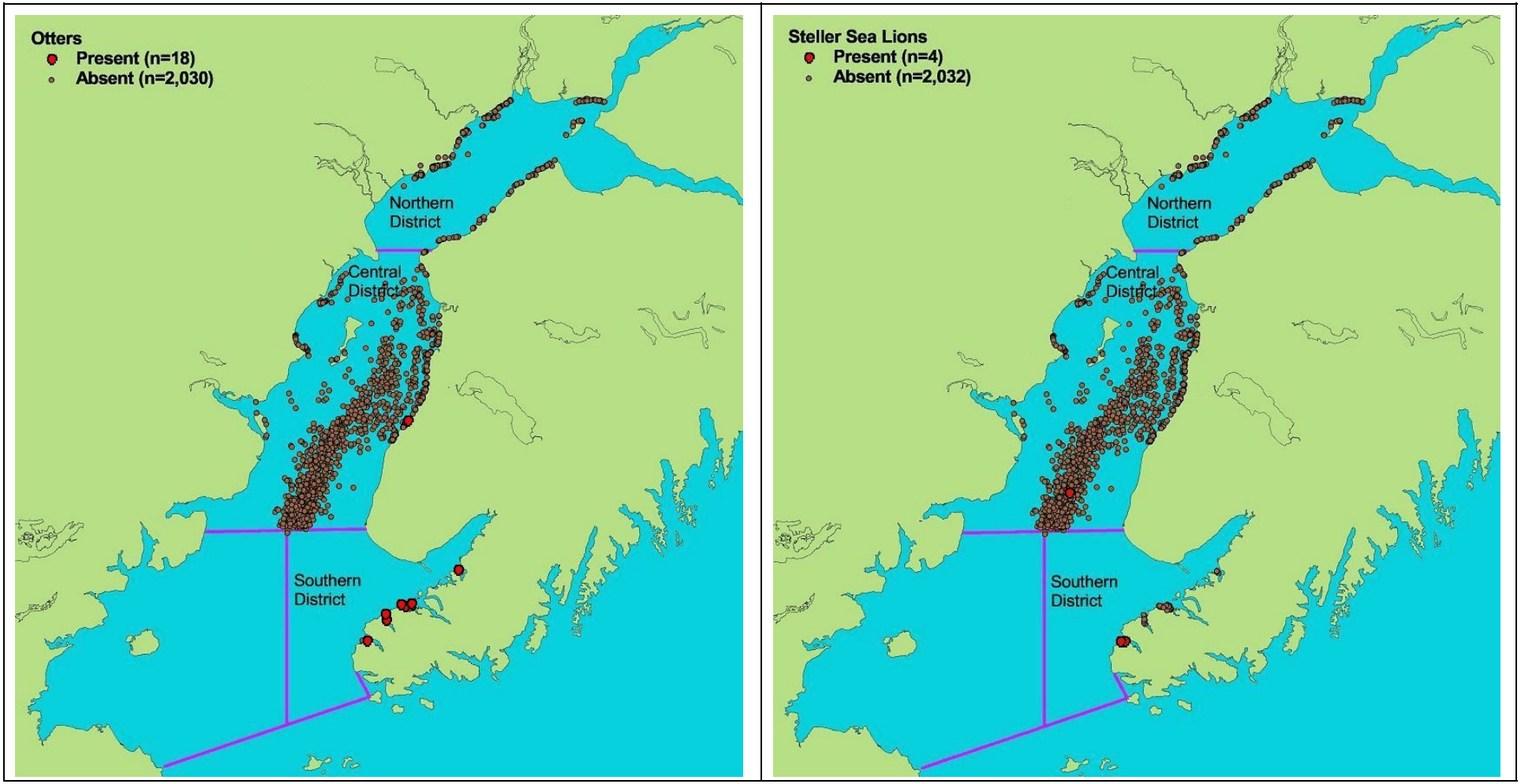


Figure 13, continued.

6. Analysis of Factors that May Affect Incidental take Rates

Because of the different nature of driftnet and setnet fishing, it seems likely that any factors that influence incidental take rates will operate differently for these two fisheries. They are therefore considered separately in this section

The Upper Cook Inlet Driftnet Fishery

In 1999 the incidental take for the Upper Cook Inlet driftnet fishery consisted of five birds (three common murre released dead, and two gulls released alive, without serious injuries), and two harbor porpoises (released alive, without serious injuries). In 2000 the incidental take consisted of one bird (a common murre released alive, without serious injuries), two harbor porpoises (one released alive without serious injuries, and one released dead), and a minke whale (released alive, without serious injuries). The total incidental take was therefore not great, consisting of six birds and five marine mammals.

Given this low amount of incidental take it is unreasonable to expect to be able to establish any clear relationship between incidental take and the fishing conditions. Therefore, rather than attempting to carry out any detailed analyses, a purely graphical approach has been adopted here. This involves plotting the incidental take per hour against the values for 26 variables that are available for describing the fishing conditions. The idea then is that the plots may indicate some relationships that might be investigated further with more data.

The 26 variables describing the fishing conditions are as follows:

1	Year	The fishing year 1999 or 2000 (coded 1 and 2).
2	Month	The month of the year (6, 7 or 8).
3	PlatCd	The platform code: the fishing vessel, a research vessel or the shore (coded 2, 3 and 4, respectively).
4	NetLth	The net length in fathoms.
5	NetDth	The net depth in meshes.
6	MshSz	The mesh size in inches.
7	Current	Whether the net orientation was unknown, with the current, against the current, or both with and against the current (coded 0, 1, 2 and 3, respectively).
8	Shore	Whether the net orientation relative to the shore was unknown, parallel to the shore, perpendicular to the shore, at an angle to the shore, or more than 300m offshore (coded 0, 1, 2, 3 and 4, respectively).
9	NLT800	Number of fishing nets within 800m of the observed net.

10	TdCd	The tide code: unknown, ebb, flood or slack (coded 0, 1, 2 or 3, respectively).
11	StCd	The stage code: unknown, mid, high or low (coded 0, 1, 2 and 3, respectively).
12	DShr	The distance to shore from the net code: unknown, 0, 0-10m, 11-70m, 71-200m, 201-300m, 301-400m, 401-800m, 801-1600m, 1-2 miles, 2-5 miles, and more than 5 miles (coded as 0, 1, 2, ..., 11, respectively).
13	DNet	The distance of the observer from the net code, with the same coding as used for DShr.
14	ObsHD	the distance of the observer to the haul in feet.
15	HabCd	The habitat code: unknown, sandy/mud, gravel or rocky/hard (coded as 0, 1, 2 and 3, respectively).
16	ZoneCd	The zone code: unknown, open beach, peninsula, bay/inlet, river mouth, bar/reef, surf, rip tide or offshore (coded as 0, 1, 2, ..., 8, respectively).
17	Taunt	Whether the net was taunt: unknown, no or yes (coded 0, 1 and 2, respectively).
18	Hook	Whether the net was hook shaped: unknown, no or yes (coded 0, 1 and 2, respectively).
19	Curved	Whether the net was curved: unknown, no or yes (coded 0, 1 and 2, respectively).
20	Tangled	Whether the net was tangled: unknown, no or yes (coded 0, 1 and 2, respectively).
21	Debris	Whether the net had debris: unknown, no or yes (coded 0, 1 and 2, respectively).
22	Damage	Whether the net was damaged: unknown, no or yes (coded 0, 1 and 2, respectively).
23	SeaSt	The Beaufort sea state during the haul (0 to 7).
24	WthCd	The weather code: unknown, clear, glare, part cloudy, overcast, drizzle, fog/mist or rain (coded 0, 1, 2, ..., 7).
25	VisCd	Visibility code: unknown, excellent, good, fair, poor, twilight, dark, none and obstructed (coded 0, 1, 2, ..., 8, respectively).
26	RnGr	Whether the gear was run: unknown, no and yes (coded 0, 1 and 2, respectively).

A value for each of these variables was obtained for each observed set, as far as possible. There were many missing values in some cases, and these were where possible replaced with the known values from the set immediately before or after the one in

question. When this was not possible, the unknown code was used. Data were then available for 1731 observed sets.

Figure 14 shows the plots of the bird and mammal incidental take rates (the incidental take per observed hour) for the sets plotted against the corresponding values for the 26 variables. From these plots the following points can be noted:

Year	There was more bird incidental take in year 1 than in year 2, but more mammal incidental take in year 2 than in year 1.
Month	There was no incidental take in month 8 (August), but this is possibly because the fishing effort was lower than in June and July.
PlatCd	All of the incidental take was observed from platform code 2 (the fishing vessel). This is perhaps not surprising. Platform code 4 is the shore and it is not clear how drift fishing could in fact have been properly observed from the shore.
NetLth	All of the incidental take was with the longest net length of 150 fathoms. This was the length almost always used, so this is not surprising.
NetDth	All of the incidental take was with nets with 45 meshes. This was the depth almost always used, so this is not surprising.
MshSz	All incidental take was with mesh sizes in the middle of the observed range. This may just reflect the fact that the mesh size was usually equal or close to the average size of 5.13 inches.
Current	All of the incidental take was with the net orientation against the current. Again this may just reflect the fact that this was the most common situation.
Shore	All of the incidental take was when the net was perpendicular to the shore or the shore was further than 300m. Again this may just reflect the fact that this was the most common situation.
NLT800	All of the incidental take was when the number of fishing nets within 800m was low. This occurred even though high values of this variable were common. Possibly this is due to a higher probability of incidental take in a net when there is little competition from other nets for this incidental take.
TdCd	There was no bird incidental take with tide code 2 (flood), and no mammal incidental take with tide code 3 (slack). Given the low incidental take numbers it is not clear whether this is just due to chance, but it seems that the tide may influence the incidental take rate.
St Cd	There was no bird incidental take with stage code 2 (high), and all of the mammal incidental take was with stage code 1 (mid). As with the tide code, due to the low incidental take numbers it is not clear whether this is just due to chance, but it seems that the tide stage during hauls may influence the incidental take rate.

DShr	All of the incidental take was when the distance from shore code was 11 (more than 5 miles). This may just reflect the fact that most driftnet fishing was far from the shore.
DNet	All of the incidental take was at moderate distances from the observer to the net. This may just reflect the fact that this was the situation for most of the time. It seems strange that there are numerous cases where the recorded distance from the observer to the net has the codes 9 to 11 which are all greater than one mile.
ObsHD	Incidental take occurred at all distances between the observer and the haul.
HabCd	All incidental take occurred with unknown or sandy/muddy habitats, but this may just reflect the fact that these were the usual conditions.
ZoneCd	All incidental take occurred with surf, riptide or offshore, but this may just reflect the fact that these are the usual conditions.
Taunt	Incidental take occurred when the net was or was not taunt.
Hook	All the incidental take occurred when the net was not hook shaped. This may just reflect the fact that this was the usual situation.
Curved	Incidental take occurred when the net was curved or not.
Tangled	No incidental take occurred with tangled nets, but tangling was a rare occurrence.
Debris	No incidental take occurred in nets with debris, but debris was a rare occurrence.
Damage	No incidental take occurred with damaged nets, but damage was a rare occurrence.
SeaSt	All incidental take occurred with low to moderate sea states, but this may just reflect the fact that these were the usual conditions.
WthCd	All incidental take occurred with low to moderate weather codes, but this may just reflect the fact that these were the usual conditions.
VisCd	All incidental take occurred with low visibility codes, but this may just reflect the fact that these were the usual conditions.
RnGr	Incidental take occurred whether or not the gear was run.

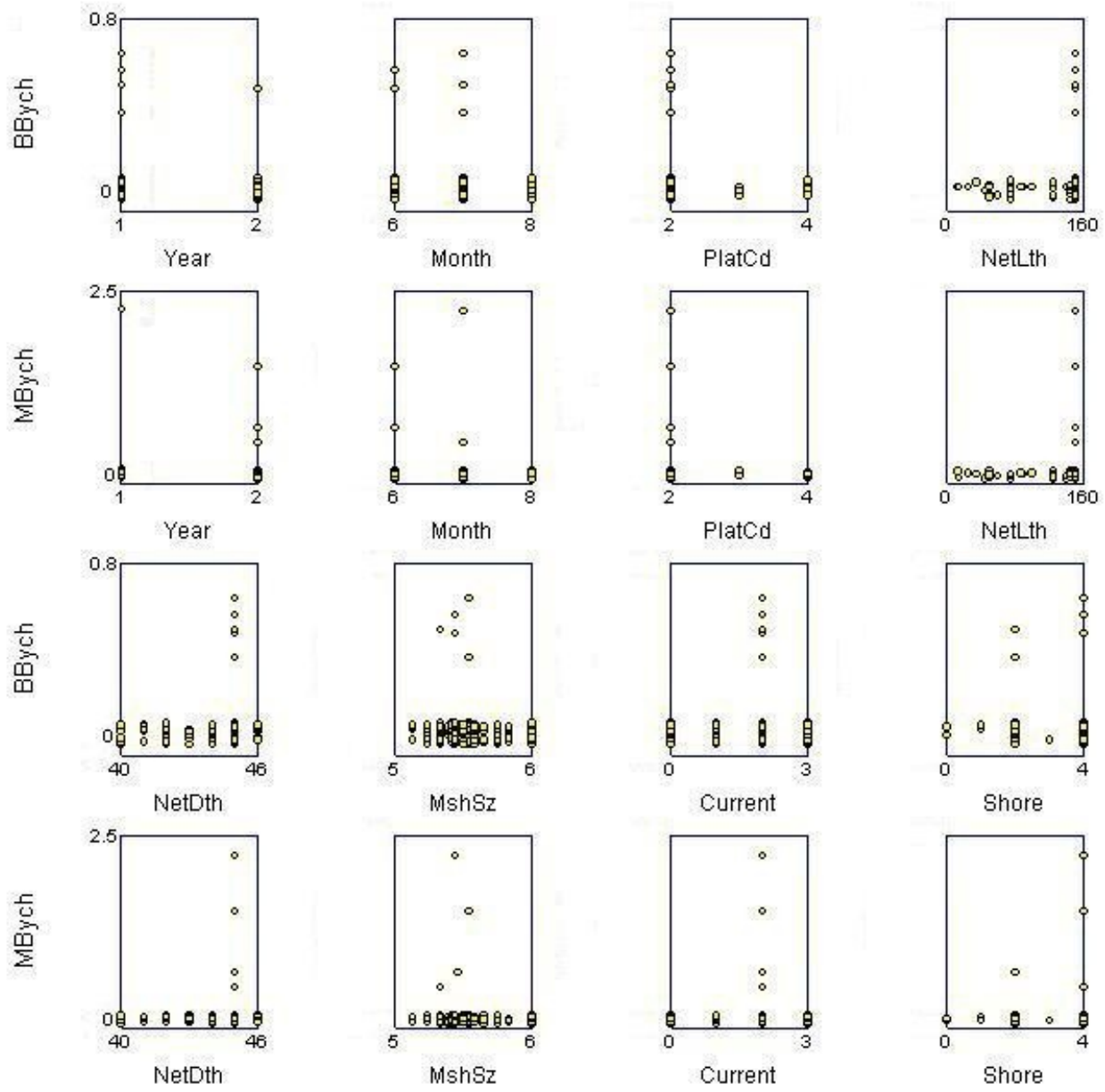


Figure 14 Plots of incidental take rates against 26 variables describing the driftnet fishing conditions. The vertical variables are the number of marine birds entangled per hour of observation (BBych), and the number of marine mammals entangled per hour of observation. The zero incidental take rate values have been jiggered vertically slightly so that they do not all fall at exactly the same place on some of the plots.

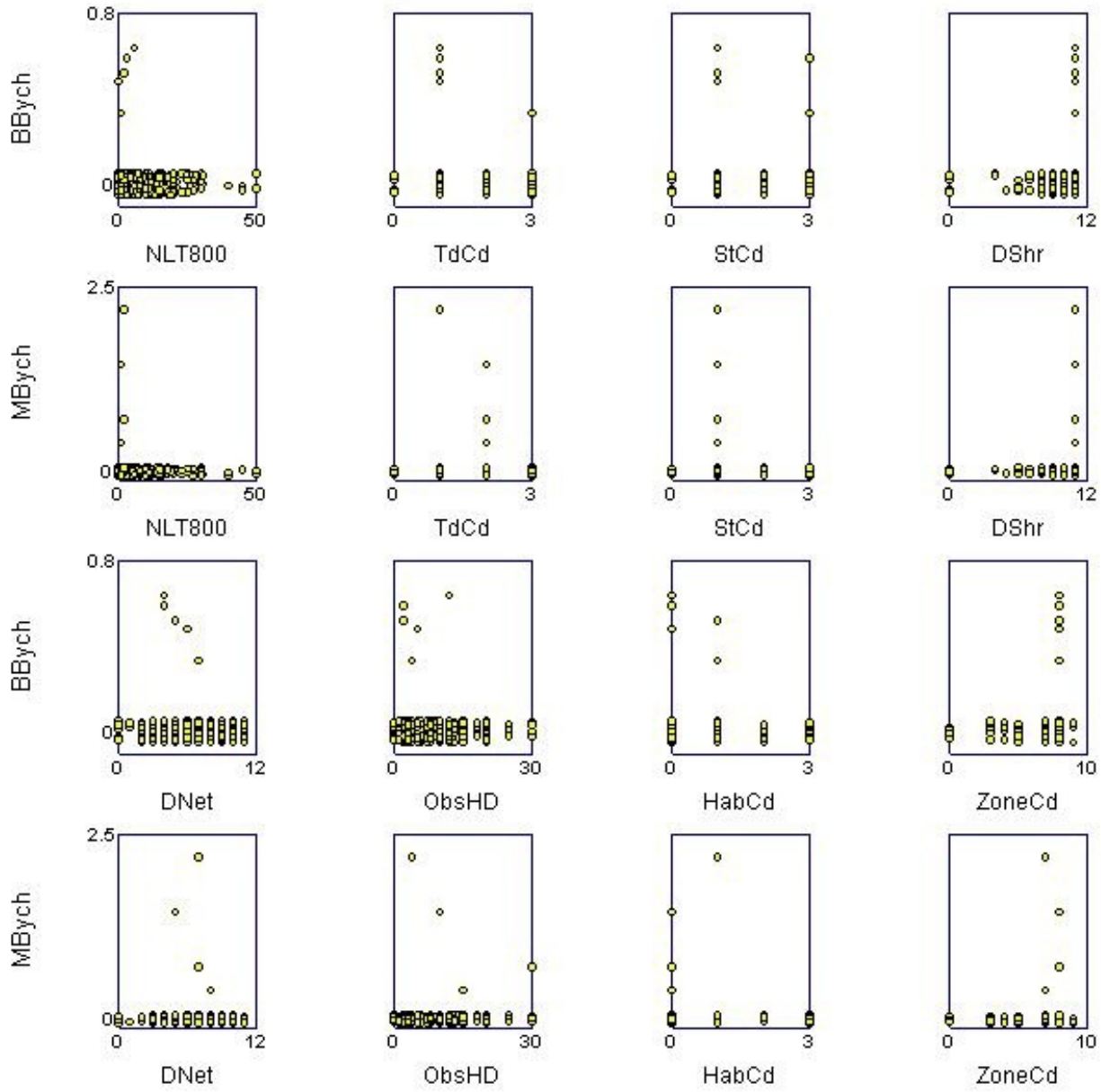


Figure 14 Continued.

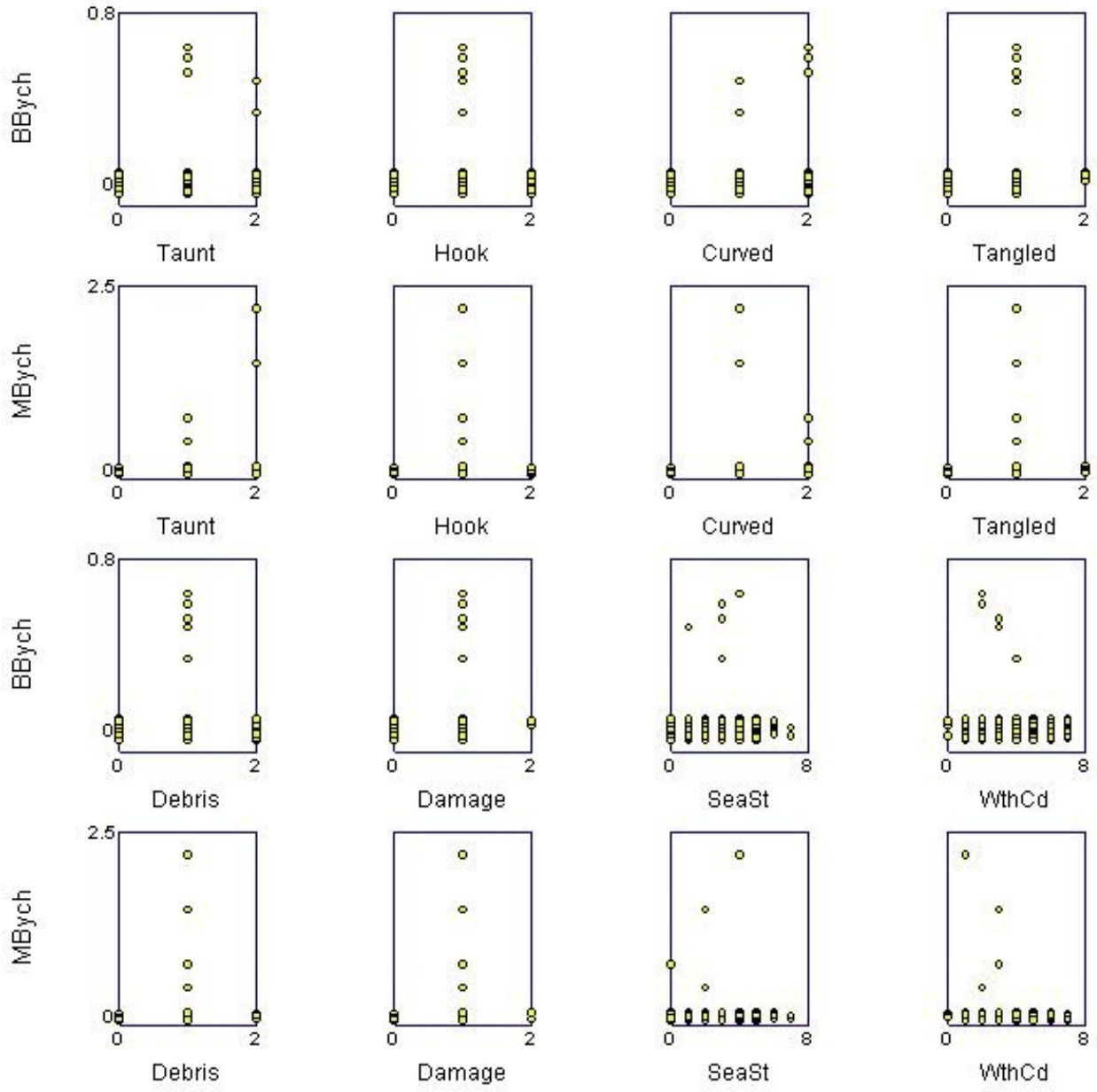


Figure 14 Continued.

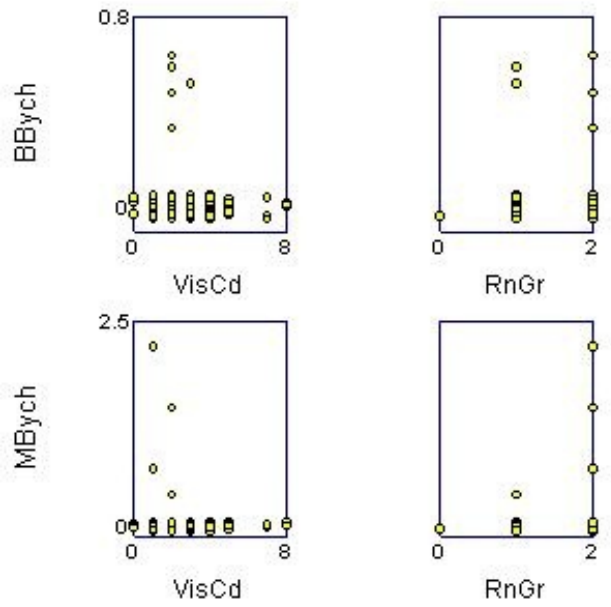


Figure 14 Continued.

The Cook Inlet Setnet Fisheries

In 1999 the incidental take for the Upper Cook Inlet setnet fishery consisted of two birds (one gull released alive, without serious injuries, and one common loon released dead). There was no marine mammal incidental take. In the same year in the Lower Cook Inlet setnet fishery the incidental take consisted of two birds (a white-winged scoter and a common loon, both released alive, without serious injuries), and one marine mammal (a harbor porpoise released alive, without serious injuries). In 2000 the Upper Cook Inlet incidental take consisted of two birds (a marbled murrelet and a white-winged scoter, both released dead), and one marine mammal (a harbor seal released alive, without serious injuries). In the same year there was no incidental take in the Lower Cook Inlet setnet fishery. The total incidental take for both years was therefore six birds and two marine mammals.

With the very low observed incidental take for marine mammals there seems little point in even plotting the incidental take against factors that may influence incidental take. Nevertheless, plots have been produced for both bird and mammal incidental take. There are 31 variables available to describe the setnet fishing conditions, many of which are the same as the variables used for driftnet fishing. These variables are as follows:

1	Year	The fishing year 1999 or 2000 (coded 1 and 2).
2	Month	The month of the year (6, 7 or 8).
3	Fishery	This is 2 for the Upper Cook Inlet fishery and 3 for the Lower Cook Inlet fishery.

4	Skiff	Whether the observer used a skiff: unknown, no or yes (coded 0, 1 and 2, respectively).
5	FshVs	Whether the observer used a fishing vessel: unknown, no or yes (coded 0, 1 and 2, respectively).
6	ResVs	Whether the observer used a research vessel: unknown, no or yes (coded 0, 1 and 2, respectively).
7	Shore	Whether the observer was on the shore: unknown, no or yes (coded 0, 1 and 2, respectively).
8	RemSk	Whether the observer used a remote skiff: unknown, no or yes (coded 0, 1 and 2, respectively).
9	NetLth	The net length in fathoms.
10	NetDth	The net depth in meshes.
11	MshSz	The mesh size in inches.
12	Current	Whether the net orientation was unknown, with the current, against the current, or both with and against the current (coded 0, 1, 2 and 3, respectively).
13	Shore1	Whether the net orientation relative to the shore was unknown, parallel to the shore, perpendicular to the shore, at an angle to the shore, or more than 300m offshore (coded 0, 1, 2, 3 and 4, respectively).
14	NLT800	Number of fishing nets within 800m of the observed net.
15	TdCd	The tide code: unknown, ebb, flood or slack (coded 0, 1, 2 or 3, respectively).
16	StCd	The stage code: unknown, mid, high or low (coded 0, 1, 2 and 3, respectively).
17	DShr	The distance to shore from the net code: unknown, 0, 0-10m, 11-70m, 71-200m, 201-300m, 301-400m, 401-800m, 801-1600m, 1-2 miles, 2-5 miles, and more than 5 miles (coded as 0, 1, 2, ..., 11, respectively).
18	DNet	The distance of the observer from the net code, with the same coding as used for DShr
19	ObsHD	The distance of the observer to the haul code, with the same coding as used for DShr.
20	HabCd	The habitat code: unknown, sandy/mud, gravel or rocky/hard (coded as 0, 1, 2 and 3, respectively).
21	ZoneCd	The zone code: unknown, open beach, peninsula, bay/inlet, river mouth, bar/reef, surf, rip tide or offshore (coded as 0, 1, 2, ..., 8, respectively).
22	Taunt	Whether the net was taunt: unknown, no or yes (coded 0, 1 and 2, respectively).
23	Hook	Whether the net was hook shaped: unknown, no or yes (coded 0, 1 and 2, respectively).

24	Curved	Whether the net was curved: unknown, no or yes (coded 0, 1 and 2, respectively).
25	Tangled	Whether the net was tangled: unknown, no or yes (coded 0, 1 and 2, respectively).
26	Debris	Whether the net had debris: unknown, no or yes (coded 0, 1 and 2, respectively).
27	Damage	Whether the net was damaged: unknown, no or yes (coded 0, 1 and 2, respectively).
28	SeaSt	The Beaufort sea state during the haul (0 to 7).
29	WthCd	The weather code: unknown, clear, glare, part cloudy, overcast, drizzle, fog/mist or rain (coded 0, 1, 2, ..., 7).
30	VisCd	Visibility code: unknown, excellent, good, fair, poor, twilight, dark, none and obstructed (coded 0, 1, 2, ..., 8, respectively).
31	RnGr	Whether the gear was run: unknown, no and yes (coded 0, 1 and 2, respectively).

A value for each of these variables was obtained for each set, as far as possible. There were many missing values in some cases, and these were where possible replaced with the known values from the set immediately before or after the one in question. When this was not possible, the unknown code was used. Data were available for 2579 observed sets.

Figure 15 shows plots of the marine bird incidental take rate per hour (BBych) and the marine mammal incidental take rate per hour (MBych), against each of these 31 variables. From these plots it can be noted that:

Year	There was some observed incidental take in each year.
Month	There was no incidental take observed in June.
Fishery	There was incidental take observed in both the Upper and Lower Cook Inlet fisheries.
Skiff	Bird incidental take was only observed from a skiff.
FshVs	No incidental take was observed from a fishing vessel.
ResVs	No incidental take was observed from a research vessel.
Shore	No bird incidental take was observed from the shore.
RemSk	No incidental take was observed from a remote skiff.
NetLth	Incidental take was only observed with a net length of 35 fathoms, but this is not surprising because this was the usual length.
NetDth	Incidental take was observed for the full range of net depths.

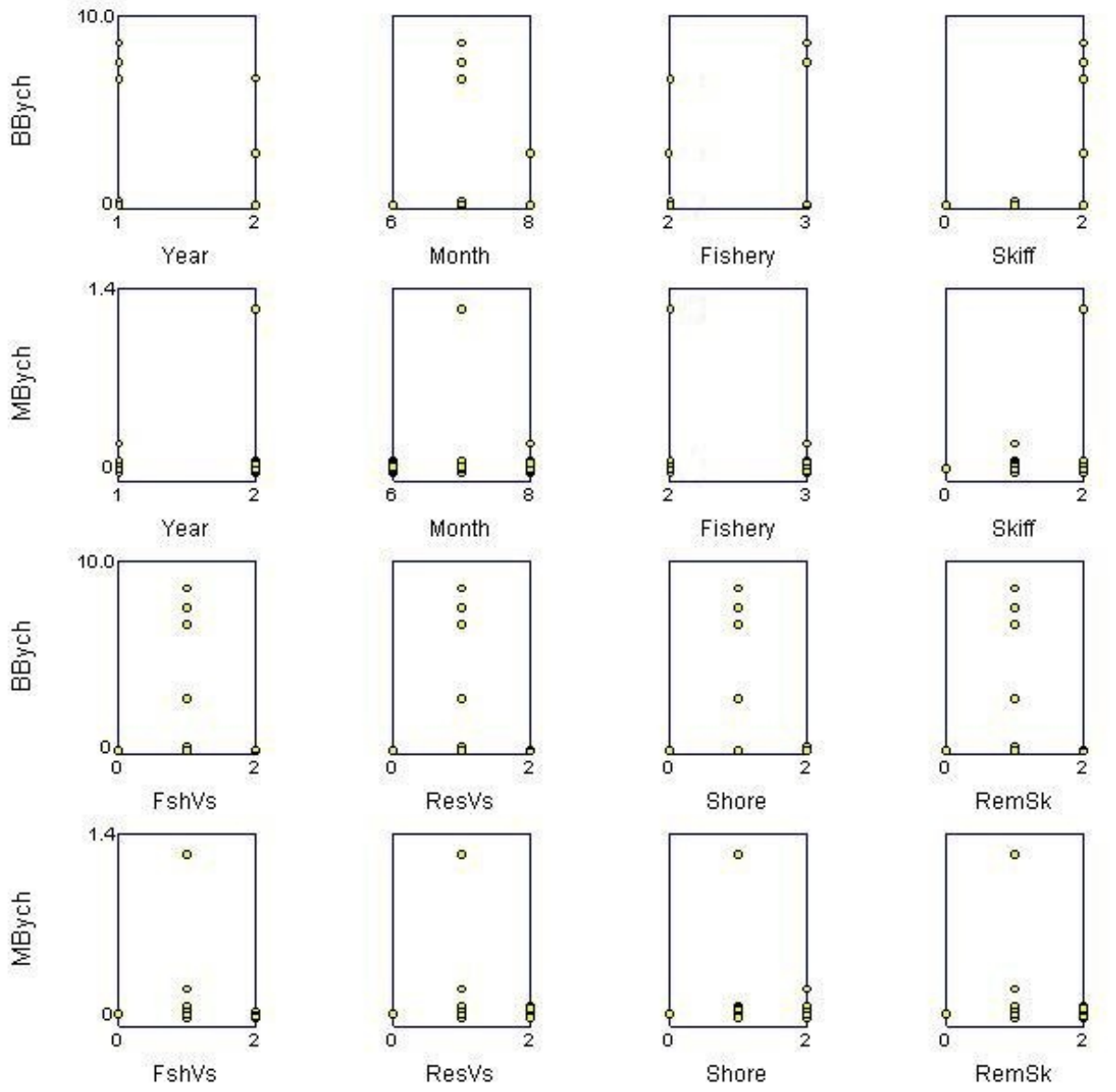
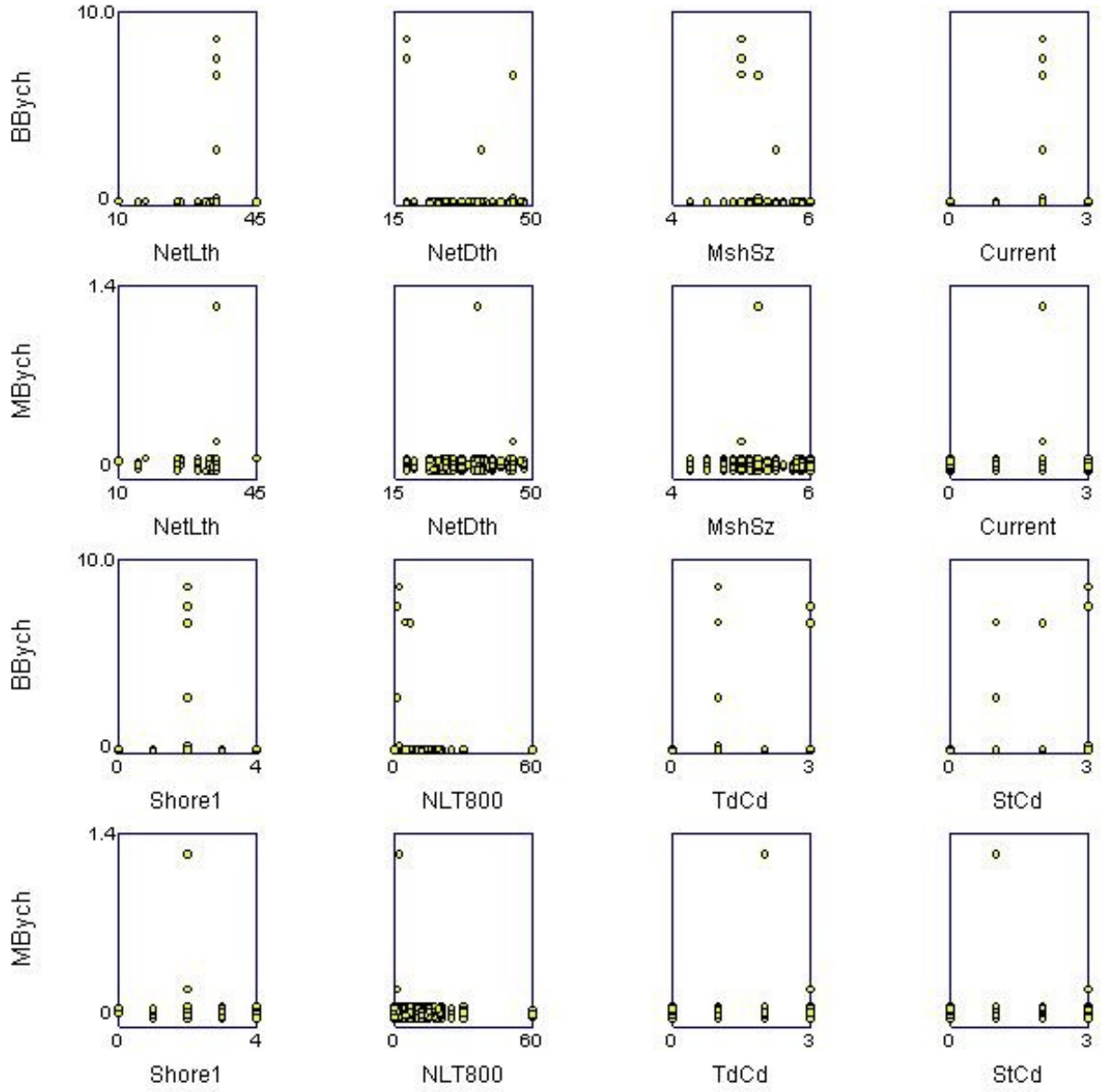


Figure 15 Plots of incidental take rates against 31 variables describing the setnet fishing conditions. The vertical variables are the number of marine birds entangled per hour of observation (BBych), and the number of marine mammals entangled per hour of observation. The zero incidental take rate values have been jiggered vertically slightly so that they do not all fall at exactly the same place on some of the plots.



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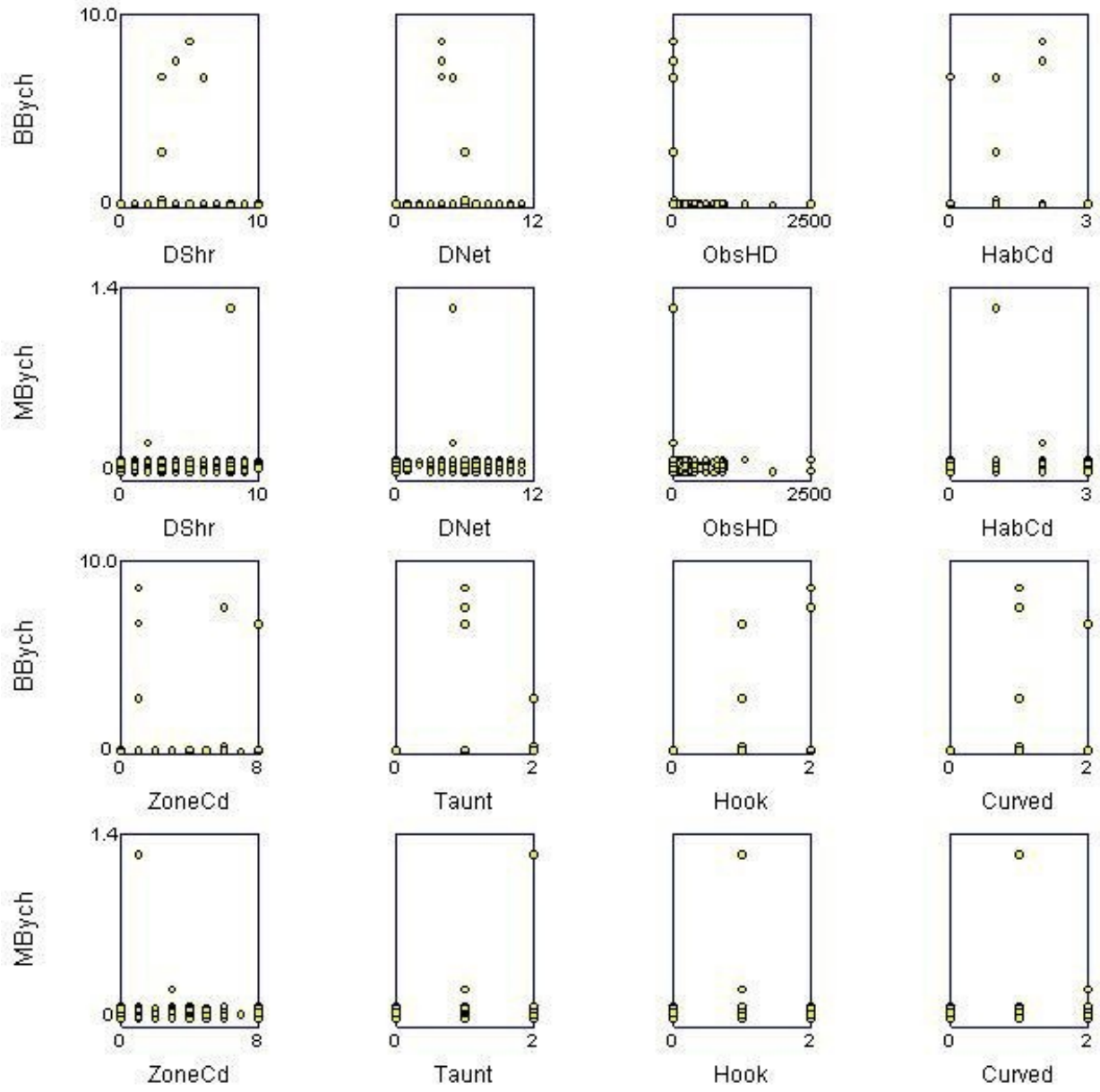

Figure 15 Continued.

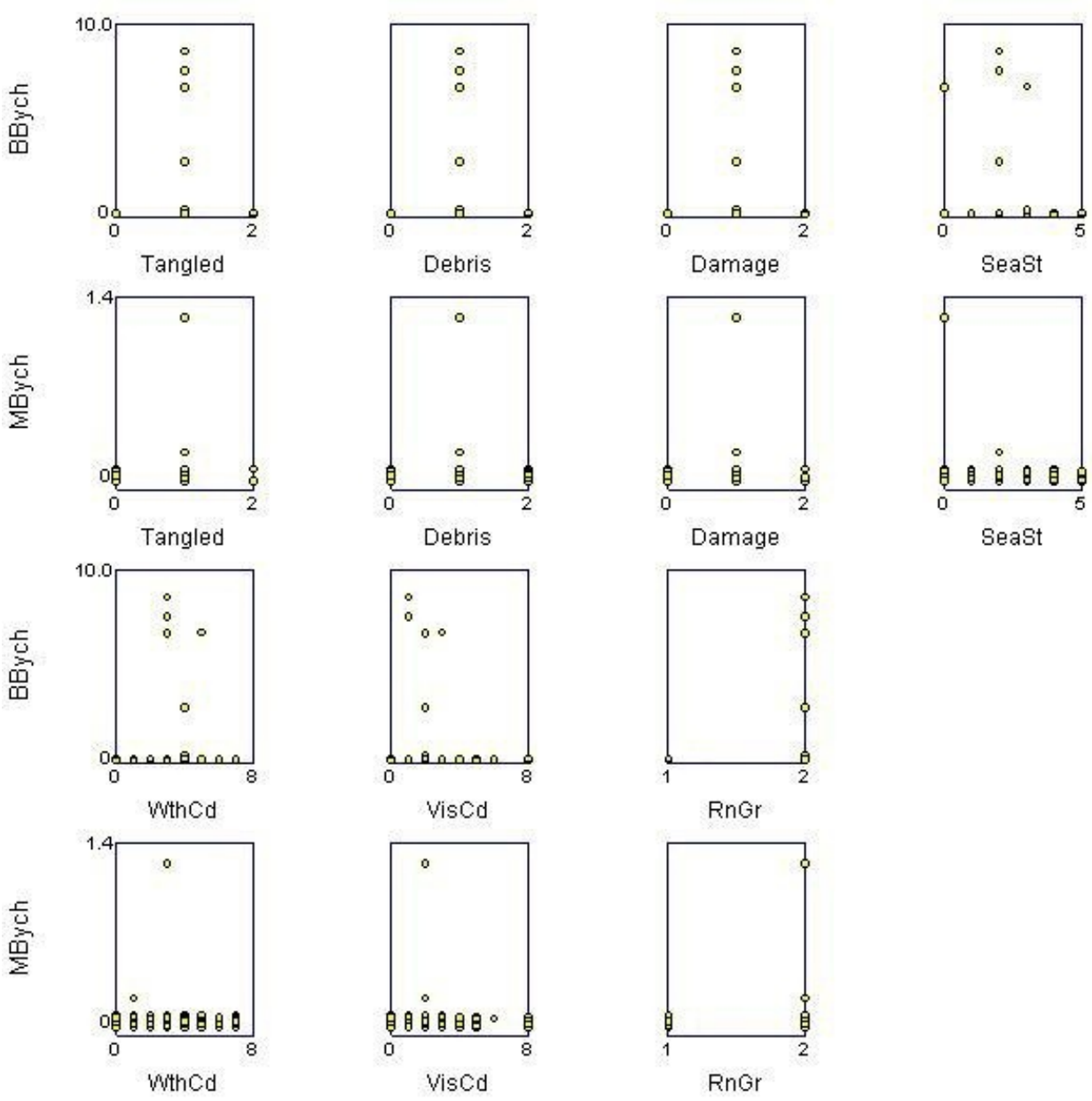

Figure 15 Continued.

MshSz	Incidental take was only observed with a mesh size of about 5 inches, but this was the usual situation so this is not surprising.
Current	Incidental take was only observed when the net orientation was against the current, but this was the usual situation so this is not surprising.
Shore1	Incidental take was only observed when the net orientation relative to the shore was perpendicular to the shore, but this was the usual situation so this is not surprising.
NLT800	Incidental take was observed only when the number of fishing nets within 800m of the observed net was low. As noted above with the driftnet fishery, possibly this is due to a higher probability of incidental take in a net when there is little competition from other nets for this incidental take.
TdCd	Incidental take was observed at all tides.
StCd	Incidental take was observed at all tide stages.
DShr	Incidental take was observed at most distances to shore from the net.
DNet	Incidental take was only observed in a narrow range of distances of the observer from the net, from 200 to 800m.
ObsHD	Incidental take was only observed when the distance of the observer to the haul was unknown.
HabCd	Incidental take was only observed when the habitat was unknown, sandy/mud or gravel, but as these were the usual conditions this is not surprising.
ZoneCd	Incidental take was observed on open beaches, bays and inlets, in surf, and offshore.
Taunt	Incidental take was observed whether the net was taunt or not.
Hook	Incidental take was observed whether the net was hook shaped or not.
Curved	Incidental take was observed whether the net was curved or not.
Tangled	No incidental take was observed when the net was tangled.
Debris	No incidental take was observed whether the net contained debris.
Damage	No incidental take was observed whether the net was damaged.
SeaSt	Incidental take was only observed when the Beaufort sea state was unknown or less than 4, but this was the usual situation.
WthCd	Incidental take was only observed when the weather code was unknown or less than 6, but this was the usual situation.
VisCd	Incidental take was only observed when the visibility was fair or better, but this was the usual situation.

RnGr Incidental take was only observed when the gear was run, but this was the usual situation.

7. Discussion

The only mortality or serious injury of a marine mammal observed in the Cook Inlet fisheries observer program in 1999 and 2000 was the mortality of a harbor porpoise in the Upper Cook Inlet driftnet fishery in 2000. If the PBR for the harbor porpoise had remained at 71 and the target observer coverage level for the driftnet fishery had been reached this would mean that there would not be 95% confidence that the PBR was not exceeded for this species, i.e. it could be concluded that the PBR may have been exceeded in this fishery during the years 1999 and 2000. However this conclusion is not justified because the PBR for harbor porpoises was raised from 71 to 166 in 2000, and then further raised to 255 in 2003, and the observer coverage of the driftnet fishery for 1999 and 2000 was 241 days rather than the targeted 360 days.

The estimated total number of mortalities or serious injuries for harbor porpoise is zero for 1999 and 31 for 2000, giving a yearly average of 15 animals. This is 5.9% of the current annual PBR of 255 for the harbor porpoise, which therefore falls within the range from 1% to 10% of the PBR in terms of classifying the fishery as described in Section 2 of this report. This is the basis for retaining the Upper Cook Inlet driftnet fishery as a Category II fishery (Department of Commerce, 2003, p. 41729).

The target observer coverage levels determined using the Wade (1999) method are not sufficient to estimate total mortality rates with reasonable accuracy, and therefore are not altogether satisfactory for the purpose of categorizing fisheries. In the case of the harbor porpoise in the driftnet fishery, the standard error associated with the mortality or serious injury estimate of 31 in 2000 is 55. Very roughly this suggests that the total number of serious injuries or mortalities in 2000 might have been anywhere from 1 (the observed death) to 141 (the estimated number plus two standard errors). As the estimated number of deaths in 1999 is zero, the upper limit of 141 deaths represents 70.5 deaths per year, which is 27.6% of the PBR. Therefore, although the best estimate of the yearly serious injury and mortality rate for harbor porpoise is 5.9% it is possible that it is four or five times as high as this.

Questions concerning the observer coverage levels required to determine whether a PBR is exceeded, to estimate total serious injury and mortality rates, and to categorize fisheries are discussed in more detail in another report (Manly, 2006).

There were no observed serious injuries or mortalities for marine mammals in the Upper and Lower Cook Inlet setnet fisheries. These fisheries have therefore been

reclassified from Category II to Category III fisheries (Department of Commerce, 2003, p. 41729).

In the Upper Cook Inlet driftnet fishery three common murres were observed to be entangled in nets in 1999 and released dead, while one common murre was entangled and released alive in 2000. The only other bird incidental take in this fishery was of two gulls released without serious injuries. The dead murres in 1999 translates into an estimated total of 183 common murres for the whole driftnet fishery, with this estimate being subject to a large potential sampling error. Incidental take of common murres is of concern because most (74%) of the oiled bird carcasses picked up after the *Exxon Valdez* oil spill were common murres and the species may also adversely affected by the regime change in the oceanic conditions in the early 1980's.

In the setnet fisheries the bird incidental take involving death or serious injury consisted of one common loon (in the Upper Cook Inlet in 1999), one marbled murrelet and one white-winged scoter (both in the Upper Cook Inlet in 2000). These incidental takes of single birds translate into estimates of the whole fishery of 89 common loons in 1999, 37 marbled murrelets in 2000, and 37 white-winger scoters in 2000. Sea ducks such as white-winged scoters and common loons are a group that is becoming of concern to the U.S. Fish and Wildlife Service, so that the incidental take of these birds is important. Incidental take of marbled murrelets is also important because of the adverse effects of the *Exxon Valdez* oil spill and the oceanic regime change in the early 1980's.

Although Kittlitz's murrelet (*Branchyramphus brevirostris*) was not observed as fisheries incidental take, it is in the area and incidental take could occur. As this species is a candidate for listing under the Endangered Species Act, any such incidental take would be of major concern.

Acknowledgments

Mary Sternfield (NMFS) helped enormously with the production of this report by producing the data in the required formats, checking inconsistencies and definitions, and pointing out places where the text needed changes. The report also relied heavily on information from many ADFG and NMFS staff, and I am particularly thankful to help and comments from Robyn Angliss (NMFS), Bryan Belay (Marine Resources Assessment Group Americas Inc.), Brian Fadely (NMFS), Lee Hammarstrom (ADFG), Kathy Kuletz (USFWS), Bridget Mansfield (NMFS), Mandy Merklein (ROAN Inc., Seattle), and Pat Shields (ADFG).

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Appendix A: Forms Used to Record Data

The forms reproduced here are the ones used in 2000. There are some differences between these forms and the ones used in 1999. The differences are shown in the following table.

Form	Name	Differences Between Years
1	Gear and Set data Form.	There are minor differences in the layout, with the 1999 form having a blank back page for comments. Some codes for variables are not the same in both years.
2	Marine Mammal and Bird Encounter Data Form.	There are minor differences in the layout. Some of the codes used are quite different between the years.
3	Marine Mammal and Bird Entanglement Data Form.	There are minor differences in the layout and some minor code differences.
4	Biological Sample Collection.	There are differences in the layout and data collected relative to the set involved. Codes are quite different in some cases.
5	Opener Summary Form.	This form was not used in 1999.

In addition to these forms, observers were also required to fill out a *Marine Mammal Sighting Form 11US* for the National Marine Mammal Laboratory for all of their sightings of marine mammals.

Form 1

FORM 1	Gear and Set Data Form	Fishery *(check)*	Set:	Debrief ID	Entry ID	Check ID	Final ID	Page of
			Drift:					Obs. code:

SET DATA:

Vessel or site name:_____ Permit #:_____ Net ID *(if >1 net/permit)*:____|____ # of nets fished:___

District:_____ Date *(mm/dd)*:_____2000 Platform code's):_____ Full opener. obs.*(y/n)*:_____ Observed set:____

GEAR:

Net length (fath.):_____ Net depth *(meshes)*:_____ Mesh size *(inch.)*:____.____ If leader length*(fath.)*_____ If weedline *(inch)*____

Orientation :___|___ Relt. to nets*(circle)*: Outside Inside Overlap (y/n):____ # nets< 800m_____

POSITION AND CONDITIONS:		**(At the beginning)**			**Distance**		**(Most predominate state while fishing)**					**Obs.vis.**	
	Latitude (N)	Longitude (W)	Tide	Stage	Shore	Next net	Obs.	Depth *(ft.)*	Habitat	Zone	Net codes	Sea state	W	V
Soak		1												
Haul		1					ft.							

FISHING EFFORT		**If partial haul (time)**		**OBSERVER EFFORT:**		**FISHING OPERATIONS**			
FISHING EFFORT	Time	Start	End	Start obs.	End obs.	Whole net fished (y / n)		Run gear ? (y / n)	
Begin (set/last haul)	:	:		:	:	**(Only if "no" fill in below)**		Pulled gear ? (y / n)	
Begin/soak	:	:		:	:	% time whole net fished:		% time tended gear :	
Begin haul	:	:		:	:	min % of net fished:		Est.sq.ft. gear damage:	
End haul	:	:		:	:	**Other forms:**		Circle other forms for this set: 2 3 4 11us	

CATCH DATA:					**COMMENTS: Reference comments**	**MM/MB presence within 300m**		
Species name	Code	# caught	(e/a	# damaged	*For more info. See back of form(circle one) : Y N*	Species	Code	#
					Log book #:_____ page #_____.			

Note codes: Do not leave data fields blank ! "U" = unknown/undetermined" "Z"="other" code. Draw an "X" through fields that don't apply to this set.

Outside	Platform	Orientation	Tides	Distance Code	Habitat	Net Code	Sea State	Observer **Vis**ibility		% code
no net w/in	*a=sn skiff*	*a= with current*	*E= ebb*	*a= 0 b= 0-10m*	*a=sandy/mud*	*a= taut*	*0= <1knt/ <1/4ft.*	**W**eather	**V**isibility	*a=100 %*
300m of at	*b=fishing v.*	*b=against current*	*F= flood*	*c=11-70m (35 fathoms)*	*b=gravel*	*b= hook*	*1= 1-3knt/ 1/4ft.*	*a= clear*	*a= excellent*	*b=76-100*
least 1 side	*c=research v.*	*c=changed (both)*	*S=slack*	*d=71-200m(100 fathoms)*	*c=rocky/hard*	*c= curved*	*2= 4-6knt/ 1/2ft.*	*b= glare*	*b= good*	*c=51-75%*
of obs.net	*d=shore*	*a=parallel to shr.*		*e= 201-300m(150 fathoms)*	Zone	*d= tangled*	*3= 7-10knt/ 2ft.*	*c= pt.cloudy*	*c= fair*	*d=26-50%*
Inside	*e=remote fv*	*b=perpn.to shr.*	Stage	*f= 301-400m(<1/4mile)*	*a=open beach*	*f= debris*	*4= 11-16knt/ 4ft.*	*d= overcast*	*d= poor*	*e=1-25%*
nets on both	*f=remote sk.*	*c=at angle to shr.*	*M= mid*	*g= 401-800m(<1/2 mile)*	*b=peninsula*	*g= damage*	*5= 17-21knt/ 6ft.*	*e= drizzle*	*e= twilight*	*f=0*
sides<300m	*g=tender*	*d=off shore>300m*	*H= high*	*h= 801-1600m(<1mile)*	*c=bay,inlet*	*f=surf*	*6= >28knt/ 10ft.*	*f=fog/mist*	*f= dark*	
of obs.net			*L= low*	*i=1-< 2 miles*	*d=river mouth*	*g=rip tide*	*7=28-34kn./14ft.*	*g=rain*	*g= no*	
shore=net				*j=2-5 miles k=>5 miles*	*e=bar,reefs*	*h=off shore*	*8=>34 kn./14 ft.*		*h= obstructed*	

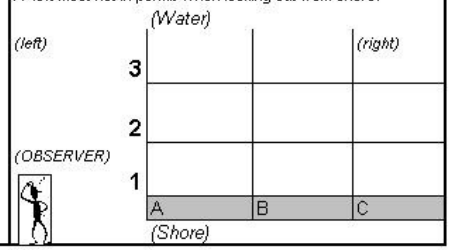
COMMENTS FROM FRONT PAGE: Reference Comments to Associated Data Field's on the front of the Form.

For set net: Draw (from an aerial view) the lay out of the set net site and the relationship (and Net ID) of each net in the permit and other associated nets near by. Include the shore line and any coastal formations that may be influencing the net. Do this on the back of the first page for a Form 1 for each new permit and suite of nets.
For drift net and set net: Draw and describe any unusual/interesting or useful information about the gear and how it is fished. If there are other nets near by or if the net is set close to shore. Include this in the drawings and description.

Important note for all: Write questions for debriefing.
If photos forhis set: Roll #_____Frams#____to____. Record on Form 5.
"u" and "z" codes need to be referenced sequentially by number.
Clarify inconstancies or unusual events.
Add additional species, times etc. if not enough room on form
Enter comments into database so that the data users can understand what happened and why. They may not have access to this form.

Net ID Grid

A=left most net in permit when looking out from shore.



Form 2

FORM 2	Marine Mammal and Bird Encounter Data Form		Set:	Debrief ID	Entry ID	Check ID	Final ID	Page of
		Fishery (check):	Drift:					Obs. Code:

Set Data:

Vessel or site name:_____ Permit code:_____ Net id code (set net):_____

Date*(mm/dd)*:_____2000 Associated forms *(circle)*: 3 4 11us Comments/log *(y/n)*:___ *(see back if y)* Observed set #_____

ENCOUNTERS (<10m)				Group				Time <10m		Behavior		at net <2m		DETERRENTS						Impact	React.
ID#	Species name	Code	#	A	S	G#	C	1st	total	b4 net	to net	at net	where	Time	N	P	Method	Distance	# times	code	code
								:						:							
								:						:							
								:						:							
								:						:							
								:						:							
								:						:							
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								:						:							
								:						:							

Note: Do not leave data fields blank ! "U" = unknown/undetermined" "Z"="other" code. Draw an "X" through fields that don't apply.

MM Codes	ID #	Time	**Primary** behavior (comment on back)			Deterrents	Physical Impact
pv=*harbor seal*	*The unique*	**1st**= first sighted	Before net **(b4 net)**	**to net**	Behavior **at net**<2m	**N**otice to fisher	*a=no apparent impact*
ej=*steller s. lion*	*animal(s)*	<10 m of net (24hr)	*a=stationary*	*a=stationary (drifting)*	*a= stationary*	*a=no notice*	*b=possible injury**
cu=*n.fur seal*	*identifier*	**Total** time <10m	*b=meandering around*	*b=miss(parallel/outside)*	*b= feeding near net*	*b=uninten. notice*	*c=injured**
pp=*harbor porp.*	Age	*a=< 1 min.*	*c=directional*	*c=avoid (went around)*	*c= feeding on net*	*c=intend notice*	*d=died**
pd=*Dall's porp.*	*a=adult*	*b=1-5 min.*	*d=bow riding*	*d=avoid(u turn at net)*	*d=swam over net*	Provided Info.	*(injured = comments)**
dl=*beluga whl.*	*b=sub adult*	*c=6-15 min*	*e= feeding*	*e= approached*	*e=mostly diving*	*d=no comment*	Reaction
oo=*killer whale*	*c=pup/calf*	*d=16min.-30min*	*f= at another net*	*f= unintended deterrence*	*f=in/out of 2m area*	*e=comnt.*	*a=no apparent reaction*
el=*sea otter*	Sex	*e=31min-1 hr.*	*g=on land near by*	*g=enticed (lured)*	*g=outside of 2m*	Method	*b= temporarily retreated*
See code list for more	*f=female*	*f=<1hr.*	*h=(bird) flew in& landed*	*h=flew in (landed)*	*h= travel along*	*a=seal bomb*	*c=successfully deterred*
# Note :	*m=male*	*g=on/off whole set*	*i=flew away*	*i=flew away*	**Where** most time	*b=run gear*	*d=approached net*
Number of individuals	Composition	*h=present all time*	*j=dove*	*J=dove under*	*a= far end*	*c=gun shot*	*e=into net (entangled)*
that share all the same	*a=alone.*		*k=surfaced (poped up)*	*k=surfaced (poped up)*	*b= tended end*	*d=moved gear*	*f= marked chg. behavior*
fields on this line.	*b=with juv.*				*c= mid net*	Distance	*(if "f comment)*
Group # Note:	*c=with adult*				*d= all along net*	*1=hit* *4=>10m*	
Total # of animals	*d= w/adult& jv.*				*e= outside;10m of net*	*2=<5m* *5=undt*	
in the group. Alone= 1.	*e=mix species*				*f =both sides of net*	*3=<10m* *6=unobs.*	

COMMENTS FROM FRONT PAGE: Reference Comments to Associated Data Field(s) on the Front of the Form.	
Describe all relevant information, especially behavior and injuries. Draw marine mammal/bird in relation to net/vessel. Describe any unusual marks, damage, debris, fishing gear, tags, etc.. Draw in location of any wounds, scars, net marks, debris:	Reference all "U" and "Z" codes with numbers for comments. Photo reference: (if yes): roll #_____ and frame #____ Log book #_____ page _____ to _____ Write down any questions you may have about how to fill out this form.

Form 3

FORM 3	Marine Mammal and Bird Entanglement Data Form			Set:	Debrief ID	Entry ID	Check ID	Final ID	Page of
			Fishery *(check)*	Drift:					Obs. Code:

Set Data:

Vessel or site name:_____ Permit code:_____ Net id code (if >1 net/permit):____

Date (mm/dd):_____2000 Circle associated forr 2 4 11us Log #____ Pg. #_____ Observed set #_____

Entanglements				Time	Obs.eft.		Release	Time	Condition/Injur.		Position in net			Sex	Age	Length		Sample
(I /U)	ID #	Species name	Code	(24 hr.)	N	R	Code	(24hr.)	Cond	Injur. *	Along	S	Depth	*(m,f,u)*	*(a,s,j)*	*cm/mm*	*(e/a,*	sp.code#
				:				:										
				:				:										
				:				:										
				:				:										
				:				:										
				:				:										
				:				:										
				:				:										
				:				:										
				:				:										
				:				:										

Note: Do not leave data fields blank ! "U" = unknown/undetermined" "Z"="other" code. Draw an "X" through fields that don't apply.

MM Codes

pv=*harbor seal*
ej=*steller s. lion*
cu=*n.fur seal*
pp=*harbor porp.*
pd=*Dall's porp.*
dl=*beluga whl.*
oo=*killer whale*
el=*sea otter*

(I/U) ID # (note)

The unique animal ID # If sure it is the same indiv animal as on from 2 enter in "I" for identified and form 2 ID #. If not certain enter in "U" and a sequential number for each new animal on 3.

N= Observer effect (obs. eft.)

a=fisher aware of entanglement
b=obs. notified fisher immediately
c=obs. notified fisher later(>5 minutes.)
d=obs. did not notify fisher

R=If human assist in release (obs. eft)

a=fishermen released
b= observer assisted in released

Released Codes

a=momentary contact
b=self-release
c=self-rel w/net damag
d=human-release
e=human-rel w/net dama
z=other (comment)

Condition Codes

a= alive unknown conditi
b= alive uninjured
c=alive trailing gear (se*
*d= alive injured**
e=alv. injur.due to human
f=dead; due to entanglem
*g=dead;due to release**
h=frsh dead; caused unk
*i=previously dead**

Along Net Codes

a= tended end
b=mid net
c=last quarter pulled
d=anchor line
e=lead
S= if <300m shore
a=end close to shore
b=end furthest/shore

Depth Codes

a=float line d=bottom
b=top msh. u=unkn.
c=mid msh.

Age Codes

a=adult
s=subadult
j=(pup/calf)

COMMENTS: Reference to associated data field.

***Injuries** must be described in comments. If injured or dead enter all codes that best reflect the injuries and describe further in comments. Enter "x" if there are no injuries observed.

Injury codes *

a=penetrating
b=gashes, slits
c=net marks
d=blood evident
e=head trauma
f=fishing gear
g=entangle debris
h=oiled
I=behavioral trauma; (unsteady/disoriented/ exhausted/gasping)
z=other

More comments on back (y/n)___

COMMENTS FROM FRONT PAGE: Reference Comments to Associated Data Field(s) on the Front of the Form.	
Describe and/or draw all relevant information. Especially behavior/injuries/cause of death. Draw marine mammal/bird in relation to entanglement in ne Describe any unusual marks, damage, debris, fishing gear, Draw in location of any wounds, scars, net marks, debris.	Be generous with your comments and enter them in the data base. Photo reference (circle): Y N (if yes): roll #_____ and shot #____ Photo: Associated forms and data field:_____. Write down any questions you may have about how to fill out this form. Enter detailed comments into the data base.

Form 4

FORM 4	BIOLOGICAL SAMPLE COLLECTION			Debrief ID	Entry ID	Check ID	Final ID	Page of
								Obs. Code:

SAMPLE SOURCE									
Date *(mm/dd)*:	00	Vessel or site:			Permit code:			Sample #	
Sample from observed permit *(circle)*:		**Y**	**N**	**Unobs. set info. continued Fill below (draw line though if unknown)**					
Observed set information		**Fill below**		Time of entanglement:	:		Distance to shore *(m)*		
There should be a Form 1	Observed set #:			Time of death:	:		Dist. to net if <300m:		
Circle other forms filled for this set:		2 3	11us 4	Platform code:			# fishing < 800m:		
Unobserved set information		**Check below**		Latitude (N)			Habitat/zone *(codes)*.		
Form 1 filled in for this permit on this day		y	n	Longitude(W)	1		MM with in 300m(y/n) ?		
Sample taken from a fi/sn site with no observer:		y	n	District			MB with in 300m(y/n) ?		
Sample not from a fishing site/boat:		y	n	Depth *(ft)*			Other dead MM/MB near by(y/n) ?		
If unobserved set fill in info. to right				Tide*(2codes)*			Circle associated forms	11us	other from 4's

SPECIES IDENTIFICATION *(fill in or circle)*					MM measurements		Bird measurements		Tags and brands		
Species					Standard length(cm):		Bill length (mm)		Type	#/description	
Species code					Curviliner length (cm):				Tags		
Sex*(circle)*	F	M	U		Axillary girth(cm):				Brand		
Age*(circle)*	Adult	subadult	pub/calf	unkn.	Fluke width (cm):				Bird bands		
Beluga color*(c)*	White	gray/white	gray	dark gray	Blubber thickness:				Other		

CARCASS CONDITION		USE BACK OF FORM TO DRAW LOCATION OF MARKS AND ADD COMMENTS						
Condition	Check below	Wounds Present	Check below	Body location (codes)	Extent (code)	Photos(y/n)	roll	frame
Darely alive*(see cautions)*		Penetrating						
Dead; recently		Gashes, slits						
Dead partly decomposed		Net marks						
Dead very decomposed		Blood evident						
Skeleton only		Head trauma						
Scavenger damage		Fishing gear(keep!)						
Human damage*(comment)*		Oiled						
Other*(see comments)*		Other						

Samples type	Check all taken	Time collected (24hr.)	frozen date(99)	Time (24hr.)	Where stored
Whole carcass		:		:	
Whole head		:		:	
Jaw / not head		:		:	
Teeth		:		:	
Skin		:		:	
Stomach		:		:	
Other:		:		:	

CODES u=unknown z=other x=not applicable			
Platform	Habitat/Zone	Tides	Extent
a=sn skiff	*a=sandy/mud*	*E= ebb*	*a=slight(<10%)*
b=fishing vessel	*b=gravel*	*F= flood*	*b=modrat.(<50%)*
c=research vesse	*c=rocky/hard*	*M= mid*	*c=very (>50%)*
d=shore	*e=penisula*	*H= high*	Body location
e=remote fish v	*b=bay,inlet*	*L= low*	*a=head* *e=fin*
f=remote skiff	*c=river mouth*	*R= rip*	*b=body* *f=fluke*
t=tender	*d=bar,reets*	*t=surf*	*c=front flipper*
	e=off shore	*g=rip tide*	*d= back flipper*

Sample tracking				
Date	Name	Organization	Contact Address	Contact number

COMMENTS FROM FRONT PAGE: Reference Comments to Associated Data Field(s) on the Front of the Form.

Note: Do not leave data fields blank ! "U" = unknown/undetermined" "Z"="other" code. Draw an "X" through fields that don't apply.

Draw the sampled animal.

Describe any unusual marks, damage, debris, fishing gear, tags, etc..)
Draw in location of any wounds, scars, net marks, debris:
Draw location of samples taken:
Retain fishing gear sample.

Photo reference (circle): Y N (if yes): roll #_____ and shot #____
Photo: Associated forms and data field:_____.
Write down any questions you may have about how to fill out this form.

Form 5

FORM 5	Opener Summary Form					Debrief ID	Entry ID	Check ID	Final ID	Page of
										Obs. code:

Legal Opener Date and Times		Start		End		Observer at site	Start		End		Total time off site for opener in hours
	Code	Day	Time	Day	Time		Day	Time	Day	Time	
Opener 1						opener 1					
Opener 2						opener 2					

				Fishing Effort						Observer presence					Salmon	Marine mammals and birds			
Date	Fishery			Total	Total	Fishing time				Time	Time	# Hauls	# Hauls		caught	Injured killed obs. sets			
2000	S/D	District	Permit #	# nets	Fathoms	Began	A/E	Ended	A/E	Started	End	Obs.	Not Obs.	A/E	#	Species	Code	#	M/ I

Note: Do not leave data fields blank ! "U" = unknown/undetermined" "Z"="other" code. Draw an "X" through fields that don't apply.

Instructions For Form 5 are in the manual section 3. Please refer to them !

Logbook entries (include all pages)

Logbook#: page # to

# of Forms			Photos	
Form	opener 1	open. 2	Roll #	Frame #
Form 1 #				
From 2 #				
Form 3 #				
Form 4 #				
Form 5 #				
11 US #				

COMMENTS FROM FRONT PAGE: Reference Comments to Associated Data Field's on the front of the Form.

Be generous with comments. Write safety concerns, suggestion and comments about this opener. If any permit holder or fishermen refuses to allow you to observe their net document this here: Record the permit #, holder/fishers name. Describe: When, where, and how this refusal occurred. Explain why if you know or record if a reason is given. Make sure log book notes are refurenced. This is not a citation but a record/explanation to the program, documenting DCI's attempt to cover perm Draw and describe any unusual/interesting or useful information about the opener.	Write down any question you have about how to fill out this form. "U" and "Z" codes need to be referenced sequentially by number. Clarify inconstancies or unusual events. Add additional species, times etc. if not enough room on form Enter comments into database so that the data users can know what happened and why. They may not have access to this form.

Refusals (use more space if necessary). Enter this information into the data base.

Permit #/name	date	time	Where	how /why

Contacts

contact date	Name	permit	phone	when will take observer	where / how details

Notes:

Appendix B: Details of Incidental Take of Marine Mammals and Birds

Fishery	Date	Animal	Condition	Notes
Drift	12/07/1999	Unidentified Gull	Alive, uninjured	The gull was tangled at the float-line depth, mid-net, at the end closest to shore. The net was <300m from shore. The gull self-released, alive and uninjured.
Drift	12/07/1999	Unidentified Gull	Alive, uninjured	The gull was tangled at the float-line depth, in the last quarter of the net pulled, at the end closest to shore. The gull self-released, alive and uninjured.
Drift	11/07/1999	Common Murre	Dead, due to entanglement	The murre was tangled in the last quarter pulled, at the end furthest from shore, at mid-mesh depth. The net was <300m from shore. The fisher released the bird, but it was dead, due to the entanglement.
Drift	11/07/1999	Harbor Porpoise	One alive, uninjured and one alive, injured	Two porpoises were entangled at the float line depth, in the tended end of the net. Both appeared to be adults (with 122 cm estimated length). The two animals collided with the net. The net was set in a rip tide. The tide was ebbing and they were entangled traveling north, against the current. Once into to the net, they did not seem to be badly entangled, but were trying to swim through the net rather than backing out or turning and swimming parallel to the net. The crew noticed the entanglement and began net retrieval. The animals were about 40-50 fathoms from the vessel. Upon tightening of the net during retrieval the first porpoise became disentangled with no apparent injury or impairments. The other porpoise made it to within 12 ft of the vessel. As the fishers spread the net by hand it became disentangled. It quickly swam away with a deep dive with no obvious impairments although while entangled some blood was visible coming from a laceration on the posterior of the dorsal fin. The extent of the laceration was not seen, but it was definitely was not severe and probably no more than a few inches (3-4 in.).
Drift	15/07/1999	Common Murre	Dead, due to entanglement	The murre was tangled in the last quarter of net pulled, at the top mesh depth. The fisher released the murre dead. The murre was an adult, length 49 cm, and sex unknown.
Drift	28/06/1999	Common Murre	Dead, due to entanglement	Observer recorded entanglement at 11:03 hrs. Murre was entangled mid-net at an unknown depth. Fisher was aware of tangle and released the murre dead, due to entanglement at 11:19 hrs. The observed noted "neck through net." The murre's length was not recorded; the adult murre was collected.

Set	29/07/1999	Common Loon	Alive, uninjured	Loon was entangled mid-net at end closest to shore at top mesh depth. Net was <300m from shore. The observer assisted in the release of the loon alive, uninjured but with damage to the net. The loon, which had an estimated length of 55 cm. The sex and age were unknown.
Set	29/07/1999	White-winged Scoter	Alive, uninjured	Scoter was entangled mid-net at end furthest from shore at top mesh depth. Net was <300m from shore. The observer participated in the release of the loon, alive and uninjured. The bird was an adult male, 45 cm in length.
Set	14/07/1999	Unidentified Loon	Dead, due to entanglement	The loon was found in net at the time the haul-soak was watched. It was entangled mid-net at an unknown depth, and was released dead, due to the entanglement. The loon was an adult with the sex unknown, and a length of 7.6 cm.
Set	31/08/1999	Harbor porpoise	Alive, condition unknown	The entanglement occurred mid-net, at the end close to shore at top mesh depth. The net was <300m from shore. The porpoise self-released, alive and uninjured. The age, sex, and length were unknown.
Set	08/07/1999	Unidentified Gull	Alive, condition unknown	The gull self-released alive with the condition unknown. The entanglement occurred in the in last quarter pulled, in the end furthest from shore at the float line depth. The net was <300m from shore. The sex and age were unknown, no length was recorded, and no samples were collected.
Drift	26/06/2000	Harbor porpoise	Alive, injured due to human release	The porpoise was entangled mid net at the top mesh depth. The fisher released the animal alive, but it was injured due to the release, with damage to the net. The age and sex could not be determined. The estimated length was 100 cm. The dorsal fin was nicked up and bleeding, with wounds about 1/2 cm deep. No other wounds were present. When it was released it vigorously swam away and disappeared
Drift	26/06/2000	Harbor porpoise	Alive, condition unknown	The fisher released the animal in an unknown condition unknown from the net in the last quarter pulled at mid-mesh depth. It was an adult male with length 131 cm. No injuries were observed, but the observer commented that it was barely alive, probably due to drowning. On release it sank and was not seen again. It is assumed to have died.
Drift	03/07/2000	Common Murre	Alive, injured	The murre was entangled mid-net, at the bottom depth. The observer assisted in the release, and the murre was alive but injured. The observer noted that the bird was released in good condition but the webbing on it's left

				foot was cut by the drift net. The murre was an adult of unknown sex and length.
Drift	26/06/2000	Minke Whale	Alive, condition unknown	The minke was in the tended end of the net, in end furthest from shore. The net was <300 m from shore. The fisher released the minke alive, but in unknown condition. The sex and age were unknown.
Set	24/07/2000	Harbor Seal	Alive, uninjured	The observer noted that the seal popped up with the net over it's head and a fish in it's mouth. The seal self-released, alive and uninjured.
Set	03/08/2000	White Winged Scoter	Fresh dead, cause unknown	The observer recorded a scoter found entangled and dead in the bottom of the net while pulling the net in. The adult, male scoter was freshly dead by an unknown cause. The length was 24 cm. No injuries were observed. It was found in the tended end, in the end furthest from shore. The net was <300 m from shore.
Set	21/07/2000	Unidentified Gull	Previously dead	Observer recorded that the subadult seagull had a wing missing and its body was torn apart. There were seagull nests on the shore, and eagles eat the gulls.
Set	21/07/2000	Marbled Murrelet	Dead, due to entanglement	The fisher released the murrelet dead, due to the entanglement. The entanglement occurred mid-net, in the end furthest from shore at the top mesh depth. The net was <300m from shore. The murrelet was of unknown sex and age, and the length was not measured.

Appendix C: Detailed Fishing Effort in the Upper Cook Inlet Setnet Fishery

	Effort in 1999				Effort in 2000			
Area	Date	Permits	Open Hours	Permit Hours	Date	Permits	Open Hours	Permit Hours
24421	01-Jul	39	12	468	03-Jul	46	12	552
	03-Jul	46	15	690	06-Jul	18	12	216
	05-Jul	48	12	576	10-Jul	48	12	576
	08-Jul	41	17	697	12-Jul	49	13	637
	09-Jul	48	15	720	13-Jul	56	16	896
	11-Jul	23	13	299	15-Jul	37	14	518
	12-Jul	59	12	708	16-Jul	44	12	528
	14-Jul	26	19	494	17-Jul	43	17	731
	15-Jul	49	19	931	18-Jul	37	14	518
	17-Jul	53	18	954	20-Jul	41	12	492
	18-Jul	45	10	450	24-Jul	41	12	492
	19-Jul	52	12	624	31-Jul	25	12	300
	22-Jul	52	12	624	07-Aug	20	12	240
	24-Jul	41	14	574				
	25-Jul	41	12	492				
	27-Jul	37	19	703				
	28-Jul	35	12	420				
	29-Jul	38	17	646				
	30-Jul	43	24	1032				
	31-Jul	18	24	432				
	01-Aug	31	24	744				
	02-Aug	38	24	912				
	03-Aug	37	24	888				
	04-Aug	26	24	624				
	05-Aug	34	19	646				
	09-Aug	22	12	264				
	12-Aug	14	12	168				
	Total	1036	447	16780	Total	505	170	6696
24422	01-Jul	42	12	504	03-Jul	38	12	456
	03-Jul	35	15	525	06-Jul	34	12	408
	05-Jul	42	12	504	10-Jul	41	12	492
	08-Jul	38	17	646	12-Jul	41	13	533
	09-Jul	40	15	600	13-Jul	38	16	608
	11-Jul	34	13	442	15-Jul	42	14	588
	12-Jul	39	12	468	16-Jul	35	12	420
	14-Jul	29	19	551	17-Jul	40	17	680
	15-Jul	39	19	741	18-Jul	45	14	630
	17-Jul	39	18	702	20-Jul	43	12	516
	18-Jul	40	10	400	24-Jul	33	12	396
	19-Jul	47	12	564	31-Jul	25	12	300
	22-Jul	54	12	648	07-Aug	19	12	228
	24-Jul	33	14	462				
	25-Jul	42	12	504				
	27-Jul	39	19	741				
	28-Jul	35	12	420				
	29-Jul	38	17	646				
	30-Jul	35	24	840				
	31-Jul	31	24	744				
	01-Aug	30	24	720				
	02-Aug	24	24	576				
	03-Aug	27	24	648				
	04-Aug	24	24	576				

	05-Aug	30	19	570				
	09-Aug	22	12	264				
	12-Aug	13	12	156				
	Total	941	447	15162	Total	474	170	6255
24431	01-Jul	34	12	408	03-Jul	44	12	528
	03-Jul	35	15	525	06-Jul	35	12	420
	05-Jul	31	12	372	10-Jul	53	12	636
	08-Jul	49	17	833	12-Jul	44	13	572
	09-Jul	28	15	420	13-Jul	48	16	768
	11-Jul	17	13	221	15-Jul	45	14	630
	12-Jul	43	12	516	16-Jul	44	12	528
	14-Jul	16	19	304	17-Jul	45	17	765
	15-Jul	41	19	779	18-Jul	35	14	490
	17-Jul	29	18	522	20-Jul	46	12	552
	18-Jul	27	10	270	24-Jul	26	12	312
	19-Jul	42	12	504	31-Jul	27	12	324
	22-Jul	47	12	564	07-Aug	15	12	180
	24-Jul	27	14	378				
	25-Jul	30	12	360				
	27-Jul	47	19	893				
	28-Jul	46	12	552				
	29-Jul	41	17	697				
	30-Jul	45	24	1080				
	31-Jul	32	24	768				
	01-Aug	28	24	672				
	02-Aug	47	24	1128				
	03-Aug	39	24	936				
	04-Aug	42	24	1008				
	05-Aug	36	19	684				
	09-Aug	28	12	336				
	12-Aug	10	12	120				
	Total	937	447	15850	Total	507	170	6705
24432	08-Jul	18	12	216	10-Jul	22	12	264
	12-Jul	41	12	492	13-Jul	34	16	544
	15-Jul	38	12	456	17-Jul	34	17	578
	19-Jul	48	12	576	18-Jul	29	14	406
	22-Jul	50	12	600	20-Jul	35	12	420
	27-Jul	43	14	602				
	29-Jul	47	17	799				
	30-Jul	39	13	507				
	01-Aug	40	19	760				
	02-Aug	42	24	1008				
	03-Aug	41	24	984				
	04-Aug	36	24	864				
	05-Aug	36	19	684				
	09-Aug	19	12	228				
	12-Aug	8	12	96				
	Total	546	238	8872	Total	154	71	2212
24441	08-Jul	22	12	264	10-Jul	26	12	312
	12-Jul	21	12	252	13-Jul	33	16	528
	15-Jul	28	12	336	17-Jul	33	17	561
	19-Jul	34	12	408	18-Jul	21	14	294
	22-Jul	38	12	456	20-Jul	34	12	408
	27-Jul	39	14	546				
	29-Jul	36	17	612				
	30-Jul	35	13	455				

	01-Aug	28	19	532				
	02-Aug	30	24	720				
	03-Aug	21	24	504				
	04-Aug	28	24	672				
	05-Aug	25	19	475				
	09-Aug	20	12	240				
	12-Aug	18	12	216				
	Total	423	238	6688	Total	147	71	2103
24442	08-Jul	12	12	144	10-Jul	13	12	156
	12-Jul	11	12	132	13-Jul	31	16	496
	15-Jul	16	12	192	17-Jul	17	17	289
	19-Jul	21	12	252	18-Jul	4	14	56
	22-Jul	17	12	204	20-Jul	14	12	168
	27-Jul	23	14	322				
	29-Jul	22	17	374				
	30-Jul	14	13	182				
	01-Aug	15	19	285				
	02-Aug	16	24	384				
	03-Aug	13	24	312				
	04-Aug	15	24	360				
	05-Aug	15	19	285				
	09-Aug	11	12	132				
	12-Aug	7	12	84				
	Total	228	238	3644	Total	79	71	1165
24510	01-Jul	1	12	12				
	12-Jul	1	12	12				
	15-Jul	1	12	12				
	22-Jul	1	12	12				
	23-Jul	1	12	12				
	24-Jul	1	12	12				
	30-Jul	1	12	12				
	Total	7	84	84				
24520	28-Jun	1	12	12				
	01-Jul	2	12	24				
	05-Jul	2	12	24				
	08-Jul	1	12	12				
	12-Jul	1	12	12				
	14-Jul	1	24	24				
	15-Jul	2	24	48				
	16-Jul	2	24	48				
	17-Jul	2	24	48				
	19-Jul	2	24	48				
	21-Jul	3	24	72				
	22-Jul	3	24	72				
	23-Jul	3	24	72				
	24-Jul	2	24	48				
	29-Jul	2	24	48				
	31-Jul	2	21	42				
	05-Aug	2	12	24				
	23-Aug	2	12	24				
	Total	35	345	702				
24530	21-Jun	1	12	12	22-Jun	10	12	120
	24-Jun	3	12	36	26-Jun	13	12	156
	28-Jun	11	12	132	29-Jun	13	12	156
	01-Jul	9	12	108	03-Jul	14	12	168

	05-Jul	11	12	132	05-Jul	12	18	216
	08-Jul	11	12	132	06-Jul	12	24	288
	12-Jul	11	19	209	07-Jul	13	24	312
	13-Jul	9	24	216	08-Jul	10	24	240
	14-Jul	8	24	192	09-Jul	14	24	336
	15-Jul	7	24	168	10-Jul	12	24	288
	16-Jul	6	24	144	11-Jul	14	24	336
	17-Jul	7	24	168	12-Jul	17	24	408
	18-Jul	11	24	264	13-Jul	13	24	312
	19-Jul	8	24	192	14-Jul	12	24	288
	20-Jul	10	24	240	15-Jul	12	24	288
	21-Jul	6	24	144	16-Jul	5	24	120
	22-Jul	12	24	288	17-Jul	14	24	336
	24-Jul	11	24	264	18-Jul	15	24	360
	25-Jul	6	24	144	19-Jul	11	24	264
	26-Jul	9	24	216	20-Jul	13	24	312
	27-Jul	4	24	96	21-Jul	14	24	336
	28-Jul	10	24	240	22-Jul	13	24	312
	29-Jul	12	24	288	23-Jul	10	24	240
	31-Jul	8	21	168	24-Jul	13	24	312
	02-Aug	8	12	96	25-Jul	14	23	322
	05-Aug	7	12	84	27-Jul	10	12	120
	09-Aug	9	12	108	31-Jul	10	12	120
	12-Aug	6	12	72	03-Aug	6	12	72
	16-Aug	2	12	24	07-Aug	8	12	96
	23-Aug	2	12	24	10-Aug	6	12	72
	26-Aug	2	12	24	14-Aug	4	12	48
	30-Aug	1	12	12	17-Aug	1	12	12
	Total	238	592	4637	Total	358	629	7366
24540	24-Jun	1	12	12	17-Jul	1	12	12
	28-Jun	1	12	12	03-Aug	1	12	12
	01-Jul	1	12	12	14-Aug	1	12	12
	05-Jul	2	12	24				
	08-Jul	1	12	12				
	12-Jul	1	19	19				
	13-Jul	1	24	24				
	14-Jul	1	24	24				
	15-Jul	1	24	24				
	18-Jul	2	24	48				
	20-Jul	1	24	24				
	22-Jul	1	24	24				
	26-Jul	5	24	120				
	28-Jul	1	24	24				
	29-Jul	1	24	24				
	31-Jul	1	21	21				
	Total	22	316	448	Total	3	36	36
24550	12-Jul	3	12	36	10-Jul	3	12	36
	15-Jul	3	12	36	13-Jul	3	12	36
	19-Jul	3	12	36	17-Jul	3	12	36
	22-Jul	3	12	36	20-Jul	3	12	36
	29-Jul	4	12	48	24-Jul	3	12	36
	02-Aug	4	12	48	27-Jul	3	12	36
	05-Aug	2	12	24	31-Jul	3	12	36
	09-Aug	3	12	36	03-Aug	2	12	24
	12-Aug	3	12	36	07-Aug	2	12	24
	16-Aug	2	12	24	17-Aug	1	12	12
	Total	30	120	360	Total	26	120	312

24555	02-Jun	4	12	48	02-Jun	8	12	96
	04-Jun	6	12	72	05-Jun	8	12	96
	07-Jun	6	12	72	07-Jun	5	12	60
	09-Jun	6	12	72	09-Jun	7	12	84
	11-Jun	6	12	72	12-Jun	7	12	84
	14-Jun	4	12	48	14-Jun	3	12	36
	16-Jun	4	12	48	16-Jun	6	12	72
	18-Jun	1	12	12	19-Jun	1	12	12
	21-Jun	1	12	12	07-Aug	1	12	12
	23-Jun	1	12	12	10-Aug	1	12	12
	05-Jul	1	12	12				
	Total	40	132	480	Total	47	120	564
24560	28-Jun	1	12	12	29-Jun	1	12	12
	01-Jul	1	12	12	03-Jul	1	12	12
	05-Jul	1	12	12	06-Jul	1	12	12
	12-Jul	1	12	12	10-Jul	2	12	24
	15-Jul	1	12	12				
	19-Jul	1	12	12				
	22-Jul	3	12	36				
	26-Jul	1	12	12				
	29-Jul	1	12	12				
	02-Aug	1	12	12				
	05-Aug	1	12	12				
	09-Aug	1	12	12				
	16-Aug	1	12	12				
	23-Aug	1	12	12				
	Total	16	168	192	Total	5	48	60
24610	28-Jun	8	12	96	26-Jun	9	12	108
	01-Jul	9	12	108	29-Jun	10	12	120
	05-Jul	8	12	96	03-Jul	9	12	108
	08-Jul	10	12	120	06-Jul	9	12	108
	12-Jul	12	12	144	10-Jul	9	12	108
	15-Jul	12	12	144	13-Jul	9	12	108
	19-Jul	12	12	144	17-Jul	10	12	120
	22-Jul	12	12	144	20-Jul	10	12	120
	26-Jul	10	12	120	24-Jul	10	12	120
	29-Jul	13	12	156	27-Jul	10	12	120
	02-Aug	11	12	132	31-Jul	10	12	120
	05-Aug	10	12	120	03-Aug	10	12	120
	09-Aug	12	12	144	07-Aug	10	12	120
	12-Aug	11	12	132	10-Aug	10	12	120
	16-Aug	11	12	132	14-Aug	8	12	96
	19-Aug	4	12	48	17-Aug	5	12	60
	23-Aug	3	12	36	21-Aug	2	12	24
	26-Aug	1	12	12	24-Aug	2	12	24
	30-Aug	2	12	24	28-Aug	2	12	24
	02-Sep	2	12	24	04-Sep	2	12	24
	06-Sep	1	12	12	07-Sep	1	12	12
	Total	174	252	2088	Total	157	252	1884
24620	28-Jun	3	12	36	26-Jun	3	12	36
	01-Jul	2	12	24	29-Jun	2	12	24
	05-Jul	2	12	24	03-Jul	2	12	24
	08-Jul	1	12	12	06-Jul	2	12	24
	12-Jul	2	12	24	10-Jul	2	12	24
	15-Jul	3	12	36	13-Jul	2	12	24

	19-Jul	3	12	36	17-Jul	2	12	24
	22-Jul	3	12	36	20-Jul	3	12	36
	26-Jul	3	12	36	24-Jul	4	12	48
	29-Jul	2	12	24	27-Jul	3	12	36
	02-Aug	3	12	36	31-Jul	3	12	36
	05-Aug	2	12	24	03-Aug	2	12	24
	09-Aug	3	12	36	07-Aug	1	12	12
	12-Aug	1	12	12	10-Aug	1	12	12
	16-Aug	3	12	36	14-Aug	1	12	12
	19-Aug	1	12	12				
	23-Aug	1	12	12				
	26-Aug	3	12	36				
	Total	41	216	492	Total	33	180	396
24710	07-Jun	6	12	72	05-Jun	7	12	84
	14-Jun	1	12	12	12-Jun	7	12	84
	08-Jul	1	12	12	19-Jun	3	12	36
	12-Jul	1	12	12	10-Jul	2	12	24
	15-Jul	5	12	60	13-Jul	1	12	12
	19-Jul	2	12	24	17-Jul	1	12	12
	26-Jul	1	12	12	20-Jul	4	16	64
	02-Aug	3	12	36	24-Jul	8	12	96
	05-Aug	3	12	36	27-Jul	6	12	72
					31-Jul	2	12	24
					03-Aug	2	12	24
					07-Aug	2	12	24
					10-Aug	1	12	12
	Total	23	108	276	Total	46	160	568
24720	07-Jun	15	12	180	05-Jun	11	12	132
	14-Jun	15	12	180	12-Jun	14	12	168
	28-Jun	13	12	156	19-Jun	11	12	132
	01-Jul	17	12	204	26-Jun	13	12	156
	05-Jul	14	12	168	29-Jun	10	12	120
	08-Jul	6	12	72	03-Jul	8	12	96
	12-Jul	13	12	156	06-Jul	9	12	108
	15-Jul	16	12	192	10-Jul	12	12	144
	19-Jul	17	12	204	13-Jul	16	12	192
	26-Jul	19	12	228	17-Jul	5	12	60
	02-Aug	20	12	240	20-Jul	19	16	304
	05-Aug	12	12	144	24-Jul	13	12	156
	09-Aug	16	12	192	27-Jul	14	12	168
	12-Aug	8	12	96	31-Jul	8	12	96
	16-Aug	10	12	120	03-Aug	7	12	84
	19-Aug	2	12	24	07-Aug	10	12	120
	23-Aug	9	12	108	10-Aug	5	12	60
	26-Aug	6	12	72	14-Aug	5	12	60
	30-Aug	4	12	48	24-Aug	4	12	48
	Total	232	228	2784	Total	194	232	2404
24730	07-Jun	6	12	72	05-Jun	6	12	72
	08-Jul	3	12	36	12-Jun	3	12	36
	12-Jul	12	12	144	06-Jul	1	12	12
	15-Jul	16	12	192	10-Jul	10	12	120
	19-Jul	17	12	204	13-Jul	18	12	216
	26-Jul	16	12	192	17-Jul	11	12	132
	02-Aug	18	12	216	20-Jul	14	16	224
	05-Aug	10	12	120	24-Jul	13	12	156
	09-Aug	2	12	24	27-Jul	12	12	144

					31-Jul	8	12	96
	Total	100	108	1200	Total	96	124	1208
24741	07-Jun	2	12	24	05-Jun	3	12	36
	14-Jun	3	12	36	12-Jun	3	12	36
	28-Jun	2	12	24	03-Jul	1	12	12
	08-Jul	1	12	12	06-Jul	2	12	24
	12-Jul	1	12	12	10-Jul	2	12	24
	15-Jul	4	12	48	13-Jul	2	12	24
	19-Jul	8	12	96	17-Jul	2	12	24
	26-Jul	4	12	48	20-Jul	4	16	64
	02-Aug	4	12	48	24-Jul	4	12	48
	05-Aug	6	12	72	27-Jul	5	12	60
	09-Aug	2	12	24	31-Jul	2	12	24
	12-Aug	2	12	24	03-Aug	1	12	12
	16-Aug	1	12	12	07-Aug	3	12	36
					10-Aug	2	12	24
					14-Aug	1	12	12
					17-Aug	1	12	12
					21-Aug	1	12	12
					24-Aug	1	12	12
					28-Aug	1	12	12
	Total	40	156	480	Total	41	232	508
24742	07-Jun	4	12	48	05-Jun	4	12	48
	14-Jun	4	12	48	12-Jun	2	12	24
	28-Jun	1	12	12	19-Jun	1	12	12
	05-Jul	1	12	12	29-Jun	1	12	12
	12-Jul	6	12	72	03-Jul	1	12	12
	15-Jul	2	12	24	06-Jul	2	12	24
	19-Jul	4	12	48	10-Jul	1	12	12
	26-Jul	4	12	48	13-Jul	2	12	24
	02-Aug	3	12	36	17-Jul	2	12	24
	05-Aug	2	12	24	20-Jul	8	16	128
	09-Aug	3	12	36	24-Jul	7	12	84
	12-Aug	2	12	24	27-Jul	6	12	72
	16-Aug	1	12	12	31-Jul	5	12	60
					03-Aug	3	12	36
					07-Aug	4	12	48
					10-Aug	3	12	36
					14-Aug	4	12	48
					17-Aug	2	12	24
					21-Aug	4	12	48
					24-Aug	1	12	12
					28-Aug	1	12	12
					31-Aug	1	12	12
					04-Sep	1	12	12
					07-Sep	1	12	12
					11-Sep	1	12	12
	Total	37	156	444	Total	68	304	848
24743	07-Jun	4	12	48	05-Jun	3	12	36
	12-Jul	2	12	24	12-Jun	1	12	12
	15-Jul	3	12	36	19-Jun	1	12	12
	19-Jul	3	12	36	03-Jul	1	12	12
	26-Jul	4	12	48	10-Jul	3	12	36
	02-Aug	4	12	48	13-Jul	2	12	24
	05-Aug	2	12	24	17-Jul	6	12	72
	09-Aug	5	12	60	20-Jul	5	16	80

	12-Aug	3	12	36	24-Jul	4	12	48
					27-Jul	4	12	48
					31-Jul	1	12	12
					07-Aug	3	12	36
					10-Aug	2	12	24
					14-Aug	2	12	24
					04-Sep	1	12	12
					07-Sep	1	12	12
	Total	30	108	360	Total	40	196	500
24770	07-Jun	8	12	96	05-Jun	4	12	48
	14-Jun	7	12	84	12-Jun	2	12	24
	28-Jun	4	12	48	19-Jun	2	12	24
	01-Jul	8	12	96	26-Jun	4	12	48
	05-Jul	6	12	72	29-Jun	6	12	72
	08-Jul	10	12	120	03-Jul	6	12	72
	12-Jul	11	12	132	06-Jul	4	12	48
	15-Jul	9	12	108	10-Jul	10	12	120
	19-Jul	13	12	156	13-Jul	4	12	48
	26-Jul	11	12	132	15-Jul	2	12	24
	02-Aug	13	12	156	17-Jul	10	12	120
	05-Aug	5	12	60	20-Jul	9	16	144
	09-Aug	4	12	48	24-Jul	15	12	180
	12-Aug	5	12	60	27-Jul	4	12	48
	16-Aug	3	12	36	31-Jul	10	12	120
	19-Aug	3	12	36	03-Aug	6	12	72
	23-Aug	3	12	36	07-Aug	6	12	72
	26-Aug	3	12	36	10-Aug	5	12	60
	30-Aug	3	12	36	14-Aug	5	12	60
	02-Sep	2	12	24	17-Aug	4	12	48
	06-Sep	2	12	24	21-Aug	5	12	60
	09-Sep	2	12	24	24-Aug	5	12	60
	13-Sep	2	12	24	28-Aug	3	12	36
	16-Sep	2	12	24	04-Sep	2	12	24
					07-Sep	3	12	36
					11-Sep	1	12	12
	Total	139	288	1668	Total	137	316	1680
24780	07-Jun	5	12	60	05-Jun	1	12	12
	28-Jun	3	12	36	19-Jun	2	12	24
	01-Jul	4	12	48	26-Jun	3	12	36
	05-Jul	3	12	36	29-Jun	3	12	36
	08-Jul	4	12	48	03-Jul	1	12	12
	12-Jul	4	12	48	06-Jul	4	12	48
	15-Jul	6	12	72	10-Jul	2	12	24
	19-Jul	5	12	60	13-Jul	1	12	12
	26-Jul	7	12	84	17-Jul	2	12	24
	02-Aug	4	12	48	20-Jul	3	16	48
	05-Aug	4	12	48	24-Jul	3	12	36
	09-Aug	3	12	36	03-Aug	2	12	24
	12-Aug	2	12	24	07-Aug	4	12	48
	16-Aug	3	12	36	10-Aug	2	12	24
	19-Aug	4	12	48	14-Aug	2	12	24
	23-Aug	6	12	72	17-Aug	2	12	24
	26-Aug	3	12	36	21-Aug	2	12	24
	30-Aug	4	12	48	24-Aug	3	12	36
	02-Sep	3	12	36	28-Aug	1	12	12
	06-Sep	2	12	24				
	09-Sep	1	12	12				

	Total	80	252	960	Total	43	232	528
24790	07-Jun	3	12	36	05-Jun	3	12	36
	14-Jun	3	12	36	12-Jun	2	12	24
	28-Jun	3	12	36	19-Jun	2	12	24
	01-Jul	2	12	24	26-Jun	3	12	36
	05-Jul	3	12	36	29-Jun	2	12	24
	08-Jul	1	12	12	03-Jul	2	12	24
	12-Jul	1	12	12	06-Jul	2	12	24
	15-Jul	4	12	48	10-Jul	4	12	48
	19-Jul	3	12	36	13-Jul	4	12	48
	26-Jul	6	12	72	17-Jul	3	12	36
	02-Aug	3	12	36	20-Jul	5	16	80
	05-Aug	2	12	24	24-Jul	6	12	72
	09-Aug	5	12	60	31-Jul	4	12	48
	12-Aug	3	12	36	03-Aug	4	12	48
	16-Aug	3	12	36	07-Aug	2	12	24
	19-Aug	3	12	36	10-Aug	5	12	60
	23-Aug	3	12	36	14-Aug	4	12	48
	26-Aug	2	12	24	17-Aug	5	12	60
	30-Aug	2	12	24	21-Aug	4	12	48
	02-Sep	2	12	24	24-Aug	1	12	12
	06-Sep	2	12	24	28-Aug	3	12	36
	09-Sep	1	12	12	31-Aug	3	12	36
					04-Sep	3	12	36
					07-Sep	3	12	36
	Total	60	264	720	Total	79	292	968

Members: Board of Fisheries re. Kenai River Dipnetting / boat

My concerns are the same as yours.I feel that the rules that we have now should remain,such as ,dates,limits,etc.Since the closure of many fisheries,up north,the numbers of people participating in this fishery,has GREATLY INCREASED.It has become a SERIOUS HAZARD to participate.I'm suggesting some kind of a system that would restrict the number of BOATS that are fishing at the same time.For example,registered boatowners,whose last names start w/A-G fish day 1,H-M day 2,N-T day 3,etc.This would reduce the numbers of boats at any one time,AND greatly reduce the risk.It would also reduce the numbers of fish,harvested,which I think is your goal.
I would also like to find a way to restrict the number of trips that a single boat may participate in this fishery.I'm aware of a couple of boats that made several trips,with a different group of people,each time.I know that's not against the law,but I think it's greedy.
I would like to see this fishery continue,the way it was intended,in a fair & SAFE manner.

sportsman,
Gerald Anderson
Kenai,AK.

February 2, 2011

State of Alaska, Depart of Fish and Game
Upper Cook Inlet Area Board
FAX: 907-465-6094

Dear Board of Fisheries Members:

I am writing to let you know that as a life long Alaskan I am NOT in favor of any changes to the subsistence dipnetting rules. I was born in Palmer in 1943 and have participated in the red salmon dipnetting harvest on the Kenai River and Copper River for over 30 years. I depend on the fish I net to provide a healthy (organic) part of our yearly food supply.

When you meet on February 5th in Anchorage, please leave the dipnetting rules and regulations alone.

Sincerely,

Maurice L. Johnson

Maurice Johnson
Palmer, AK

Mat-Su!

January 31, 2011

MATANUSKA-SUSITNA CONVENTION & VISITORS BUREAU

ATTN: BOF COMMENTS
Boards Support Section
ADFG
PO Box 115526
Juneau, AK 99811-5526

RECEIVED
FEB 0 2 2011
BOARDS

Re: Sportfishing in the Mat-Su Borough

Dear Board of Fisheries,

The Mat-Su Convention and Visitors Bureau is made up of 273 businesses that are concerned with the economic impacts of sportfishing to their businesses. Each closure, restriction, and related regulatory actions have had, and will continue to have, significant social and economic impacts on our Alaskan owned businesses, state residents, and out-of-state visitors.

Please take some time to review the Economic Importance of Sportfishing in the Matanuska-Susitna Borough report from August 2009. When less fish are available to sportfishermen there is a correlation with less revenue spent in our local businesses. The availability of fish does not only affect guides and lodges, but it also affects many support services such as fuel suppliers, restaurants, retail businesses, and other tourism operators.

On behalf of our Board of Directors we would like endorse the proposals supported and opposed which have been selected by the Matanuska-Susitna Borough Mayor's Blue Ribbon Sportsmen's Committee for the Board of Fisheries meeting that includes Upper Cook Inlet Finfish scheduled in Anchorage, February 20-March 5, 2011.

Support Proposals

126- This will ensure that greater numbers of salmon return to streams located in the Mat-Su which will give greater opportunities for sportfishermen. Successfully passing this proposal will create a positive economic impact for businesses located in the Mat-Su.
134/135- These proposals will open up discussion about improving the management plan for escapement goals of salmon in the Yentna and Susitna Rivers. Updating management plans, and managing the plan correctly will ultimately protect the stocks from overharvesting. When there are plenty of fish there will be plenty of positive economic impact for businesses located in the Mat-Su.
136- Modifying the OEG for Yentna River Sockeye will assist in protecting the stock. Without increased concern over the Sockeye return, the chance of overharvesting is present. A healthy return of Sockeye will hopefully lead to healthy returns of the other salmon stock. We need to address this concern now before we are in position where it is too late to improve the return. Many businesses will falter if there is not a healthy sustainable return of fish in the drainage.
137- Amending the management plan for Yentna River Sockeye will assist in protecting the stock. Without increased concern over the Sockeye return, the chance of overharvesting is present. A healthy return of Sockeye will hopefully lead to healthy returns of the other salmon stock. We need to address this concern now before we are in position where it is too late to improve the return. Many businesses will falter if there is not a healthy sustainable return of fish in the drainage.

142- This will promote greater numbers of salmon return to streams located in the Mat-Su which will give greater opportunities for sportfishermen. Successfully passing this proposal will create a positive economic impact for businesses located in the Mat-Su.
143- (Preferred support over 142) This will promote greater numbers of salmon return to streams located in the Mat-Su which will give greater opportunities for sportfishermen. Establishing preference for recreational use will assist identified species in making their way back to their spawning streams, and thus creating a sustainable fishery. Successfully passing this proposal will create a positive economic impact for businesses located in the Mat-Su.
144- Establishing the management plan for Kings in Susitna River and small streams will protect the stocks from overharvesting. Although the initial management may affect sportfishermen and associated businesses with less closures or restrictions, the anticipated results in the long run will provide improved returns which in turn will create positive economic impact for businesses located in the Mat-Su. The goal is to have sustainable King stock in all of the streams in the management plan.
159- Amending the regulation to minimize incidental harvest of no-targeted species in the Upper Cook Inlet will promote greater numbers of salmon return to streams located in the Mat-Su which will give greater opportunities for sportfishermen. Successfully passing this proposal will create a positive economic impact for businesses located in the Mat-Su.
202- This will improve the fishing experience for Knik Arm Drainage sportfishermen by returning to the previous level of bag and possession limit of 3 Coho's. Successfully passing this proposal will create a positive economic impact for businesses located in the Mat-Su.
203- This will improve the fishing experience for Anchorage Bowl Drainage sportfishermen by returning to the previous level of bag and possession limit of 3 Coho's. Successfully passing this proposal will create a positive economic impact for businesses located in the Mat-Su.

Oppose Proposals

108- This proposal will allow commercial fisherman increased catches of salmon bound for spawning streams and sportfishermen in the Mat-Su. If an increase in commercial fishing is allowed the results will be devastating to the sustainability of the stocks and also devastating to the businesses in the Mat-Su.
110- The sportfishermen and businesses of the Mat-Su will be dramatically affected by the decrease in Coho's making it to Mat-Su streams due to extending the commercial season. Sustainability of Coho's would be put in peril due to the lack of spawners returning to their streams.
145- The Board of Fisheries has no authority to mandate program elements to AKFG. The Northern District Setnetters Association admits that there is a potential for overharvesting of Susitna River bound King's. If there is an increase in interception of Susitna River King's the results will be devastating to the sustainability of the stock, as well as devastating to the businesses in the Mat-Su.

Sincerely,

Bonnie Quill

Bonnie Quill
Mat-Su CVB Executive Director

Enclosed: Economic Importance of Sportfishing in the Matanuska-Susitna Borough

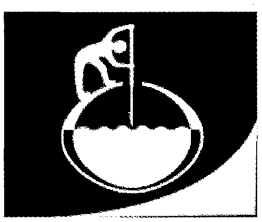
Economic Importance of Sportfishing in the Matanuska-Susitna Borough

Prepared for:

Matanuska-Susitna Borough
Economic Development Department

Prepared by:

Steve Colt and Tobias Schwoerer
Institute of Social and Economic Research
University of Alaska Anchorage
www.iser.uaa.alaska.edu



31 August 2009

contact:
steve.colt@uaa.alaska.edu
tobias.schwoerer@uaa.alaska.edu

Table of Contents

Table of Tables

Acknowledgments

The authors thank Kathrin Sundet and Bill Romberg of the Alaska Department of Fish and Game, Sport Fish Division, for providing data on fishing effort within the Mat-Su Borough.

Summary

We estimated the economic importance of sport fishing in the Matanuska-Susitna (Mat-Su) Borough. We based our estimates on year 2007 data. These data come from a recent major study conducted by the Alaska Department of Fish and Game (ADF&G).[1] We allocated a portion of the economic effects for the Southcentral region to the Mat-Su Borough based on relative numbers of Southcentral angler days that occurred within the Borough boundary. Our estimates include a range of results because it is not possible to say with certainty how much of the total reported spending on things like boats, cabins, or food is due exclusively to sport fishing. Also, angler spending patterns in the Borough may be different from overall Southcentral patterns.

Overall, our estimates show that:

- In 2007, resident and nonresident anglers fished almost 300,000 days in the Matanuska-Susitna (Mat-Su) Borough.
- Anglers spent anywhere between $63 million and $163 million in the Borough on goods and services primarily used for sport fishing. Alaska residents spent an average of between $126 and $517 per angler day, while nonresidents spent an average of between $344 and $602.
- After accounting for multiplier effects, this spending generated between 900 and 1,900 jobs and between $31 million and $64 million of personal income for people who work in the Borough.
- Mat-Su sport fishing activity also generated between $6 million and $15 million in state and local taxes.

Table 1
Economic importance of sport fishing in the Mat-Su Borough

(estimates based on Southcentral modeling results allocated using angler days)

	Low	Medium	High
Mat-Su angler days	295,981	295,981	295,981
as % of Southcentral	16.5%	16.5%	16.5%
Direct spending ($)	62,766,103	118,185,916	162,841,500
Average spending			
$ per angler day	212	399	550
Economic contribution			
Employment (average annual)	904	1,180	1,900
Income ($)	31,406,254	40,118,532	63,660,732
Local & state taxes ($)	6,085,357	7,721,572	14,957,085

[1] Southwick Associates and Alaska Department of Fish and Game, 2008. Economic Impacts and Contributions of Sportfishing in Alaska, 2007.
Available at: http://www.sf.adfg.state.ak.us/Statewide/economics/

Introduction

We have estimated the economic benefits of sport fishing activity occurring within the Matanuska-Susitna (Mat-Su) Borough, using data from year 2007. Our estimates are based on the recent study entitled, *Economic Impacts and Contributions of Sportfishing in Alaska, 2007.*[2] It contains estimates of angler spending patterns within three regions: Southcentral, Interior, and Southeast. We also used year 2007 data from the ADFG annual Statewide Harvest Survey (SWHS).[3] These data allow us to allocate economic benefits to the Mat-Su Borough.

Methods

Step 1. Determine number of angler days spent fishing in Mat-Su Borough

ADF&G provided us with a data extract from their raw survey data on fishing effort in year 2007. The extract included all fishing sub-areas within the Mat-Su Borough. The estimated total number of angler days is 295,981.[4] Since there is no separate data on Alaska resident vs. nonresident split, we have assumed that the nonresident fraction is the same as it is for Southcentral – 39.6% nonresident. Thus, we estimate that Mat-Su angler days account for 16.5% of total Southcentral angler days.

Table 2. Angler days spent fishing in Mat-Su Borough

	Alaska Resident	Res. %	Nonresident	Nonres. %	Total
Mat-Su Borough angler days	178,886	60.4%	117,095	39.6%	295,981
% of Southcentral	16.5%		16.5%		16.5%

Step 2. Determine appropriate values for spending per angler day

The ADF&G economic survey measured direct angler spending by the location of the expenditure, not by the location of the fishing that generated that expenditure. This approach makes good sense, but it means that some caution must be used when

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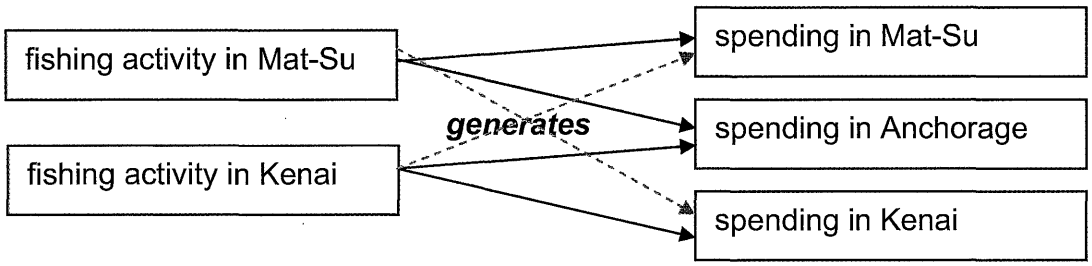
[2] Southwick Associates and Alaska Department of Fish and Game, 2008. Economic Impacts and Contributions of Sportfishing in Alaska, 2007.
Available at: http://www.sf.adfg.state.ak.us/Statewide/economics/

[3] These year 2007 SWHS data have not been formally published as of August 2009. Statewide and regional numbers are reported in the economic impacts study and numbers for areas within the Mat-Su Borough were provided by ADF&G.

[4] About 8% of these angler days were generated at locations with less than 12 respondents to the ADF&G angler survey. While ADF&G recommends not using these data points because of the sampling error involved, we have included them because we are aggregating over all of the 118 locations that have this problem.

interpreting the spending data. Figure 1 shows how fishing in one area can cause angler spending in another area. For example, a German tourist who fishes on the Little Susitna River might spend significant amounts of money in Anchorage. Clearly, Anchorage is the major recipient of this type of spending that relates to fishing outside of Anchorage. The lighter, dotted lines in the figure reflect the idea that fishing in Mat-Su causes very little spending in Kenai, and vice versa.

Figure 1. Relationship between location of fishingand location of spending



Because the data on angler days and the data on spending within each region were collected in two separate surveys, we must use caution when speaking of "spending per angler day." Specifically, we need to remember that a simple calculation of spending in a region per angler day of fishing in that same region is a mixture of two different quantities that were measured in two separate surveys.

Each of the five regions that ADF&G uses in its economic significance reporting are large enough that this problem is unimportant as a practical matter. Clearly Southcentral and Southeast are distinct economic regions. Even the Cook Inlet subregion includes Anchorage plus the major fishing locations close to it.

With this caveat in mind, we calculated numbers for "spending per angler day" in various regions based on the total spending numbers reported by the Southwick/ADF&G study. Table 3 shows these ratios. We looked carefully at these regional ratios to determine whether an allocation of total Southcentral *spending* to Mat-Su and non-Mat-Su subregions could be done based on the relative numbers of angler days. We wanted to consider whether some adjustment was needed to capture the possibility that money associated with Mat-Su fishing is spent outside the Borough. Using the ratios for the Cook Inlet subregion would be inappropriate, because Anchorage weighs too heavily in those numbers. We concluded that the best approach was to use the Southcentral region numbers for average spending per angler day as the basis for determining economic activity within the Mat-Su Borough.[5]

[5] We also looked at regional patterns of spending on fuel, guides, groceries, and lodging to verify that no adjustment was needed based on this spending.

Table 3. High case regional spending per in-region angler day, by region using total spending amounts reported by Southwick/ADFG
(dollars spent in the region per angler day of fishing in the region)

Statewide	Resident	Nonresident	Total
Licenses & stamps	5	15	9
Trip	151	321	223
Package	-	127	54
Equipment	297	38	187
Real Estate	50	102	72
Total	502	604	546

Southcentral	Resident	Nonresident	Total
Licenses & stamps			
Trip	167	332	233
Package	-	127	50
Equipment	302	41	199
Real Estate	47	102	69
Total	517	602	550

Cook Inlet	Resident	Nonresident	Total
Licenses & stamps			
Trip	162	327	226
Package	-	49	19
Equipment	383	46	252
Real Estate	56	149	92
Total	602	571	590

Other Southcentral	Resident	Nonresident	Total
Licenses & stamps			
Trip	180	343	248
Package	-	290	120
Equipment	112	31	79
Real Estate	25	3	15
Total	317	666	462

Interior	Resident	Nonresident	Total
Licenses & stamps			
Trip	100	443	182
Package	-	155	37
Equipment	317	31	249
Real Estate	18	61	28
Total	435	691	496

Step 3. Determine total Mat-Su spending, jobs, and income based on Southcentral spending per angler day

We multiplied the average spending per angler day in Southcentral by the number of Mat-Su angler days to determine total spending in Mat-Su from sportfishing activity that occurs in Mat-Su. We then applied the economic multiplier values for the Southcentral region from the Southwick/ADF&G analysis to these spending numbers. For the High case, our final results for direct spending, jobs, and income occuring in Mat-Su are simply equal to 16.5% of the ADF&G values for all of Southcentral.[6] The 16.5% number is the Mat-Su share of Southcentral angler days, as determined above in step 1. The 16.5% share is assumed to be the same for resident and non-resident angler days because we have no direct data to indicate otherwise.

Step 4. Develop Low, Medium, and High cases to better reflect the uncertainty about spending patterns

As a final step we considered the fact that much of the spending on equipment, real estate, and even on trips may not be attributable solely to sport fishing. ADF&G attempted to address this issue by asking survey respondents to say what percentage of their equpment and real estate spending was attributable to sport fishing. They used those percentages when determining the total spending and average spending per angler day. However, we believe these numbers represent a high case estimate of spending that relates directly to fishing. There are three reasons for this belief. First, as we have already mentioned, some of the spending associated with Mat-Su fishing may occur in Anchorage. Second, some of the spending on a trip whose "primary purpose" is fishing might well have occurred anyway, albeit in a different pattern. Third, the ADFG numbers reflect the total, or overall, economic effects of all existing sportfishing. However, if one is interested in how a *change* in fishing opportunities might translate into a *change* in spending, the resulting numbers are lower. That's because many expenditures are fixed costs. People who fish 10% more days are not going to buy 10% more hip waders or 10% more cabins.

We developed Low and Medium cases by assuming lower expenditures in some categories – especially equipment and real estate. The Low case uses 75% of the reported numbers for trip-related and package categories and none of the equipment and real estate category spending. For the medium case we include 100% of the trip-related and package expenditures, 50% of the reported equipment spending, and 25% of the reported real estate spending. The High case includes 100% of all spending reported to ADF&G for all categories – trip-related, package, equipment, and real estate. The following table summarizes these assumptions.

[6] ADF&G did not develop Low, Medium and High cases. They only reported one set of estimates. These correspond to our High case estimates.

Table 4. Difference in spending pattern assumptions between low, medium, and High cases

(Fraction of total reported spending that is included in each case, by category)

	Low	Medium	High
Licenses & stamps			
Tri-related	75%	100%	100%
Package	75%	100%	100%
Equipment	0%	50%	100%
Real Estate	0%	25%	100%

Results

Overall, our estimates show that:

- In 2007, resident and nonresident anglers fished almost 300,000 days in the Matanuska-Susitna (Mat-Su) Borough.
- Anglers spent anywhere between $63 million and $163 million in the Borough on goods and services primarily used for sport fishing. Alaska residents spent an average of between $126 and $517 per angler day, while nonresidents spent an average of between $344 and $602.
- After accounting for multiplier effects, this spending generated between 900 and 1,900 jobs and between $31 million and $64 million of personal income for people who work in the Borough.
- Mat-Su sport fishing activity also generated between $6 million and $15 million in state and local taxes.

Table 5
Economic importance of sport fishing in the Mat-Su Borough

(estimates based on Southcentral modeling results allocated using angler days)

	Low	Medium	High
Mat-Su angler days	295,981	295,981	295,981
as % of Southcentral	16.5%	16.5%	16.5%
Direct spending ($)	62,766,103	118,185,916	162,841,500
Average spending			
$ per angler day	212	399	550
Economic contribution			
Employment (average annual)	904	1,180	1,900
Income ($)	31,406,254	40,118,532	63,660,732
Local & state taxes ($)	6,085,357	7,721,572	14,957,085

High Case. We first present results for the High case, because they correspond most directly to the previously published spending numbers.

Table 6 shows estimated direct spending from Mat-Su sportfishing. More than $163 million was spent, of which more than $70 million came from people who came from outside Alaska. Residents spent heavily on equipment, while nonresidents spent heavily on trips and packages.

Table 6. Direct spending from Mat-Su sportfishing – High case

	Alaska Resident	Nonresident	Total
Licenses & stamps	-	-	-
Trip	29,961,901	38,879,365	68,841,266
Package	-	14,846,871	14,846,871
Equipment	54,058,396	4,779,358	58,837,754
Real Estate	8,383,744	11,931,864	20,315,609
Total	92,404,041	70,437,459	162,841,500
Average spending $ per angler day	517	602	550

Table 7 shows our High case estimates of the economic importance of Mat-Su sport fishing. Under the High case assumptions, the direct spending by anglers immediately generates 1,300 jobs and almost $40 million of income. After multiplier effects are included, Mat-Su sport fishing generates 1,900 jobs and $63.7 million of personal income for people working in the Borough.

Table 7. Economic importance of Mat-Su sportfishing – High case

HIGH case	Alaska Resident	Nonresident	Total
Mat-Su angler days	178,886	117,095	295,981
as % of Southcentral	16.5%	16.5%	
Direct effects			
Spending			
Income	17,957,673	21,536,960	39,494,633
Employment	588	713	1,301
Multiplier effects			
Income	10,841,421	13,324,678	24,166,099
Employment	264	335	599
Total effects			
Income	28,799,095	34,861,638	63,660,732
Employment	852	1,048	1,900
Tax revenues	14,259,233	15,433,546	29,692,779
Local and state	7,513,582	7,443,503	14,957,085
Federal	6,745,651	7,990,043	14,735,694

Spending on fishing also generates significant amounts of tax revenues. As the original ADFG study authors stress, these numbers must be interpreted with special caution, since they reflect average, overall ratios of economic activity to tax collections.[7] However, it is clear that much of the spending, especially by nonresidents, does contribute incremental revenues through taxes on lodging, meals, rental cars, and sales.

[7] Southwick/ADFG study, p. 56.

Low and Medium Cases. The following tables show the results for spending, income, and jobs for the Low and Medium cases.

Table 8. Direct spending from Mat-Su sportfishing – Low and Medium cases

LOW case	Alaska Resident	Nonresident	Total
Licenses & stamps	-	-	-
Trip	22,471,426	29,159,524	51,630,950
Package	-	11,135,153	11,135,153
Equipment	-	-	-
Real Estate	-	-	-
Total	22,471,426	40,294,677	62,766,103

MEDIUM case	Alaska Resident	Nonresident	Total
Licenses & stamps	-	-	-
Trip	29,961,901	38,879,365	68,841,266
Package	-	14,846,871	14,846,871
Equipment	27,029,198	2,389,679	29,418,877
Real Estate	2,095,936	2,982,966	5,078,902
Total	59,087,035	59,098,881	118,185,916

Table 9. Economic importance of Mat-Su sportfishing – Low case

LOW case	Alaska Resident	Nonresident	Total
Mat-Su angler days	178,886	117,095	295,981
as % of Southcentral	16.5%	16.5%	
Direct spending ($)	22,471,426	40,294,677	62,766,103
Average spending $ per angler day	126	344	212
Economic contribution			
Employment (average annual)	351	553	904
Income ($)	11,192,675	20,213,579	31,406,254
Local & state taxes ($)	1,827,203	4,258,154	6,085,357

Table 10. Economic importance of Mat-Su sportfishing – Medium case

MEDIUM case	Alaska Resident	Nonresident	Total
Mat-Su angler days	178,886	117,095	295,981
as % of Southcentral	16.5%	16.5%	
Direct spending ($)	59,087,035	59,098,881	118,185,916
Average spending $ per angler day	330	505	399
Economic contribution			
Employment (average annual)	468	712	1,180
Income ($)	14,923,567	25,194,965	40,118,532
Local & state taxes ($)	2,436,270	5,285,302	7,721,572

References

Alaska Department of Fish and Game 2008. Economic Impacts and Contributions of Sportfishing in Alaska, 2007. Available at: http://www.sf.adfg.state.ak.us/Statewide/economics/

Robert J. Turner
19712 Highland Ridge Dr.
Eagle River, AK 99577
(907) 726-1912

To: Board of Fisheries
FAX: (907) 465-6094

Subject: Public Opinion Comment

Dear Board Members,

This letter is in opposition to changes in the dip net subsistence fishing limits under consideration. I am an Alaska resident and I strongly support measures to protect our fisheries for the sustained yield for the maximum benefit of our residents.

I believe that the direct benefit of subsistence fishing to the Alaska residents should take priority of commercial fishing in consideration of escapement quotas. I also believe that escapement quotas should be met before ANY fishing of any kind and that Residents should take priority over commercial fishing.

I am also a disabled Veteran and I rely on the annual limit of 30 salmon to feed my family throughout the year.

Please contact me if you have any questions.

Robert J. Turner
Robert James Turner

2 Feb 11

PUBLIC COMMENT

February 1, 2011

Cook Inlet Finfish 2010/2011

Subsistence, sport, personal use fisheries

Please leave our fish alone! As a single mom I depend on subsistence fishing to feed my family of eight. Subsistence salmon fishing is the mainstay of our diets. If you take away our fishing areas or reduce our limits we will not have fish in our diets as my family can't afford to buy store bought fish and meat. We are barely making it now. Please don't reduce or take away our subsistence fishing. I do not agree with non residents being able to subsistence fish, it isn't fair. We already have a hard time trying to get fish with all of the commercial openers during our fishing times. I am begging you to leave our fish alone; we need them to survive, especially in this economy!

Thank you for your consideration!

Deborah Selman

PO Box 520183

Big Lake, AK 99652

907-315-7708

Kenai River Recreation Study
Major Findings and Implications

Prepared by…
Doug Whittaker, Ph.D. and Bo Shelby, Ph.D.
Confluence Research and Consulting

Prepared for…
State of Alaska
Department of Natural Resources
Division of Parks and Outdoor Recreation

June 2010

Acknowledgements

The authors thank Alaska State Parks for the opportunity to study recreation issues on the Kenai River, as well as assistance with several aspects of the study, including: providing use information, developing the guide survey sample, assisting with our fieldwork, inviting us their patrols, and reviewing study plans, analyses, presentations, or the report. In particular, we would like to thank Don Barber, Tami Carrico, Chris Degernes, Denise Dutile, Alison Eskelin, James King, Jacques Kosto, Jack Ransom, Pam Russell, and Jack Sinclair.

We appreciate help from staff at the Alaska Department of Fish and Game on several aspects of the study, including participation in fieldwork, providing boat counts from the lower river, and thoughtful comments on study plans, draft surveys, or an earlier draft of the report. In particular, we thank Robert Begich, Robert Clark, James Hasbrouck, Ivan Karic, Stacie Mallette, Brad Palach, Jeffrey Perschbacher, Bill Romberg, and Tom Vania.

We thank Robert Ruffner and the Kenai Watershed Forum for providing July 2009 overflight use information on the lower and middle river; Bobbi Jo Skibo, John Eavis, and Branden Bornemann from the US Forest Service for providing use information from the Russian River Campground and confluence angler counts; Janet Schmidt (US Fish and Wildlife Service) for providing Russian River Ferry information; George Heim for recording daily fishing reports for the Upper River; and Cheryle James (Wildman's) and Annette & Max Finch (Alaska Canoe and Campground) for 2009 shuttle use information. We also appreciate assistance in developing the landowner sample from John Mohorcich and Dan Nelson (KPB).

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Finally we thank over 2,000 Kenai river users, guides, and landowners who took time away from their trips or leisure to complete on-site, on-line, or mail surveys. As their survey comments attest, many users have great passion for the river and strong opinions about how it should be managed. We hope this report conveys some of that passion as well as fair characterizations of the opinions of diverse users.

Of course, inclusion in the preceding lists does not imply endorsement of information or conclusions in the report. These people provided very helpful information and diverse opinions that we have attempted to understand and represent, but we are responsible for how the study was conducted and presented.

Doug Whittaker and Bo Shelby

Executive Summary

Alaska State Parks commissioned a study of Kenai River recreation use in the summer of 2009. The overall goal was to describe use patterns, user characteristics, impacts and tolerances, responses to impacts, and the acceptability of management actions that might be used to improve environmental health or the quality of recreation experiences.

Methods

The study included focus groups with stakeholders; collection and analysis of use data; an on-site user survey; and follow-up surveys with users, guides, and landowners.

Use data. The study organized use data from several sources, including vehicle or boat counts onsite; ADF&G boat counts on the lower river; overflight boat counts from Kenai Watershed Forum; and launch, campground, ferry, or parking data from other agencies.

On-site survey. Users were surveyed at 25 locations on three segments from late May through September. Over 2,300 groups were contacted; 2,180 provided completed surveys (92% cooperation rate), including 896 bank anglers, 691 drift anglers, 466 powerboat anglers, and 127 non-anglers.

Follow-up surveys. 65 to 87% of ***onsite users*** (depending upon the group) provided addresses for a follow-up survey. A final sample of 852 users completed follow-up surveys (65% response rate), including 318 bank anglers, 274 drift boat anglers, 191 powerboat anglers, and 69 non-anglers. All 385 registered ***guides*** were sent a follow-up survey; 218 completed surveys (64% response rate of those with "good" addresses), including 153 powerboat guides, 47 driftboat guides, and 18 scenic raft or other guides. A sample of 494 ***landowners*** stratified by the three segments was sent a follow-up survey; 208 completed surveys (45% response rate).

Highlight findings

Use levels. Due to an economic downturn, weak second king run, and mid-season floods, 2009 was not a high use year, particularly during king salmon season and the second red salmon run. However, the first red run on the upper river attracted high use, and use levels were "normal" during silver and trout / dolly seasons.

Characterizing users, guides, and landowners. Questions about "most important" recreation opportunities provided profiles of different groups on variables such as age, gender, residency, Kenai experience, boat ownership, and target species. Most Kenai anglers are men (>80%) who fish in small groups (2 to 5). Users take diverse trips; for example, 30% of powerboaters sometimes use driftboats and 29% of drift anglers sometimes use powerboats.

Perceived crowding. A standard question used in many recreation studies shows some Kenai locations and times can be perceived as "very crowded" (e.g., bank anglers on the Upper River during the first red run, drift anglers on the Upper River on Sept weekends, powerboat anglers on high use days on the Lower River; 79 to 98% report crowding). Most locations and times had "high-normal" perceived crowding (50 to 65%), and a few had "low-normal" (35 to 50%) or "no crowding" (< 35%). Perceived crowding was higher while fishing than while using facilities, parking, or traveling to fishing.

Use-impact relationships. Correlations between use measures (e.g., Russian River ferry users per day, boat counts on the Lower River) and various impacts (e.g., perceived crowding, distance between bank

anglers, competition for fishing locations, interference from boats) show that higher use levels are related to higher impacts. Combined with information about impact tolerances, data help show when use produces unacceptable impacts.

Impacts and tolerances. Similar to findings from a 1992 study, most Kenai users identified tolerances for impacts; only 10 to 20% report that social impacts "don't matter to me as long as I'm catching fish." Example tolerances for bank anglers include less than three line entanglements and fishing at least one rod length from others; boat-based anglers tolerate fishing competition and boat interference no more than 25% of the time.

Issue priorities. Follow-up surveys had respondents rank 24 management issues on an "importance" scale; few were rated "not at all" important. The highest ranked issues related to environmental impacts (e.g., litter, bank trampling, wildlife impacts, and powerboat effects on erosion, hydrocarbon pollution, and water clarity), but discourteous behavior of users and boating safety were also important. These are a starting point for high quality recreation. Facility or access improvements and use level issues were lower but also important (particularly for certain sub-groups). Higher ranking use issues included boats on the Lower River in July, bank and boat anglers during red salmon runs, and boats on the Upper River during the late summer trout season.

Responding to crowding. Most respondents (70 to 90%) said they sometimes feel crowded and described ways they respond. About 45% try to avoid others while staying in the same area, and about 30% said they take trips during the middle of the week, at a different time of day, or to a different segment. About 24% go less frequently, 23% resign themselves to a more crowded experience, and 21% become dissatisfied.

King salmon angling use. Guides reported that several factors affect when, where, and how long they fish for kings, including personal knowledge, personal success from recent days, and seeing others having fishing success. Nearly all agreed that "being first" at a hole is important and that king fishing generally diminishes through the day. Because of this, it may be challenging to address crowding by redistributing use in space or time.

Development actions. Among all groups, there is majority support (usually 60 to 75%) for development actions including new launches on the lower river, launch improvements on all three segments, new or improved restrooms, and improved trails or bank fishing platforms (especially if this allows some closed angling areas to be reopened).

Education and regulation actions. There is majority support (but typically less than 60%) for education and regulation actions related to boating safety, including no wake zones or "driving lanes" in congested areas, and requirements for all boat users to wear PFDs. However, powerboat user support for all these actions is more qualified and most powerboat guides oppose them. Powerboaters oppose (but guides support) requiring operators pass a written test for a Kenai "boating license."

"Drift only" issues. Majorities of driftboat users (80%), driftboat guides (85%), and bank anglers (55%) support additional "drift-only" days on the Lower and Middle River (there is one day a week of "drift-only" use during the king season now), while majorities of powerboat users (50%) and powerboat guides (70%) are opposed. Opinions about "drift only" days on one segment at a time suggest "compromise" options may be workable. There was little consensus about the best times for "drift only" days, but support is greatest in higher density periods. The study also reviews other issues that need to be addressed if additional drift only days are considered.

Use limit actions. Similar to the 1992 study, about 68% of users say they would never support boating use limits or they are not needed now, while about 20% might support them (depending upon how the permit system works) and 10% believe they are necessary now. Among those who might support limits, over 80% want limits to freeze or reduce use. Support for specific use limit actions depends largely on who the action would limit. Unguided users support limits on guides or guided use, while opposing limits on all use (which would include them). Guides oppose limits on guides or all users, with the exception of Upper River guides, who support limits on unguided users (complex regulations on the Upper River already effectively limit guides there). There was little support for an all-user registration system that might be used to help redistribute use through information. Less than 20% of users provided estimates of capacities; among those who did, estimates were similar to current averages on high use (but not peak) days.

Guided / unguided use issues. In response to statements about guided and unguided use issues (developed in focus groups), there is general agreement that some guides can be aggressive and that the number of guided boats can detract from experiences. Similarly, many groups agree that some unguided users have inadequate boats, equipment, or skills for high density fishing. Responses help understand use conflicts, suggesting improved education / regulation options might diminish some "frictions" between groups. There is also agreement about "sharing the burden" of reducing overuse, although groups disagree on specific actions. Most disagreements appear to be based on "reasonable self-interest" in their own chances of improved conditions or lost access.

Fees. Just under half of all users are willing to pay user fees; drift anglers were the only group with a majority reporting a willingness to pay. Of those willing to pay in 2009, average amounts were $5 to 7 per day and $40 to 50 per season.

Visual impacts from riversides development. Most users favor current levels of development (about 55%) or reductions (about 20%). Of those favoring more development, most prefer slight increases, and less than 5% prefer doubling or tripling development (which current regulations allow).

Final comments

The following report documents use and impact levels on the Kenai River and support for management actions that might be used to address them. Taken together, information supports a common narrative about the Kenai: there are times and places where use and impacts diminish the quality of experiences, and the river is "not what it used to be." Results also show considerable support for some actions (particularly development and education) to address these problems, but more divided opinion about several regulation options, changes in the type of use (e.g., more drift-only times/segments), or use limits (for guides or all users).

Kenai recreation use is a classic "tragedy of the commons" situation – there is little incentive for individuals or groups to constrain their own growing use, even though the collective impacts could ultimately degrade the resource. The study provides agencies, stakeholders, and the public use information to discuss the kind of recreation opportunities and conditions they want on the Kenai River, allowing agencies to "manage by design" rather "by default."

Table of Contents

1. Introduction

The Kenai River is widely known as one of the most outstanding recreation resources in Alaska. It has world record *Chinook* salmon, large runs of *Sockeye* and *Coho*, outstanding rainbow and *Dolly Varden* fisheries, abundant wildlife, spectacular scenery, and interesting whitewater. With multiple access points for bank, float, and powerboat use, the Kenai attracts local, state, national, and international use. This popularity has led to high use densities at some times and places, and many have commented about the Kenai's potential for crowding and congestion (Route, 1994; Atcheson, 2002; Pedersen, 2005). For at least three decades, river managers have been challenged by the social and biophysical impacts of high recreation use on the Kenai.

Several agencies or governmental organizations have (sometimes overlapping) management responsibilities on the Kenai, including the Division of Parks and Outdoor Recreation in the Alaska Department of Natural Resources (hereafter referred to as State Parks), Alaska Department of Fish and Game (ADF&G), U.S. Forest Service (FS), U. S. Fish and Wildlife Service (USFWS), Kenai Peninsula Borough (KPB), the cities of Kenai and Soldotna, and the Alaska Board of Fisheries. State Parks is the lead managing agency for recreation use on the river and adjacent state land, which includes several State Park units. Designated as a "Special Recreation Management Area" (KRSMA) in 1984, State Park responsibilities include Kenai Lake (14,500 acres); the Upper River (17 miles); Skilak Lake (25,000 acres); the Middle River (29 miles), and the Lower River (25 miles, ending about 4 miles from the mouth at Cook Inlet).

State Parks prepared an initial Comprehensive Management Plan in 1986, focusing on facility development, fish and wildlife habitat protection (particularly regulations to control development in riparian zones), and boating regulation (horsepower limits and non-motorized zones). Plan implementation included a "carrying capacity" study in 1992-93 (hereafter referred to as the 1992 study), which documented several "impact problems" and support for management actions. A Comprehensive Plan revision in 1997 addressed continuing issues related to recreation use, including facility needs, motorized vs. non-motorized use, bank vs. boating use, commercial vs. non-commercial use, bank erosion from powerboats, and riparian degradation from bank anglers.

The 1997 Plan also identified the need for periodically-collected information about recreation use and impacts, including a user survey. Since adoption of this Plan, monitoring or other studies by agencies have addressed some of these needs, but State Parks was interested in a more comprehensive study. A 2004 settlement to litigation regarding proposed Kenai guide limits required additional information about river use and impacts before such limits could be considered. The Alaskan Legislature provided funding for the study in 2008 and it was conducted in 2009-10.

This report provides an overview of major findings and implications for management. It integrates information from focus groups, fieldwork, surveys, and previous studies to assess the "state of recreation" on the river and suggest ways that problems might be addressed. A supplemental report offers additional information about methods and results, including:

1. Use information;
2. Fieldwork;
3. Focus group notes;
4. On-site survey instruments;
5. Follow-up survey instruments;
6. Additional methods information;
7. Additional onsite survey results;
8. Additional follow-up survey results;
9. Verbatim comments from surveys;
10. Notes from Upper River field technician;
11. Excerpts from Forest Service bear incident report

Study information will be considered by State Parks, the KRSMA Advisory Board, other agencies, stakeholders, and the public before additional recreation management actions are implemented.

Study objectives

The overall goal of the study was to describe user and trip characteristics, use levels, impacts, impact tolerances, attitudes toward management strategies, and acceptability of specific management actions. The study was primarily directed at "recreation experience" issues rather than "biophysical" impacts (e.g., bank trampling, boat erosion, hydrocarbon impacts), although respondents were asked about the importance of these issues and some management actions that could be used to address them.

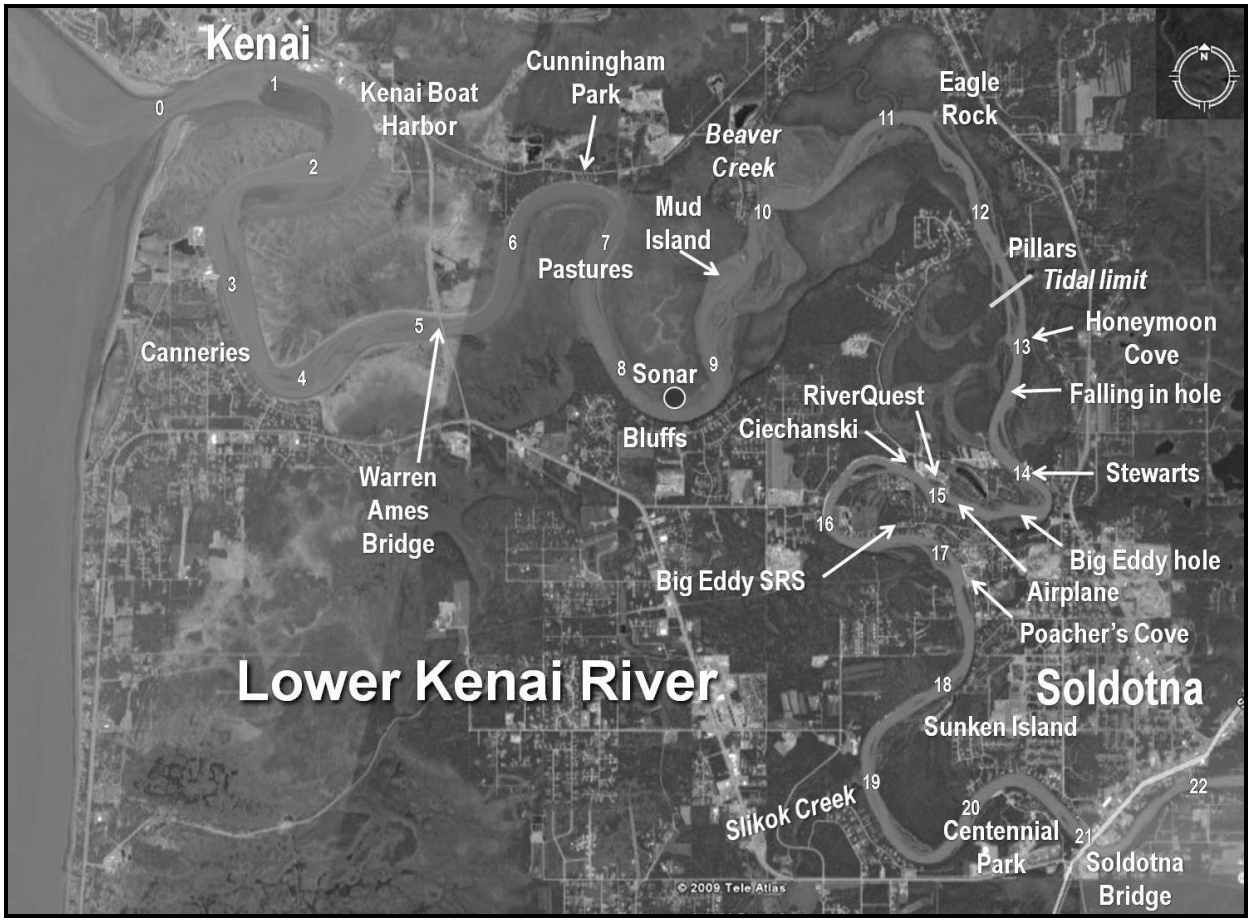
The study replicated parts of the 1992 capacity study, but also addressed more recent issues, and collected more specific information about use-impact relationships and support for specific management actions. Study objectives included:

- Describe "study year" use patterns, focusing on daily and at-one-time estimates to compare with survey findings, and developing specific use-impact relationships.
- Summarize trends in use patterns based on existing agency data to provide context for study year information.
- Summarize "study year" weather, fish escapement, angler effort and harvest, and other potential factors that may influence local, statewide, or out-of-state use.
- Describe specific geographic distributions of drift and power boat use at high density times and locations.
- Describe user and trip characteristics for different groups.
- Assess overall importance of management issues for user groups, segments, and seasons.
- Assess overall evaluations of use levels and perceived crowding.
- Describe reported impact levels and impact tolerances for user groups, segments, and seasons.
- Compare reported impacts with tolerances to define "impact problems."
- Develop relationships between reported impacts and use levels at specific times and locations (segments and sub-segments).
- Assess public support/opposition for several general strategies and specific management actions that might be used to address impact problems.
- Assess place and time displacement of current river users due to crowding or other impacts, and describe potential resource/activity substitutions (that may affect use on other regional rivers).
- Assess proportions of users employing different "coping" strategies when faced with crowding, conflict, or impacts greater than tolerances;
- Ensure that all information is collected for representative samples of major Kenai user groups: drift, power, and bank anglers; non-anglers, guides, and landowners;
- Collect and organize information by user group, segments, and seasons. The three major study segments are identified in Map 1; more detailed maps for the three segments follow.
- Compare findings from the present study with those from 1992 when possible.

- Provide opportunities for agencies (e.g., ADF&G, KPB, USFS, and USFWS) and regional stakeholders (e.g., sport fishing groups, guides, environmental groups, local businesses, and landowners) to help develop issues, impacts, and management strategies to be addressed in the study.

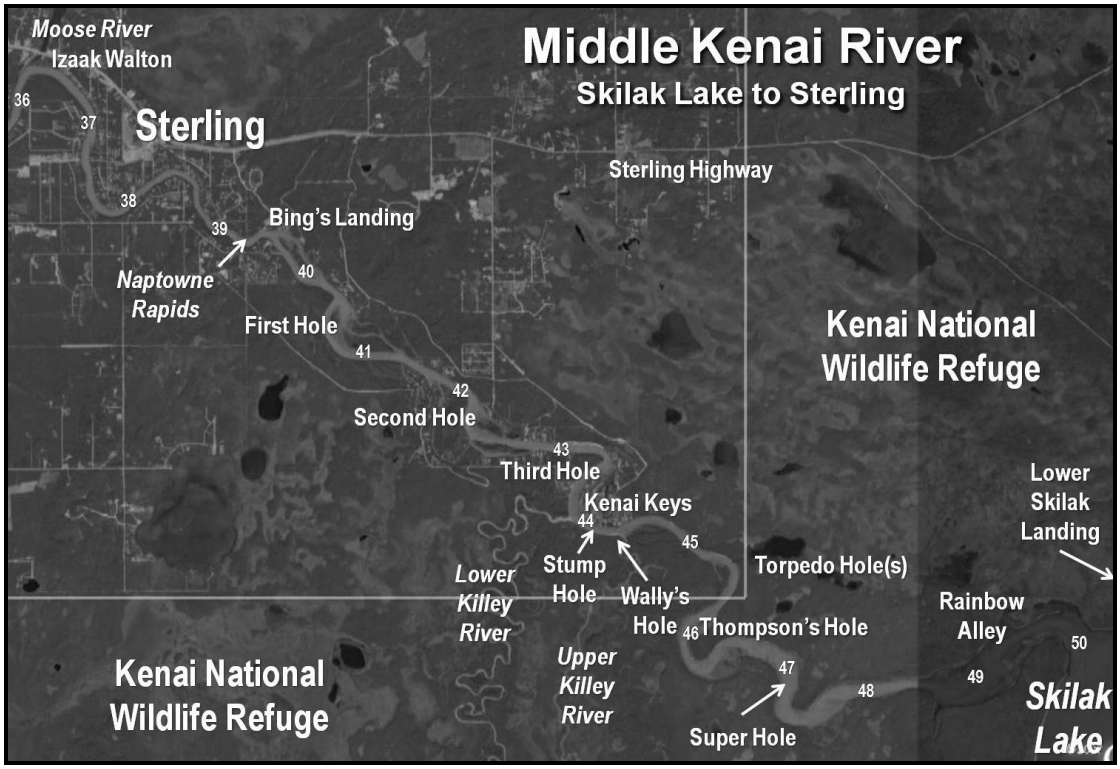
Note: Several Kenai management issues are beyond the scope of the study, including personal use fisheries at the mouth (outside the KRSMA boundaries); allocation between sport, commercial and subsistence fisheries; fishing regulations (the purview of the Board of Fisheries); and land management decisions on non-state lands (although results may help federal and local governmental agencies with their decision-making).

Map 1. Kenai River segments (as used in this report).

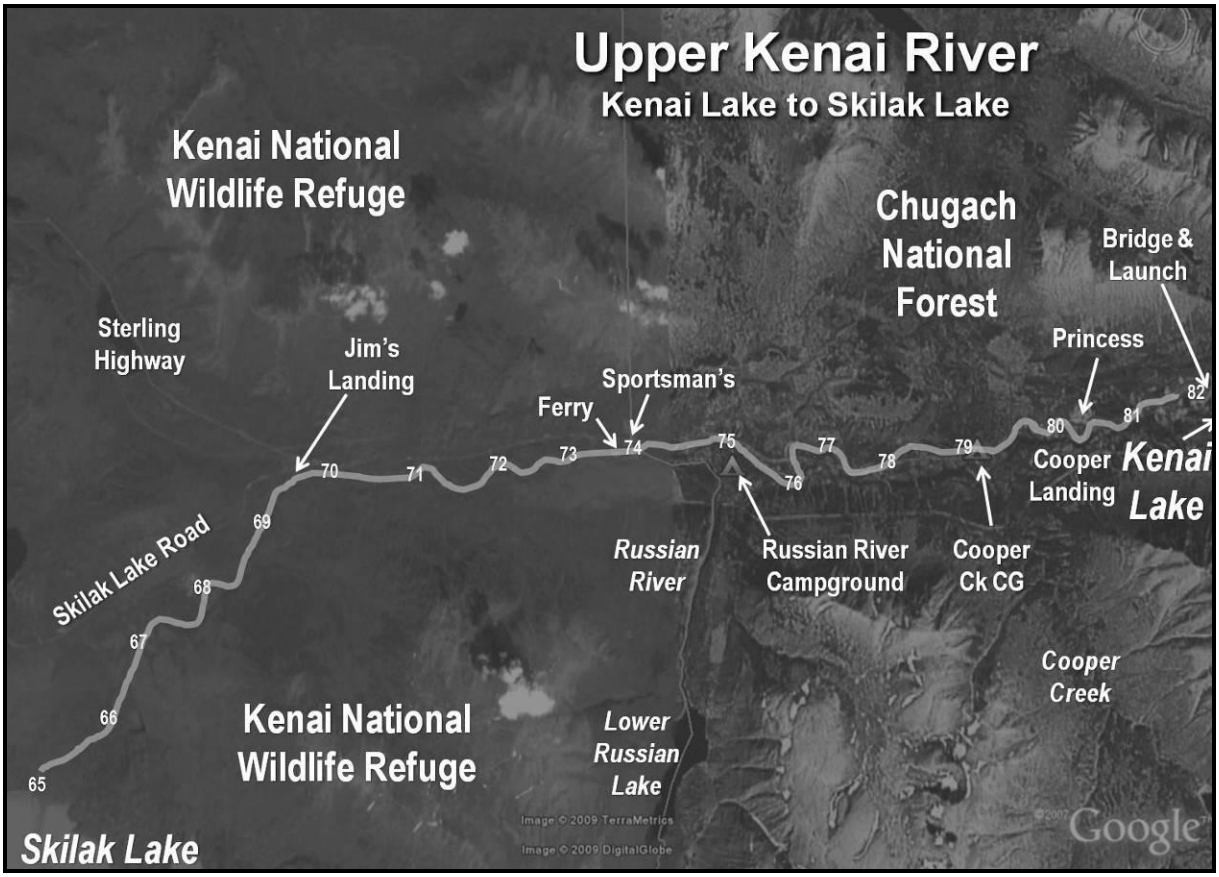


Map 2. Lower Kenai River (River Mile 5 to 21).

Map 3. Middle Kenai River from Soldotna Bridge to Sterling (River Mile 21 to 36).



Map 4. Middle Kenai River from Sterling to Skilak Lake (River Mile 36 to 50).



Map 5. Upper Kenai River (River Mile 65 to 82).

2. Methods

Several types of information were collected during the study. Summaries of method components are provided below; additional information is available in the supplemental report sections on 1) focus groups; 2) use information; 3) fieldwork; 4) onsite-survey methods; and 5) follow-up survey methods. The chapter concludes with several cautions about study findings.

Agency use information and "count" programs

Several agencies operated independent use monitoring or "count" programs that helped summarize use during the study year or place that year in a larger context. Information sources are listed below; additional details are provided in the supplemental report on use information:

- Boating and user counts on the Upper River collected by a photo time lapse program (2004) or through "exit interviews" in 1994, 1999, and 2004 by USFWS.
- Angler effort and harvest data collected by ADF&G creel surveys and the annual Statewide Harvest Survey (SWHS) from previous years.
- Weekly fishing report assessments by ADF&G during Chinook season.
- Daily boat counts on the Lower River collected by ADF&G from mid-May through July.
- Salmon run information (escapement) collected by ADF&G for the study year and previous years.
- Guide information collected by State Parks.
- Aerial boat counts conducted for hydrocarbon monitoring by Kenai Watershed Forum and/or Department of Environmental Conservation.
- Russian River Ferry and Sportsman's launch and parking information (USFWS concession).
- Russian River Campground and Day Use information.
- Daily Pillars launch and parking information.
- Monthly use information from State Park units (e.g., Cooper Landing, Morgan's Landing, Bing's Landing, Izaak Walton).
- State Park ranger counts of bank anglers and boats on selected days.
- USFS staff counts of bank anglers in specific zones in the Russian River confluence area.

Use information was collected in databases that allowed comparisons across different sources, and links to impact information from on-site surveys. Graphs and descriptive statistics were developed to describe seasonal, weekly, and time of day use patterns for different segments.

Fieldwork

This study expanded field data collection from the 1992 study to ensure "at-one-time" use estimates for specific river segments could be associated with the on-site survey information. In addition to the count programs described above, "at-one-time" (AOT) boat, trailer, and parking counts were conducted by study technicians at all sampling locations (i.e., visible counts by category for a specific location at a specific time). Several specific observation stations were also established to improve information about geographic distributions of specific types of users (e.g., different craft, anglers using different fishing techniques, guide/non-guide proportions) within certain segments. Stations and protocols are provided in the supplemental report on fieldwork.

Periodic fieldwork was also conducted on all three segments during the 2009 season to provide context for study findings. This included on-land, floating, and powerboating trips with ADF&G and State Parks field staff. Trips focused on photographing typical use patterns, impacts, and facilities; learning about

ADF&G count programs; interviewing users; and developing supplemental observations of sub-segment use patterns. Additional information about fieldwork is provided in a supplemental report.

Focus groups and interviews

A series of meetings or interviews with agency staff, stakeholders, and user groups were conducted from January to March 2009 to review issues and help develop survey items. The primary purpose was to review:

- Conclusions from the 1992 study and 2002 monitoring program, then develop priorities for this study;
- Impact "indicators" studied in 1992 and 2002, then help decide which should be replicated;
- Management strategies studied in 1992 and develop new actions to be assessed in this study;
- Use and field work data collection options.

Focus group meetings were conducted with guides (2 meetings); Kenai River Sport Fishing Association; Kenai Area Fisherman's Coalition; landowners who live on the Kenai Peninsula; landowners who live in Anchorage; Cooper Landing area residents (landowners and guides); long-time users in the Anchorage area (recruited from Alaska Outdoor Forum); and agency staff or KRSMA river use committee members (including staff from ADF&G, State Parks, USFWS, USFS, KPB or other non-governmental organizations such as Kenai Watershed Forum). Additional interviews were conducted with individual guides, Kenai Guide Academy instructors, local Chamber of Commerce staff, and landowners.

Candidates for focus groups and interviews were developed with assistance from leaders of formal stakeholder groups, KRSMA board members, and other experienced users identified by agency staff. The goal was to have participants represent a diversity of opinions within the identified groups, but many had broad experience with several segments and types of uses.

Focus groups ranged from 4 to 15 participants; they were conducted with a single facilitator (Doug Whittaker), and several were attended by agency observers. Interviews were conducted by phone or in person by Whittaker. Interviews and focus groups were structured to cover a full range of topics; the supplemental report on focus groups includes notes from the sessions. Focus group participants and interviewees were invited to pre-test survey instruments. Notes from the focus groups are included in the supplemental report.

On-site survey

The on-site survey used similar methods to those employed in the 1992 study. Technicians were provided with a "roving" sampling schedule designed to survey groups of users (bank anglers as they fish and boat-based anglers as they take-out) at several locations on each segment through seasons (defined after discussions with stakeholders and agencies). Technicians surveyed one person per group (e.g., 1 person per bank angler group, 1 person per boat) chosen randomly.

The technician provided respondents with a one-page survey about users' trips, overall trip and crowding evaluations, and impacts, focusing on evaluations of that day's trip. In some instances, technicians read questions and recorded responses (because respondents were busy de-rigging boats or bank fishing). The survey also asked for contact information (email or mail address), which gave users the opportunity to complete a follow-up survey (see below).

2009 on-site sampling targeted users during angling seasons, but also sampled some non-angling users (e.g., scenic rafters, wildlife viewers, campers) who are present during those times. The study did not

focus on sampling during the non-fishing seasons (e.g., before trout season opens on the Upper River). The on-site survey did not target personal use fishery (dip-net) users at the mouth of the river and outside KRSMA (although some boat-based dip-netters launch upstream and were included in the sample).

The overall goal of the on-site survey was to represent the diversity of 2009 users on the Kenai River, which is related to several variables:

- Geography (Upper, Middle, and Lower rivers, and by location within those segments)
- Activity (powerboat anglers, driftboat anglers, bank anglers, and non-anglers)
- Type of use (guided vs. unguided)
- Time of year (primarily delineated by salmon run timing)
- Day of the week (primarily weekends vs. weekdays, plus special regulation days)
- Time of day

The on-site survey sampling goal was to ensure that the sub-groups of interest had a sample of about 30 for descriptive statistics and analysis. For larger sub-groups (e.g., all Lower River powerboaters), the goal was sample sizes about 200, which provide "margin of error" about ±8% (at the 95% confidence level). Sample sizes of 400 (for larger-still groups such as "all bank anglers") produce a margin of error about ±5%.

The 2009 sampling effort had several elements, including:

- Segment stratification (roughly equal sampling effort by the three segments)
- Type of day stratification (weekends vs. weekdays);
- Random sampling by specific days within weekend/weekday strata;
- Random sampling by time of day (in general, between 11 am and 8pm);
- Quotas that limited the number of surveys from any given location/time period to avoid "over sampling" a particularly high use setting;
- Professional judgments that defined the frequency of sampling by location and season to include a diversity of locations and maintain logistical efficiency for technicians.
- Minor adjustments based on in-season considerations (e.g., adding more powerboat sampling in late July and August in response to low use levels during king season; reducing some bank angling locations due to no or very low use).

The supplemental report provides additional details about the on-site survey sampling plan. Sampling locations included 15 locations on the Lower River (including Pillars, Centennial Park, Eagle Rock, Cunningham Park, Poachers Cove, and River Bend); 13 locations on the Middle River (including Bing's Landing, Swiftwater Park, Morgan's Landing, Izaak Walton, Kenai River Center, Rotary Park, Funny River, and Lower Skilak) ; and 6 locations on the Upper River (including Russian River Ferry/Sportsman's, Jim's Landing, Sterling Highway turnouts, Russian River campground/day use area, and Upper Skilak).

The supplemental report provides additional information about sampling effort and response by location and month. The bank anglers sample included roughly equal samples from both red runs and periods outside red salmon season. The powerboat sample had unexpected lower numbers from the king runs due to poor king returns, the economic downturn, and flooding in late July; we adjusted sampling to capture more powerboat anglers after July. The driftboat sample was larger than expected because of high use levels on the Upper River.

In total, the 2009 study surveyed 2,180 users on-site (including 896 bank anglers, 466 powerboat anglers, 691 driftboat anglers, and 127 non-anglers). The survey was conducted over 428 time- and location-

specific "sessions" (totaling 671 hours) at over 30 different locations on over 90 days from late May through late September (34% of hours on the Lower River, 31% on the Middle River, and 35% on the Upper River). Table 2-1 provides the number of on-site users contacted, the percent who completed surveys, and a "cooperation rate." It also shows the proportion of users who gave addresses for follow-up surveys.

Table 2-1. Onsite survey contacts, refusals, completions, and cooperation rate.

	Bank anglers	Drift boat anglers	Powerboat anglers	Non-anglers	Total
Contacted	987	709	527	141	2,364
Refused	91	18	63	14	185
Completed	**896**	**691**	**466**	**127**	**2,180**
Cooperation rate	**91%**	**97%**	**88%**	**90%**	**92%**
Provided addresses for follow-up	654 (73%)	599 (87%)	302 (65%)	95 (75%)	1,650 (76%)

Content for the on-site survey was developed from the 1992 study and revisions were suggested by focus groups and interviews. The survey was pre-tested by focus group participants and agency staff. Technicians were trained to provide a consistent approach to users and preamble about the survey. A one-page "frequently asked questions" (FAQ) brochure was available for interested participants; it described the study, the confidentiality of responses, and contacts for more information. The supplemental report on onsite methods provides the on-site survey instruments, survey protocols, and FAQ.

On-site survey analysis used sampling and stratification variables (e.g., type of user, target species, guided/unguided, high use days vs. low use days) to conduct comparative analyses. In general, statistics for small sub-groups were reported separately only when differences were statistically significant and substantively important (as discussed when results are presented).

Follow-up surveys

As with the 1992 study, the 2009 study included a follow-up survey that allowed more detailed questions. The follow-up survey was sent to a sample within each group of onsite respondents, a sample of landowners, and all guides (details below).

All follow-up surveys included questions about user and trip characteristics, issue priorities, responses to crowding, past use and potential segment or activity displacement, support for general management strategies, support for specific management actions, "drift-only" issues, guided / unguided use issues, and visual impacts from development. Most of these topics were addressed in the 1992 study, but many questions were modified or added after focus groups and agency input. The guide survey included additional questions about king salmon fishing trends and "drift only" issues; the landowner survey included additional questions about properties and trespass issues.

User follow-up survey

Respondents could take the survey on-line or by mail. On-line respondents were sent one email invitation and three reminders. Mail survey respondents were sent the survey and a cover letter, a post card reminder, and two additional reminders (the last containing a replacement copy of the survey in case they misplaced the first).

In total, 1,650 on-site respondents provided email or mail addresses, 126 were illegible or duplicate addresses (because some people were surveyed more than once) and 221 were "bad addresses" (returned undeliverable by regular mail or bounced by email). This provided a total follow-up survey sample frame of 1,303 potential respondents; of these, 852 or 65% returned completed surveys. This was similar to the response rate for the 1992 study (68%). Additional information about the sample is provided in the supplemental report on follow-up survey methods.

A series of questions asked survey respondents to identify their 1st and 2nd most important recreation opportunities (and any others that they do). Results were used to group respondents into the four primary user groups (bank angler, drift boat angler, powerboat angler, or non-angler; see details in supplemental report). Of the 852 follow-up survey respondents, 318 were bank anglers, 274 were driftboat anglers, 191 were powerboat anglers, and 69 were non-anglers.

This method of categorizing users was different than for the 1992 study, which grouped users by the activity they were doing and the segment they were visiting on the day of the onsite survey. The 1992 method limited information about other segments and activities and may have "artificially" grouped users; the 2009 method allows users to self-identify their most important activities and segments.

Guide survey

State Parks had a list of 385 registered guides for 2009, which included outfitters, guides, and a few other commercial service providers (e.g., shuttle services, rental boats, etc.). All were sent an invitation to take the survey on-line or through the mail. In total, 43 addresses were undeliverable, so the final sample frame was 242. Completed surveys were received from 218 individuals, a response rate of 64%. This was slightly lower than the 1992 response rate of 76%, although that survey was only sent to a sample of guides, so the total samples size in 2009 was higher (218 vs. 143). The State Parks guide list was considered more comprehensive than the ADF&G Guide License Database (because it included other commercial enterprises operating in the river corridor); we did not cross-reference the two databases.

Using other information from the State Parks guide database, we were able to do a non-response check. Our final sample was representative regarding the proportion of fishing guides, Alaskan residents, and independent guides (as opposed to those who work for an outfitter). Based on the same questions about 1st and 2nd most important opportunities, the final sample included 157 powerboat guides, 48 driftboat guides, and 13 scenic raft guides or other commercial service providers. Details are provided in the supplemental report.

Landowner survey

Kenai Peninsula Borough (KPB) estimates there are approximately 3,500 properties along the Kenai River (most along the Middle and Lower Rivers). KPB provided a random sample of 200 landowners on the Lower and Middle River; all landowners with property adjacent to public easements; and all landowners on the Upper River (because there are only 82).

From this initial sample of 682, 188 were removed because they were duplicates, corporations, or governmental agencies (we only wanted to send surveys to private individuals). We sent a postcard invitation to take the survey to the 494 remaining. Of these, 32 were "bad addresses," providing a final sample frame of 462. Completed surveys were received from 208 individuals (a response rate of 45%), including 81 from the Lower River, 108 from the Middle River, and 19 from the Upper River. Thirty-five were landowners adjacent to easements. This was lower than the 1992 response rate of 74%, although that survey was sent to a smaller sample of landowners (200), so the total samples size in 2009 was higher (208 vs. 147). Based on the same questions about "most important opportunities," the final sample included 74 bank anglers, 14 driftboat anglers, 99 powerboat anglers, and 21 non-anglers. Details are provided in the supplemental report.

Survey sample sizes

Taken together, follow-up surveys were completed by 1,278 individuals, including 852 users, 218 guides, and 208 landowners. Table 2-2 provides sample sizes by types of users.

Table 2-2. Sample sizes by types of users for the follow-up user, guide, and landowner surveys.

	Users	Guides	Landowners	Total
Bank anglers	318	0	74	397
Driftboat anglers	274	48	14	335
Powerboat anglers	191	157	99	443
Non-anglers	69	13	21	103
Total	**852**	**218**	**208**	**1,278**

Analysis

This primary study report integrates information from components of the study; the supplemental report provides additional detailed information (e.g., results for different subgroups, the full range of questions in the survey, verbatim open-ended comments etc.). Analysis was based on recreation research protocols, including those used in the 1992 study and 2002 monitoring on the Kenai, and several other studies of Alaskan and Lower 48 rivers. Unless differences are small, analyses separate relevant sub-groups. This strategy avoids characterizing an "average user who doesn't exist" (Schaefer, 1976), addresses concerns about unequal group sample sizes, and helps show how management actions might affect different groups. It also creates some artificial divisions between users that may encourage polarization (e.g., driftboaters vs. powerboaters, guided vs. unguided users). Additional information on specific analyses is provided as results are presented.

Reporting

Presentations of results and implications were made to 1) the KRSMA river use committee and 2) at a public meeting in February 2010, allowing feedback on concerns or additional analysis. A draft report (this document) will be presented to KRSMA advisory board for internal review in April 2010. The final report is expected in June 2010.

Cautions and study context

Study results apply to 2009 conditions and users. The study provides information from Kenai users in 2009 – a "snapshot" of conditions and user attitudes from one year. For the onsite survey, information from previous years has been reviewed to help put study findings in context. For the follow-up survey, responses reflect evaluations of the river or management actions that are probably not dependent on year-to-year variations. This issue is explored through comparisons to 1992 study findings.

The study explores a full range of management actions, including controversial ones. To be comprehensive, the study included several actions that are unpopular with some groups or agencies. Effective management actions usually involve "costs" – money, time, agency effort, or restrictions on how people use the river. The relevant adage here is, "if the choices were easy, they would have already been made."

The study does not advocate specific action, but tries to clarify their trade-offs – identifying what problems they may address (e.g., problems they may address, new problems they may create, which groups would benefit). Managing agencies (and specifically State Parks through its KRSMA advisory board process) will consider study information when making management decisions, but will also integrate other information (e.g., biophysical studies, use trends, stakeholder and public input) through a public process. Issues are likely to be "handled" through programmatic decisions or case-by-case amendments to the existing plan.

The study develops some management options and recommends specific monitoring. Some study results (or information from other rivers) suggest potential solutions that deserve additional attention. These suggestions provide a "starting point" for additional discussion among agencies, stakeholders, and the public. The study also recommends future monitoring that may help agencies or the public become better "calibrated" to use and impact levels, also intended as a "starting point" for agency consideration.

The study generally focuses on State Parks responsibilities, but some issues cross jurisdictional boundaries. The Kenai has a complex management environment, and decisions by one agency can affect use and impact patterns that create problems for others. It is beyond the scope of this report to sort through jurisdictional challenges, so we generally discuss management solutions without assessing specific agency responsibilities. We encourage multi-agency decision-making in these situations, even as we recognize these have their own difficulties. As study results are presented, our goal is to anticipate new problems or identify connections to past management decisions.

Surveys are not "votes" on study issues. There is a tendency to consider survey results as referenda on specific issues, but we caution against this. The purpose of this study is to provide information, identify group positions, and search for solutions that address problems (or share the burden of addressing them). In addition to studies, good planning integrates information from stakeholder input, public testimony at workshops and meetings, laws and legal mandates, and agency missions and regulations.

The study assumes the overall goal of managing for a diversity of high quality recreation opportunities. The Kenai provides many recreation opportunities, including those with low, moderate, and high use levels. No particular opportunity is better or worse than others, but all opportunities cannot be provided on every mile of river. This means careful management is required to insure high quality. The study is designed to clarify differences among opportunities or management options; agencies make these judgments with public and stakeholder input through their planning processes.

3. Use Information – Characterizing 2009

This chapter summarizes use and related information for 2009, and compares it to similar information from other years for context. A supplemental report provides supporting evidence and more detailed use or related information for specific fisheries, seasons, and locations. Other sections of the report (specifically Chapter 5 on king salmon use trends, Chapter 16 on guide/unguided use issues, and Chapter 15 on use limits and capacities) also provide detailed use information or integrate it into discussion.

Factors influencing use levels

Salmon runs and fishing success

Early king (Chinook) run

This run arrives in early May and (by definition) the run ends July 1. It is historically much smaller than the late king run; the long term (1986-2006) average in-river return is about 16,300 fish (with fishing mortality of about 6,000). In 2009, sonar estimates suggest about 11,000 early run kings entered the river, making this a lower than average return.

The timing of the run was normal, but started slowly; per day sonar counts did not exceed 100 fish until May 27. Counts exceeded 300 fish on only 15 days, with the sustained period of higher counts occurring from June 5 to June 14. Only three days exceeded 500 fish per day; the highest day was 603 on June 11.

Fishing was generally "slow" through this run, with ADF&G creel information suggesting it took over 60 hours per unguided angler to catch a king in most weeks (the exception was the week of June 4, when the average was 37 hours). For guided anglers, it generally took about 40 hours per caught fish (with the best week at 23 hours per fish).

Late king (Chinook) run

This run is much larger than the early run. By definition, kings entering the river after July 1 are categorized as late run fish. Fishing for the late run closes July 31, but a few kings continued to arrive after that date. Sonar counts were discontinued on August 3. The long term (1986-2007) in-river return is about 42,000 fish (with about 13,000 harvested or lost to catch & release mortality). In 2009, sonar estimates suggest only 25,700 fish entered the river, making it the lowest run on record.

The timing of the run was normal, but after an initial period of higher daily counts numbers dropped and did not rebound. Per day counts through the sonar exceeded 600 on most days through July 23, but averaged about 500 afterwards. Counts exceeded 1,000 fish on only 9 days, with the sustained period of higher counts occurring from July 11 to 22. The highest count was 1,249 on July 17. In an average year, counts will exceed 1,000 fish on over 20 days, and it is common for nearly half of those to exceed 1,500. In "good years," counts from 2,000 to 3,000 may occur on a handful of days.

Fishing success was better than the early run as anglers were allowed to use bait, and success rates approached long term averages early in the month. It took unguided anglers about 8 to 21 hours to catch a king during this run, with the rate degrading through July (particularly in the last week of July). For guided anglers it took between 10 and 14 hours, with success rates following the same timing pattern.

Early red (Sockeye) run

The first red run to enter the Kenai River are bound primarily for the Russian River and is smaller than the late run. 2009 had 52,178 fish through the Russian River weir, coincidentally similar to the long term average of 52,000 fish. By regulation, the fishery in the Russian and Upper Kenai rivers for sockeye salmon opens June 11. The run was strong enough to allow ADF&G to increase the area open to fishing by allowing anglers to fish in the Russian River Sanctuary effective June 15. The fishery was further liberalized by increasing the bag / possession limit from 3 daily / 3 in possession to 6 daily / 12 in possession on June 17. ADF&G assesses creel for this fishery through its statewide harvest surveys, which estimated a harvest of approximately 59,000 reds. Success rates were good to excellent throughout this run, particularly on the Upper River (where most use is concentrated). However, several long term users remarked that fishing success was also unusually good (and use levels were higher) for the early run at some Lower and Middle River locations (especially during the first week of the run).

Late red (Sockeye) run

The second red run to enter the Kenai River is substantially larger than the first, with fish bound for many areas including the Russian River. The long term average is about 900,000 fish through the sockeye sonar counter at RM 19 near Sterling Highway Bridge in Soldotna; the 2009 count was about 745,000 or 83% of the average. This run arrived in two distinct surges, with peak counts from July 14 to 21 (averaging about 39,000 fish per day) and a shorter, smaller peak from July 27 to 31 (averaging about 32,000 per day). Per day averages did not exceed 8,000 fish until July 11, were about 13,000 fish per day between the peaks, and averaged less than 10,000 per day after the second peak.

ADF&G statewide harvest survey results indicate anglers harvested about 240,000 reds above the sonar counter, slightly lower than the long term average (see below). Several sources suggest that success rates were fair to good in the early part of the run on the Lower and Middle River, but declined substantially after water levels rose about July 23 and then again in early August. On the Upper River, there were short periods of "excellent" red fishing from July 13-15 (before the flooding) and from August 2-15 (after flooding had subsided; it was not affected by the second flood).

ADF&G statewide harvest surveys indicate the catch averages about 315,000 sockeye each year (1997-2006), although this fluctuates from 217,000 (1998) to 389,000 (2005). Segment data suggest about 37% are caught in the Lower River; 36% downstream of Moose River on the Middle River; 13% upstream of Moose River on the Middle River; and 13% from the Upper River (the remainder come from unspecified locations).

Silver (Coho) runs

ADF&G does not monitor in-season run strength of the Kenai silver return via sonar. Some sources suggested that 2009 silver success rates were "typical" although others suggest they were "better than average," particularly on the Lower River. Silver success rates appeared to slow from August 14 to 20 during a second round of flooding on the Lower and Middle River. Success rates for silvers on the Upper River (Heim, 2009) suggest the best fishing was from Aug 20 to Sept 3, but it never reached "good," "excellent," or "superb" levels.

ADF&G statewide harvest surveys indicate Kenai silver harvest levels have recently averaged about 43,000 fish per year (1997-2006), with about 59% caught in the Lower River, 21% in the Middle River,

and 11% in the Upper River, and the remainder in lakes or unspecified locations. About 70% (approximately 30,000 silvers) are harvested prior to September.

Trout and Dolly Varden fisheries

ADF&G assessments of trout and Dolly fisheries for 2009 indicate catch of these two species was similar to previous years and over the past decade catch has trended upwards. Several other sources suggest that 2009 success rates were "typical" of recent years (and generally considered "excellent"). The highest use targeting these species is on the Upper and Middle Rivers. Fishing success ratings from the Upper River (Heim, 2009) suggest trout fishing was best from August 1 through September 6, and from September 14-20.

From ADF&G statewide harvest surveys, about 113,000 Kenai rainbow are caught each year (1997-2006). Only about 2.5% of rainbow are retained; a shift to a catch and release fishery (in the mid-1980s, 22 to 27% retained fish). About 11% are caught in the Lower River; 9% downstream of Moose River on the Middle River; 24% upstream of Moose River on the Middle River; 55% from the Upper River; and the remainder in unspecified locations.

From ADF&G statewide harvest surveys, about 98,000 Dolly Varden are caught in the Kenai each year (1997-2006). About 6% are retained; a continuing shift toward a catch and release fishery (in the early 1990s, 15 to 34% retained fish). About 15% are caught in the Lower River; 9% downstream of Moose River on the Middle River; 22% upstream of Moose River on the Middle River; and 53% from the Upper River; and the remainder in unspecified locations. This is similar to the rainbow distribution.

Weather

Based on a review of Soldotna and Cooper Landing mid-day temperatures and total precipitation, weather during 2009 was generally warmer and sunnier than average (particularly from May through mid-August, and in late August through early September). In Southcentral Alaska as a region, 2009 had the 3rd lowest amount of cloud cover over the past 13 years (Papineau, 2010). However, there was a substantial rainstorm in the Kenai Mountains in late July led to flooding that affected fishing success and access (and diminished use). A glacier dam outburst above Skilak Lake also created flooding on the Lower and Middle Rivers in mid-August.

Flows and flooding

Substantially higher than normal flows occurred during two distinct floods, from July 23 to August 8 (the "first flood") and August 13 to 21 (the "second flood"). A third flood occurred in October 2009, but outside the study period. Figure 3-1 graphs flow levels (and shows days with substantial rain).

The first flood was caused by rain in the Kenai Mountains and affected the entire river, but with greater flooding on the Middle and Lower Rivers. Starting from typical mid-summer peak flows about 7,000 cfs at Cooper Landing and 14,000 cfs at Soldotna, the peak at Cooper Landing was 10,500 cfs on July 31; flows dropped below 8,000 cfs by August 4. At Soldotna, flows peaked at 24,000 cfs on August 1, and dropped below 18,000 cfs by August 8.

The second flood resulted from a glacial lake outburst in the mountains above Skilak Lake, causing flooding only from the lake downstream a week after the first flood. At Soldotna, flows increased from 17,000 cfs to a peak of 26,000 cfs on August 17. The river returned to typical summer high flows (below

18,000 cfs) by August 21. Both floods inundated recreation facilities (docks, launches, and angler boardwalks/platforms) or made bank fishing in many areas challenging.

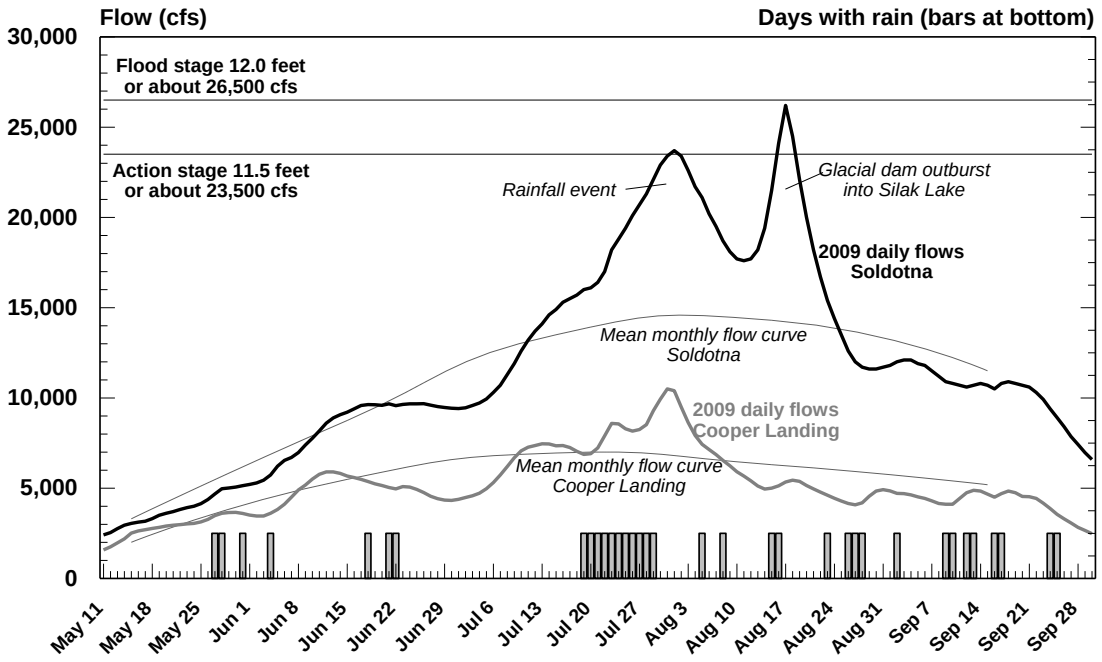


Figure 3-1. 2009 flow levels at Cooper Landing and Soldotna USGS gages.

Economic downturn

There was a major economic recession in the United States in 2009, which may have affected local and national visitation to the river. Alaska summer tourism visitation was down an estimated 7% (passenger arrivals) and the number of post-cruise land-based users (estimated to comprise two-thirds of Southcentral Alaska tourism arrivals) was down about 13% (McDowell Group as reported by Bradner, 2009). On the follow-up survey for this study, guides were asked to estimate whether the number of client-days on the river were "substantially lower" (-5 to -30%), "lower" (0 to -5%), "about the same," "higher" (0 to +5%), or substantially higher (+5 to +30%) than previous years. For all guides taken together, 20% reported "substantially lower," 34% reported "slightly lower," and only 6% "higher" or "substantially higher" (see supplemental report for more details).

Other potential factors

King salmon fisheries in the Susitna basin were closed due to poor returns early in 2009, which may have affected Kenai River fishing levels. When Kenai red salmon fishing opened on June 11, no other substantial Southcentral salmon fishery had opened previously. When this first red run appeared strong (and especially after limits were increased to 6 fish per day one week into the season), high latent demand led to high use levels.

In contrast, when rod and reel fishing for the second Kenai red run peaked in mid-July, the July 10-31 ***Kenai personal use fishery*** targeting reds at the mouth had been open for a week and was on track to

having the ***highest use on record*** (despite flooding at the end of the month that made dipping challenging).

Overall, the personal use fishery at the mouth appears to have substantially reduced fishing pressure among rod and reel anglers on the rest of the river over the past decade. The personal use fishery did not exist during the 1992 study, and the number of personal use "days fished" (people fishing x number of days) has more than doubled from 10,500 in its first year (1996) to just over 26,000 in 2009 (ADF&G, 2009).

Use level estimates

By definition, recreation use studies pay attention to use information. A half century of visitor impact research shows that other factors besides use levels affect impacts, but use levels "drive" many impacts and are an integral part of recreation management. Accordingly, we have tried to profile use levels on the Kenai for various segments and seasons below.

Most recreation use information is reported for large areas (e.g., for an entire river) or for long periods of time (e.g., for a month, season, or entire year). This is important for some management issues (e.g., total harvest estimates, economic impact analyses), but is less useful for assessing impacts at specific times or locations. It is important to include more specific use measures, each of which specify units (e.g., user days, people, boats, or trips), timing (e.g., at one time, per day, per week, per month, per season), and location (e.g., at a launch area, in the entire segment, at specific attraction sites). For the Kenai, "at one time" or daily estimates for specific segments and sites are probably the most relevant for this report, although some annual or run-specific information is also provided.

With all use information, the goal is to understand overall use patterns. However, visitor impact management tends to focus on peak levels, which is when impacts are more likely to reach "unacceptable" levels and require management attention.

Use information comes from several sources (as noted when results are presented). Most use information is based on counts of boats, cars, or anglers at public facilities. There may be considerable bank use from private property that was not assessed in this study.

Effort and harvest on the entire river

ADF&G statewide harvest surveys estimate about 315,000 angler-days of effort on the Kenai River each year from 1997-2006. This is an increase over 1977-1995 average of 278,000 angler-days. 2009 estimates will not be available until fall 2010.

Segment distributions of angler effort (1997-2006) suggest about 47% occurs in the Lower River; 26% in the Middle River (below Moose River); 12% in the Middle River (above Moose River); and 13% in the Upper River (with the rest unspecified by location).

Species harvest on the Kenai (1997-2006) suggests anglers keep about 16,000 kings; 225,000 reds; 43,000 silvers; 10,000 pinks (with large disparities in odd and even years); 3,000 rainbow; and 6,000 Dolly Varden per year. With rainbow and Dollies, many more fish are caught and released.

Lower River

Bank angling

Bank angling on the Lower River during 2009 was highest during the second red run, but was also substantial during kings, silvers, and the first red run. Entire segment counts were not conducted, but site counts indicate use levels and patterns:

- Cunningham Park had rare bank angler use during red or king runs, but it had consistent use during silver season. Maximum 2009 bank angler counts were 22 at one time (Aug 21). With 230 feet of shore, this creates spacing of about 9 feet between anglers (assuming anglers are evenly spaced and an average width of 2 feet per angler).
- The beach across from Beaver Creek is a popular bank angling site (accessed from boats) during the second red run. An average of 14 anglers was observed at this site during second red run, with a high of 45. This beach also had similar high use levels (41) during silvers over Labor Day weekend. With a length of about 800 feet, spacing between anglers at these peak levels is about 16 feet.
- Eagle Rock has almost no bank anglers until silver season; then it averages about 4 at one time.
- River Bend campground has substantial bank angling use during the second red run, with up to 20 anglers at one time.
- RiverQuest properties offer some bank angling during the second red run, with up to 15 anglers at one time during peaks in 2009.
- Ciechanski SRS (immediately adjacent to RiverQuest) usually attracts only 2 to 3 bank anglers at one time during the second red run, but 15 were observed on one day.
- Big Eddy SRS typically had 5 to 10 anglers at one time during the second red run, but the island beach (directly across the river; accessible by boat) had as many as 41. That beach is about 680 feet long, so evenly distributed anglers at this peak equates with about 15 feet between anglers.
- Poacher's Cove may have 1 to 3 anglers in king or red seasons, but 14 to 16 were observed at Pipeline SRS (across the river) during the second red run.
- Centennial Park is a primary bank angling area during kings, reds, and silvers. King and silver fishing is concentrated near the boat launch parking lot; red fishing occurs along the entire property (usually clustered at stairwells down the bank). Average numbers at one time were 4 (with peaks about 10) during kings; 30 (with the peak of 47) during reds; and 21 (with a peak of 29) during silvers. The shore from boat harbor to trees is about 800 feet long; it provided spacing of about 15 feet during red peaks and 26 feet during silvers.
- Bank anglers visible from the Visitor Center boardwalks (including those under the bridge or fishing from private land across the river) averaged about 17 during the second red run (with a peak at 37).

Boat-based angling

Boat-based angling is highest on the Lower River during the second run of kings (July), but is also substantial during silver season. Some boats also access bank angling areas for reds during July. Accurate counts of boats during king runs are provided by ADF&G (four counts daily on a sample of days during first and second king runs) and overflight information (from the Kenai Watershed Forum turbidity / hydrocarbon monitoring on three days in July). Vehicle counts at major launches through the entire season provided estimates of silver season use levels, recognizing that many boats may originate from private land docks rather than public launches.

Figure 3-2 shows ADF&G boat counts for the 2009 king seasons. The figure reports the highest count for a given day (out of four counts daily; time of counts is randomized; the peak count is typically the first count that occurs after 6 am, when guides are allowed on the river). The figure also distinguishes

between boats that are engaged in fishing vs. "active" boats (not fishing at the time of the count); and between "drift only Mondays" and all other days (fishing from a powerboat is prohibited on Mondays). Chinook sonar counts are also shown to help illustrate relative fishing success.

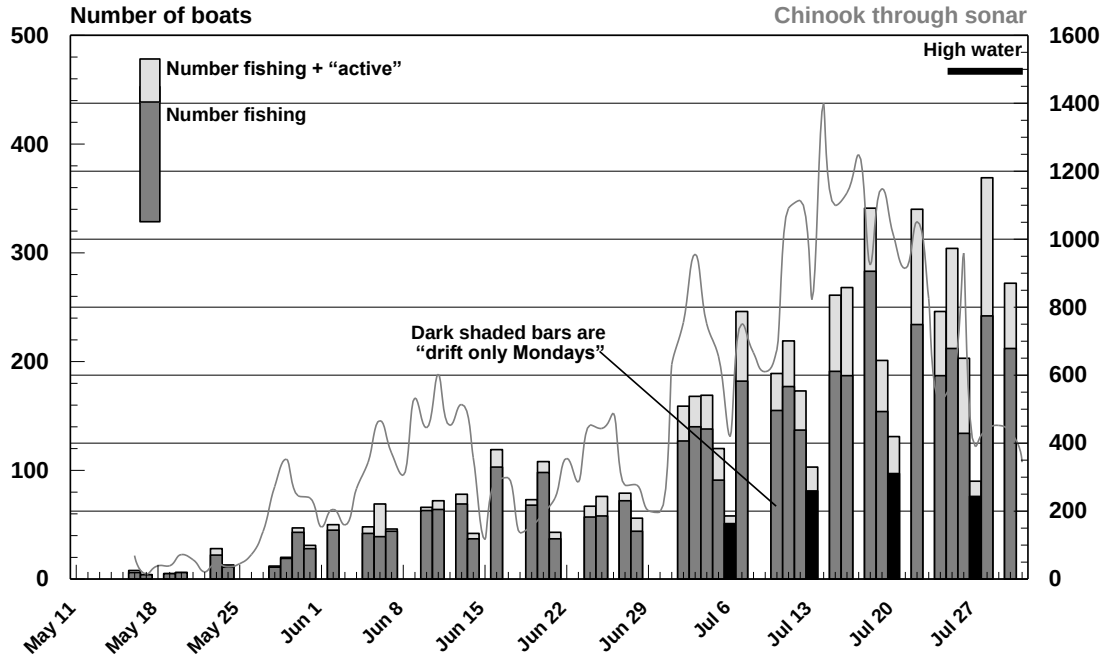


Figure 3-1. Highest daily boat counts (fishing + active) during king season on the Lower River, 2009.

Results suggest several findings about 2009 Lower River boating use during king season:

- Boat counts increased through the season, peaking toward the end of July. If flooding had not occurred in the last week of July, counts would probably have gone higher.
- Boat counts on powerboat days during the first run (before July 1) rarely exceeded 100 boats at one time, but ranged around 150 to 350 in July (when bait is allowed and fishing success was considerably higher).
- Boat counts tend to be highest on Saturdays (the weekend day when guides are allowed) and Tuesdays (after a day of lower fishing pressure due to "drift-only" fishing regulations).
- Boat counts from 2005-2008 show common peaks on Tuesdays and Saturdays in late July were about 450 boats at one time, so 2009 peaks between 300 and 350 were lower by 20 to 30%.
- Assuming relatively even distributions throughout the Lower River (not including downstream of Warren Ames Bridge), 350 boats at one time would average about 21 boats per mile. If boat peaks ever reached 500 boats at one time, an even distribution would produce averages of about 29 boats per mile. As discussed below and in Chapter 6, king anglers do not evenly distribute themselves throughout Lower River, so densities of boats are likely to be much higher in some areas (e.g., Sunken Island to Big Eddy, Eagle Rock to the *Chinook* sonar station).
- Sundays had lower boat counts than Saturdays; guides are not allowed to fish commercially on Sundays.
- The proportion of active boats averaged about 17% and was higher in late July (26%).
- Boat counts on "drift-only" days (which rarely exceeded 100 boats) were considerably lower than powerboat days. On powerboat days, drift boats account for less than 2% of boat counts.
- Boat counts on drift-only Mondays increased through July until the last week, which was affected by flooding.

- Boat count data suggests that the proportion of guided boats during "guide hours" (Tuesday through Saturday, 6 to 6) averaged about 65%, with slightly higher proportions in the first run (67%) than the second (59%). The maximum number of guide boats on any given day in 2009 was about 210, but in other years may have reached 250 or 300. According to 2009 ADF&G guide logbook data (Sigurdsson & Powers, 2010), as many as 255 guides reported using the segment at some point in the year. Because the maximum number of guided boats is probably more static than the total number of boats, the proportion of guided boats is sometimes lower on the highest use days. (See further discussion in Chapter 15 on guided/unguided use issues).
- Guide logbook information (Sigurdsson & Powers, 2010) provides additional evidence of use patterns. It suggests there were 21,156 guided angler days on the Lower River. This is substantially higher than the 5,300 guided angler-days on the Lower River and 6,900 guided angler days on the Upper River. About 80% of the guided angler-days were used by non-residents.
- Vehicle counts at the Pillars also show 2009 was a low use year. In recent years, the lot was closed (because it filled) nearly every morning the last three weeks in July; in 2009, this only happened on 3 days.
- Pillars boat trailer counts during first run king season averaged 19 and never exceeded 34; during July they averaged 42 and never exceeded 62. The capacity of the parking lot is about 80 spaces; the number occupied by trailers vs. vehicles varies).
- Pillars trailer counts during silver season averaged 14, rarely exceeded 20, but had one unusually high day in mid-August (40). Based on this information (assuming Pillars trailers to ADF&G count ratios are similar in king and silver seasons), total boat counts during silver season in 2009 probably averaged between 80 to 100 boats at one time and rarely exceeded 150. Assuming relatively even distributions, this would produce boat density averages of 4 to 6 per mile (with a maximum of about 9 per mile) during silver season. A "typical" silver season average of 5 per mile is about one-quarter of the density on the highest use days during the 2009 king season (about 21 per mile); the silver season density peak of 9 per mile is about half of the king season peak (21). Again, we stress that these average densities assume even distributions of boats, which is a substantial oversimplification.

Time of day patterns during high use king salmon runs can best be illustrated by the number of boats passing Eagle Rock per hour (counts conducted by the Kenai Watershed Forum). Figure 3-3 shows a distinct peak in early morning followed by a declining limb through the rest of the day when guided powerboats are allowed (Sat. and Tues.). In contrast, the Sunday pattern shows no early morning peak and lower use levels overall, with "drift-only" Mondays having even lower use still.

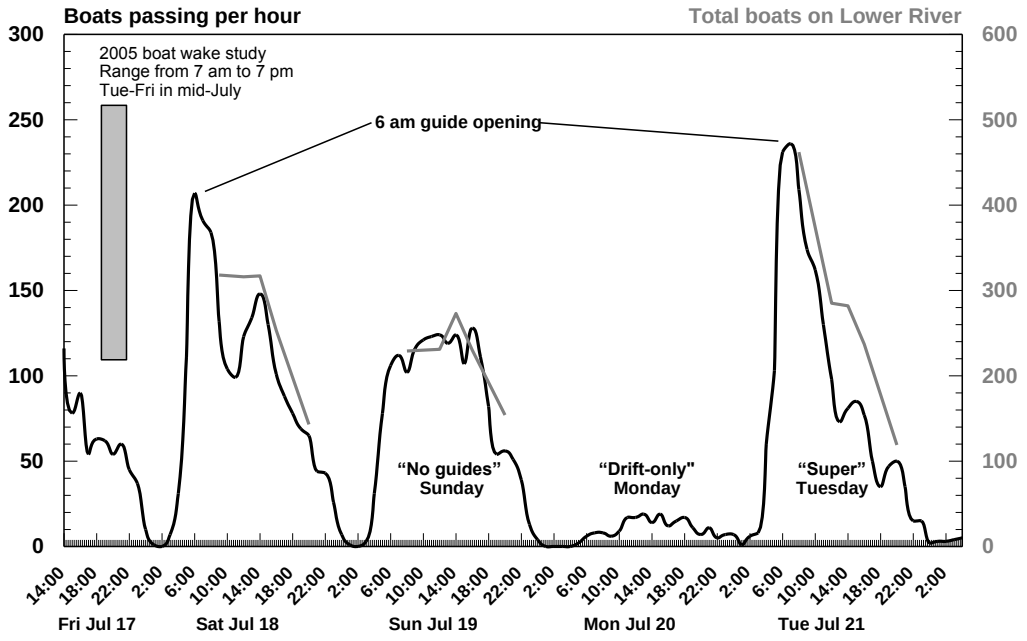


Figure 3-3. Overflight boat counts in mid-July showing example daily use patterns.

Explanations for these use patterns include:

- A large proportion of the "fishing fleet" (over half on Tuesdays through Fridays, and only slightly lower on Saturdays) is guided, which have a starting time defined by regulation (6 am). This dictates the timing of the main peak.
- Regulations require anglers who catch and keep a king to stop fishing from a boat for the day, so some boats leave the river as anglers catch and keep king salmon.
- Unguided users who want to fish prior to the guide opening have a window between "first light" (about 3 to 4 am in July) and the 6 am guide opening, but many take-out after guides appear or after completing an average trip length (about 6 hours).
- Fishing success may decline through the day. However, guides that offer two trips per day sometimes create a mid-day "bump," and some unguided users may wait until after guide hours (6 pm) to start an "evening session."
- Sundays do not show an early morning peak, and have less use overall. This is probably due to the lack of guide boats.
- Drift-boat Mondays show considerably lower use and no obvious peak.

KWF overflight and ADF&G counts on these same days suggest that the early peak is less pronounced on some segments than others, with the early peak most likely to occur lower in the river (below Beaver Creek), which would be reflected in the Eagle Rock boats passing data (since most launches are upstream). This may have reflected tide timing on those days. Questions on the guide survey address some of these issues; see Chapter 5 on king salmon fishing use and trends.

Sub-segment use patterns are also evident in the KWF data and ADF&G boat counts. In general, the highest densities (boats per mile) on high use days in 2009 were between the Sonar (RM 8.5) and Pillars (RM 12.3) and may exceed 25 boats per mile, but similarly densities are possible below the Sonar (when

tides are conducive to fishing) or upstream of the Pillars (particularly from the Poacher's Cove to Honeymoon Cove). Additional discussion of boat distributions and their implications for management are provided in Chapter 5 on king salmon use and trends.

Middle River

Bank angling

Bank angling on the Middle River in 2009 was highest during the second red run, but also occurred during the first red and silver runs. Segment counts were not conducted for bank anglers, but site counts indicate use levels and patterns.

- The highest levels at Swiftwater Park occurred during the second red run (average 17; peak 35). During the first red and silver runs, the average was 6 with peaks of 19 and 15, respectively.
- A bank angling area on Agrium property and the adjacent USFWS access site averaged 11 anglers at one time during the second red run.
- Funny River Road anglers (including Kenai River Center, Rotary Park, and Funny River SRS) averaged 41 anglers through the second red run, with a peak of 85. Counts at Kenai River Center averaged 9 anglers (with a peak of 14) during the second red run; Rotary Park had 18 anglers during the tail end of the second red run, but none after flooding began. These areas were surveyed only during the second red run.
- Morgan's Landing averaged 16 anglers (peak of 25) during the second red run, but never exceeded 6 at other times.
- Izaak Walton averaged 14 anglers (peak of 17) during the second red run, but never exceeded 7 at other times.
- Sampling at Bing's focused on the launch area, which often had no bank anglers (and averaged under 2), although sampling included some visits to the "rapids hole" on a public easement near the Landing. A peak count at the "rapids hole" near Bing's Landing (public easement) had 25 anglers during the first red run; there were not sufficient counts at the "rapids hole" to estimate averages.

Boat-based angling

Boat-based angling is highest on the Middle River during July and August, as anglers target kings, second run reds, early run silvers, and trout/Dollies. Unlike the Lower River, there is no systematic boat counting program, although State Parks rangers and overflight information (from the Kenai Watershed Forum monitoring) provide "spot boat counts" for certain segments. Vehicle counts at major launches, fieldwork vehicle counts, and shuttle company statistics also help indicate use levels and patterns.

- On three days in mid-July (Sat 18, Sun 19, and Tue 21), KWF overflights (5 per day) counted an average of 56 boats on the Middle River, with 28 (50%) upstream from Kenai Keys. The peak boat count for the entire segment was 70 (at two different times on Saturday). The peak count above the Kenai Keys was 43.
- These counts produce an average of 1.9 boats per mile of the entire Middle River (29 miles), but use is not distributed evenly. There were about 1.0 boats per mile from Soldotna Bridge to Moose River; 1.4 boats per mile from Moose River to Kenai Keys; and 5.1 boats per mile from Kenai Keys to Skilak Lake outlet. Even the highest at-one-time boat counts on the highest use sub-segment (Kenai Keys to Skilak) were only 7.8 boats per mile, far less than the 20 to 30 boats per mile that can occur on parts of the Lower River on peak days.
- Boat counts from other days suggest boat levels may range higher than the KWF counts. On six days from mid-July through mid-September, rangers counted an average of 72 boats from Moose River to

Skilak (5.3 boats per mile). Peaks from these counts were 98 on Saturday, July 25 and 91 on Labor Day Saturday (September 5). These peak densities were about 7 boats per mile over the longer Moose River to Skilak distance. It is likely that densities sometimes exceed 10 boats per mile on the higher use Kenai Keys to Skilak sub-segment; this is supported by counts in "Rainbow Alley" (a roughly one mile reach near the lake outlet) on Sunday September 6 (Labor Day weekend), when the average was 9, with a range from 3 to 13.

- Ranger counts in 2009 showed about 31% of boats in the Middle River were guided, with an average count of 23 and a high of 34. In July, guided boat counts never exceeded 10 (many guide boats were in the Lower River); in September, they averaged 29.
- 2004 USFWS interview data from Bing's Landing and Lower Skilak show guided use makes up about 25% of all boats in July and this use is focused on the early part of the day (6 am to 2 pm); in October, guided use is about 22% of all use and is evenly distributed across the whole day. In both periods, powerboats made up about 80% of all use.
- Bing's Landing trailer counts suggest that use from June through mid-August (average of 16 per count) is generally lower than from mid-August through mid-September (average of 26). The average over the whole season was 21. The highest trailer count was 55 on September 12.
- Lower Skilak boat trailer counts on nine days during surveying averaged 12, with a peak of 22 in late August. Discussions with a Middle River shuttle service (Finch, 2009) suggest that higher trailer counts probably occurred on many days from mid-July through mid-September. The "first parking lot" near the launch is typically at capacity with 12 to 15 trailers, and shuttle drivers frequently reported having to retrieve vehicles from Parking Lot B (an additional capacity of 10 to 15 trailers) and sometimes Parking Lot C (additional capacity of 20 to 30 trailers; although this was rarely full). They rarely saw trailers in Parking Lot D.
- USFWS conducted boat counts and exit interviews in July and Oct 2004; these may help suggest use patterns in 2009, although we only have anecdotal evidence that use in these years was similar. Trailer counts in late July 2004 averaged 13, with a peak of 35 on the Middle River. USFWS counts also varied through the day, with peaks in mid-afternoon. These data also showed that some boats may be on the river (or lake) overnight (between 3 and 19, with an average of 9). Caribou Island or other Skilak property owners are encouraged to use Lower Skilak with its larger parking areas because there is a 72 hour parking limit at Upper Skilak launch and campground.
- 2004 USFWS monitoring suggested a boat ratio of 60:40 for Bing's Landing vs. Lower Skilak on the Middle River, but 2009 counts suggest even higher use from Bing's. Neither 2004 or 2009 data account for use from private property on the Middle River; there are dozens of boats docked at private cabins on the reach.
- Shuttle counts from the Middle River (Finch, 2009) offer additional evidence of seasonal and segment use patterns. The company averaged 3.1 shuttles per day over the entire season (from May through September), but averaged less than 1 per day in May and June, just over 3 in July and just over 5 in September. The most popular shuttle was from Skilak to Bings (76%), but 13% had trailers shuttled from Skilak to Izaak Walton (13%), and Skilak to Centennial / Swiftwater (9%). Nearly all shuttles were driftboats.
- Guide logbook information (Sigurdsson & Powers, 2010) provides additional evidence of use patterns. It suggests there were 5,322 guided angler days on the Middle River, with 64% of those days upstream of the Moose River confluence. About 64% of the angler-days were non-residents. The total number of Middle River guided angler-days is substantially lower than the 21,000 guided angler-days on the Lower River and slightly lower than the 6,900 guided angler days on the Upper River.

Time of day use patterns during mid-July are distinctly different from those on the Lower River, as illustrated in by KWF overflight counts. Figure 3-4 shows that use builds quickly and is sustained

through the day. Although guide hours are in effect, more varied target species and lower use levels may help distribute use more evenly over time.

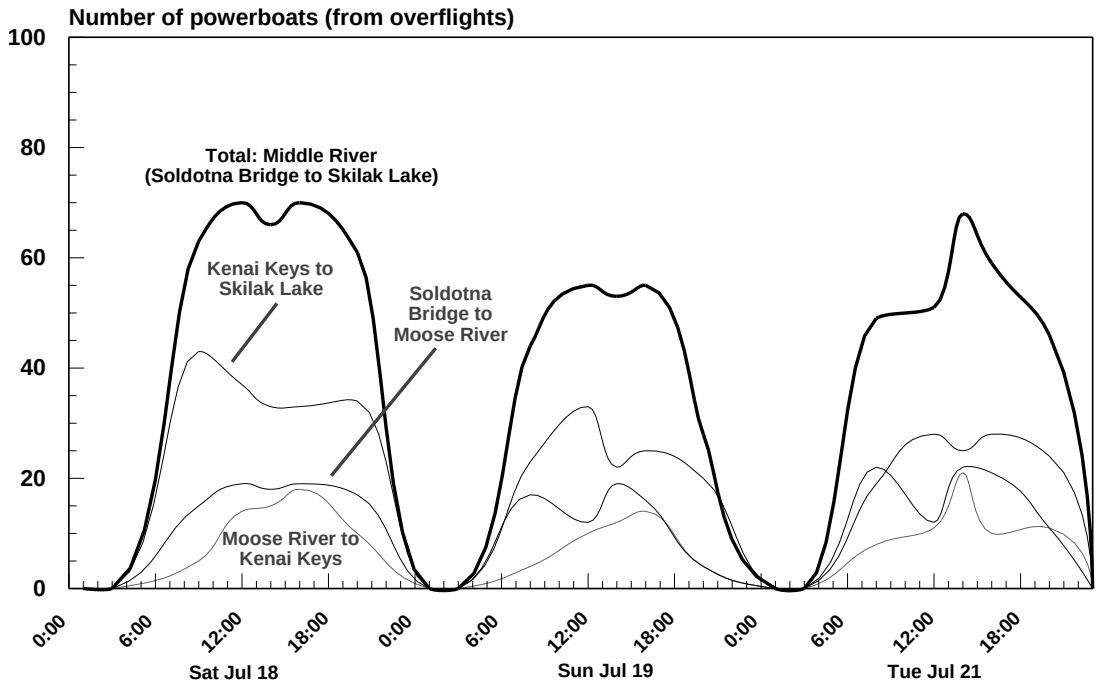


Figure 3-4. Overflight boat counts in mid-July showing patterns on high use days.

Upper River

Bank angling

Bank angling on the Upper River during 2009 was highest during the first red run, but also substantial during the second red run. There is relatively little bank angler use associated with silvers or trout/Dollies (except by bank anglers using boats for access). Segment counts were not conducted for bank anglers, but several sources indicate bank angling use levels. (Note that the study did not focus on Russian River anglers).

- Russian River ferry daily use probably provides the best indicator of Upper River bank angling use patterns, as shown in Figure 3-5. Ferry passenger use shows first red run use was higher than second run and silver season use, with peaks topping 1,300 anglers per day. The peak in the second run only reached about 450 per day. The graph also shows sharp drops during high water in late July.
- A review of ferry passenger use from 2005-2010 suggests that 2009 was similar to recent years. 2005, 2006, and 2007 all had peaks that were slightly higher than 2009 in the early run, but 2008 and 2010 had lower peaks. All six years had similar peaks in the second run, but most other years had sustained "moderate use" between 300 and 400 passengers per day for a longer period than in 2009. Of the six years, only 2010 had lower use throughout the year, which may reflect lower than average red returns and generally colder and rainier weather. A graph in the supplemental report shows passenger data for all six years.

- Daily ferry passenger totals are not always highly correlated with "at one time" use on either side of the ferry. The number of ferry tickets is also partially driven by the time it takes anglers to catch their limit; when the fishing is "hot," ferry turnover may be higher.

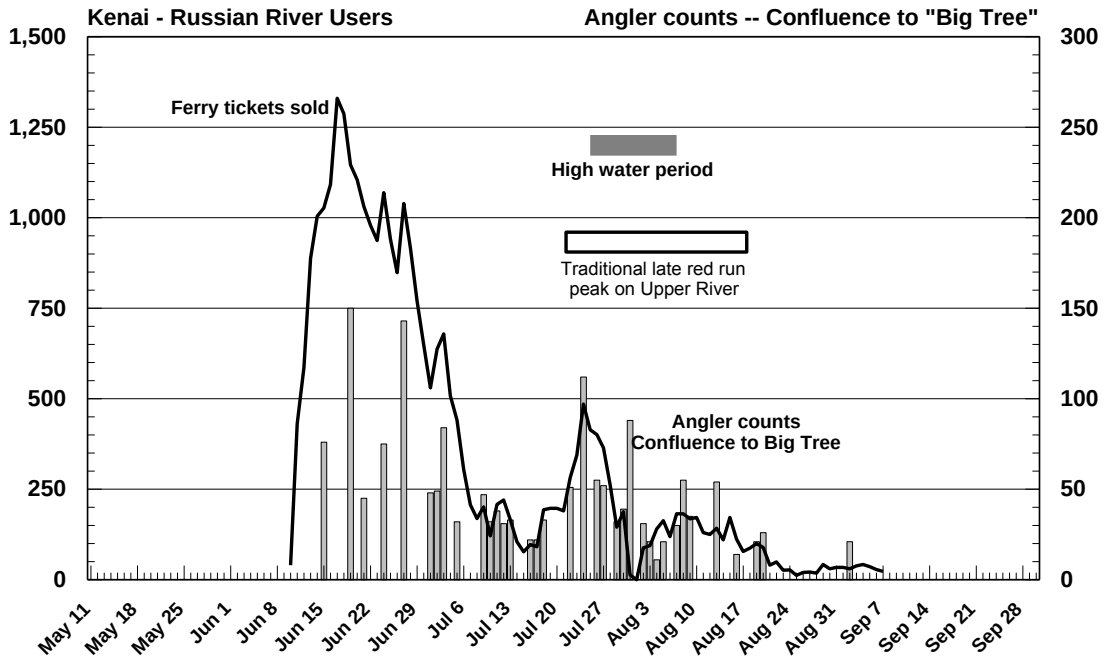


Figure 3-5. Indicators of bank angling use levels on the Upper River, 2009.

- Forest Service "on site" angler counts on the Russian River side of the Kenai helped assess "at one time" use on this shore through the year. One "count zone" was between the Russian River confluence and a distinctive tree about 700 feet downstream – traditionally the highest density bank angling location on the river when it is open (this is part of the "sanctuary"). Although highly correlated with daily ferry passenger use ($r = 0.72$), variation in counts at this site were sometimes surprising. For example, mid-afternoon counts on a Friday (150) were three times larger than a mid-afternoon count on the following Sunday (45). Nonetheless, counts showed a similar pattern to Ferry use: during the first red run, counts in this area were generally higher, averaging 98 anglers and peaking at 150. During the second run, the average was 45, with a peak of 112. In between runs, the average was 39 and the peak 47.
- At counts over 100 for this area, after considering the width of angler's themselves, spacing between anglers is about five feet. At counts of 150, distance between anglers is probably just over two feet, and probably feels like "shoulder to shoulder." At counts around 50, spacing between anglers approaches about 12 feet.
- Other counts on the Russian River side suggest there are lower densities as one moves downstream toward the Ferry and then past the powerline. Correlations between counts above and below the ferry were moderate ($r = 0.43$), suggesting distributions along this shore may not be even. Counts of bank anglers on the island across from the Russian Confluence were also much lower and even less correlated with "confluence to tree" counts ($r = 0.50$).
- Forest Service day use parking at the Russian River (number of people and vehicles) was highly correlated with daily ferry passenger use ($r = 0.92$), showing a similar high use pattern for the first run. However, onsite survey sampling suggested that relatively few Russian River day users actually fished the Kenai (most fished the Russian).

Boat-based angling

Boat-based angling (which includes anglers fishing from the shore accessed by boat) is highest on the Upper River during the two red runs, but can also be high during trout/Dolly and silver seasons in Late August and September. Like the Middle River, there is no systematic boat counting program, although USFWS fee information from Sportsman's Landing indicates boating use over the years, and 2009 data from parking lot counts at major launches, fieldwork counts, and shuttle company statistics can be examined in comparison to 2004 data from a more detailed USFWS monitoring effort that counted boats via motion-detecting video (USFWS, 2004). Note: This comparison assumes that the amount of use, the proportions of guided/unguided boats, and types of boats were similar in 2004 and 2009; as discussed below, 2009 use levels generally appear to be slightly higher overall than in 2004 (especially in the early red run).

- USFWS concessionaires tracked daily Sportsman's launches in 2009; it is likely to be a good overall indicator of boating use (and may reflect both fishing-based and scenic boating use). In addition, it has been collected in previous years and can provide some overall context for longer-term use trends. As shown in Figure 3-6, use was higher during the first red run, with an average of 52 boats launched per day and a peak of 107. In the second red run, the average was 24 with a peak of 55. After mid-August during the trout/Dolly/silver season, the average was 27 with a peak of 48.
- USFWS data also show a distinct weekend peaking pattern (with higher use on Saturday than Sundays). With the exception of the first red run, weekend peaks tended to range between 30 and 50 launches per day while weekdays were usually under 20.

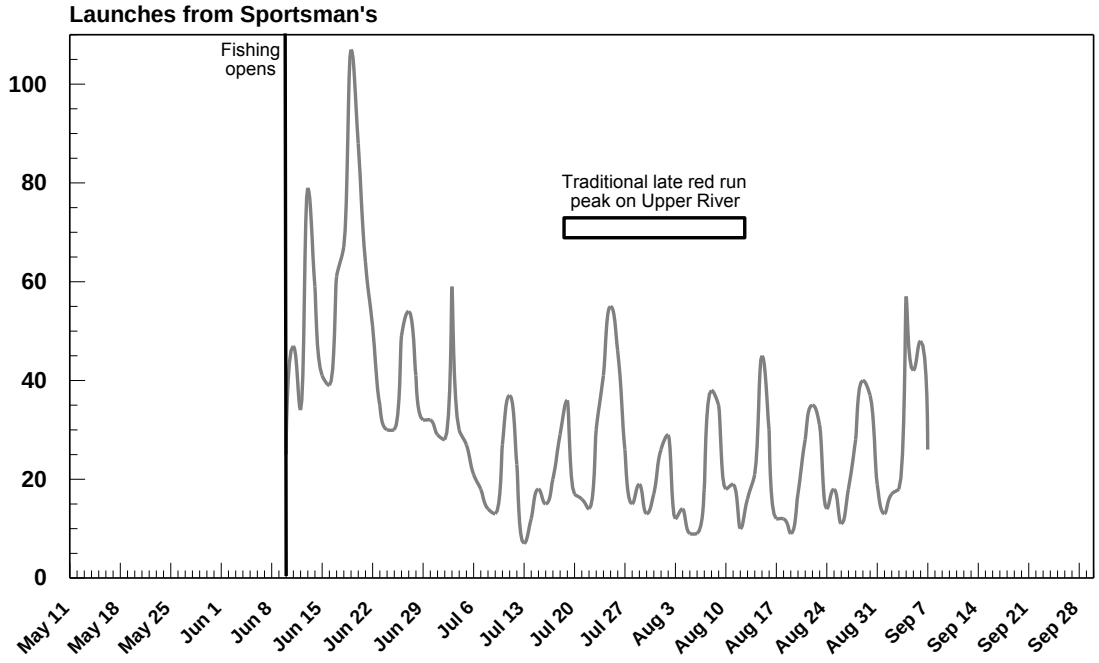


Figure 3-6. Sportsman's Access Area launches on the Upper River, 2009.

- A review of Sportsman's Landing boating launches from 2005-2010 suggests that 2009 was similar to recent years. Although 2009 had the highest single day total of any year during the early run (107 boats), several other years had peaks over 80. During the second run, all six years had some peaks exceeding 50 boats per day, but 2009 had some noticeable lower peaks during the second run for the

1.5 weeks when water levels were high. There is no clear trend toward increasing use in these six years, although there are indicators that use is increasing on Saturdays during the trout and silver season toward the end of August and start of September, with 2007, 2008, and 2009 showing peaks similar to or higher than those during the second red run. Anecdotal reports suggest this trend is continuing into mid-August, but Sportsman launch data does not continue past the first week in September so this can't be confirmed.

- USFWS conducted interviews at Jim's Landing in 2004 to assess proportions of trips from different launches. Data suggest about 55% of trips launch from Sportsman's, 33% from Cooper Landing, 10% from private land (mostly outfitters) in Cooper Landing, and 2% from Jim's Landing to run the Canyon. A small percentage of trips may also put in at Cooper Landing and take-out at Sportsman's. Applying these percentages to 2009 Sportsman's data suggests that as many as 200 boats may have been on the river on the highest use Saturday during the first red run, but more typical first run averages (and weekend peaks during the second run and trout/silver season) were about 100 boats per day. On weekdays outside the first red run, typical daily totals are probably less than 50.
- These are similar use levels to those reported from USFWS photo counts just below the ferry in 2004 (which was comprehensive when the video cameras were working, but undercounts total use because it does not include boats that took out at Sportsman's or put in at Jim's). In 2004, the first red run average was 91, with a peak at 188 (compared to 2009 estimates of 100 and 200). In the second red run in 2004, the average was 78 and the peak was 144; after the red runs, the average was 71 with a peak of 123. 2009 estimates suggest slightly higher estimates on weekends, but lower estimates on weekdays.
- Trailer counts at Jim's Landing are another indicator of use and show a similar pattern. The first run average (44 with a peak of 65) was higher than the second (26 with a peak of 49) or the trout/silver season (average of 30 with a peak of 61).
- USFWS 2004 video monitoring suggests that 34% of boats were rafts, 33% were driftboats, 21% were larger catarafts, 8% were small "fish cats," and 2% were canoes or kayaks. 2009 survey data show similar craft proportions (see user profile information).
- USFWS 2004 data suggest about 31% of all boats were guided (16% on angling trips and 15% on scenic trips). About 55% were unguided trips (about 44% angling and 6% scenic). The remaining 15% were unable to be classified as guided/unguided or angling/scenic.
- Based on 2004 USFWS video and Jim's Landing exit interviews, sampling at Jim's Landing between noon and 7 pm (similar to hours used in the 2009 study) covers about 72% of all boat trips. That data also suggests that take-outs are not evenly distributed, with highest take-out use between 3 and 7 pm (about 25% of daily launches take out in any given 2 hour period between those hours). About 15% of total daily use takes out between 1 and 3 pm.
- Shuttle counts from the Upper River (Wildman 2009) suggest that use in August and September may be higher than June and July (aside from the peak during the early red run). The company never exceeded 5 shuttles per day through July, but commonly exceeded 20 on weekends through September (with a peak of 30 on September 19). This service appears most popular among trout-focused driftboat users, but provides general support for the notion that trout season use is increasing. Wildman's reports that shuttles have been increasing in recent years, but it is not known whether this is due to more boaters or more people using shuttles.
- Guide logbook information (Sigurdsson & Powers, 2010) provides additional evidence of use patterns. It suggests there were 6,862 guided angler days on the Upper River, with 83% of those by non-residents. This is substantially lower than the 21,000 guided angler-days on the Lower River and slightly higher than the 5,300 guided angler days on the Middle River.

4. A Profile of Kenai River Users, Landowners, and Guides

This chapter summarizes important characteristics about users, guides, and landowners, and their trips on the river. It organizes information by the major "groups" used for analysis in the rest of the report. The supplemental report includes additional data from on-site and follow-up user, guide, and landowner surveys.

Categorizing respondents

For the ***on-site survey,*** users were categorized by the activity they were doing on the day they were surveyed (which dictated the survey form they received). The four types included:

- Bank anglers, including all anglers who did not use a boat during their trip;
- Powerboat anglers, including anglers who use a powerboat to access bank fishing areas;
- Driftboat anglers, including anglers who fish from rafts, catarafts, and drift boats or use boats to access shore areas, even if they used kicker motors for parts of their trip; and
- Non-anglers, including campers, hikers, wildlife viewers, and scenic rafters.

Responses to other questions were also used to categorize respondents, including:

- Segment of river when surveyed (Lower, Middle, Upper);
- Target species (especially kings, reds, or "other" [which included silvers, pinks, trout, and Dollies);
- Whether the user was on a guided trip.

For the ***follow-up survey***, users, guides, and landowners were categorized by the type of activity they self-identified as their "most important." The five choices included:

- Bank angling (including personal use fishing from shore);
- Powerboat angling (including personal use fishing from a boat);
- Driftboat angling;
- Scenic boating; and
- Other non-angling activities, including camping.

If a respondent did not indicate a "most important" activity, we reviewed other information to determine their user category (see details in supplemental report).

Responses to other questions were also used to categorize respondents, including:

- Segment of river (identified in their "most important" activity/segment;
- Type of boat they use;
- Whether they always/sometimes/never take guided trips;
- Whether they own land along the river (and on which segment); and
- Alaska residency.

Activities and segments

Respondents were asked to identify which activities and segments they used on the Kenai River, as well as their first and second most important activities and segments.

Percent reporting opportunities

For ***users and landowners,*** Table 4-1 shows the percent reporting activities on specific segments. Results highlight the diversity of trips that people take, and support having respondents self-identify their most important type of trip. Other findings include:

- Relatively fewer bank anglers take boating-based trips compared to the number of boating-based anglers that take bank angling trips.
- There is considerable "crossover" between driftboat and powerboat angling trips, although majorities in each group do not participate in the other.
- There is less "crossover" between angling and scenic rafting, although 20% of driftboat anglers have taken Upper River scenic rafting trips.
- Landowners have an activity / segment profile most similar to powerboat anglers than other types of users.

Table 4-1. Percent engaging in activity / segment "opportunities" by major groups.

	Bank anglers	Driftboat anglers	Powerboat anglers	Scenic rafters	Campers	Landowners
Bank angling						
Personal use from beach	17	10	6	3	15	8
Lower River	39	11	34	0	30	24
Middle River	54	19	34	6	30	46
Upper River	59	45	26	12	57	19
Drift angling						
Lower River	6	25	12	0	0	12
Middle River	9	50	15	9	9	16
Upper River	20	83	27	21	22	22
Powerboat angling						
Personal use from boat	6	10	37	0	13	35
Lower River	16	16	72	0	17	46
Middle River	10	18	58	3	9	48
Scenic rafting						
Lower River	<1	2	3	12	4	8
Middle River	2	6	3	24	13	22
Upper River	5	20	8	64	13	15
Camping	31	24	18	9	100	0

Note: Percentages within groups can exceed 100 because users could check "any that apply."

For ***guides,*** Table 4-2 shows the percent offering different activity/segment opportunities. Guides also show diversity among trips, although they are more likely to specialize in one type of angling trip (powerboats vs. drift boats) or scenic trips. Note: Boating-based fishing guides offer "bank angling" (usually for reds) via boat-based access, so this is different than users identified as "bank anglers" in the user survey. Other findings include:

- Powerboat guides are less likely to offer bank angling on their trips than driftboat guides.
- There is some "crossover" between drift and powerboat guides, but most do one or the other. Less than one-fifth of driftboat guides offer powerboat trips and less than a third of powerboat guides offer driftboat trips.
- There is generally less "crossover" between angling and scenic guides, although 30% of Upper River driftboat guides offer scenic trips.

Table 4-2. Percent of guides who offer activity / segment "opportunities."

	Powerboat guides	Driftboat guides	Scenic guides
Bank angling			
Lower River	31	6	14
Middle River	43	57	14
Upper River	10[1]	64	0
Drift angling			
Lower River	19	32	14
Middle River	28	81	14
Upper River	13[1]	77	14
Powerboat angling			
Lower River	98	17	14
Middle River	67	17	0
Scenic rafting			
Lower River	3	0	0
Middle River	6	9	29
Upper River	6	30	71

1. This includes some guides who also offer driftboat trips on the Upper River, where boat-based bank angling is common.

Most important opportunities

Table 4-3 shows the "most important" opportunities for users, landowners, and guides. Because this variable was the primary way respondents were categorized, percentages are given only for opportunities that vary within a group (e.g., driftboat opportunities for driftboat anglers). Campers are not shown (by definition, 100% reported camping most important).

- More bank anglers find the Middle and Upper Rivers most important.
- Many more driftboat anglers and guides consider the Upper River most important.
- More powerboat anglers and powerboat guides consider the Lower River most important.
- Landowners are more interested in powerboat angling on the Lower River.

4-3. Percent of users, landowners, and guides identifying opportunities as "most important."

	Bank anglers	Drift-boat anglers	Power-boat anglers	Scenic rafters	Land-owners	All guides	Power-boat guides	Drift-boat guides
Bank angling								
Personal use from beach	8				2			
Lower River	20				6	1		
Middle River	34				23	2		
Upper River	31				5	2		
Drift angling								
Lower River		10			1	2		6
Middle River		19			<1	7		30
Upper River		68			5	14		64
Powerboat angling								
Personal use from boat			14		10			
Lower River			50		21	57	76	
Middle River			25		17	13	19	
Scenic rafting								
Lower River				12	1	0		
Middle River				12	<1	1		
Upper River				76	2	2		

Note: Percentages within groups may not equal 100 due to item non-response for "most important" opportunity.

Users, landowners, and guides were also asked to identify their second most important opportunity. A cross-tabulation of first by second most important opportunity is given in the supplemental report (not shown here), but key findings include:

- Of ***users*** reporting driftboat angling most important, less than 10 percent chose any powerboating opportunity second. Of users reporting powerboat angling most important, 24% chose Middle River driftboat angling and 13% chose Upper River driftboat angling second. Taken together, results suggest more powerboat anglers may be slightly more interested in driftboat trips than the converse.
- Of ***guides*** reporting a powerboat angling trip most important, over 75% chose the other powerboating opportunity second. There is a core group of powerboat guides whose focus is exclusively powerboat-based angling. Of guides reporting Upper River driftboat angling most important, 26% chose a powerboating opportunity second (with most choosing the Middle River). Taken together, results generally suggest driftboat guides are more likely to be interested in powerboat trips than the converse.
- About one quarter who chose driftboat angling first chose bank angling second. Less than 15% who chose powerboat angling first chose bank angling second.

Guided vs. unguided use

Table 4-4 shows the proportion of users and landowners who take guided fishing trips or utilize other commercial services. Findings include:

- Just under half of driftboat and powerboat anglers take guided fishing trips sometimes, with 23% taking them "frequently."
- Among bank anglers, 29% have taken guided fishing trips from a boat, but only 6% do so frequently.
- No scenic rafters or campers take guided fishing trips frequently, but over 20% have taken them "sometimes."
- Over half of scenic rafters take guided scenic rafting trips.
- Few anglers take guided scenic raft trips (13% or less).
- Few Kenai users rent boats on their trips (less than 10% among the three angling groups). Scenic rafters and campers are slightly more likely to rent boats.
- Most landowners do not use commercial services; 98% never rent boats, 91% never use shuttles or take a scenic rafting trip, and 79% never taking guided fishing trips.

Table 4-4. Proportion of users and landowners that use commercial services.

	n	Never	Sometimes	Frequently	Sometimes / frequently guided rafting	Sometimes / frequently rent boat	Sometimes / frequently use shuttles
		take guided fishing trip					
Bank anglers	318	71	23	6	12	7	12
Driftboat anglers	274	55	22	23	13	10	47
Powerboat anglers	191	56	21	23	6	6	14
Scenic rafters	33	79	21	0	52	16	25
Campers	23	77	23	0	28	18	26
Mixed users	13	46	23	31	11	0	11
Landowners	208	79	16	5	9	2	9

Camp on the river

Table 4-5 shows the proportion of users and landowners who camp on the river (not in developed campgrounds). Most users never take overnight trips, suggesting the Kenai is primarily a "day use frontcountry" river. However, 26% of driftboat anglers and 38% of scenic rafters camp on their trips.

Discussions with rangers and fieldwork suggest there are about 14 to 16 "backcountry" campsites in common use on the Upper River or near the inlet to Skilak Lake and an additional 10 to 12 on the Middle River (all between Skilak and Kenai Keys). There are no commonly used campsites below Kenai Keys or on the Lower River (more private land and public land typically has developed campgrounds or "no camping" regulations).

Table 4-5. Percent of respondents who camp on the river (not in developed campgrounds).

	N	% never	% sometimes	% frequently
Bank anglers	318	93	7	<1
Driftboat anglers	274	72	22	6
Powerboat anglers	191	86	12	2
Scenic rafters	33	63	19	19
Campers	23	74	22	4
Landowners	208	87	12	1

Types of boats

Respondents were asked if they use a boat on their trips; for those who did, other questions asked about types of boats and other characteristics. Results are given in Table 4-6. Notes: User and landowner respondents did not have to own boats – just use them (could be rented, a friend's, a guide's, etc.). For guides, the question referred to boats used during guiding. This was for any opportunity (not just their "most important") and percentages can exceed 100% because they could check more than one type.

Table 4-6. Percent who use boats (and which type) on Kenai River trips.

	Bank anglers	Drift anglers	Power-boat anglers	Scenic rafters	Campers	All users	Land-owners	All guides
% use a boat	45	100	100	72	48	75	86	100
Of those who use a boat, what percent use…								
% kayak	<1	3	1	12	9	2	10	<1
% canoe	<1	4	0	9	4	2	8	4
% driftboat	19	69	30	21	17	38	21	53
% raft or cataraft	88	39	9	58	26	23	9	11
% "fish cat"	3	16	5	0	0	8	1	1
% powerboat	26	29	91	6	13	41	77	77

Many Kenai River users have used boats on the river (even among bank anglers and campers). Key findings include:

- Drift anglers were more likely to report use of driftboats or rafts, while powerboat anglers were more likely to report use of powerboats.
- Bank anglers were more likely to use driftboats or rafts rather than powerboats.
- Landowners were more likely to use powerboats, but many who have both. Further analysis shows that among landowners that use powerboats, 23% also use drift boats; among those who use drift craft, 82% also use powerboats.
- Other analysis suggests that among the majority (54%) of guides who use a raft or driftboat, 73% also use powerboats. Among guides that use drift craft, 16% use rafts or catarafts and 92% use drift boats.

Of those who use a boat, respondents were asked which boat they used most often; results are given in Table 4-7. These percentages sum to 100 because uses could only name one. Findings include:

- Roughly similar proportions of bank anglers use motorized and non-motorized craft "most often."
- A majority of drift anglers use driftboats more often than rafts, catarafts, or fish cats.
- About 4% of drift anglers report they use a powerboat most often, just as small proportions of powerboat anglers use driftboats or rafts "most often." They were probably unsure how to classify a driftboat with a kicker.
- Most landowners and guides use a powerboat most often.

Table 4-7. Most often used boat types on Kenai River trips.

	Bank anglers	Drift anglers	Powerboat anglers	Scenic rafters	All users	Land-owners	All guides
% kayak	<1	0	0	9	<1	2	0
% canoe	<1	0	0	0	<1	1	0
% driftboat	26	59	4	14	33	5	19
% raft or cataraft	20	30	5	77	22	2	8
% "fish cat"	2	7	<1	0	4	0	0
% powerboat	49	4	90	0	41	90	73

Of those who use driftboats, rafts, or catarafts, 55% of users and 58% of guides use a motor (typically kicker motors less than 10 horsepower) for different purposes. Key findings include:

- Scenic boaters are more likely use a kicker to cross Skilak after running Kenai Canyon (18%) than for any other reason (less than 6%) on the Lower or Middle River.
- Drift anglers were most likely to use kickers for crossing Skilak after a Canyon trip (35%), but were also likely to use them to access the Middle River from Lower Skilak (20%), travel upstream to re-drift a reach on the Middle River (18%), or travel against the tide on the Lower River (10%).
- Among drift guides, percentages using kickers were higher than for users. About 36% use them to cross Skilak after a Canyon trip, 31% use them for re-drifting reaches on the Middle River, 25% use them to access the Middle River from Lower Skilak, and 20% use them to travel against tides on the Lower River. Only 9% use them to back troll on the Middle River.
- Among guides who reported driftboats as their most often used craft, over half use them to cross Skilak after a Canyon trip (55%) or to access the Middle River (50%); smaller proportions use them to re-drift reaches on the Middle River (11%).
- Among landowners who use drift craft with kickers, the most popular purposes are to cross Skilak after a Canyon trip (29%), access the Middle River (17%), re-drift reaches of the Middle River (20%), or travel against the tide on the Lower River (17%).

Respondents who use powerboats were asked to report boat lengths, hull types, and percent using four stroke motors. Results are summarized in Table 4-8. Compared to guides, users and landowners (on average) are more likely to have smaller boats, flat hulls, and not have four-stroke engines (now required in July; soon to be required on the entire river).

Table 4-8. Information about powerboats (among those who use them).

	All uses who reported about powerboats n=279	Users for whom powerboat trips most important n=191	Guides who reported about powerboats n=165	Landowners who reported about powerboats n=187
Length (average)	18.2	18.5	20.0	18.3
Length (interquartile range)	16 to 20	17 to 20	20 to 20	17 to 19
Hull type % vee or semi-vee	67	77	77	61
Hull type % flat	33	23	23	39
% four stroke motor	85	93	99	86

Land ownership and property characteristics

Most users at public facilities do not own land on the river; the 4% who reported owning land from this study is similar to proportion in 1992. This also supports the decision to sample landowners separately (because few utilize public facilities where sampling can occur).

4-9. Property characteristics among guides and landowners (percent).

	Landowners	Guides who own property
Percent on Lower River	39	51
Percent on Middle River	52	36
Percent on Upper River	9	13
Percent have residence on property	89	85
Percent not a resident	18	9
Percent part-time resident	40	38
Percent full-time resident	41	53
Percent use a boat from the property	67	73
Percent fish from the property	76	63
Percent have a dock	31	32
Percent have a fishing platform	29	38
Percent natural materials erosion control	41	45
Have non-natural erosion control (rip rap)	0	14
Percent offer some kind of lodging	Not asked	30
Cabins		12
Rooms (e.g., motel)		2
Other		16

Among guides, 30% own land, a substantially higher percentage than for users. There are obvious advantages to staging guided trips from private property or integrating guide services with lodging or other commercial activities (see Table 4-9). Findings include:

- Compared to non-guide landowners, higher proportions of guides own property on the Lower River, which is the focus of guided king fishing. Lower proportions of guides do not reside on the property.
- Similar proportions of all landowners have docks, fishing platforms, and erosion control on their banks.
- Majorities of both groups fish or use a boat from the property.

Age and gender

Respondents were asked to report their age and gender (Table 4-10). Findings include:

- Over 80% of anglers are men and they tend to be older than the general population.
- Non-anglers are more likely to have gender balance (within a few points of 50-50).
- Landowners are generally older than users.
- Guides tend to be slightly younger than users but are more predominately male.
- Differences between other groups were generally small.

Table 4-10. Age and gender of major groups.

	Mean age	% male
All users	50	83
All landowners	63	82
All guides	44	95

Alaska residents

Respondents were asked about their residency in Alaska; results by group are in the supplemental report. Proportions were similar to those from 1992; key findings include:

- The highest proportions of Alaskan residents were among unguided powerboat anglers (84%) and unguided driftboat anglers (79%).
- The lowest proportions were among guided powerboat anglers (36%) and guided driftboat anglers (39%).
- Over half of bank anglers (52%) and campers (62%) were AK residents.
- Among landowners, 85% were AK residents.
- Among guides, 72% were AK residents.

Hosting and visitation information

Respondents (except for guides) were asked about the number of days they hosted guests from in/out of state (if they were Alaska residents and live in the Kenai Basin) or about the number of days they visit the area (if they were non-residents or live outside the basin). Summary information is provided in Table 4-11; additional data are provided in the supplemental report. Findings highlight the substantial number of visitors who stay in the area with local residents or in commercial lodging (contributing to the local economy).

Table 4-11. Hosting and visitation information for users and landowners.

	Users	Landowners
Among those who live in the watershed (Residents)	20%; n=168	n = 208
Average days hosting out of state	15.6	20.1
Median days hosting out of state friends/family	10	14
Average days hosting in-state friends/family	18.3	26
Median days hosting instate friends/family	10	15
Among those who visit the watershed (Non-residents & those who live outside the watershed)	80%; n=684	Not applicable
Median days on Kenai Peninsula	8	
Median days in Alaska	11	
% camped in a campground	36	
% stayed in hotels/motels	21	
% stayed with family and friends	19	
% day users	12	
% camped in the backcountry	8	
% stayed in bed and breakfast / lodges	8	

Experience on the river

On-site surveys asked users to describe their experience on the river (number of years and days per year). Medians for major groups are provided in Table 4-12; additional data for segments and sub-groups are in the supplemental report. Findings include:

- About 62 to 76% of Kenai users have been using the river for less than 5 to 8 years, 24 to 38% were visiting for the first time in 2009. For most users, conditions in recent years are "what they know."
- However, there are also many long-term users. Averages were much higher than medians due to some high outliers (so medians reflect the "central tendency" of the distribution of responses better), but some groups average over a decade of experience using the river.
- For example, unguided drift anglers averaged 11 years of experience while guided drift anglers averaged 4 (and over half of these users were first year visitors). Unguided powerboat anglers averaged 23 years, while guided powerboat anglers averaged 9. Some examples:
  Unguided drift anglers averaged 17 days per year while guided drift anglers averaged 5.
  Unguided powerboat anglers averaged 14 days, while guided powerboat anglers averaged 9.
- Powerboat anglers generally have more years of experience, while bank and powerboat anglers tend to use the river more days per year.

Table 4-12. Years of experience and days per year for major user groups.

	Bank anglers	Drift anglers	Powerboat anglers	Non-anglers
Median years on Kenai	5	5	8	5.0
% first year	30	29	24	38
Median days per year	9	5	10	4

The guide survey also asked experience questions (years on the river, years guiding, days guiding per year, and estimated clients per year). Results are summarized in Table 4-13; additional data are in the supplemental report. Findings include:

- Guides average over 20 years on the river and 13 years guiding. Few guides had less than two years experience.
- Scenic guides guide fewest days per year, while drift guides guide the most. Drift guides probably have a longer season because they tend to target trout / Dollies into early fall, while some powerboats guides stop guiding after kings (July) or early silvers (August). Scenic rafting may tail off in late July when the weather typically turns colder and wetter.
- More days per year is generally associated with more clients per year, but estimated clients per year suggest drift boat fishing guides average slightly more clients ***per day*** than powerboat guides (4.1 vs. 3.3). 2009 fishing guide logbook data from ADFG suggests that Upper River guides (who are all drift guides) averaged exactly 3.0 anglers per trip, which is probably a better estimate of the number of clients per boat. ADFG logbook data for the Middle and Lower River is not segregated by drift vs. powerboat guides, so estimates for those groups cannot be compared to survey results.
- Non-anglers had slightly higher percentages of first year users and spent fewer days on the river.

Notes: The guide survey asked about days per year for a "typical year" (not 2009) to avoid confounding results for a potentially "atypical" year like 2009. A separate question asked guides to roughly estimate whether the number of days guiding or clients were different in 2009 (details are in the supplemental report).

Table 4-13. Years of experience and days per year for guides.

	All guides	Powerboat guides	Drift boat guides	Scenic trip guides
Average years	20.1	21.6	15.6	15.4
Percent in first two years	4	<1	13	29
Average years guiding	12.7	13.9	8.8	10.7
Average days/year (not 2009)	63	61	75	43
Average clients/year (not 2009)	221	202	308	124

Trip characteristics

The on-site surveys asked several questions about specific trip characteristics. Findings for major groups are summarized below. More details are in the supplemental report.

Group size

Over 90% of all groups have 6 or fewer people. Other findings include:

- Boat-based angling groups average 3 to 4 per boat (depending on type of trip and segment).
- Two-thirds of bank anglers fish alone or with one partner only.
- Guided fishing boats average about 1 person more than unguided boats.
- For powerboat anglers, group sizes are slightly larger during kings compared to trips after July.
- Non-guided users had a median group size of 4, but sometimes traveled in larger groups (especially for scenic rafting trips).

Trip lengths

Most Kenai River users take day trips, although many camp in developed campgrounds. Among day users, typical trip lengths are 5 to 8 hours on the river (does not include travel times to the river, launching, etc.). Other findings include:

- Bank angling trips average about 6 hours for all three segments, with small differences between seasons or target species.
- Drift angling trips average about 7 hours, with trips on the Middle River slightly longer (8 hours) and trips on the Upper River slightly shorter (6 hours). This fits with some logistical considerations regarding the Middle River (time crossing Skilak).
- Powerboat angling trips average about 6.5 hours, with slightly longer trips (8) on the Middle River after July (when the focus shifts to trout, Dollies, and silvers).

Typical boating segments

Drift anglers

Drift anglers were asked to identify their put-in and were interviewed at their take-out which can help identify the popularity of various "floats." Detailed findings are presented in the supplemental report. Findings include:

- Most Lower River drift trips (63%) start from Centennial Park, although others start at Pillars (10%) and River Bend (12%), Eagle Rock (4%), or other private land launches/docks. Most end at Pillars or Eagle Rock, although a few continue to private launches at Beaver Creek or Kenai Boat Ramp.
- Most Middle River drift trips (75%) start from Lower Skilak, although a few anglers (less than 7% each) start from Dot's (Kenai Keys), Bing's Landing, Izaak Walton, or easements off Keystone Road.
- Most Upper River drift trips (74%) start from Sportsman's Landing, but 23% begin at Cooper Landing Bridge. Very few start at Jim's Landing (the most popular take-out) or private land in Cooper Landing. Note: The proportion taking the Sportsman's – Jim's Landing trip appears higher among 2009 users than the 2004 USFWS (where the proportion was 55%). This may indicate a shift to shorter trips and a greater focus on angling time in the productive waters below Sportsman's.

Powerboat anglers on Lower River

Powerboat anglers on were asked to identify the segments they used on the Lower River. Detailed results are in the supplemental report; findings include:

- Eleven percent of powerboat anglers could not specify the segments they use. The number is higher among anglers targeting kings (19%) and especially among guided anglers targeting kings (36%). Many of these anglers may not know where they fished because they rely on the boat driver or guide to select the most promising locations.
- Of those targeting kings who did specify segments, the highest use occurs from the Chinook sonar to Pillars (50%) and Pillars to Poacher's Cove (46%). Far fewer anglers used the river below the sonar (9%) or above Poacher's Cove (16%).
- Of those targeting other species, use is more evenly distributed, with 32% using the mouth to sonar; 47% using sonar to Pillars, 30% using Pillars to Poacher's, and 11% using Poachers to Soldotna Bridge.
- Note that anglers reporting use of a segment does not necessarily correlate with the amount of time spent in each segment. ADF&G boat counts during king season offer opportunities for more in-depth analysis of segment distributions.

Trip characteristics

Powerboat guides were asked to identify the launch they use most often.

- For the Lower River, 38% use public launches most often (Pillars at 22%, Centennial at 19%, and Swiftwater at 4%), but private launches are also well-used (including 22% combined at Stewarts, RiverBend, and Poacher's Cove; 4% at Eagle Rock, and 18% at other private residences).
- For the Middle River, most guides (63%) use Bing's Landing, while some use Lower Skilak (8%), Swiftwater (7%), Centennial (7%), and other private launches/docks (12%).

Non-anglers

Most non-anglers in this study were scenic rafters on the Upper River (81%). About 67% were on scenic raft trips (with one-third of the sample guided). About 10% used the Lower River and 9% used the Middle River.

Target species and fishing statistics

Onsite surveys asked anglers to identify 1) all species they were fishing for; 2) their primary target species; 3) how many fish they caught, released, and kept (all species); and 4) whether other anglers in

their group were successful. The primary goal was to categorize anglers by target species and indicate individual fishing success (which might correlate with other variables in the study). These questions were not intended to estimate harvest, catch and release rates, or address other fishery management issues, although information provides relative indicators of fishing success rates that generally fit with ADF&G fishery statistics from multiple sources. General conclusions are provided below; more detailed information is in the supplemental report.

Bank anglers

- Most bank anglers fish for reds: 50% on the Lower River, 84% on the Middle River, and 90% on the Upper River.
- King salmon are the primary target for 14% of Lower River bank anglers and 3% on the Middle River; silvers are the primary target for 30% on the Lower River anglers and 7% on the Middle and Upper River.
- Trout and Dollies are primary targets for less than 3% of bank anglers on any segment (Note: this does not include boat-based anglers that may fish for these species from the bank or wading).
- Success hooking fish is largely driven by target species. More than two-thirds of red and silver anglers hooked at least one fish; king anglers had lower catch rates.
- On the Upper River, first red run anglers hooked (10.5) and kept (2.3) roughly twice as many fish as second red run anglers (4.9 and 1.0), which fits with the run limits (6 for the first, 3 for the second). Total kept fish is well below limits; despite anecdotes, most red anglers do not "limit out."

Drift anglers

- Drift anglers fish for a variety of species, but there are segment/season differences. For example, 88% of Lower River drift anglers target kings on "drift only Mondays" compared to 4% on the Middle River.
- Reds are not the primary target for most drift anglers, especially on the Lower and Middle Rivers (less than 8%), but 26% target reds on the Upper.
- Silvers are the primary target for less than 11% on the Lower and Middle, and only 2% on the Upper.
- Trout/Dollies are the primary target for about 70% of Middle and Upper anglers.
- Success hooking fish is largely driven by target species, with trout/Dolly anglers averaging 11.9 hooked fish, red anglers 6.8, silver anglers 3.6 and king anglers 2.0. These success rates are generally similar to powerboat anglers and higher than bank anglers.
- Success hooking fish was weakly correlated with the number of days an angler fishes per year (r=.14) and being on a guided trip (r=.21).

Powerboat anglers

- Powerboat anglers also fish for a diversity of species, with specific targets for seasons and segments.
- During king seasons, the focus is on the Lower River (87% identify kings as the primary target before August), compared to the Middle River (21%).
- In the second red run, 32% of Middle River powerboat anglers target reds first compared to 11% on the Lower River.
- After July, silvers become the focus for 92% of Lower River powerboaters and 48% of Middle River powerboaters. Most of the remaining Middle River powerboat anglers (45%) target trout/Dollies.
- Success hooking fish is largely driven by target species, with trout/Dolly anglers averaging 13.5 hooked fish, red anglers 2.9, silver anglers 4.1 and king anglers 0.6. These success rates tend to be

higher than those for bank anglers, but similar to drift anglers (the notable exception is kings, where drift anglers did better).

- Success hooking fish was not correlated with the number of days an angler fishes per year; there was a strong correlation between success and being on a guided trip for trout (r=.46), but it was somewhat lower for silvers (.27) and not significant for kings or reds.

Non-angler activities

Non-anglers during the on-site survey were asked to indicate activities they did on their trips. Rafting was the most common non-angling activity (67%), but 54% reported viewing scenery, 44% viewing wildlife, 34% picnicking or rafting, and 28% camping. Asked to identify a single primary activity, 56% reported rafting and 14% camping, 10% viewing scenery, 8% picnicking, and 3% viewing wildlife.

5. Lower River King Fishing Trends

*This chapter provides information from guides who target kings on the Lower River; the information comes from the **guide follow-up survey**. Information helps characterize important use patterns and factors that influence where anglers fish, with implications for other management issues.*

Factors influencing fishing locations

Guides were asked to rate the importance of factors influencing "when, where, and how long" they fish for king salmon. Responses were on a 5-point scale from "not at all important" to "extremely important." Figure 5-1 ranks responses of all guides who answered these questions (n=134) by mean scores; additional analyses in the supplemental report examined differences between drift (n=24) and powerboat guides (n=114).

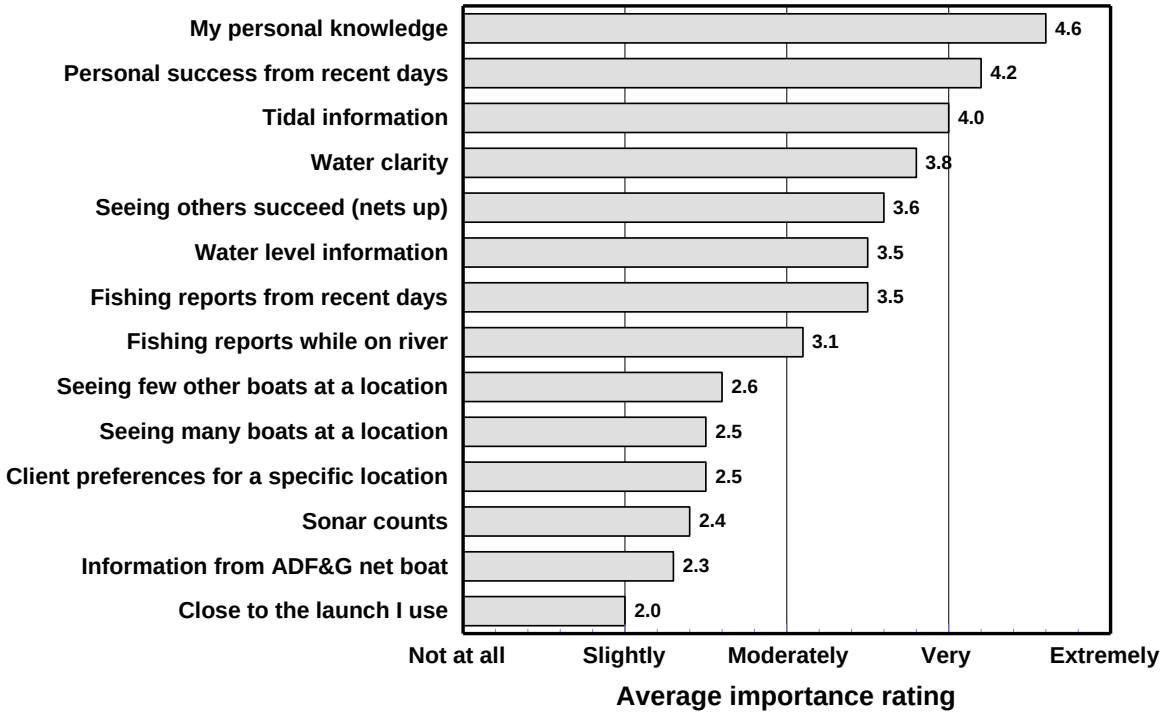


Figure 5-1. Importance of factors influencing where, when and how long king guides fish.

Findings include:

- Guides consider personal knowledge and recent success most important.
- Tides are also important. Focus group discussion and fishing guide books suggest that many users target incoming tides in the lower segments of the Lower River and then move upstream during slack or outgoing tides. This can concentrate use, increasing crowding. Water clarity and water level (often related) may make some fishing areas more challenging and further concentrate use when conditions are poor.
- Success of other anglers, fishing reports from recent days, and fishing reports while on the river are moderately important and may also concentrate users. Like some wildlife viewing opportunities (e.g. whale watching), success attracts more use, which might increase crowding, competition, and potentially decrease future success.

- The number of boats seen at a location appears to have a smaller influence on where guides go. Actual success appears to count more.
- Few guides base their fishing location choices on the number of fish in the river (from sonar or net counts from ADF&G), or proximity to their launch.
- Differences between powerboat and drift guides were generally small, although drift guides rated tides less important (it is logistically challenging to time tides without a motor), and seeing many boats, sonar counts, client preferences for locations, and proximity to launches more important. Differences appear related to specific drift trip logistics (difficulty fighting tides, need for easy launch and shuttle) or greater sensitivity to higher densities.

Early morning fishing success

The spike of powerboating use as guide hours open (6 am, Tuesday through Saturday) is a well-known phenomenon on the Lower River. The survey asked guides about reasons for the "rush" as fishing opens; responses were on a five point agree-disagree scale with a neutral option (Figure 5-2). Most guides agree that "being among the first boats at a location when guide hours open (6 am) is important" and "aside from tidal considerations, king salmon fishing is generally better in the morning and diminishes through the day."

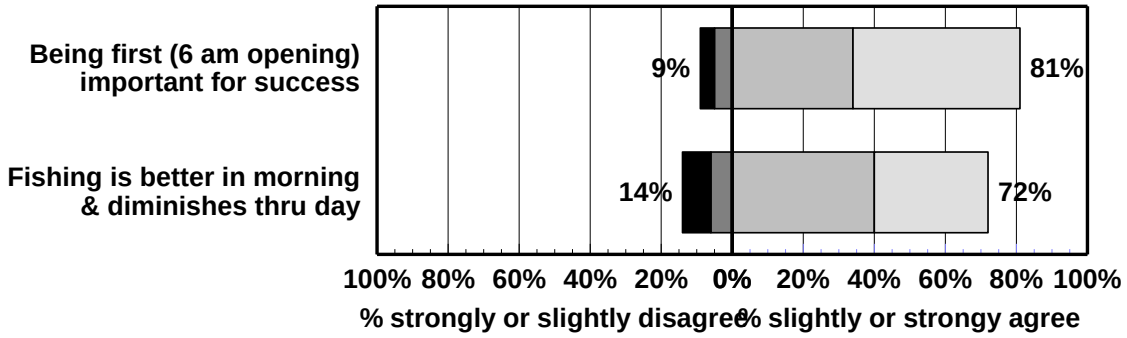


Figure 5-2. Percent of guides that agree/disagree with reasons that may explain 6 am peaks.

Focus group discussion suggests this is mostly about perceived competition for "early biters," fish that enter the river or reach holes when angler densities are low over night and have not yet been exposed to many lures/bait. Guides noted that early morning unguided users who are allowed to fish before the 6 am opening are very successful. ADF&G boat count and creel survey technicians note anecdotal evidence that many anglers have success early in the day, but they are less certain that success rates continue to diminish through the day and some guides apparently agree.

These findings suggest that strategies to reduce crowding by redistributing use to later in the day are likely to be resisted by many anglers. Similarly, guides opposed "staggered guide hours" (e.g., if half of the guides start an hour later than the other half on alternating days) in the 1992 and this study (see Chapter 12). Taken together with information from focus groups, many guides simply appear reluctant to give up the most productive hour every other day even if they might have less competition the next day.

Fishing techniques

Guides were asked to estimate the percent of time they fish with different techniques. Most prefer back trolling (70%); fewer prefer back-bouncing (21%) or drifting/dragging (22%). Conflicts between anglers

using different techniques (especially when densities are high) were mentioned in several focus groups. These tend to occur in specific traditional "drifting/dragging" reaches (see additional discussion in Chapter 12).

King salmon trends in recent years

Guides were asked whether they agreed or disagreed (on the same 5 point scale with a neutral option) with several statements about king fishing trends. Results are shown in Figure 5-3.

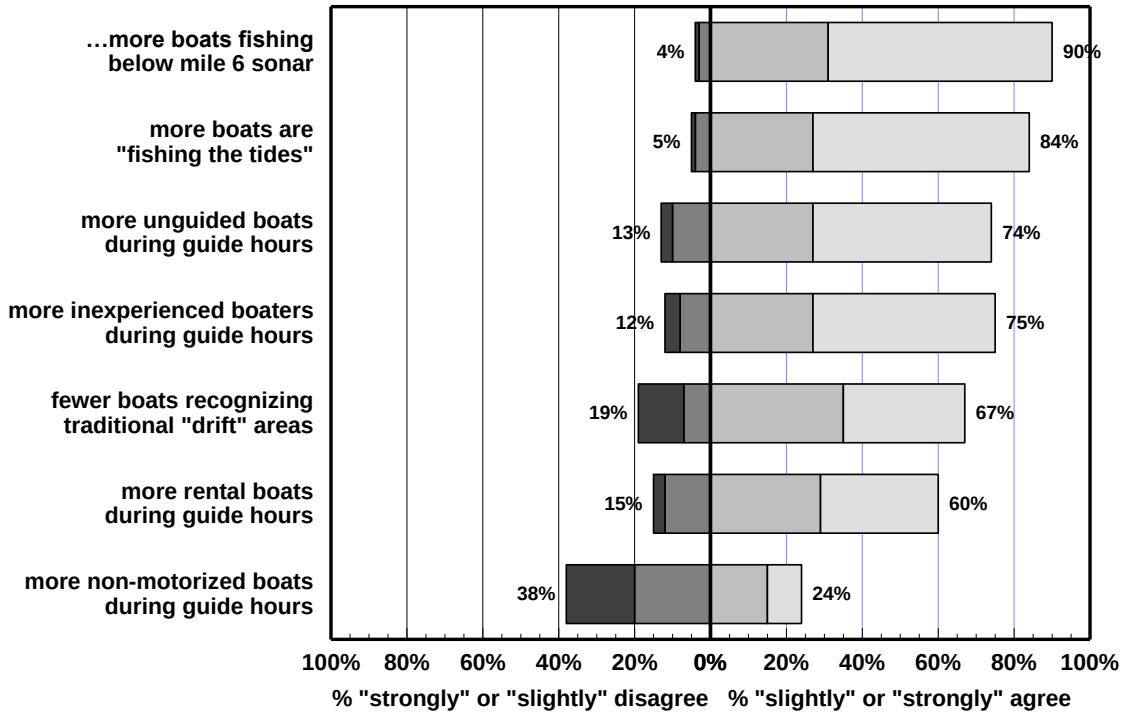


Figure 5-3. Agreement with statements about king salmon fishing trends in recent years.

Findings include:

- Most guides agree use in recent years has been generally shifting farther downstream, with more boats fishing the tides. In focus groups, some described trolling and back bouncing techniques that increase success in these areas even when tides are less favorable. These trends may increase the miles of river anglers can fish, which can reduce crowding. However, if this success becomes well publicized, it may also concentrate use in these lower river areas.
- Most guides believe the number of unguided users has increased during guide hours, but ADF&G boat count data do not confirm this. Although total use levels may be higher in recent years (excepting 2009), it is not clear that unguided use accounts for the increase. Guided boats accounted for about two-thirds of Lower River counts during the 2009 king season and this is much higher than the one-third estimate given in the 1992 study.
- Fewer guides agree that "fewer boats recognize traditional drifting/dragging (not back trolling) areas." Guides who drift or drag more often were more likely to agree with this statement.
- Many guides agree there are more rental boats and inexperienced boaters during guide hours. We don't have independent confirmation of this trend, but it fits with guide opinions about guide/unguided conflicts and boating safety (see Chapter 15).
- Preferred fishing technique did not predict any other fishing trend.

6. On-river Crowding, Impacts, and Use-Impact Relationships

*This chapter presents **on-site survey** information about perceived crowding, reported impacts, tolerances for impacts, and use-impact relationships. Crowding provides a broad indicator of visitor impact problems and whether use is below, at, or over "capacity." Reported impacts (and related tolerances) can help identify potential management standards for indicator impacts and whether current conditions are exceeding them. Use-impact relationships show whether managing use (through direct limits or indirect methods) is likely to reduce impacts.*

Perceived crowding

Most theorists recognize a difference between use density and crowding, but even scientists sometimes use the word "crowding" inappropriately when referring to high density (Shelby et al., 1989). Density is a descriptive term that refers to the number of people per unit area. It is measured by counting the number of people and measuring the space they occupy, and it can be determined objectively. Crowding, on the other hand, is a negative evaluation of density; it involves a value judgment that the specified number is too many. The term *perceived crowding* is often used to emphasize the subjective or evaluative nature of the concept.

Perceived crowding combines descriptive information (the density or encounter level experienced by the individual) with evaluative information (the individual's negative evaluation of that density or encounter level). When people evaluate an area as crowded, they have at least implicitly compared the conditions they experienced (impacts) with their perception of what is acceptable (standards). If they conclude that the area is crowded, it would appear that the existing conditions exceeded their definition of a standard (one criterion for an area being "over capacity").

Researchers have developed a simple measure of perceived crowding (Heberlein & Vaske, 1977). The question asks people how crowded they feel during their visit. Responses are given on a 9-point scale:

1	2	3	4	5	6	7	8	9
Not at all Crowded		Slightly Crowded		Moderately Crowded			Extremely Crowded	

The approach is simple and easy to apply. Two of the nine scale points on the crowding scale label the situation as uncrowded, while the remaining seven points label it as crowded to some degree.

The scale can be analyzed in different ways. The scale has traditionally been collapsed into a dichotomous variable (not crowded versus any degree of crowding; the formula that was used here). This provides a conceptually meaningful break point between those who labeled the situation as not at all crowded (scale points 1 and 2, a positive evaluation), and those who labeled the situation as slightly, moderately, or extremely crowded (scale points 3 through 9, a negative evaluation).

Since 1975, this single item indicator has been used in over 200 studies conducted across the United States (e.g., Alaska, Arizona, California, Colorado, Delaware, Maryland, Michigan, Minnesota, Nevada, New Hampshire, Oregon, Pennsylvania, West Virginia, Wisconsin), Canada (British Columbia, Alberta), New Zealand, Australia, and Korea resulting in crowding ratings for over 500 different settings/activities. The activities included hiking, backpacking, wildlife viewing, wildlife photography, hunting of many types, fishing of many types, rafting, canoeing, tubing, motor boating, rock climbing, sailing, and driving for pleasure. The areas studied represented considerable diversity, with some showing extremely high

density and use impact problems, others showing low densities and no problems, and still others actively utilizing management strategies to control densities and use impacts.

A meta-analysis of 35 studies (Shelby, et al., 1989) identified five "rule of thumb" categories of crowding when the scale was collapsed in the manner described in Table 6-1. A substantially larger meta-analysis by the same authors supports continued use of this simple analytic technique, which helps categorize whether a resource is likely to have capacity / visitor impact problems (and helps managers consider potential responses).

Table 6-1. Carrying capacity judgments based on levels of perceived crowding.

% Feeling Crowded	Capacity Judgment	Comment
0-35%	Very low crowding	Crowding usually limited by management or situational factors (remote location, difficult access, or permit programs).
35-50%	Low normal	Problems are unlikely to exist; may offer important low density opportunities.
50-65%	High normal	Studies or focused management attention may be needed if increased use is expected, allowing management to anticipate problems.
65-80%	Over capacity	Studies & management probably necessary to preserve experiences; increased use is likely to change types of opportunities available.
80-100%	Greatly over capacity	Impacts and crowding-related problems are likely; manage for high-density recreation or reduce use to provide higher quality.

Source: Shelby, Vaske, & Heberlein (1989).

Perceived crowding by segment / season / group "context"

For the Kenai, percent feeling crowded for several segment / season / group "contexts" are provided in Table 6-2. Results indicate several general findings:

- Five of the six highest crowding ratings for 2009 were on the Upper River. As discussed in Chapter 3, the first run red season on the Upper River had the highest use levels and densities on the entire river in 2009, and they were among the highest use levels ever on that section of river. In addition, boat counts during trout/dolly season approached levels common in the traditionally higher use red runs, and these appear to be rising in recent years. These use levels produce high crowding and represent situations needing management attention.
- Higher use days for Lower River for powerboat anglers during the second run of kings also showed high crowding; this is traditionally the highest use boating fishery on the river.
- There are many "low normal" and "high normal" crowding ratings, as well as some "no crowding" situations that may provide low density experiences.

Table 6-2. Percent feeling crowded and mean crowding scores for 2009 Kenai River groups.

	Percent feeling crowded[1]	Mean
Greatly over capacity: Impact problems likely; manage for high density.		
Upper early red run bank anglers	88	5.4
Upper weekends in Sep for drift anglers	88	4.7
Over capacity: Studies and management likely needed to preserve quality		
Lower on high use king days for powerboat anglers	79	4.5
Upper weekends drift anglers	70	4.1
Upper unguided drift anglers	69	4.0
Upper weekends bank anglers	66	3.8
High Normal: Monitor if use increases expected to anticipate problems		
Middle second red run peak bank anglers	64	3.7
Lower second red run peak bank anglers	64	3.5
Upper all drift anglers	63	3.7
Upper all bank anglers	62	3.7
Upper weekdays in Sep drift anglers	62	3.6
Upper weekdays bank anglers	57	3.7
Upper second red run bank anglers	56	3.2
Lower primary target kings power anglers	54	3.1
Lower drift anglers	53	3.2
Upper weekdays drift anglers	50	3.1
Low Normal: Unlikely to be a problem; may offer important low density experiences		
Lower on low use king days power anglers	48	2.6
Middle bank anglers	47	2.9
Upper drift guided anglers	47	3.1
Upper bank anglers	45	2.9
Lower bank anglers	41	2.7
Middle drift unguided anglers	39	2.4
No Crowding: no problem; likely to offer rare low-density experiences		
Middle drift anglers	34	2.2
Middle guided drift anglers	30	2.1
Middle after kings power anglers	30	2.1
Lower other times power anglers	22	2.0
Middle other times power anglers	17	1.7
Lower after kings powerboat anglers	7	1.4

[1] Percent reporting 3 through 9 ("slightly, moderately, or extremely" crowded) on the scale.

Table 6-2 includes mean perceived crowding scores which are a highly correlated with "percent feeling crowded;" they can be used to statistically compare groups. Findings include:

- Crowding was statistically higher on weekends vs. weekdays for all drift anglers, particularly on the Upper River and in September. Use levels show a strong pattern of higher use on weekends, and higher perceived crowding scores follow.
- Weekends vs. weekdays crowding scores were not statistically different for powerboat anglers, probably because Tuesdays are among the highest use days and Sundays (with no guiding allowed) tend to have lower use levels similar to weekdays (aside from Tuesdays). High use and low use days (defined by actual use levels) show significant crowding differences.
- There were few weekday vs. weekend differences for bank anglers on the Upper River during the first red run. Perceived crowding scores followed from the date of run arrival and the date of the increase in harvest limits, not the day of the week.

Crowding comparisons with other resources

Table 6-3 (following page) shows crowding ratings for other rivers in Alaska or the Lower 48, including Kenai groups /segments /seasons from the 1992 study. Taken together with the 2009 findings in Table 6-2, findings include:

- There are times and places on the Kenai (in 1992 and 2009) when crowding is as high as any river studied. These "hot spots" are at greater risk for impact and congestion problems that discourage return use ("displacement") or cause users to adjust their expectations to fit with the new higher impact conditions ("product shift"). These phenomena are further discussed in Chapter 8.
- Results also show many situations where crowding levels are much lower. Managing for a diversity of use, impact, and crowding levels makes sense in a complex system like the Kenai, but it is challenging to develop standards that define "how much crowding is too much?" Additional discussion is needed to identify when conditions "break down" and reach unacceptable levels (see below).
- Comparisons between 1992 and 2009 are also challenging. However, a few situations persistently rank among the most crowded (first red run bank angling on the Upper River, drift angling on the Upper River during both red runs, and on weekends during trout/Dolly season, and Lower River powerboat angling for kings in July).
- Second run red bank anglers were generally more crowded in 1992 than in 2009. This finding is counter-intuitive because riparian protection efforts have since closed about 26 miles of Kenai River bank fishing areas (providing fewer places from which bank anglers can fish during this run). We suspect bank angler use densities in many areas have decreased despite the loss of bank angling access due to increased personal use fishing opportunities at the mouth (which did not exist in 1992). With more anglers participating in the dip net fishery during the second red run, the popularity of rod and reel fishing at this time may have declined and reduced crowding. The important "take home" point is that changes in either fishery could affect use levels and crowding at the other.

Table 6-3. Percent feeling crowded at other rivers (including the Kenai in 1992, 2002).

% Feeling Crowded[1]	Resource	Population/Comments
Greatly over capacity: Manage for high densities; might be described as sacrifice area		
100	Deschutes River, Or 1986	Boaters on weekends
100	Kenai River, Ak 1992	Upper river bank anglers on high use days
97	Deschutes River, Or 1986	Lower river boaters on weekends
94	Colorado River, Az	Anglers at Thanksgiving (high use period)
92	Kenai River, Ak 1992	Lower river powerboaters on high use days
89	Little Susitna River, Ak 1990	All users
88	Deschutes River, Or 1986	Boaters on weekdays
86	Kenai River, Ak 1992	Upper river driftboaters on high use days
84	Gulkana River, Ak 1999	All users - Richardson Highway Bridge
81	Kenai River, AK 2002	Lower River powerboat anglers in July
Over capacity: Studies and management likely needed to preserve quality		
80	Kanektok River, Ak 1996	Guides
78	Kenai River, Ak 1992	Middle River powerboaters on high use days
78	Lake Creek, Ak 1990	All users
75	Waimakariri and Rakia Rivers, NZ	Salmon anglers
72	Grand Canyon, Az	Rafters
69	Kanektok River, Ak 1996	Unguided floaters
65	Gulkana River, Ak 1999	All users – Sourdough Launch Area
High Normal: Should be studied if use increases expected; managers might anticipate problems		
65	Kenai River, Ak 1992	Lower river bank anglers on low use days
64	Talachulitna River, Ak 1990	All users
63	Gulkana River, Ak 1999	All users – Lower Main Stem
62	Kenai River, Ak 1992	Middle river bank anglers
60	Gulkana River, Ak 1999	All users – Sourdough Segment
59	Kanektok River, Ak 1996	All users
55	Kenai River, Ak 1992	Middle River driftboaters on low use days
54	Delta River, AK 2004	Lower Tangle Lakes
53	Goodnews River, Ak 1996	Guided users
53	Kanektok River, Ak 1996	Guided users
51	Gulkana River, Ak 1999	All users – Upper Main Stem
51	Kroto Creek (Deshka), Ak 1990	All users
Low Normal: Unlikely to be a problem; may offer unique low density experiences		
48	Delta River, Ak 2004	Upper Tangle Lakes
46	Kenai River, Ak 1992	Middle river powerboaters on low use days
44	Delta River, Ak	All respondents – overall
43	Goodnews River, Ak	All users
42	Togiak River, Ak 1996	King salmon season
41	Kenai River, Ak 1992	Lower river powerboaters during catch/release
36	Goodnews River, Ak 1996	Middle Fork users
No Crowding: no problem; may offer unique low-density experiences		
33	Gulkana River, Ak 1999	All users – Middle Fork
33	Togiak River, Ak 1996	All users
27	Delta River, Ak 2004	Lower River
25	Delta River, Ak 2004	Upper Delta and Portage Area
14-19	Gwaii Haanas, BC 1998	Touring kayakers at various areas
1-9	Athabasca-Sunwapta Rivers, Al	Whitewater rafters at various areas

[1] Percent reporting 3 through 9 ("slightly, moderately, or extremely" crowded) on the scale.

Crowding during different parts of a trip

In addition to the overall crowding question, Kenai users were asked to report how crowded they felt during different parts of their trips (e.g., finding parking, at the boat ramps, while fishing, etc.); see Table 6-4. Findings include:

- Crowding "while fishing" was higher than crowding during other parts of the trip or overall. In general, this suggests that congestion at facilities or while traveling to fishing areas is less of a problem than finding an uncrowded place to fish (improved facilities will not reduce crowding while fishing, and could make it worse if facilities attract more use).
- The disparity between crowding while fishing and other parts of the trip are generally larger for bank anglers than drift or powerboat anglers.
- Drift anglers tend to feel more crowded at take-outs compared to put-ins. Among powerboat anglers, differences were smaller.
- The highest crowding percentages were for Upper River bank and drift anglers, and Lower River powerboat anglers.
- Crowding percentages were higher for king powerboat anglers while traveling to fishing on the Lower River, the segment/season with the highest boat densities.

Table 6-4. Percent feeling crowding during different parts of trips (by segment and group).

	Lower River	Middle River	Upper River
Bank anglers			
At parking areas	34	34	42
To/from fishing	31	30	43
While fishing	**44**	**55**	**68**
While cleaning fish	25	27	43
Overall	41	47	62
Drift anglers			
At put-in	32	18	51
At take-out	45	31	62
While fishing	**57**	**39**	**64**
Overall	53	34	62
Powerboat anglers	**Kings as primary**	**Lower (not kings)**	**Middle (not kings)**
At put-in	45	13	19
At take-out	42	13	21
While fishing	**59**	**28**	**43**
While traveling on river	53	17	24
Overall	54	18	31

Highest crowding percentage in **bold**.

Impacts and tolerances

Impacts – social or biophysical conditions experienced by users – have been a topic of recreation research for at least three decades. In backcountry settings, the focus is typically on river or trail encounters (number of other groups seen per day), camp encounters (number of groups is sight or sound while camping), or camp sharing. In higher density frontcountry settings, the focus shifts to "interference" and "competition" variables, some of which were developed on the Kenai in the 1992 study and repeated in 2009 (Table 6-5).

Table 6-5. List of impacts measured through the on-site survey.

Impact	Description	Response categories
All groups		
Discourteous behavior	How often did you see others causing problems such as littering, being aggressive, violating regulations, etc.	Number of incidents reported
Courteous behavior	How often did you see others being courteous such as offering advice, returning gear, creating space for you, etc.)	Number of incidents reported
Bank anglers		
Fishing competition	How often did you have trouble finding an uncrowded place to fish?	0, 25, 50, 75, and 100% of the time
Angler proximity	What was the average distance between you and the next angler?	shoulder to shoulder (<3 ft); one rod (6-10 ft); one car (15-20 ft); two cars (30-40 ft); casting distance (60 ft); out of sight.
Line entanglements	How often did your line become entangled with others today?	Number of times
Boat interference	How often did boats interfere (come too close or create large wakes) with your fishing today?	Number of times
Drift and powerboat anglers		
Fishing competition	How often did you have trouble finding an uncrowded place to fish?	0, 25, 50, 75, and 100% of the time
Boat interference	How often did boats interfere (come to close or create large wakes) with your fishing today?	Number of times
Put-in waiting time	How long did you wait today?	In minutes
Take-out waiting time	How long did you wait today?	In minutes
Powerboat anglers only		
Close calls	Did you have any "near accidents" with other boats where you took evasive action to avoid a collision?	Number of times

Reported impacts

Tables 6-6 through 6-8 summarize reported impacts (means, medians, and the 25% - 75% "typical range"). The median response represents "50% of the sample reported this number or less," and is a better measure of central tendency than averages because of outliers. These tables provide a general description of conditions; analyses presented later in the chapter show how impacts compare to users' tolerances or how they vary by use level.

Table 6-6. Bank angler reported impacts.

	Mean	Median	Typical Range[1]
Upper River Bank Anglers			
# of discourteous incidents	1.1	0	0 to 1
# of courteous incidents	5.0	3.0	1 to 5
Angler proximity impact	2.6 (6-10 & 15-20 ft)	2.0 (15-20 feet)	2 to 3
Fishing competition impact	35%	25%	0 to 50%
Entanglements	2.6	1.0	0 to 3
Boat interference	0.2	0.0	0
Middle River Bank Anglers			
# of discourteous incidents	0.4	0	0 to 0
# of courteous incidents	3.0	2.0	0 to 4
Angler proximity impact	2.7	3.0	2 to 3
Fishing competition impact	25%	0%	0 to 50%
Entanglements	1.6	0	0 to 2
Boat interference	0.5	0	0 to 0
Lower River Bank Anglers			
# of discourteous incidents	0.5	0	0 to 0
# of courteous incidents	2.1	1	0 to 3
Angler proximity impact	3.0	3	2 to 4
Fishing competition impact	23%	0%	0 to 25%
Entanglements	1.1	0	0 to 2
Boat interference	0.8	0	0 to 0

[1]Typical range defined as the 25% and 75% responses (interquartile range).

Table 6-7. Drift angler reported impacts.

	Mean	Median	Typical Range[1]
Upper River			
# of discourteous incidents	0.6	0	0 to 1
# of courteous incidents	3.2	2	0 to 4
Boat interference impact	1.3	1	1
Fishing competition impact	23%	25%	0 to 25%
Put in impact	4.8	1	0 to 10
Take out impact	5.9	0	0 to 10
Middle River			
# of discourteous incidents	0.3	0	0
# of courteous incidents	2.1	1	0 to 3.75
Boat interference impact	1.2	1	1 to 2
Fishing competition impact	13%	25%	0 to 25%
Put in impact	2.4	0	0 to 5
Take out impact	2.8	0	0 to 5
Lower River			
# of discourteous incidents	0.6	0	0
# of courteous incidents	1.9	2	0 to 3
Boat interference impact	1.5	1	1 to 2
Fishing competition impact	23%	25%	0 to 50%
Put in impact	2.4	1	0 to 5
Take out impact	4.9	1	0 to 5

[1]Typical range defined as the 25% and 75% responses (interquartile range).

Table 6-8. Powerboat angler reported impacts.

	Mean	Median	Typical Range[1]
Middle / Lower River (first run kings)			
# of discourteous incidents	0.2	0	0 to 1
# of courteous incidents	1.8	1	0 to 3
Close calls	0.01	0	0
Boat interference	1.1	0	0 to 2
Fish competition impact	13%	0%	0 to 25%
Put-in waiting time	1.7	0	0 to 5
Take-out waiting time	1.8	0	0 to 5
Middle / Lower River (July kings)			
# of discourteous incidents	0.9	0	0 to 0
# of courteous incidents	2.4	2	0 to 3
Close calls	0.2	0	0
Boat interference	1.4	1	0 to 2
Fish competition impact	20%	25%	0 to 50%
Put-in waiting time	5.2	0	0 to 10
Take-out waiting time	4.3	0	0 to 5
Middle River (after kings)			
# of discourteous incidents	0.2	0	0 to 1
# of courteous incidents	0.6	0	0 to 2
Close calls	0.04	0	0
Boat interference	1.1	0	0 to 1
Fish competition impact	5%	0%	0 to 25%
Put-in waiting time	0.6	0	0
Take-out waiting time	0.5	0	0
Lower River (after kings)			
# of discourteous incidents	0.2	0	0
# of courteous incidents	0.5	0	0 to 1
Close calls	0.05	0	0
Boat interference	1.0	0	0 to 1
Fish competition impact	5%	0	0 to 25%
Put-in waiting time	0.8	0	0
Take-out waiting time	1.1	0	0 to 3

[1]Typical range defined as the 25% and 75% responses (interquartile range).

Tolerances for impacts

For each impact question, users were asked to identify a tolerance (the amount of impact "you would tolerate before your trip becomes unpleasant") on the same scale; they could also check "it doesn't matter to me" or "it doesn't matter to me as long as I'm catching fish." Data are useful in several ways:

First, the percent who give a number (do not check "it doesn't matter") measures "norm prevalence" (the percent who have a norm) and may indicate an impact's importance (Shelby 1981; Whittaker and Shelby 1988; Roggenbuck et al., 1991; Shelby et al., 1996; Vaske et al., 1999). Second, median responses help identify the amount of impact tolerable to 50% of those with an opinion, which stakeholders and agencies may consider when developing standards (a key element in most visitor impact management or capacity frameworks). Frequency distributions identify whether the evaluations represent "no tolerance," "single tolerance," or "multiple tolerance" norms, which help assess the level of agreement about potential standards (Whittaker and Shelby, 1988). Third, comparisons of reported impacts and tolerances identify possible problem areas.

Figure 6-1 shows the percent reporting "this impact doesn't matter" or "it doesn't matter as long as I'm catching fish." Findings include:

- Large proportions (100 minus the sum of these percentages; 60 to 90%) care about impacts and were able to specify tolerances. Most anglers don't come to the Kenai to "just to catch fish," and other components of the experience matter. When fishing is poor, impacts become relevant even for harvest-oriented users.
- Some impacts appear "less important" than others, such as entanglements and boat interference for bank anglers, and launch waiting time for drift anglers.
- "It doesn't matter" percentages are similar to those found in the 1992 Kenai study (combined percentages ranged from 8 to 35%, depending upon the impact) and several other studies (Vaske et al., 1999).
- The "doesn't matter" percentages are about evenly split, so "it doesn't matter to me as long as I'm catching fish" is never the full explanation.

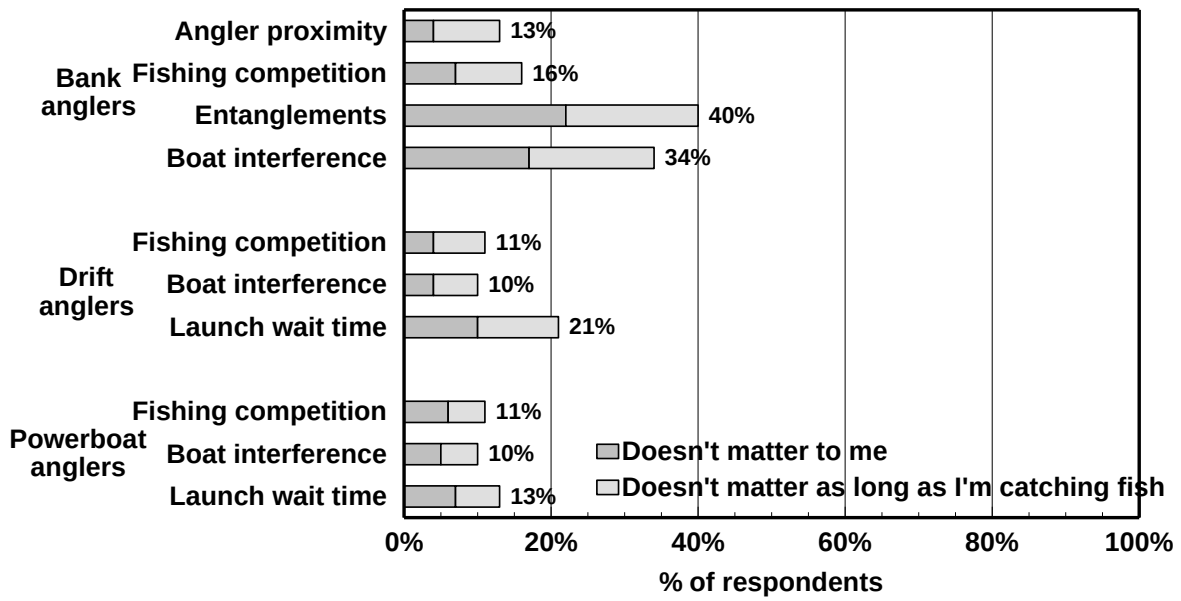


Figure 6-1. Percent reporting impacts "do not matter" to them.

Figures 6-2, 6-3, and 6-4 provide examples of frequency distributions for tolerances to illustrate "types of norms." Table 6-9 summarizes generalized norms (medians) for all impacts, as well as providing additional notes about differences between segments or target species.

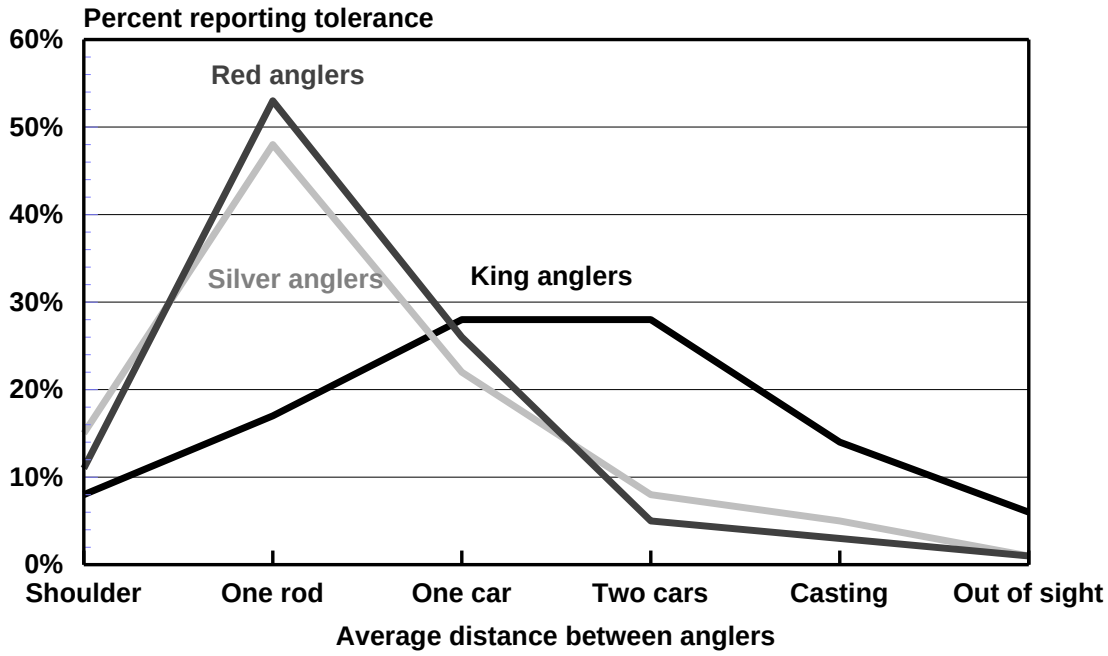


Figure 6-2. Angler proximity tolerances among bank anglers who fish for different species.

In Figure 6-2, angler proximity tolerances for bank anglers that pursue different species show:

- An example of two different "single tolerance norms" with relatively high agreement about acceptable spacing between anglers.
- The spacing differs for the two types of fishing. King anglers require more space (most prefer one or two car lengths) than silver or red anglers (most require only one rod length).
- A small proportion (12 to 15%) of red and silver anglers will tolerate fishing "shoulder-to-shoulder," compared to 8% for king anglers.
- Some king anglers require "casting distance" or being "out of sight," but very few red or silver anglers have the same requirement.
- Data from 1992 suggest red angler tolerances have changed over time. Although the percentage who tolerate shoulder-to-shoulder spacing is similar (8% in 1992 vs. 12% in 2009), 60% of anglers in 1992 required a car length or greater, compared to 34% now. This is consistent with a "product shift," where anglers have learned to accept higher density conditions (possibly displacing more sensitive users).
- Results suggest the number of anglers that can "fit" along a segment of shore and have a high quality experience. Managers could calculate this number for a land management unit (e.g., a park unit) and use it when designing day use parking or other facilities that access such areas.

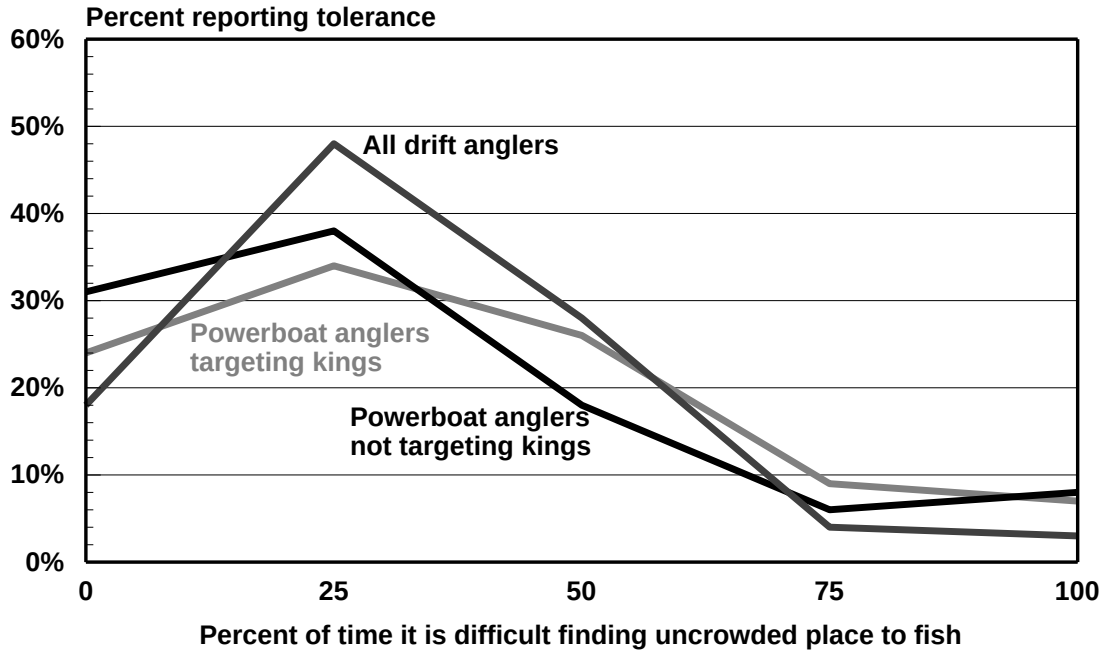


Figure 6-3. Fishing competition tolerances among drift and powerboat anglers.

In Figure 6-3, fishing competition tolerances show:

- More examples of "single tolerance norms," with general agreement about acceptable impacts. There are some differences among the groups. Drift anglers show more agreement about a single tolerance level (25% of the time) and powerboat anglers targeting kings show the least consensus (with substantial percentages choosing 0, 25 and 50% of the time).
- Few anglers accept having difficulty finding uncrowded fishing more than 75% of the time. The majority report a tolerance of 25% or less.
- Data relatively strong agreement for a standard about 25%; however, the boat density that exceeds this standard varies by segment (see use-impact relationships below).
- Data from 1992 suggest fishing competition tolerances have not changed much.

In Figure 6-4, launch waiting time tolerances show:

- Examples of "multiple tolerance norms" with less agreement about a single acceptable level. It is more difficult to set standards for these impacts because different groups have different ideas about what is acceptable. However, a majority will not tolerate waiting longer than 15 minutes, and very few tolerate over 30 minutes.
- Some drift anglers appear willing to tolerate longer waits at take-outs than put-ins.
- Waiting time tolerances have changed slightly since 1992. For example, in 1992 only 8% of drift anglers would tolerate waits over 20 minutes compared to 29% in 2009. This fits with the "product shift" concept, where users have "downgraded" their expectations and tolerances to fit with higher use conditions.

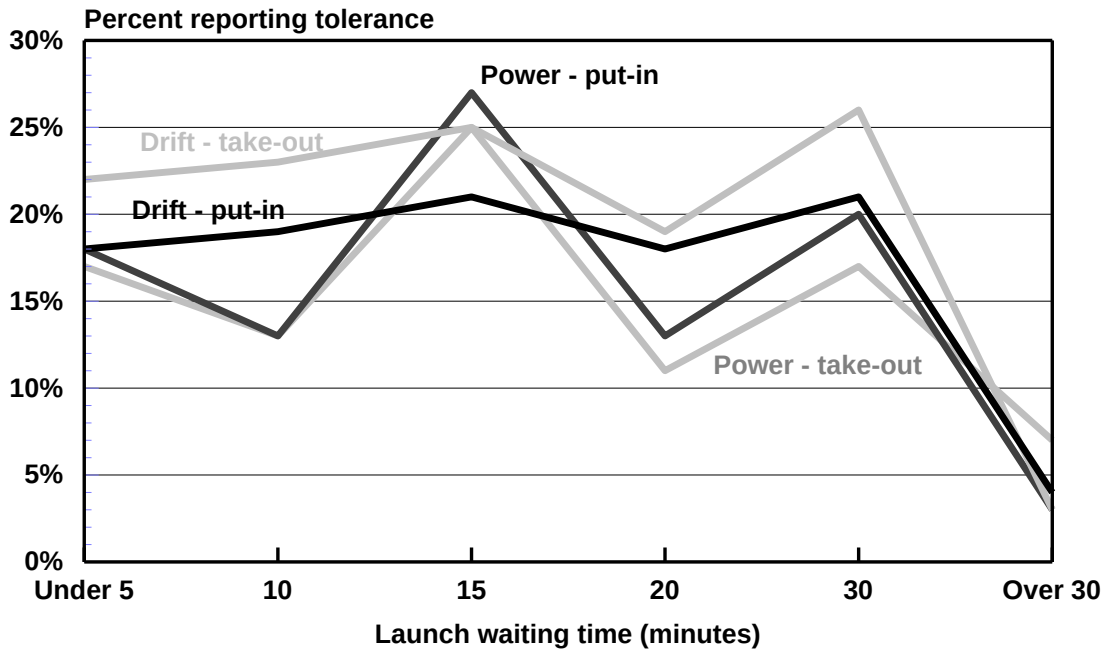


Figure 6-4. Launch waiting tolerances among drift and powerboat anglers.

Table 6-9 provides median tolerances for several impacts. The median says, "50% will tolerate this amount or less" (and is a better measure of central tendency than an average, which can be influenced by outliers). Results suggest potential standards, but differences by segment or species/season may be important considerations for managers who decide to use these to set capacities for a specific time and place.

Table 6-9. Median tolerances for impacts.

	Median	Comments
Bank anglers		
Fishing competition	25% of the time	Small differences by species.
Angler proximity	one rod	Differences by species.
Line entanglements	0 to 1	1 for red anglers; 0 for other species.
Boat interference	0 per day	No tolerance norm.
Drift anglers		
Fishing competition	25% of the time	Small differences by segment.
Boat interference	2 per day	No segment differences.
Launch waiting time	15 minutes	
Powerboat anglers		
Fishing competition	25% of the time	Small differences by species.
Boat interference	25% of the time	Small differences by species.
Launch waiting time	15 minutes	

"Impact problems"

Table 6-10 shows the percent of respondents reporting impacts greater, equal, and less than their tolerances. The supplemental report provides additional detail. Findings include:

- Small percentages (generally less than 15%) reported impacts greater than their tolerances, and average impact levels were never greater than average tolerances (another potential definition of an "impact problem"). In general, 2009 impact levels were acceptable to most users.
- However, reported impacts were often equal to tolerances (22 to 65%), indicating little "margin" for increased impact.
- Combining the "impact > tolerance" and "impact = tolerance" categories, a majority reported impacts greater than or equal to their tolerances for 7 of the 12 impacts. For these, most users accept what they experienced in 2009, but don't want impacts to worsen.
- Higher percentages of bank anglers report impacts greater than or equal to their tolerances.
- 1992 results generally showed similar total percentages greater than or equal to tolerances. However, bank angler findings provided some exceptions. For example, more 1992 Upper River bank anglers reported impacts greater than (33%) or equal to tolerances (55%) than 2009 (with 10% and 45%, respectively). This fits with earlier discussion noting higher bank angler use levels during the second red run in 1992 than in 2009.

Table 6-10. Percent reporting impacts greater than, equal to, or less than tolerances.

	Impact > tolerance (impact problem)	Impact = tolerance (potential problem)	Impact < standard (no problem)
Bank anglers			
Angler proximity	14	49	37
Fishing competition	11	42	47
Entanglements	18	42	40
Boat interference	8	65	27
Drift anglers			
Fishing competition	15	38	47
Boat interference	7	36	57
Put-in time	6	29	65
Take-out time	7	22	71
Powerboater anglers			
Boat interference	3	40	57
Fishing competition	3	36	65
Put-in time	11	50	39
Take-out time	10	49	41

Use - impact relationships

Analyses explored relationships between use measures and several reported impacts (including perceived crowding). Following Cohen (1988) and Vaske (2008), correlations in applied social sciences are considered "small effect" if they are about 0.1, a "moderate effect" about 0.3, and a "strong effect" at or above 0.5. A list of impacts and the most highly correlated use measures are given in Tables 6-11 to 6-14. Findings are discussed separately; the supplement provides correlations for other use measures.

Table 6-11. Correlations between use levels and reported crowding / impacts for bank anglers.

	Overall crowding	Angler proximity	Fishing competition	Line entanglements	Boat interference
Upper River bank anglers					
Ferry passenger counts	.55	-.32	.26	.37	--
RR confluence to tree counts	.40	-.14	--	.17	--
RR day parking users	.52	-.31	.23	.30	--
Jim's Landing trailer counts	.24	-.11	.14	.12	.23
Middle River bank anglers					
Bing's vehicle counts	.47	-.29	.39	.32	.29
Lower River bank anglers					
Pillars vehicle counts	.38	--	.26	.35	.21
Centennial vehicle counts	.41	-.22	.33	.40	--

-- Denotes no statistically significant relationship (p>.05).

Table 6-11 shows use-impact correlations for bank anglers. Findings include:

- Several impacts are related to use measures at moderate to strong levels, showing that higher use levels produce higher reported impacts or perceived crowding among bank anglers. This is true for many but not all social impacts in recreation settings, so verification is important.
- In general, the strongest relationships are between use and perceived crowding (correlations between .24 and .55).
- Bank angler use level measures are "imperfect" because they count people or vehicles at specific access points, which does not always account for variation in where they go in a segment. Vehicle counts at major access points are helpful for describing relative use levels.
- The weakest use-impact relationship is for boat interference, which is probably mediated by boater behavior (they may spread out through a segment), and therefore less correlated with boat numbers.
- Discourteous behavior was not related to use measures on any segment (not shown).

Table 6-12. Correlations between use levels and reported crowding / impacts for drift anglers.

	Overall crowding	Boat interference	Fishing competition	Courteous behavior
Upper River				
Ferry passenger counts	.21	--	.20	.16
Sportsman launches	.37	.18	.25	.16
Sanctuary counts	.34	.27	.27	.21
RR day parking users	--	--	.10	.13
Jim's Landing trailer counts	.36	.12	.23	.15
Middle River drift anglers				
Bing's trailer counts	.30	--	--	.54
Lower River drift anglers				
Pillars boat trailers	.54	--	--	--
Total boats	.39	--	--	--
Total guided boats fishing	.37	--	--	--

-- Denotes no statistically significant relationship (p>.05).

Table 6-12 shows use-impact correlations for drift anglers. Findings include:

- Perceived crowding shows moderate to strong correlations with use. Other impacts are less strongly related.
- Weaker relationships may be due to more coarse use measures on certain segments or specific attributes of drift trips (e.g., Lower River drift trips were usually on lower use "drift-only Mondays").
- Reports of discourteous behavior were not related to use (not shown), but courteous behavior was positively related (more use = more courteous behavior). The relationship was particularly strong for the Middle River. Higher use may encourage people to "be nicer" to offset "friction" or put more people in close contact, affording more chances for courteous interactions. Notably, courteous behavior incidents outnumber discourteous behavior by a substantial margin (a finding that persists across segments and types of anglers).
- Use-perceived crowding relationships are stronger for measures of boating use (e.g., launches) as opposed to measures of bank use (e.g., Ferry passenger counts). Boaters feel crowded from other boaters rather than bank users. Interestingly, trailer counts at Pillars showed a higher correlation than actual boat counts for the Lower River. The Pillars trailer count might effectively reflect the most crowded fishing areas (which are often downstream of that launch).
- Put-in waiting time was not significantly correlated with use levels (not shown), but take-out time was correlated with the ADF&G boat counts on the Lower River at r=0.41 (p<.001).

Table 6-13. Correlations between use levels and reported crowding / impacts for powerboat anglers.

	Overall crowding	Boat interference	Fishing competition	Putin time	Take-out time	Discourteous behavior
For anglers targeting kings						
Pillars trailer counts	.56	--	--	.32	--	.24
Centennial trailer counts	.55	--	--	--	--	--
ADF&G boat counts	.54	.23	--	.22	.20	--
For anglers not targeting kings						
Lower River						
Pillars boats – Suzanne	.67	.43	.42	.53	.53	--
Centennial trailer counts	.68	.56	.37	.59	.60	--
Total boats fishing	--	--	--	.62	.72	--
Total boats	--	--	--	.63	.68	--
Middle River						
Centennial trailer counts	--	.50	.69	.45	--	--
Pillars trailer counts	.59	--	.52	.66	--	--
Bings trailer counts	.25	--	--	--	--	--

-- Denotes no statistically significant relationship (p>.05).

Table 6-14 shows use-impact correlations for powerboat anglers targeting kings and those targeting other species. Findings include:

- Perceived crowding shows moderate to strong correlations with use on all three segments, while other impacts are less strongly related.
- "Close calls" between boats were related only to use levels measured by Pillars trailers (r=.24). The number of close calls reported was very low, but the few that were reported tended to occur during higher use levels (1% reported any before July; 11% reported any in July).
- As with drift anglers, courteous behavior incidents were related to use levels (not shown) as measured by Pillars trailer counts (.22) and Centennial trailer counts (.35), but not ADF&G boat counts.
- Powerboat launch congestion on the Lower River appears to be higher on days with at least medium use (over 200 boats counted) vs. lower use (under 200); average put-in times increase from 2.7 to 6.3 minutes, and average take-out times increase from 2.7 to 4.8 minutes. These waiting times are still low compared to median tolerances about 15 minutes. There was little launch congestion on the Lower River in 2009 compared to some previous years (see Chapter 2).
- In general, different use measures were highly correlated. The correlations between per day Pillars trailer counts and peak ADF&G boat counts were 0.68. Pillars trailer counts are a reasonable indicators of use levels (R^2=.44) using the following formula (most accurate when boat counts are between about 100 and 200):

Counts on the river = 43 + 2.03 x (the count of Pillars trailers)

Figure 6- 5 shows how use affects angler proximity and number of line entanglements per day for bank anglers on the Upper River. These curves show how conditions change as use increases, and allow stakeholders and managers to estimate the use level at which average impacts exceed tolerances. For angler proximity, at over 1,000 Ferry anglers per day, the distance between anglers has decreased to less than one rod-length (the median tolerance for red anglers). For entanglements, use levels as low as 400 ferry passengers per day produce more entanglements than the median tolerance (1 per day), and entanglements increase dramatically (to 6 – 7 per day) over 1,000. In 2009, these higher use levels occurred during the peak of the first red run but not during the second.

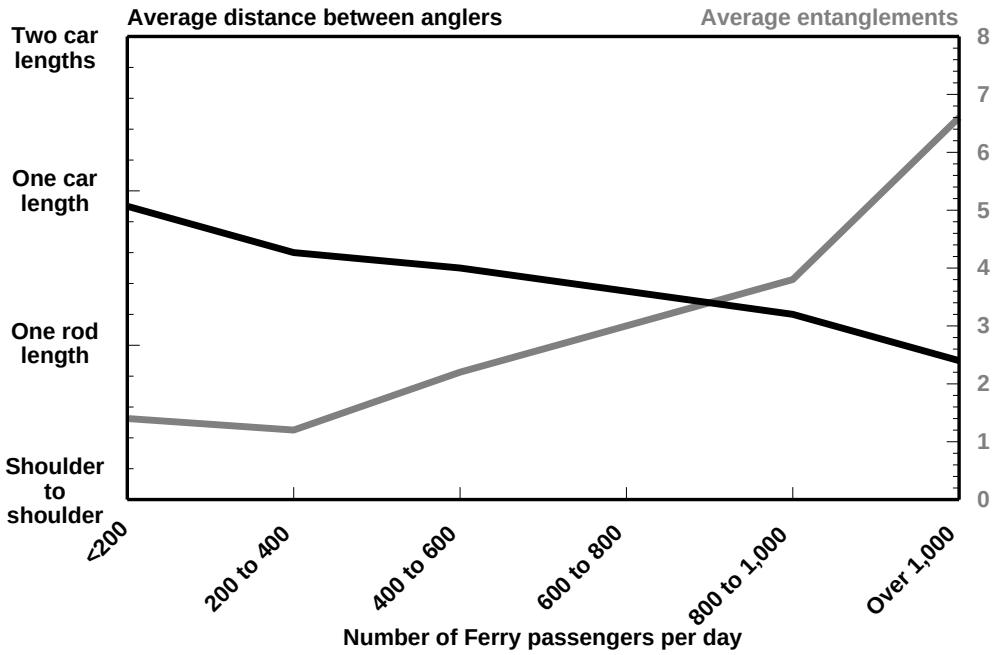


Figure 6-5. Use vs. impact relationships for angler proximity and line entanglements for Upper River bank anglers.

Figure 6-6 (next page) shows how use affects perceived crowding among Upper River bank anglers. Using this example to apply the "rule of thumb" capacity categories, use levels of about 800 to 1,000 ferry passengers per day produce crowding levels in the "over capacity" range, and use levels over 1,000 are "greatly over capacity." This is consistent with reported angler proximities (which begin to exceed tolerances at those use levels).

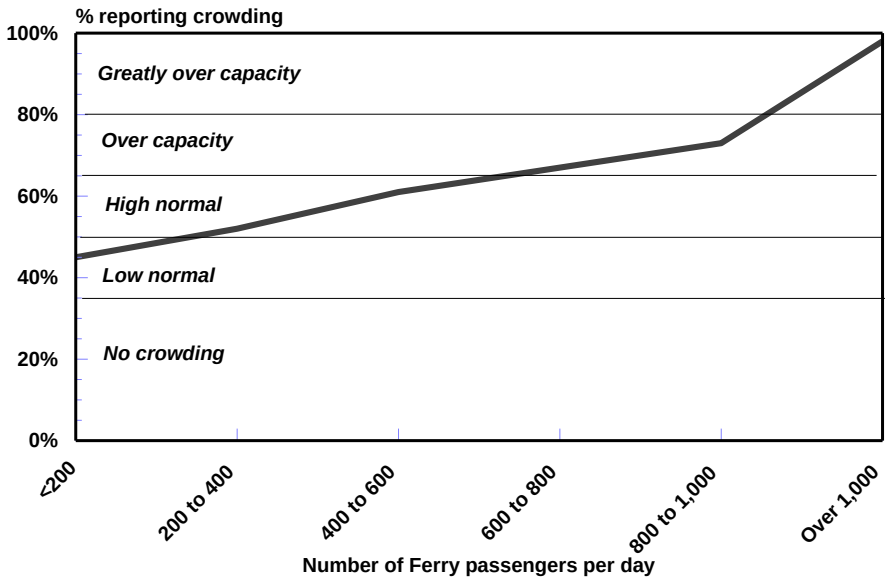


Figure 6-6. Use vs. percent reporting crowding for Upper River bank anglers.

Figure 6-7 shows how use affects perceived crowding and fishing competition among Upper River drift anglers. Applying the "rule of thumb" capacity categories, use levels over 40 Sportsman launches per day produce crowding levels in the "over capacity" range. In 2009, use did exceed 60 launches enough to create "greatly over capacity" levels. The percents of time anglers had difficulty finding an uncrowded place to fish follow perceived crowding levels. Median tolerance for this impact was about 25 percent of the time, which occurred at about 40 boats per day – the same use level that is "over capacity" by the perceived crowding "rule of thumb."

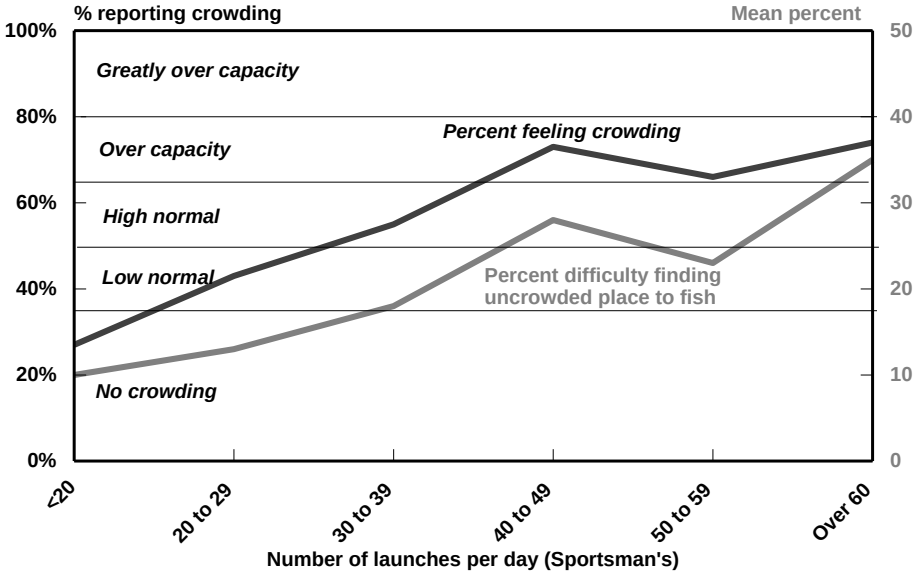


Figure 6-7. Use vs. crowding and fishing competition for Upper River drift anglers.

Figure 6-8 shows how use affects perceived crowding among Lower River king powerboat anglers. Applying the "rule of thumb" capacity categories, at boat counts below 150 crowding is low. At about 150, crowding levels reach "over capacity," remaining there through the highest use levels in 2009 (about 350 boats). Counts on high use days in other years have reached 450 to 500 boats, and might produce higher crowding ratings (this study can't confirm that). Figure 6-9 shows how use affects fishing competition and boat interference. Median competition tolerances are exceeded above 210 to 240 boats, while boat interference impacts were close to tolerances throughout the 2009 season.

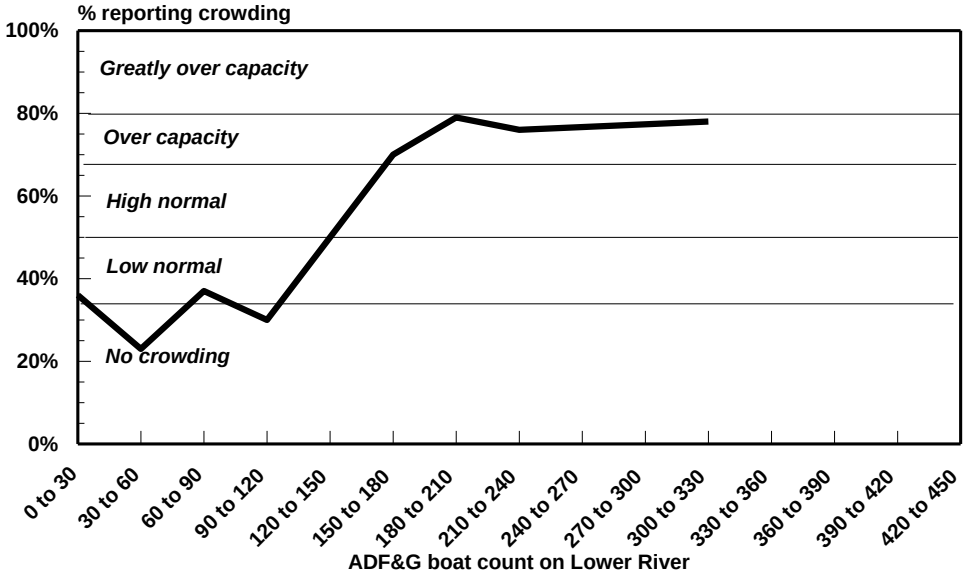


Figure 6-8. Use vs. percent feeling crowded for powerboat anglers on the Lower River.

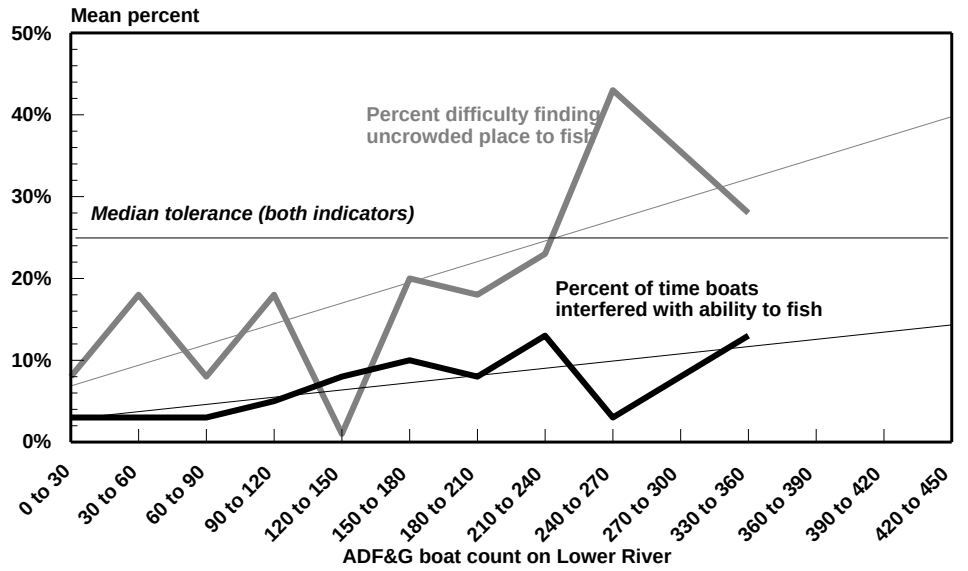


Figure 6-9. Use vs. percent feeling crowded for powerboat anglers on the Lower River.

Taken together, use-impact and tolerance information can help managers and stakeholders assess which use levels produce unacceptable conditions. Although relationships between use and impacts vary, and tolerances for impacts are sometimes diverse, planning efforts offer opportunities to consider the choices and state which conditions are acceptable. These choices then can be integrated with, and help choose between, management actions that address impacts that exceed standards (and may include reducing or redistributing use). If the goal is to manage for high quality opportunities, it is critical to define what that means and then implement actions that will achieve those conditions. Managers unwilling to define "acceptable," or act to maintain them, are probably managing for other goals than high quality opportunities (e.g., to maximize quantity of use rather than quality).

Other relationships among on-site survey variables

Crowding and Satisfaction

Visitor satisfaction has frequently been measured in recreation settings (Heberlein & Vaske 1977; Kuss, et al., 1990). However, satisfaction is not a particularly useful measure for assessing recreation experience quality. In addition, satisfaction levels are typically quite high, although consumptive users such as hunters and anglers consistently show lower satisfaction compared to non-consumptive users such as hikers and rafters (Vaske, et al., 1982; Vaske et al., 2009). For many well-documented reasons, satisfaction is usually weakly or unrelated to use, crowding, or impact measures, and it is usually too general a variable to evaluate conditions managers might actually influence (Shelby & Heberlein, 1986).

Having noted these limitations, general satisfaction ratings are often requested by managing agencies, and they are included in this study for completeness. On a five point scale from "very unsatisfied" to "very satisfied," 78% of bank anglers, 91% of drift anglers, 81% of powerboat anglers, and 91% of non-anglers reported they were satisfied or very satisfied with their trips, and averages for most group/segment combinations were about 4.0 to 4.2. Consistent with previous research, non-anglers averaged higher satisfaction (4.6), although they were joined by driftboat anglers on the Upper River at 4.7 and powerboat anglers on the Middle River at 4.6. Both groups have higher catch rates associated with trout/Dolly fisheries, which may be another factor in their higher ratings than other consumptive users.

The relationship between satisfaction and crowding was statistically significant and in the predicted direction (more crowding = less satisfaction) for a few group/segment situations, but was always weak (as predicted by the literature). For bank anglers, the satisfaction-crowding correlation ranged from -.07 to -.15; for drift anglers it was significant only on the Middle River (-.13); for powerboat anglers it was significant only for Lower River anglers not targeting kings (-.27). Note that the number of fish caught was also weakly related to satisfaction (.13 to .14 for different groups); crowding and the number of fish hooked have roughly the same effect on satisfaction ratings.

What impacts influence crowding?

Table 6-4 provides correlations between perceived crowding and reported impacts; results indicate which impacts affect experiences most. Findings include:

- Over three quarters (55 of 72) of the group/segment situations showed statistically significant relationships ($p<.05$) and all significant ones were in the predicted direction (more impact = greater crowding). Some but not all impacts measured clearly influence crowding ratings, as predicted in the literature (Vaske et al., 2002).
- Significant correlations ranged from small (about 0.1) to strong (0.5), with the latter deserving greater management attention. Strong correlations include fishing competition among bank anglers on the

Lower and Middle River, fishing competition among drift anglers on the Lower and Upper River, and boat interference, fishing competition, and launch waiting times among powerboat anglers on the Lower River (outside the king season).

Table 6-14. Correlations between perceived crowding and reported impacts.

	All anglers	Lower River	Middle River	Upper River
Bank anglers				
Angler proximity	-.33	-.29	-.33	-.32
Fishing competition	.47	.54	.54	.34
Discourteous behavior	.24	.34	.13	.23
Courteous behavior	.18	.31	--	.19
Boat interference impact	.14	.36	.17	--
Entanglements	.32	.37	.31	.29
Drift anglers				
Boat interference impact	.41	.45	.50	.40
Discourteous behavior	.13	--	--	.13
Fishing competition	.53	.81	.22	.54
Courteous behavior	.18	--	--	.18
Put in time	.25	--	--	.22
Take out time	.24	--	.30	.19
	All anglers	**Kings as primary**	**Lower not kings**	**Middle not kings**
Powerboat anglers				
Boat interference impact	.42	.30	.67	.32
Discourteous behavior	--	--	.22	--
Fishing competition	.43	.25	.65	.44
Courteous behavior	--	--	--	--
Put in time	.40	.38	.56	.25
Take out time	.40	.31	.59	--

Additional regression analysis shows influences on crowding for all impacts taken together (using stepwise removal of non-significant impacts). Results are given in Table 6-15. Findings are similar to the bivariate correlations in Table 6-16, but account for overlapping variance and provide an "effect size" (R^2):

- Models for different groups explain about one third of the variance in perceived crowding, a reasonably strong effect for social science data. Additional variance may be related to anglers' tolerances, expectations, or preferences.
- When considered together, impacts have small to medium effects on crowding, so there is not just one kind of impact that makes people feel crowded.

Table 6-15. Relationships between crowding and reported impacts.

Group	Total explained variance (R^2)	Significant impacts and correlation coefficient (r)	Non-significant impacts (p>.05)
Bank anglers	.31	Fishing competition (.31) Angler proximity (-.20) Entanglements (.16) Discourteous behavior (.13)	Courteous behavior Boat interference
Drift anglers	.37	Fishing competition (.39) Boat interference (.22) Put-in time (.12) Take out time (.08) Courteous behaviors (.12)	Discourteous behavior
Powerboat anglers targeting kings	.32	Put-in time (.28) Take-out time (.20) Boat interference (.18) Discourteous behavior (.18) Courteous behavior (-.13)	Fishing competition
Powerboat anglers targeting other species	.36	Boat interference (.36) Fishing competition (.35)	Put-in and take-out time Discourteous or courteous behaviors

7. Issue Importance

*This chapter presents information from the **follow-up survey** for users, landowners, and guides about which issues are more important. Respondents were asked to rate 24 issues on a 5-point importance scale from "not at all important" to "extremely important." The list of issues was developed from focus groups and reviewed by agencies; respondents could also suggest other issues (see supplemental report for verbatim responses).*

For all users

Figures 7-1 ranks issues for all users by average importance ratings (and shows percent very and extremely important). Results illustrate major findings, but simplify differences between user groups (discussed in greater detail below).

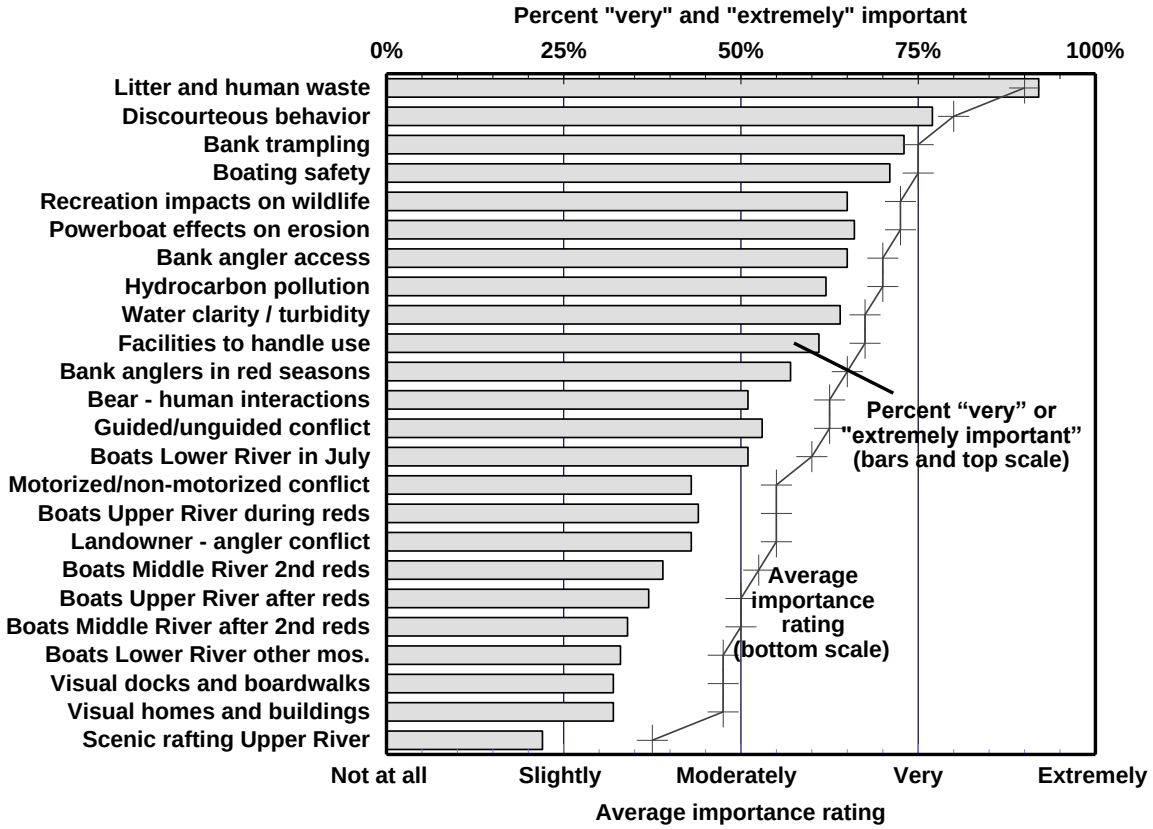


Figure 7-1. Average importance ratings and percent "very" or "extremely important" for management issues among all users.

Findings include:

- Many issues are important to majorities of users. For example, even lower-rated issues (e.g., visual impacts of docks and boardwalks, with a mean of 2.9) had one-third of all users reporting the issue was "very" or "extremely important." Over 70% rate issues such as boating safety "very" or "extremely important."
- Issues related to physical or biological conditions tend to be among the most important. Six of the top ten issues were litter and human waste, bank trampling, recreation impacts on wildlife, powerboat

effects on erosion, hydrocarbon pollution, and water clarity/ turbidity. The 1992 study showed similar findings, emphasizing that a healthy ecosystem is a starting point for high quality recreation experiences. Habitat protection and restoration efforts over the past two decades have improved habitat in several previously-impacted areas. The continued high importance ratings for these bio-physical impact issues suggest the public is still concerned about those impacts, and may support even greater management attention.

- Two user behavior issues, discourteous incidents and boating safety, were also near the top of the list, confirming that Kenai users care about social aspects of their experiences on the river.
- Two facility / infrastructure issues, the amount of river access for bank anglers and the amount of facilities to handle the volume of use, were also ranked in the "top ten." Despite an extensive array of local, state, and federal facilities along the river, many users appear interested in improvements or increased bank access.
- Except for safety and discourteous behavior, conflicts between guided and unguided users, motorized and non-motorized users, and landowners and anglers were not rated as highly as several biophysical impacts, but were generally at the top of the "experiential" issues. The lowest importance issues were visual impacts from development and scenic rafting use on the Upper River.
- The numbers of boats or users on specific segments were generally ranked lower. However, results are confounded because not all respondents use or care about every segment; for the respondents who actually use a segment, ratings are invariably higher. The supplemental report provides further "break-outs" for users from different segments.
- Overall, results for all users show the relative importance of overuse issues, suggesting greater concern about bank angling use in red salmon season, powerboats on the Lower River in July, and boating use on the Upper River during red runs. Results are broadly consistent with segments/seasons that have higher use and crowding.

Differences between user groups

Table 7-1 provides similar information for all users, landowners, and the three major angler groups. Results show some differences, including:

- Landowners were similar to powerboat anglers in their issue ratings, not surprising given that about three-quarters of landowners use powerboats on the Lower or Middle River. Landowners also ranked bank angler numbers during red seasons, trespass conflicts, guided/unguided conflicts, and boat numbers on the Lower River in July higher than did users.
- Among the three angler groups, bank anglers were predictably more concerned about the amount of bank angler access and the number of bank anglers in red season. They were less concerned than powerboat anglers about boating safety, guided/unguided use conflicts, and the number of powerboats on the Lower River.
- Drift anglers ranked many issues slightly higher than other groups, with notably higher ratings for the number of boats on the Upper River (during and after red season) and motor/non-motor conflicts.
- Powerboat anglers tended to rank many issues slightly lower than other groups. They were less concerned with hydrocarbon pollution and wake erosion, two issues which might restrict equipment or behavior. However, they showed higher concern for the boating use levels on the Lower River in July and guided/unguided use issues.

Table 7-1. Average importance ratings for management issues: all users, landowners, and major user groups.

	All users	Land-owners	Bank	Drift	Power	F	p	Different groups[1]
Litter and human waste	4.6	4.5	4.7	4.6	4.5	--	--	
Discourteous behavior	4.2	4.2	4.3	4.2	4.1	--	--	
Bank trampling	4.0	4.2	4.0	4.2	3.9	2.4	.009	Drift from power
Boating safety	4.0	4.1	3.8	4.0	4.2	6.8	.001	Bank – power
Recreation impacts on wildlife	3.9	3.4	3.9	3.9	3.6	4.7	.009	Drift – power
Powerboat effects on erosion	3.9	4.1	4.0	4.0	3.5	13.2	.001	Power from others
Bank angler access	3.8	3.4	4.4	3.3	3.7	90.1	.001	All three different
Hydrocarbon pollution	3.8	3.6	3.8	3.9	3.5	6.5	.002	Power from others
Water clarity / turbidity	3.7	3.7	3.7	3.8	3.7	--	--	
Facilities to handle use	3.7	3.6	3.7	3.5	3.8	4.8	.009	Drift – power
Bank anglers in red seasons	3.6	3.8	3.9	3.5	3.3	12.2	.001	Power from others
Bear – human interactions	3.5	3.2	3.6	3.6	3.2	8.3	.001	Power from others
Guided/unguided conflict	3.5	4.0	3.3	3.5	3.8	7.6	.001	Bank – power
Boats Lower River in July	3.4	4.2	3.2	3.4	3.7	5.9	.003	Bank – power
Motorized/non-motorized conflict	3.2	3.1	3.0	3.5	3.1	7.9	.001	Drift from others
Boats Upper River during reds	3.2	3.0	3.1	3.5	2.8	13.6	.001	All three different
Landowner – angler conflict	3.2	3.7	3.3	3.1	3.1	--	--	
Boats Middle River 2nd reds	3.1	3.4	3.1	3.1	3.0	--	--	
Boats Upper River after reds	3.0	2.9	2.7	3.4	2.7	22.8	.001	Drift from others
Boats Middle River after 2nd reds	3.0	3.1	2.9	3.1	3.0	--	--	
Boats Lower River other mos.	2.9	3.2	2.8	3.0	3.0	--	--	
Visual docks and boardwalks	2.9	2.7	3.0	2.7	2.8	--	--	
Visual homes and buildings	2.9	2.7	2.9	2.8	2.7	--	--	
Scenic rafting Upper River	2.5	2.4	2.4	2.6	2.3	3.6	.029	Drift – power

[1]Based on Scheffé tests at $p<.05$ among the three main user groups.

For guides

Table 7-2 provides similar information for guides, including differences between drift and powerboat guides, which were also compared to drift and powerboat users (not shown here; see supplement).

Table 7-2. Average importance ratings for management issues among guides.

	All guides	Drift guides	Powerboat guides	t	p
Litter and human waste	4.4	4.8	4.2	4.0	.001
Discourteous behavior	4.1	4.4	4.0	2.2	.02
Bank trampling	4.3	4.4	4.2	--	--
Boating safety	4.6	4.8	4.5	2.3	.018
Recreation impacts on wildlife	3.6	4.1	3.4	3.9	.001
Powerboat effects on erosion	3.4	4.2	3.1	5.2	.001
Bank angler access	3.3	2.9	3.4	-2.2	.032
Hydrocarbon pollution	3.6	4.2	3.4	3.9	.001
Water clarity / turbidity	3.4	4.0	3.2	3.6	.001
Facilities to handle use	4.2	4.1	4.2	--	--
Bank anglers in red seasons	3.2	3.6	3.0	2.7	.009
Bear – human interactions	3.2	3.9	2.9	4.6	.001
Guided/unguided conflict	3.6	3.9	3.4	2.1	.033
Boats Lower River in July	3.3	3.7	3.2	2.5	.013
Motorized/non-motorized conflict	3.1	3.7	2.8	4.0	.001
Boats Upper River during reds	2.8	3.7	2.3	6.3	.001
Landowner – angler conflict	3.2	3.4	3.1	--	--
Boats Middle River 2nd reds	2.7	3.4	2.5	4.5	.001
Boats Upper River after reds	2.8	3.9	2.4	6.7	.001
Boats Middle River after 2nd reds	2.8	3.4	2.5	4.2	.001
Boats Lower River other mos.	2.6	3.1	2.4	3.6	.001
Visual docks and boardwalks	2.9	3.1	2.8	--	--
Visual homes and buildings	3.1	3.1	3.0	--	--
Scenic rafting Upper River	2.1	2.3	2.0	--	--

Findings include:

- Drift guides rated 17 of the 24 issues higher than powerboat guides. The only issue powerboat guides ranked higher was bank angler access.
- Even with these differences, the rank order for the two guide groups was similar (and to their user counterparts). The few notable differences include:
  - Boating safety was rated higher for both guide groups compared to users. This makes sense given liability concerns.
  - Facilities to handle use were rated higher for guides than users; this fits with guide interest in efficient trips (e.g., avoiding launch congestion).
  - Water clarity was rated considerably lower by powerboat guides. This issue has received considerable attention in 2009-10 in response to KWF and DEC turbidity studies, and might affect powerboat use.
  - Powerboat guides rated Upper River use issues much lower than users; few powerboat guides use this segment.
  - Both types of guides rated visual impact issues slightly higher than users. This may reflect interest in marketing the Kenai's undeveloped setting.
- If one arrays importance scores for any given issue, drift guides are generally highest, followed by drift users, powerboat users, and powerboat guides. A survey of Kodiak Island trail users found a similar pattern regarding motorized/non-motorized issues; motor and non-motor enthusiasts / stakeholders (some of whom were guides) held stronger views than "average users" in their counterpart groups (Whittaker 2004).

8. Responding to Crowding

*This chapter provides information from the **follow-up survey** about how people respond to crowded situations. The questions asked if respondents ever feel crowded on the river, then provided a check list of potential responses for those who had. The question was also asked in the 1992 study. Note: This question refers to crowding in general on users' trips, and is different from the on-site questions that asked about crowding on a specific trip.*

General crowding measure

Figure 8-1 shows the percent that "sometimes feel crowded" vs. those who "never feel crowded" or "enjoy the crowds and social atmosphere." Findings include:

- Almost three-quarters of 2009 users and guides feel crowded some of the time.
- However, percent feeling crowded is lower than in 1992. One possible explanation is that 2009 had lower use levels on the Lower River during kings and on the entire river during the second run of reds. Another explanation is that current users are more tolerant of higher use and impacts that are part of the "new experience" (a so-called "product shift").
- The percentage of uses responding "I enjoy crowds" has tripled since 1992 (from 4% to 13%), additional support for the product shift explanation.
- Differences between groups were generally small. However, fewer non-anglers and more landowners felt crowded, and drift guides were more likely to feel crowded than powerboat guides.

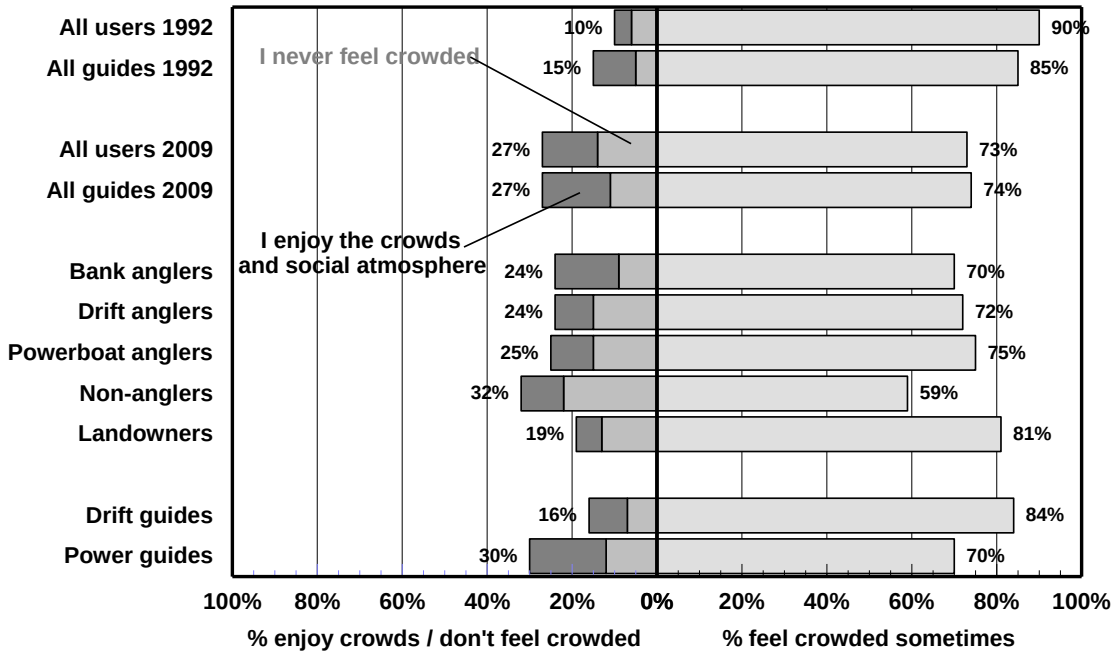


Figure 8-1. Percent of different groups that enjoy crowds, don't feel crowded, and feel crowded sometimes.

Responses to crowding

For those who felt crowded, Figure 8-2 shows user responses to crowding in 1992 and 2009. Findings include:

- The pattern of "coping" responses is similar in both years, indicating some stability in how people react. The most popular ways to deal with crowding are to 1) avoid other users in the same area, 2) plan to take trips mid-week, 3) plan a trip at a different time of day, or 4) plan a trip for a different segment. These responses all redistribute use to lower use times and places, but they also reduce the diversity of experiences in the system (e.g., weekdays start to look more like weekends).
- Higher proportions of 1992 users reported these top responses. Fewer 2009 users report proactively coping with crowding, consistent with the "product shift" hypothesis. Some report becoming more tolerant of the higher use/higher impact situation, while others may have become displaced.
- The proportion who become dissatisfied is similar, but fewer 2009 users report "resigning themselves to a new more crowded experience" (32% to 23%). This runs counter to the "product shift" hypothesis, unless current users don't recognize they have adapted to the higher use/impact situation.
- Nearly one-quarter of current users report taking trips less frequently, a response not offered in 1992. This is an estimate of "partially displaced" users. The study cannot estimate "fully displaced" users because they would not go to the river at all (and can't become part of the sample).
- Taking trips in the off season, using another river, or engaging in another type of recreation are less common responses to crowding.

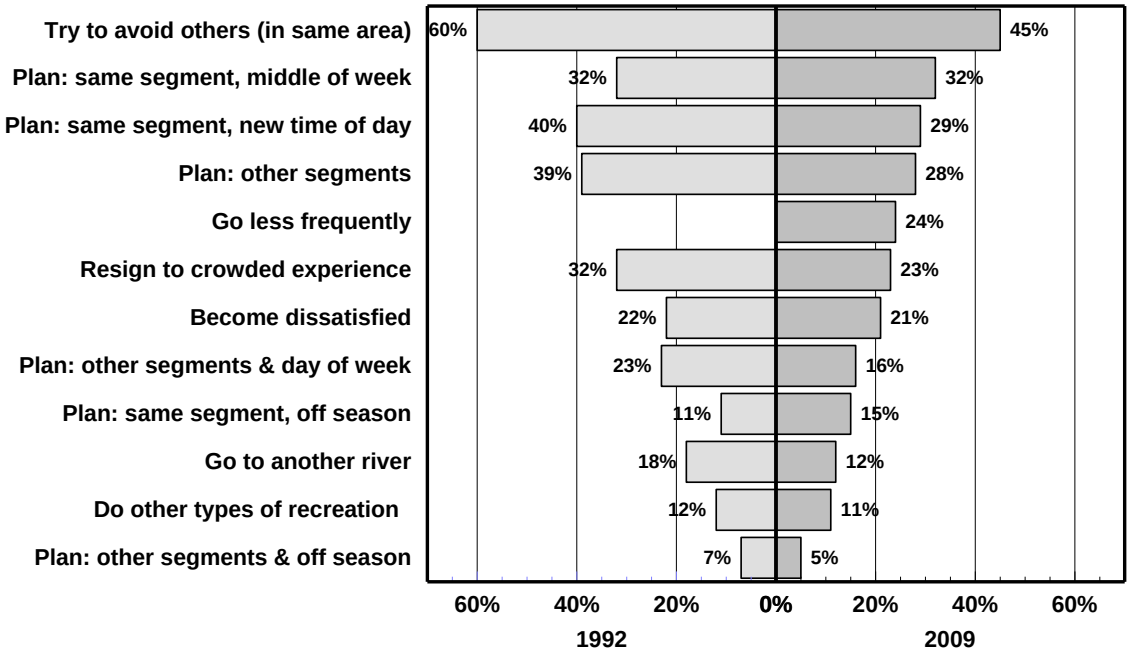


Figure 8-2. Among those who felt crowded, percent checking coping responses (all users).

Table 8-1 provides "responses to crowding" for different user groups. Findings include:

- Powerboat anglers are less likely to avoid others in the same area, supporting the idea (in Chapter 5) that some powerboat anglers may even seek out others (because boat concentrations indicate fishing success).
- Powerboat anglers are much more likely to take trips at a different time of day, a common unguided user strategy on the Lower River during July king season. Guide hours constrain guided users, although they can go later in the day, which tends to have lower use.
- Powerboat anglers are slightly more likely to become resigned to a higher density experience.
- Drift anglers are slightly more likely to go to another river than other anglers (with the drift-only Kasilof listed most often).
- Non-anglers generally engage in fewer coping responses, and lower percentages report feeling crowded; these users appear less sensitive to high use levels.
- Landowners are generally similar to powerboat anglers, but they are less likely to go to another segment (probably because they access the river from their residence).

Table 8-1. Among those who felt crowded, percent checking different coping responses (different groups).

	All users	Bank anglers	Drift anglers	Powerboat anglers	Non-anglers	Land-owners
Try to avoid others (in same area)	45	47	50	40	30	35
Plan: same segment, middle of week	32	33	33	31	20	36
Plan: same segment, new time of day	29	31	24	40	12	41
Plan: other segments	28	29	31	26	22	15
Go less frequently	24	23	27	26	20	43
Resign to crowded experience	23	23	22	27	16	17
Become dissatisfied	21	22	21	23	15	25
Plan: other segments & day of week	16	13	17	20	13	15
Plan: same segment, off season	15	10	23	15	15	19
Go to another river	12	10	17	11	7	5
Do other types of recreation	11	9	11	9	17	16
Plan: other segments & off season	5	4	7	4	4	4

Figure 8-3 provides "responses to crowding" for drift and powerboat guides. Findings include:

- Guides are about twice as likely as users to "resign themselves" to crowded experiences as users (52% vs. 23%). Guides who want to work regularly must take trips even when it's crowded, consistent with a product shift.
- Drift guides reported more coping responses, with large percentages reporting they try to avoid others on the same segment (77%) and become resigned to the new experience (66%). They were also more likely to report dissatisfaction due to crowding (28% vs. 8%). In general, drift guides appear more sensitive to crowding and more likely to actively cope with it.
- Powerboat guides are less likely to avoid others or go to other segments. Their trips are more focused on fishing success for kings and silvers, they target specific times and places, and they are less willing to fish other times and places just to avoid crowding.
- No guides reported willingness to go to another river in response to crowding (not shown).

- Guides in 2009 are less likely to utilize several coping responses compared to 1992. For example, 60% of all guides in 1992 reported avoiding others in the same area compared to 48% in 2009. This is consistent with a product shift.

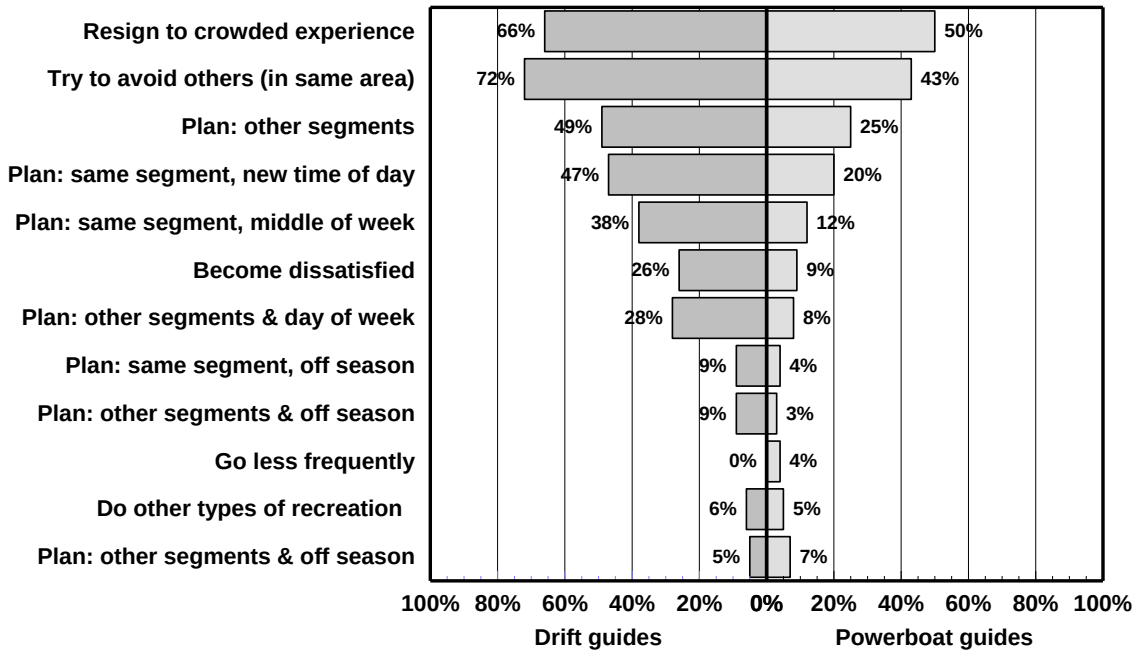


Figure 8-3. Percent of guides checking different responses to crowding (among those who felt crowded).

9. Changing Conditions, Past Use, and Displacement

*This chapter provides information from the **follow-up survey** about how the river may have changed in recent years. The survey asked respondents to rate the overall quality of trips and management, whether they have reduced or stopped use of certain segments and seasons, and why.*

Overall trip quality and management

Figure 9-1 shows reported changes in the quality of trips and agency management over the years (percent "stayed the same" are not shown). Findings include:

- For ***trip quality,*** greater percentages of most groups report decline rather than improvement (often more than twice as many). For landowners, who generally have used the river for more years, the ratio of decline to improvement is 3 to 1. Results suggest that the Kenai's "trip quality reputation" is trending downward.
- Bank anglers are the only group with more respondents reporting improvement than decline. One explanation is that many bank anglers have seen lower use levels during recent red salmon seasons as the personal use fishery has provided an alternative. A second is that the fishing platform system has provided many better places to fish (even though other bank angling areas have been closed).
- Non-anglers were evenly divided, with most reporting quality had "stayed the same" (100 – the sum of improvement + decline).
- For ***quality of agency management,*** most groups reported more improvement than decline. Even though trip quality may be trending downward, many respondents credit agency management for trying to address problems. Non-anglers and bank anglers were most likely to feel this way; expanded facilities (especially boardwalks for bank anglers) and facility improvements are two of several possible explanations.

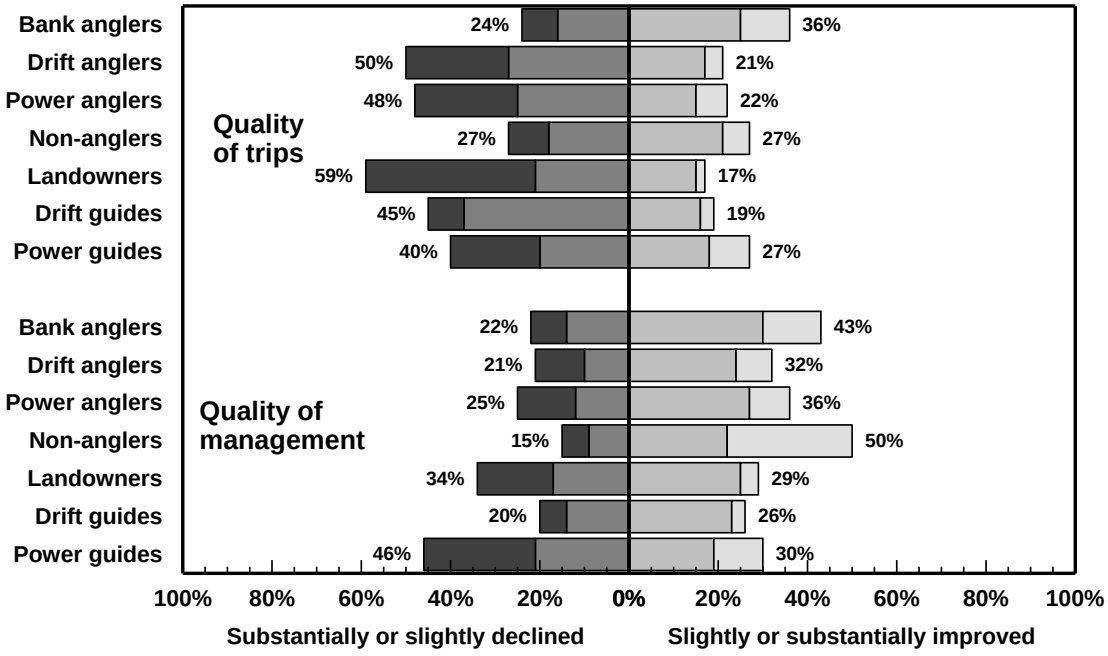


Figure 9-1. Percent reporting improvement or decline in trip and management quality.

- The two groups that showed more management decline than improvement were powerboat guides and landowners, who generally have longer experience on the river. These groups are also more likely to use powerboats on the Lower River for kings, probably the situation with the greatest management challenges (with several crowding and fishery issues).
- As with trip quality, the "quality of management" question was intentionally general; responses could refer to a wide variety of local, state, or federal programs or facilities. Agencies received credit for their efforts despite the challenges of a complex river, but complacency is not warranted because 15 to 40% of different groups still report a decline in management.

Past use and displacement

Respondents were asked if they have reduced or stopped visiting at some times (Figure 9-2 and Table 9-1). The question was also asked in 1992 (but without the "reduced" option). Displacement may technically only apply to users that have completely stopped using a resource, but reported reduced use is a related concept – essentially a kind of "temporary displacement" – and remains a useful indicator of whether users are changing their visitation due to changing conditions. Findings include:

- About one-third of all users have reduced or stopped using segments of the river. Taken together with trip quality findings, substantial numbers of users perceive a downward trend and have adjusted their behavior by "within site" displacement.
- A majority of landowners report displacement, with about half reducing their use and half no longer using some segments. Landowners generally have a longer history by which to evaluate trends. They are also older and more likely to be retired, so they may be more willing to change their use when conditions are less than optimal.
- Guides were slightly less likely to report displacement, which makes sense given their dependency on trips for income.

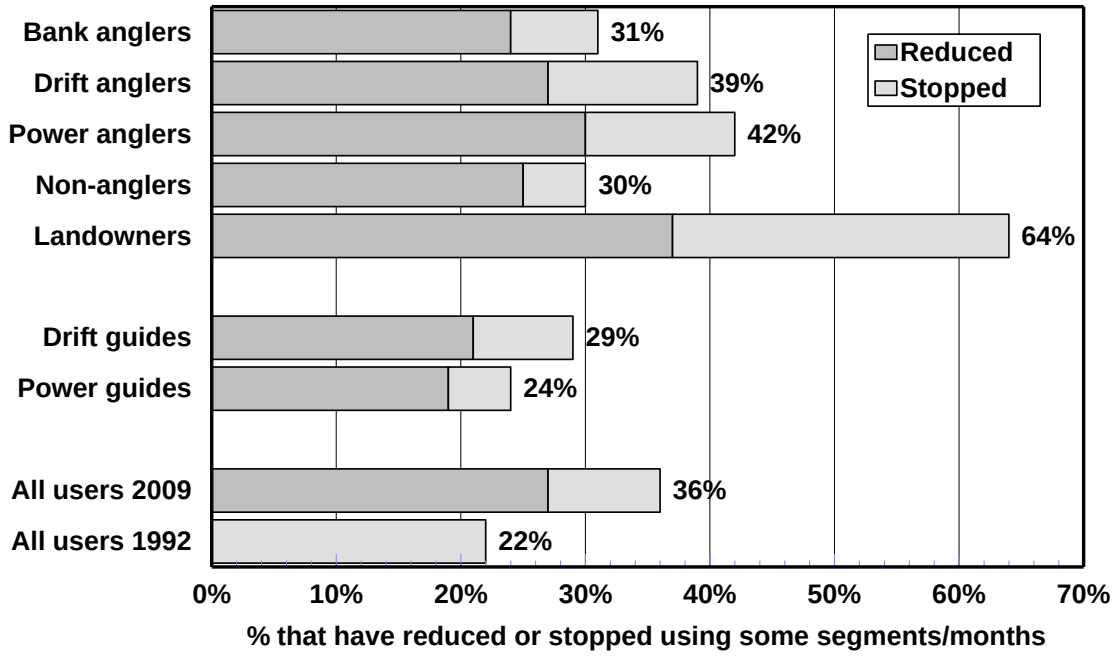


Figure 9-2. Percent of groups who have reduced or stopped visiting segments of the river.

Table 9-1. Percent reporting different reasons for reducing/stopping use on different segments.

	All users	1993	Bank	Drift	Power	Non-anglers	Land-owners	All guides	Drift guides	Power guides
No – same segments and seasons	**64**	78	69	61	57	70	36	**75**	72	76
Yes – reduced some use	**27**	22	24	27	30	25	37	**19**	21	19
Yes – stopped some use	**9**		7	12	12	5	27	**6**	8	5

Respondents who reported reducing or stopping use were asked to check the segments and reasons. The percentages for each segment are given in Table 9-2 (next page), with percentages greater than 20% in bold. Findings include:

- The most important reasons for displacement are crowding-related (e.g., too many people, boats, guide boats, powerboats, or discourteous behavior), although perceived decline in fishing success is also an issue on some segments for some groups.
- In general, the segments with more displacement are the Lower and Upper River. On the lower river the number of people and boats are more often mentioned; on the Upper River the number of people is more frequently mentioned.
- Landowners are much more likely to report many reasons, and most of their displacement has been from the Lower River. Note: Few landowners were from the Upper River.
- Guides were more likely to report displacement from the Lower River, but they cite many of the same crowding-related reasons as users; 28% even cite "too many guide boats."
- Guides were more likely to cite "decline in fishing success" as a reason for displacement (especially on the Lower River where it tied with "too many boats" for the top reason).
- Additional analysis of users reporting displacement suggests that slightly more were drift and powerboat anglers and slightly less were bank anglers.

Respondents were also asked to check the months in which they stopped or reduced their use. The percentages for each segment are given in Table 9-3 (next page), with percentages greater than 20% in bold. Findings include:

- The Lower River in July is the segment / month combination with the highest amount of displacement, although substantial numbers also identified June on the Lower River too.
- Displacement is substantial on the Middle River in July for many users and landowners, but guides were more likely to be displaced from the Middle River in August or September.
- For users, there has been some displacement from the Upper River in June, July, and August. Relatively few guides or landowners report displacement from the Upper River.

Table 9-2. Percent reporting different reasons for reducing/stopping use on different segments.

	Users n=283			Guides n=46			Landowners n=121		
	Lower	Middle	Upper	Lower	Middle	Upper	Lower	Middle	Upper
Too many people	**45**	**33**	**45**	**37**	**24**	15	**62**	**25**	16
Too many boats	**48**	**25**	**23**	**44**	**24**	17	**71**	**23**	7
Too many guide boats	**45**	**25**	**22**	**28**	11	4	**70**	**27**	7
Too many powerboats (any kind)	**40**	**21**	9	**39**	15	4	**55**	18	0
Too much discourteous behavior	**31**	**20**	**21**	**39**	13	2	**55**	17	6
Hard to find parking / camping	**27**	19	**24**	**20**	13	4	**20**	7	6
Decline in fishing success	**24**	17	16	**44**	**28**	7	**23**	12	4
Don't want to contribute to crowding	18	12	13	**22**	4	4	**22**	4	4
My partners consider it too crowded	18	12	16	--	--	--	18	5	7
Boating became unsafe	16	7	3	**33**	7	0	**37**	7	2
Too many unguided boats	15	11	11	**28**	15	15	**20**	5	4
Changes in motor regulations	12	7	1	0	0	0	12	14	3
Prefer fishing in other locations	9	6	7	**20**	13	4	8	3	1
Changes in fishing regulations	7	9	6	15	15	2	7	12	2
Now I fish from a boat	6	7	5	--	--	--	5	2	0
Fish w/ others who go to dif. Segs.	5	5	4	--	--	--	3	3	1
I no longer use a boat	2	<1	1	--	--	--	7	2	0

Percentages higher than 20% in **bold**.

Table 9-3. Percent reporting different months when they reduced/stopped use on different segments.

	Users n=283			Guides n=46			Landowners n=121		
	Lower	Middle	Upper	Lower	Middle	Upper	Lower	Middle	Upper
June	**22**	16	**24**	**24**	17	9	**33**	8	6
July	**53**	**33**	**33**	**59**	17	11	**78**	**28**	11
August	15	19	**21**	9	**33**	13	**20**	13	13
September	7	10	10	9	**22**	9	11	12	9

10. General Management Strategies

*This chapter provides information from the **follow-up survey** about general management strategies that might be used to address use and visitor impacts on the Kenai. Respondents were asked about 11 potential strategies (listed below), on a 5-point scale from "strongly support" to "strongly oppose," with "neutral" and "don't know" options.*

- Develop new facilities (such as launches, day use areas, and campgrounds) to handle the volume of use.
- Expand or improve existing facilities to handle the volume of use.
- Develop more access to less-used sections of river to help redistribute use.
- Harden high use areas (with boardwalks, stairs, or gravel/paved trails) to reduce impacts from use.
- Boater safety education programs.
- "Etiquette" education to address social impacts.
- Regulations to improve boating safety (such as no wake zones, speed limits in "thru lanes").
- "Leave no trace" education to address biophysical impacts (such as human waste, fire rings, vegetation loss).
- Regulations to address biophysical impacts (such as human waste, fire rings, vegetation loss).
- Limit use through permit / reservation systems.
- Zoning regulations to separate conflicting users (boat vs. bank anglers, motorized vs. non-motorized).

User opinions toward general management strategies

Figure 10-1 shows results for all users, ordered by average scores. Findings include:

- There is majority support for all but two general strategies, suggesting broad interest in a diverse set of management approaches.
- The strongest support was for education approaches and strategies that address biophysical impact issues. It is common to find greater support for "soft" education compared to "hard" regulation approaches to environmental problems, particularly in recreation settings. The greater interest in

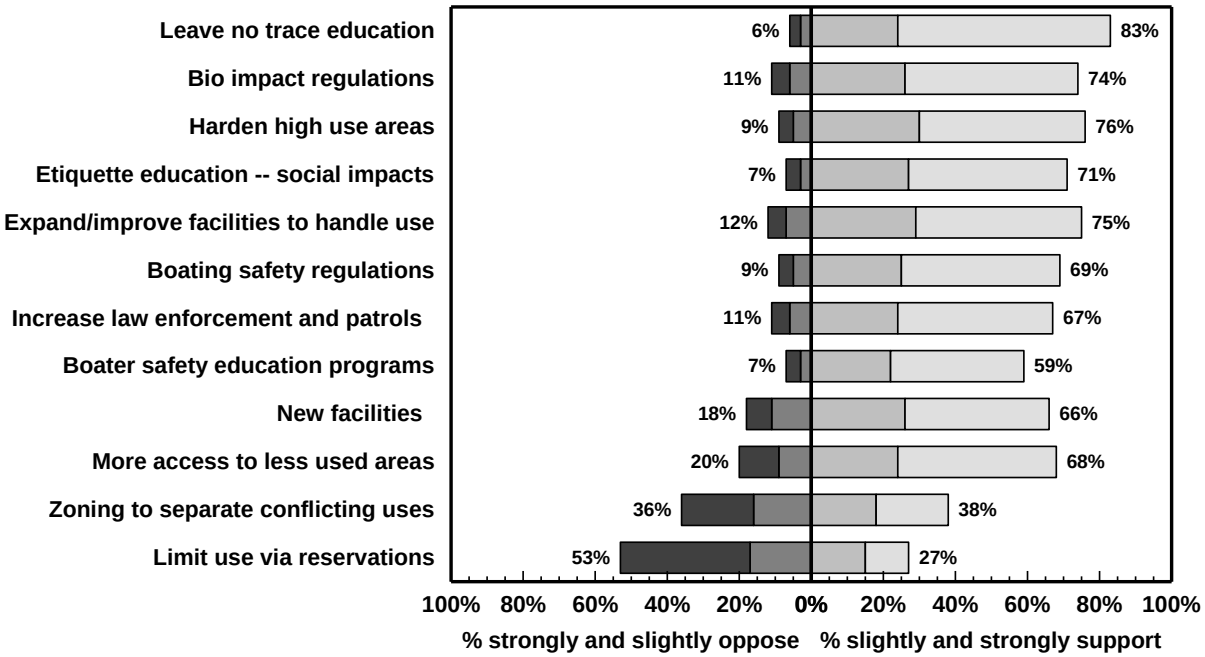


Figure 10-1. Percent support or oppose general management strategies for all users.

addressing biophysical impacts fits with issue priorities presented in Chapter 7.

- Slightly smaller proportions of users had opinions about education/regulation strategies for addressing boating safety, which makes sense because many bank anglers may not care about this issue.
- Among the "majority support" strategies, the only two with substantial (18 to 20%) opposition were new facilities or new access to less used areas. These respondents may be concerned that such development will attract greater use and exacerbate existing problems.
- Users were divided over use of zoning regulations to separate conflicting uses, and a majority opposed limiting use through permits or reservation systems.

Differences between user groups

The three angling groups were compared by average scores. Important differences are described below; specific results are provided in the supplement:

- Powerboat anglers showed less support for boating safety and zoning regulations, either of which could change how powerboat anglers currently use the river. For safety regulations, 50% support and 18% oppose the strategy, and for zoning regulations, 51% oppose and 21% support.
- Powerboat anglers were less supportive of "minimum impact" education to address biophysical impacts, but still showed majority support.
- Drift anglers were less supportive for developing new facilities, developing access to less-used areas, hardening high use areas, and expanding/improving facilities to handle the volume of use (although there was still majority support). Concern probably focuses on their potential to attract more use or provide bank angler access to areas that are currently accessible primarily by boats.
- Drift anglers were slightly more supportive of use limits, but still showed more opposition than support.

Landowner opinions toward general strategies

Landowners were similar to users for most strategies, showing majority support for most strategies and majority opposition toward use limits. However, there were some differences worth noting (see supplement):

- Landowners showed more opposition (44%) for zoning regulations than drift anglers (31%). This fits with the high proportion of landowners who use powerboats, although landowners showed less opposition than powerboat users (79% opposed).
- Landowners were similar to drift anglers (and different from other groups) in showing less support for new facilities and developing access to less-used places on the river. This is consistent with the "last settler" hypothesis (Neilson, Shelby & Haas, 1977), where current users oppose additional development that may attract more use ("close the door after I get settled").

Guide opinions toward general management strategies

Guide opinions were often similar to users in showing majority support for a broad array of strategies; drift and powerboat guides were also similar to their counterpart user groups (drift and powerboat anglers) when there were differences between those groups. In a few cases guides showed notably stronger support (or opposition) than users, as shown in Figure 10-2. The supplement provides further details about guide opinions. Findings include:

- Drift and powerboat guides were much more supportive of boater education programs than users. Guides currently have to complete a week long guide course to work on the river, while there are no boater education requirements for users (although State Parks offers free one-day boater education courses).
- Drift guides were more supportive of boater safety regulations than drift anglers, who in turn were more supportive than powerboat anglers (although all showed majority support). Powerboat guides were divided over the need for boater safety regulation.
- Drift guides showed majority support for zoning (which might include additional drift only zones or times), while drift anglers showed more support than opposition. In contrast, 79% of powerboat guides were opposed to this idea, while only 51% of powerboat anglers reported the same.
- Drift guides were the only group to show majority support for limiting use through permits or reservations. The only users on the river that already have use limits are Upper River guides (the number of guides and "starts" per week is limited by the USUSFWS from the Russian River to Skilak). Some of these limit-supporting guides may appreciate the ability of this approach to minimize impacts, but some also want limits applied to all groups (not just themselves).

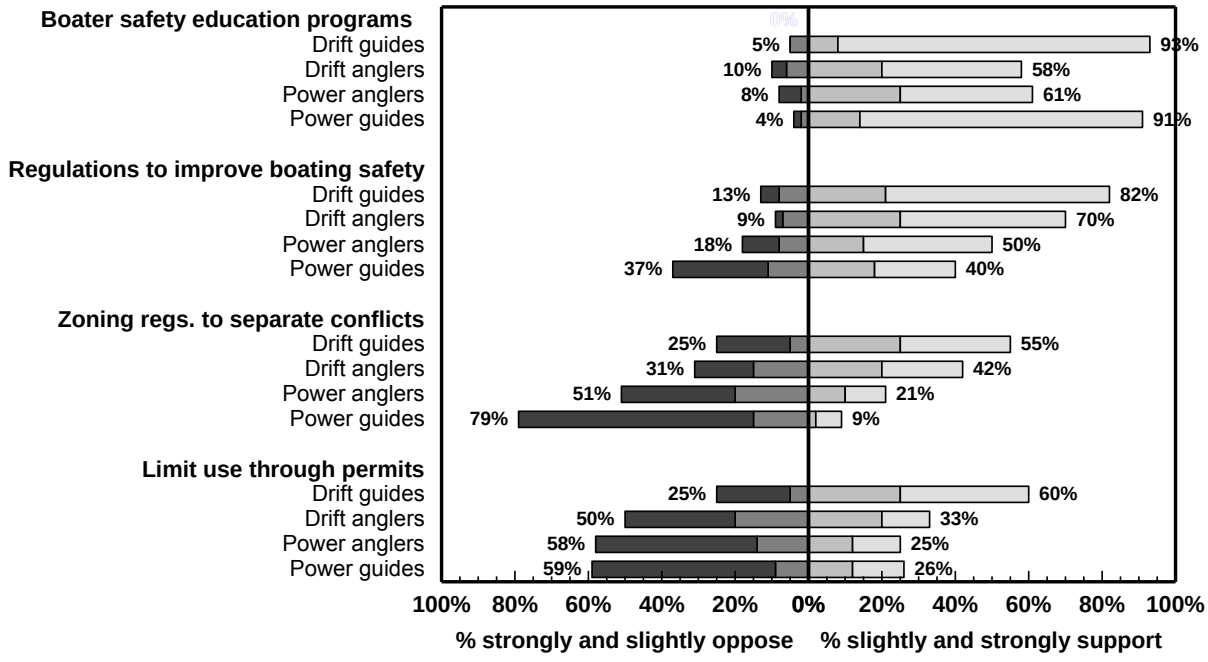


Figure 10-2. Percent support for selected general strategies among different groups.

11. Recreation Facility Development & Maintenance Actions

*This chapter provides information from the **follow-up survey** about specific development and maintenance actions that might be used to address use and visitor impacts. Respondents were asked about 8 actions for the entire river, six for the Lower River, four for the Middle River, and three for the Upper River. Responses were given on a 5-point scale from "strongly support" to "strongly oppose," with a "neutral" option. The specific actions are listed below:*

For the entire river…

- Increase patrols and litter pick-up at public easements
- More restrooms in high use bank angler areas
- More vegetation restoration in areas where there has been bank trampling
- Develop fishing platforms in some areas closed to bank fishing (to re-open parts of them)
- More fish cleaning stations in general
- More fencing / signs to direct users to bank areas that can withstand the use
- More fishing platforms / stairs to protect banks at public easements (informal access areas)
- Manage fish carcasses to reduce bear attractants

Lower River

- New launch in Cunningham Park (mile 6)
- New launch near the Pastures (mile 7 to 8)
- Expand parking and docks at Pillars (mile 12.5)
- New launch at Ciechanski (mile 15)
- Improve restrooms and access across tidal mud at Cunningham Park (mile 6)
- New boat-accessible restrooms near Mud Is. / Beaver Creek (mile 10)

Middle River

- New launch on Funny River Road across from Morgan's (mile 31)
- Expand docks at Bing's Landing
- New boat-accessible restrooms near Killey River outlet
- New boat-accessible restrooms near Skilak Lake outlet

Upper River

- Organize the "spider web of trails" at popular bank fishing areas into a smaller number of formal trails
- Improved road maintenance on Skilak Lake Road
- Explore alternative ways to manage carcasses and other bear attractants in the Russian River area

Development actions for the entire river

Figure 11-1 shows support and opposition for development actions for the entire river. More detailed information for specific groups is provided in the supplemental report. Findings include:

- There is majority support and little opposition for nearly all of these actions. There is a clear consensus among most Kenai users patrol and pick-up programs; managing bank use and providing fishing platforms to prevent trampling; efforts to restore trampled areas; or providing more facilities such as boast-accessible restrooms and fish cleaning stations.
- Results are consistent with issue priorities (Chapter 7) regarding biophysical impacts and handling the volume of use.
- Differences between user groups were statistically significant for six of the eight actions, but never substantively large. The largest differences were between bank and drift anglers on adding fishing platforms, reopening closed areas, and fish cleaning stations. Bank anglers were more supportive; drift angler support was less enthusiastic, perhaps because it might increase use in areas that drift anglers currently use but bank anglers do not.
- Landowners showed slightly more support for rest rooms and vegetation restoration, perhaps because those actions might reduce trespass problems.
- Guides showed less support for managing carcasses, fishing platforms, and fencing to direct bank angling use, but more support for additional restrooms. Drift guides showed more support for patrols (the only significant difference with powerboat guides).

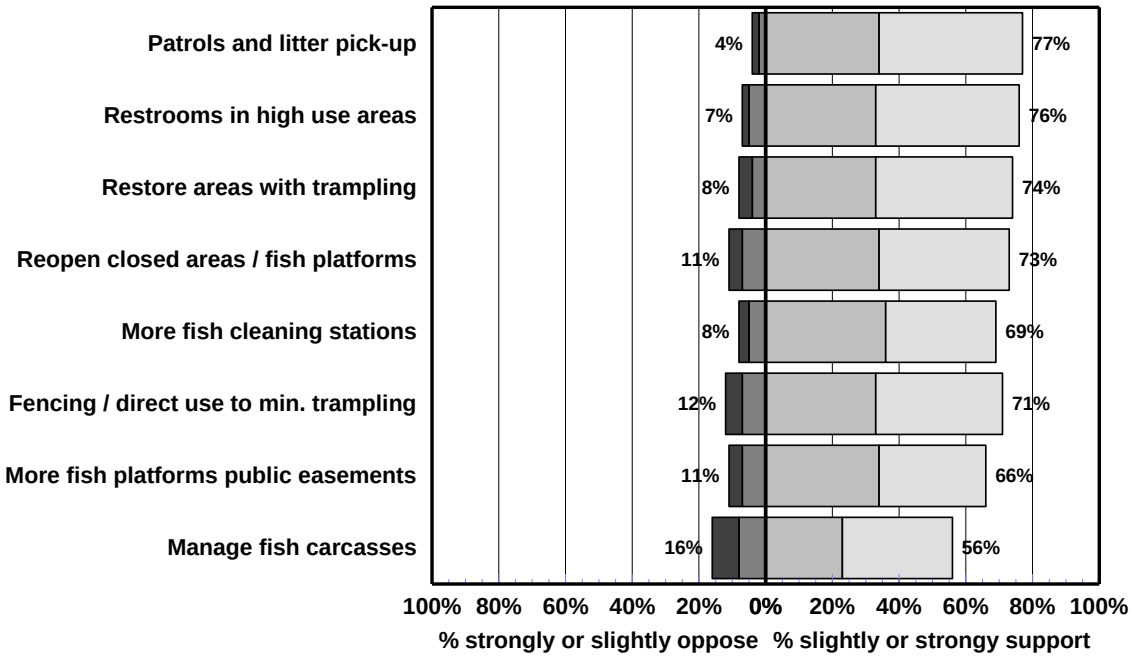


Figure 11-1. Percent support toward river-wide development actions for all users.

Development actions on specific segments

Figure 11-2 shows support for development actions for specific segments. More detailed information for specific groups is in the supplemental report. Findings include:

- There is majority support and little opposition for all of these actions.
- For the Lower River, there were few statistically significant differences between groups. Powerboat anglers were slightly more supportive of Pillars expansion and a new launch at Cunningham, while bank anglers were slightly less supportive of any launch improvement and more supportive of Cunningham access and restrooms.
- For the Middle River, there were no significant differences between groups.
- For the Upper River, there was slightly greater support for Skilak Lake Road improvements compared to other actions, but no substantive differences between groups.
- There was less support for exploring ways to manage salmon carcasses on the Upper River than for fish cleaning stations in general (an action in the list for the entire river). This may indicate greater support for more cleaning facilities than other carcass management actions.
- A majority of guides supported all of these actions, but they sometimes showed statistically significant differences from users. Guides were more supportive of three specific actions on the Lower River: Cunningham access and boat-accessible restroom improvements, Pillars expansion, and a new launch at Cunningham. They were less supportive of a new launch on Funny River Road or boat-accessible restrooms near the outlet of Skilak Lake. Drift guides showed less support than powerboat guides for Bing's Landing improvements.

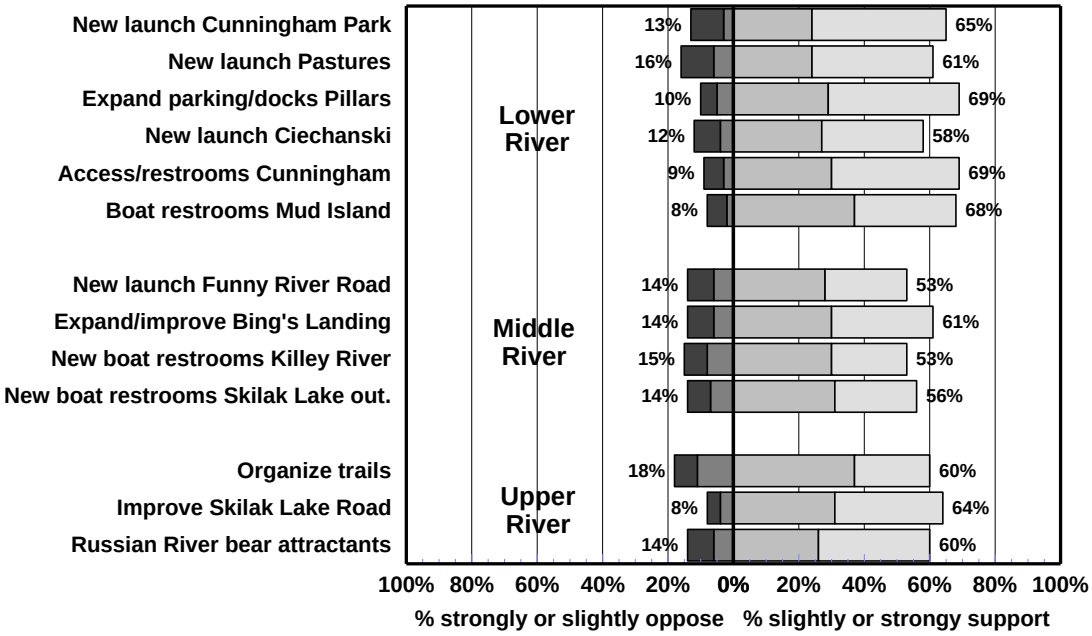


Figure 11-2. Percent support for development actions on specific segments for all users.

Integrating development findings

With extensive support for development options, it may be challenging to decide which deserve priority. Development actions can help reduce human impacts to biophysical resources; provide convenient easy access to bank fishing locations; accommodate the sheer volume of use, and reduce congestion at other facilities; or may help redistribute use to reduce on-river crowding. In sorting through development options, agencies should probably consider the following:

- Will development accommodate existing use or attract even higher use? On-site survey data (Chapter 6) showed higher crowding scores while fishing than at launches, parking lots, or other facilities. Development may reduce congestion at facilities, but exacerbate on-river crowding.

- With this in mind, development that narrowly targets specific impact problems in specific geographic locations probably makes the most sense. For example, boat-accessible restrooms downstream of Pillars (e.g., Beaver Creek/Mud Island, Pastures, or improvements at Cunningham) would primarily reduce boat traffic (and associated wake-caused turbidity) between downstream fishing water and the public facilities at Pillars and decrease mid-morning dock congestion at Pillars. Well-situated restrooms may also reduce "user-created" toilets in the alders. With Lower River peak use reaching as high as 400 to 500 boats (multiplied by 3 to 5 people per boat), the existing boat-accessible toilets at Pillars and Cunningham (difficult to access during low tides) are probably not handling the demand.

- For powerboat use, new launches or improved parking at existing launches present difficult choices. These may relieve congestion at existing launches, provide greater convenience, or reduce private launch fees. But if this simply adds more boats without redistributing them, crowding and impacts will worsen. A new launch in the lower part of the Lower River might reduce "back and forth" traffic (and resulting crowding), depending on whether users choose launches based on fees, proximity to their residence, or proximity to fishing grounds. Agencies should also note that the number of boats launching from private docks is likely to increase regardless of public launch development (as more lots develop docks).

- For drift boat use, launch development presents a different set of issues. Unlike powerboats, drift craft go in one direction, and launches need to be appropriately spaced to provide a diversity of trips. If additional "drift-only fishing days" on the Lower or Middle River are contemplated (see Chapter 13), developing more drift access points will be critical to even distributions of use that avoid "bottlenecks" at the few existing take-outs. There is a shortage of good driftboat access below Eagle Rock, which is particularly problematic when opposing winds and tides are strong.

- Development actions at launches for the Upper River (potentially at Sportsman's, Jim's or Upper Skilak) were not specifically addressed in the survey (these are not State Park facilities). However, some open-ended comments encouraged these improvements, and based on support for other launch development, we speculate they would have attracted majority support too. The Upper River survey technician, who spent considerable time at Jim's Landing, informally collected improvement suggestions in another section of the supplemental report.

- Development that "organizes" user-created trails or provides additional light-penetrating boardwalks to prevent tramping of riparian vegetation is more straight-forward. Several agencies and non-profits have supported these actions since the early 1990s, and data indicate users continue to appreciate the benefits and support them.

- Aside from biological benefits aspects, there are some trade-offs from hardening trails or banks. Additional development decreases primitiveness and visual quality of the natural setting. Most of the Kenai is not "wilderness-like" and has extensive development, but parts of the river (particularly federal lands on the Upper and Middle River) are relatively undeveloped. Additional information on visual impacts of docks, platforms, and other development is provided in Chapter 16.

- "Carcass management" and its effect on human-bear interactions is another complex topic that requires both biological and social information. The large number of carcasses at popular fishing areas (especially the Russian River confluence during red runs) is a recognized problem; two questions asked about "managing fish carcasses to reduce bear attractants," and "more fish cleaning tables" on the entire river, while another asked about "exploring alternative ways to manage carcasses" on the Upper River. In all cases, support was strong among all groups.

  Without responses to more detailed questions,[1] it is challenging to interpret support as a mandate for specific actions. Fish cleaning stations might be received differently by their size and frequency, whether they have carcass "grinders" or other removal system, and whether they include buildings to reduce odors and keep bears out. Other bear-carcass management choices could range from regulations that require fish to be carried out whole to changing bear behavior through substantial aversive conditioning. Support is likely to vary for each.

  Each carcass management strategy is also likely to have varying biological consequences and degrees of effectiveness, with no single approach likely to work on its own. Ultimately, reducing carcass concentrations that attract bears may require a mix of facility, education, and regulation actions. To be effective, agencies will probably need to 1) settle on what they want users to do (which may vary for different locations on the Russian and the Kenai); 2) develop a clear education program that encourages this behavior (and be prepared to back it up with regulations); and 3) and develop appropriate facilities that cue and enable the appropriate behavior(s). In an ideal world, agencies could experiment with different mixes of education and facilities to see which is most effective, but they may not have the luxury of time and resources to conduct such systematic assessments.

  In the meantime, continued monitoring of human-bear interactions and carcass concentrations may help identify problems and suggest ways to address them. In conjunction with planning for this study, the Forest Service developed a more systematic human-bear interaction monitoring program in 2009, which is set to be continued in 2010. Excerpts from the Forest Service monitoring report are provided in the supplemental report for comprehensiveness. The supplement also includes users' open-ended comments on bear and carcass issues, which may help agencies gauge the range of opinion on this contentious issue.

- All development involves capital investments as well as staff, equipment, and budgets to maintain them. All development may also have technical design challenges or biological and cultural resource impacts.

- There appears to be stronger public support for improving and maintaining existing facilities before building new ones.

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[1] During planning for the present survey, agencies elected not to pursue questions about more specific development, education, or regulation actions because this issue really needs a separate study.

12. Education and Regulation Actions

*This chapter provides information from the **follow-up survey** about specific education and regulation actions that might be used to address use and visitor impacts. Respondents were asked about seven actions for the entire river, three for the Lower River, three for the Middle River, and one for the Upper River. Responses were on a 5-point scale from "strongly support" to "strongly oppose," with a "neutral" option. The specific actions are listed below:*

For the entire river
- Clarify and strictly enforce "no anchoring in channel" regulations (particularly in silver season)
- Create brochures and internet media showing how to boat and fish during high density periods
- Offer a one day course about how to operate powerboats during high density periods
- Require a "Kenai boating license" for powerboat operators (includes a written test)
- Require all boaters to wear PFDs (life jackets)
- Close more areas to bank fishing where existing use is trampling vegetation
- Restrictions on number of fish allowed to be cleaned when others are waiting

Lower river
- No wake zones in high density areas such as Beaver Creek, Chicago, Big Eddy, or Pillars
- Regulations to maintain an open "driving lane" (for boats on step) through some of these same areas
- Stagger guided start times in July to reduce launch congestion

Middle river
- No wake zones in high density areas such as Swiftwater, Dot's Landing, or "3rd Hole" near Killey River
- Regulations that maintain an open "driving lane" (for boats on step) through some of these same areas
- Restrict drift boats from traveling upstream using kickers (to minimize large wakes)

Upper river
- Develop fire education / enforcement program in Russian River area

Education / regulation actions for the entire river

Figure 12-1 shows support for all users taken together. Information for specific groups is in Figure 12-2 and the supplemental report. Findings include:

- There is majority support but some opposition for most actions.
- There was generally more support for education efforts to improve boating skills / knowledge than for regulations requiring a "Kenai River boating license" or wearing PFDs.
- Users showed majority support for closing more areas to bank fishing to reduce trampling, although bank anglers themselves were divided (42% support, 38% oppose). About 26 miles of Kenai shoreline has already been restricted, and results suggest users (particularly boaters) may accept further restrictions if needed.
- Landowners were similar more likely to support closing more bank angling areas to prevent trampling. This result may reflect concern about bank anglers trespassing on private property.

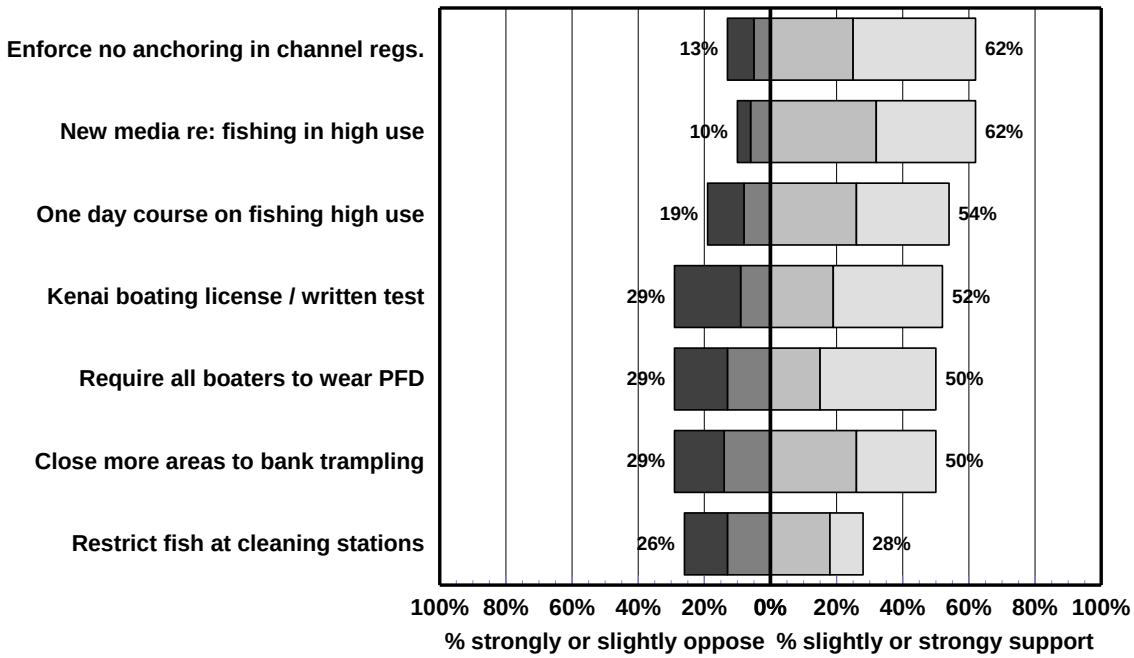

Figure 12-1. Percent support for education/regulation actions for the entire river for all users.

Figure 12-2 shows differences between user, guide, and landowner groups for three actions where differences were substantive. Findings include:

- Guides strongly support (83%) a ***one day course*** on how to boat in high use situations, along with 55 to 62% of drift and bank anglers, but powerboat anglers and landowners were more divided. State Parks currently offers a free one day course on boating in Alaska, but it is not specific to the Kenai or high use periods, and attendance does not approach the number of boaters who fish the river.
- Guides, drift anglers, and bank anglers show majority support for requiring boaters to ***obtain a Kenai boater license*** that includes a written test, but this has more opposition than support among powerboaters and landowners (the user groups most likely to be affected). The KRSMA River Use Committee has discussed several existing internet-based courses (with tests) that might be used to improve boater education, encouraging voluntary participation. Guides are required to take a week-long course to guide the river; they probably think it's a good idea for non-guided users to obtain some similar training.
- Majorities of bank anglers, drift anglers, and drift guides support a requirement that boaters wear PFDs while on the river, while powerboat anglers and powerboat guides are opposed. This result reflects two distinct boating cultures. Many drift anglers regularly wear PFDs while powerboat anglers on the Kenai rarely wear PFDs. The strength of powerboat guide opposition anticipates their resistance to this potential regulation. The survey did not explore potential explanations for resistance to wearing PFDs among powerboaters, but this is a major focus of State Park's boating safety program (see http://pledgetolive.org/). Drowning is the second leading cause of accidental death in Alaska, and it has the higher per capita drowning rate in the country. Nearly 3 out of 4 boating fatalities are due to boaters being immersed in cold water without wearing a life jacket. More in depth questions about PFSD use (or non-use) was beyond the scope of this study.

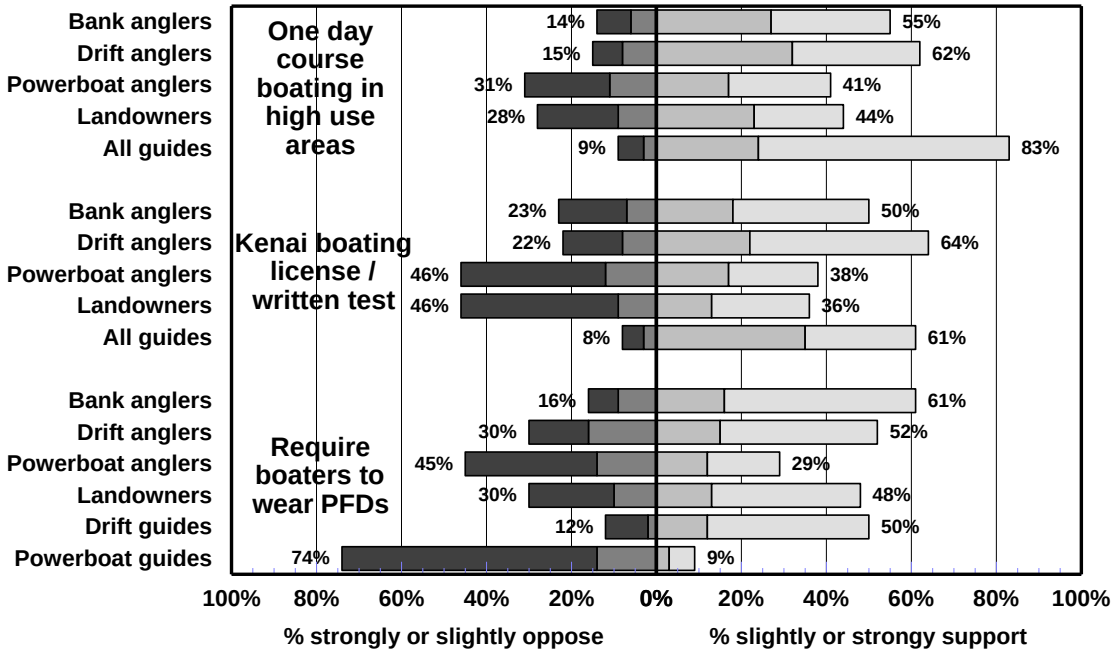

Figure 12-2. Percent support for three specific education/regulation actions among different groups.

Education / regulation actions for different segments

Figure 12-3 shows support for specific education / regulation actions on different segments. Information for specific user groups is given below or in the supplemental report. Findings include:

- There is majority support for boating safety regulations such as no wake zones or driving lanes on the Lower River; on the Middle River there is majority support for no wake zones, but less support for driving lanes.
- There were significant differences among groups for no wake zones and driving lanes. For example, 54% of Lower River powerboat anglers supported no wake zones compared to more than 75% for bank and drift anglers. There were similar differences for no wake zones on the Middle River.
- There are striking differences between drift and powerboat guides for no wake and driving lane actions. For example, 85% of drift guides support no wake zones compared with only 28% of powerboat guides.
- There is overall majority support for staggered guided start times in July, but there are statistically significant differences between unguided and guided users (60% vs. 48% support). Guides were also opposed to staggered guide hours (63% of drift guides and 82% of powerboat guides). Perceptions about the importance of "being first" at a hole (discussed in Chapter 5) probably drive this result.
- There is majority support for fire education on the Upper River, and unsurprising result given its broad topic. USFS and StreamWatch volunteers report that small campfires are common in the Russian River area despite potential fire dangers. This question was designed to ascertain public support for more intensive fire education efforts to reduce these.

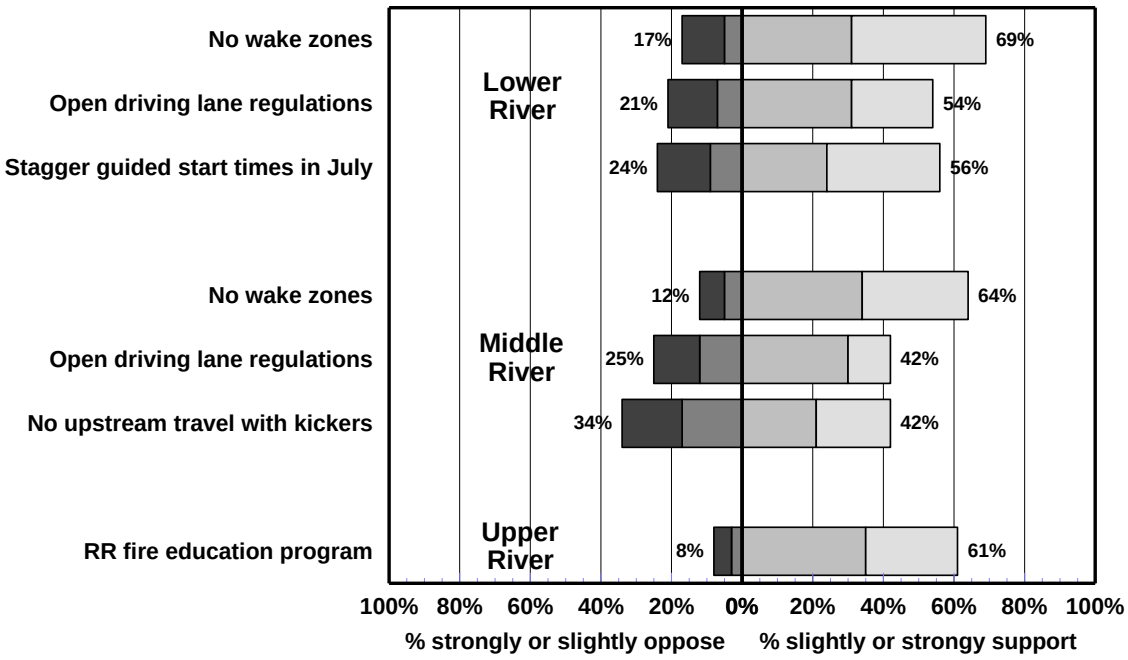

Figure 12-3. Percent support or oppose segment-specific education/regulation actions.

Integrating education and regulation actions

Additional considerations when assessing education or regulation options include:

- Education actions are a "cognitive fix" approach, where agencies use information to modify user behavior that may be causing unacceptable biophysical or social impacts. Managers and the public sometimes view education as panacea (Roggenbuck, 1992) that is less intrusive than regulations, but both may be helpful in different situations.

  Education actions in river settings focus on minimum impact practices (e.g., no trace camping, human waste disposal); resource competition ethics (e.g., codes of behavior in "combat fishing" settings); angling ethics (e.g., catch and release of non-anadramous species); and safety (e.g., powerboat "rules of the road" education). Attempts to establish "informal norms" for these behaviors are evident in agency literature, information boards, and the popular media. These efforts probably expose most users to the appropriate information, but their influence on behavior is less clear. Persuasion research indicates that using messages to change both attitudes and behavior over the long term can be complex and challenging, and many user practices are learned from peers and relatives rather than agency communications (Manfredo, 1992).

- Regulatory actions focus on changing behavior, but don't rely on changing their attitudes first. Regulations are "formal norms" enforced through **"**external sanctions," and they become necessary when educational alternatives fall short. Educational and regulatory approaches are often complementary rather than "either-or" alternatives (Lucas, 1982). Many regulations reinforce initial educational efforts and encourage users to "self-enforce," and regulations need to be widely known to be effective. In many cases, regulations raising awareness about problem behaviors (and the impacts they cause) is more important than actual enforcement (which may be challenging).

- Applying these concepts to a longstanding issue on the Lower River may help illustrate. When congestion increases, the slower-moving techniques (back trolling or back bouncing) prevent drifters from using the same water (and vice-versa). Anglers interested in ensuring that "traditional" drifts remain available have requested educational efforts to identify boundaries for their activity. Without judging the desirability of this goal, the open question is whether education can work or more formal regulations are necessary. We believe education can be effective, but it probably requires substantial effort.

  First, consensus opinion leaders such as guides and well-known unguided users need to support the concept and help identify the specific reach boundaries. Second, the zone(s) need to be identified on-site and on maps, brochures, and launch kiosks to tell a consistent story about when and where the "technique restriction" applies. This message needs to appear through other "channels" including popular media, web forums, tackle shops, and agency materials. Third, the message needs to be accompanied by a simple explanation of why separate zones are important and "fair." Because, particular techniques tend to be lost in higher densities unless everyone "goes along," zones need to be crafted with as sense of equity, considering relative proportions of anglers using different techniques.

  Finally, agencies and on-river opinion leaders need to support "norm development" through positive and negative sanctions. Agency "enforcement" that teaches "violators" why they should respect techniques of fellow anglers is likely to be as effective as "law enforcement." An "internalized" norm

with self-enforcement is the ultimate goal, particularly because extensive ranger enforcement is too costly.

The education model breaks down if a group of users doesn't go along with the behavior (e.g., they want to back troll in the traditional drift area, regardless of the use level or how many others are inconvenienced). In this case, the offending behavior is "willfully depreciative;" regulations followed up with enforcement are probably necessary (Roggenbuck, 1992).

In our experience, few recreation users fit in the "willfully depreciative" category, and well developed norms can be effective. For example, educational efforts on Oregon's North Umpqua River have successfully implemented no boating zones and times (to prevent conflicts between scenic rafters and wading anglers) during the peak steelhead season. Signs and brochures strongly recommend "no boating" in these zones and times, no regulation was needed, and compliance is near total.

13. "Drift-only" issues

*This chapter provides information from the **follow-up survey** about "drift-only" issues on the Lower and Middle River. The survey briefly described the current situation:*

> *Mondays in May, June, and July are "drift-only days" on the Lower and Middle River (from River Mile 4 to Skilak Lake). On these days, fishing from a motorized boat is not allowed (and guides are also not allowed). Some people have suggested adding more "drift-only days" on these segments, but with drift guiding allowed. Please tell us whether you support or oppose the following "drift-only" actions.*

Follow-up questions asked about general support for additional drift-only days (and how many), and preferred days and months.

General support / opposition for "drift-only" days

Two separate questions asked respondents whether "in general, more 'drift-only' days should be added" to the Lower River and Middle River. A third question asked, "If drift only days are added, they should be on different days on the two segments (so there will always be one segment available for powerboats)." Responses were given on a 5-point scale from "strongly support" to "strongly oppose" with a "neutral" option (see Figure 13-1).[2]

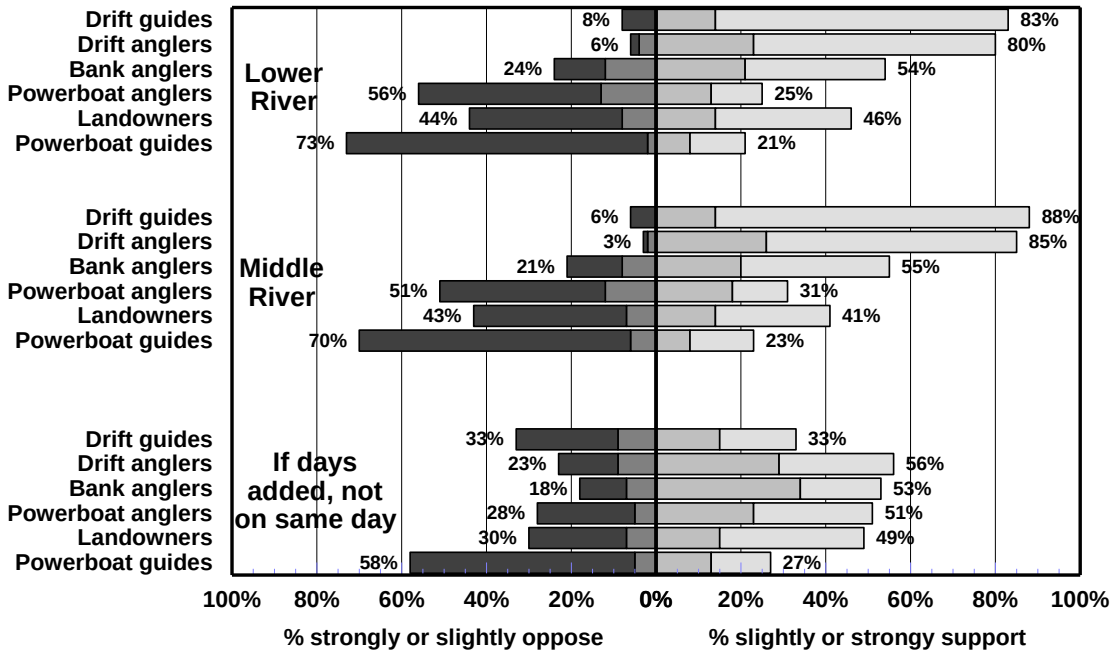

Figure 13-1. Percent support or oppose "drift-only" days on different segments for different groups.

[2] Respondents uninterested in these segments or the issue could skip them; among users, 51% of landowners, 50% of drift anglers, 44% of powerboat anglers, and 32% of bank anglers answered them. Among guides, 88% of drift guides and 78% of powerboat guides answered them.

Findings include:

- In general, results show a typical user conflict pattern: most non-motorized users support more drift-only days and most motorized users oppose them, with drift guides the most supportive and powerboat guides the most opposed.
- The pattern of responses across groups is similar for both segments. This suggests strongly held attitudes rather than segment characteristics.
- Landowners are generally divided. Many use powerboats as their primary craft, but they also live on the river and might benefit from more days with less powerboat traffic (e.g., reduced bank erosion and noise).
- For the "alternating drift-only days by segments" option, polarization is reduced and some groups shift opinions. Drift guides shift from majority support to divided, a majority of powerboat anglers join drift and bank anglers in support, and powerboat guides reduce their opposition. This suggests some "compromise" zoning options may gain greater acceptance, particularly if there are substitutes for those displaced by a drift-only regulation.
- Nonetheless, the intensity of some verbatim comments (see supplemental report) suggests that even compromise options will be strongly opposed by some users on each "side" of this debate.

How many additional "drift only" days?

Among those who support more "drift only" days, respondents were asked to specify the number of days that should be added. Findings follow the polarized general attitudes discussed above. Among the few supportive powerboat anglers, 72% recommended adding just one day. Among drift anglers, 17% want every day to be drift-only, 30% prefer three, four, or five more, and 53% recommend one or two. Among other groups, 61% of bank anglers, 71% of landowners, 52% of driftboat guides and 72% of powerboat guides prefer one or two additional days. If compromise alternatives are developed, these data suggest focusing on one or two additional drift-only days.

Preferences for days of the week

Among those who support more "drift only" days, respondents were asked to specify days of the week. Responses varied widely. Slightly higher percentages of drift anglers prefer Wednesdays, Fridays, or Sundays, while the few of the supportive powerboat anglers leaned toward Thursdays. Drift boat guides slightly favored Sundays (a day they currently cannot fish on the Lower and Middle River before August). If compromise drift-only proposals are developed, survey data offer no clear guidance about days of the week.

Preferences for months

Among those who support more "drift only" days, respondents were asked to specify months. More drift users and guides prefer July and August, while powerboat anglers and guides prefer June and July. Among all groups, there is less interest in September or May (when use levels are likely low enough that it doesn't matter). If compromise drift only alternatives are developed, these data suggest focusing on mid-summer (particularly July).

Prospective use of "drift only" days by guides

Guides were asked, "If additional 'drift only' days are added, would you offer guided drift fishing or sightseeing trips on those days (assume guides would be allowed to operate)?" Responses (Figure 13-2) show 94% of drift guides and 65% of powerboat guides said "yes." Results may broadly characterize guide intentions, but intentions are not always highly correlated with actual behavior (Fishbein & Azjen, 1975), and several assumptions may underlie those intentions.

However, if one accepts these "intentions to participate" at face value, they suggest potential guided use on additional drift only days. By rough calculation, if current peak July powerboat guide use on the Lower River ranges from 150 to 200 boats, the number of guided drift boats on drift only days might range as high as 100 to 130 boats. Add 30 to 40 drift guides that already offer float trips on the Middle River, and total guided use on any 'new' drift only days could easily exceed 150 boats. Assuming unguided use equaled current driftboat Monday use, total boats on drift only days could exceed 250 boats, more than double the highest drift only Monday in 2009.

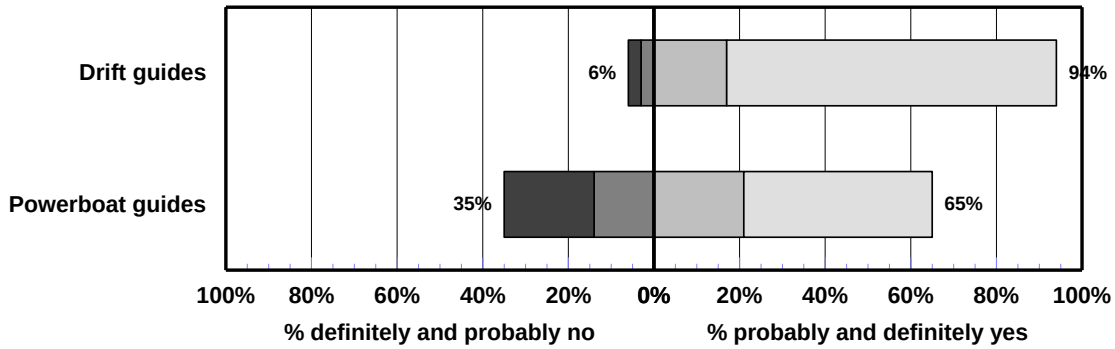

Figure 13-2. Percent of drift and powerboat guides reporting they would use drift only days.

Guides who said they would not use additional drift only days were asked to specify their reasons. Responses are given in Figure 13-3 (percents sum to greater than 100% because respondents could check any that apply). Findings include:

- The two most important reasons are that clients or the guides themselves prefer to fish from a powerboat.
- Logistics of shuttles and insufficient launch sites to provide a diversity of trip options are also important reasons. Verbatim comments highlighted the added challenges of drift trips (e.g., need for parking at put-in and take-out, need for appropriately-spaced launches, need for launches to access best fishing locations such as downstream of Eagle Rock, inability to come and go from a riverside dock).
- Half of the guides checked the physical demands of rowing. Some comments also noted that the challenges of rowing (particularly for unguided users) might encourage more anchor use, which may have habitat and social competition impacts.
- Fewer guides said they did not have a drift vessel available, would have less flexibility to reach fishing hot spots, or would be unable to match powerboat success rates. Almost none said they would have to learn new fishing techniques or skills.

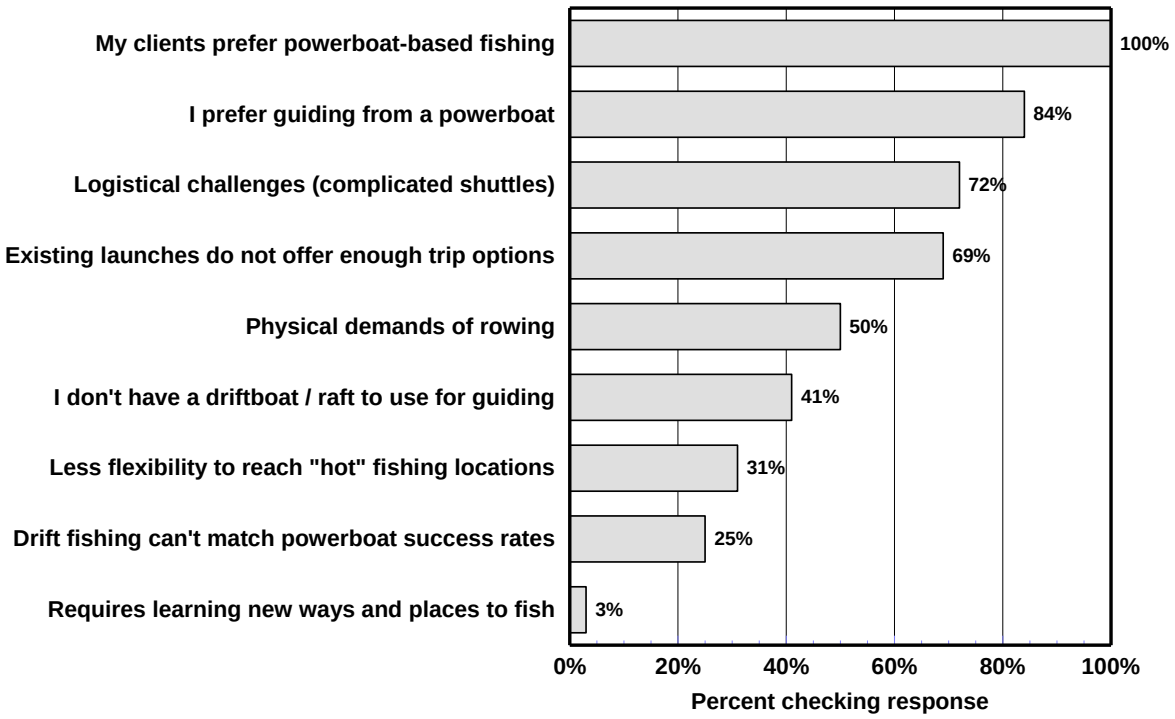

Figure 13-3. Percent of guides checking reasons for not using additional drift only days (if provided).

Developing "drift only" alternatives

Deciding whether to add more drift-only periods on the Middle or Lower Kenai is among the most consequential and controversial issues on the river. To non-motorized stakeholders, expanded drift-only would reduce crowding; produce non-motorized recreation opportunities; and address hydrocarbon, turbidity, and erosion impacts from powerboat use. To motorized stakholders, non-motorized regulations would displace them from traditional powerboat use areas without reducing (and possibly exacerbating) crowding, congestion, or related impacts. To agencies weighing these issues, type of use zoning could also substantively affect facility needs, education and enforcement programs, and fishing success and harvest.

Several of these issues are out of the scope of this study (e.g., biophysical effects and impacts on the fishery). The survey focused on support and opposition for expanded non-motorized zones/times, not the underlying reasons for those opinions. However, these types of conflicts are not uncommon in river settings, so findings from other studies may help on the Kenai. In addition, many users and stakeholders have offered considerations in this debate. We have distilled them below:

Conceptual and process issues

- Conflicts between motorized and non-motorized users are well-documented in the recreation literature (Lucas, 1964; Jacob & Schreyer, 1980; Shelby, 1980; Adelman et al., 1982; Jackson & Wong, 1982; Kuss et al., 1990; Graefe, 2004). Research shows antipathy from non-motorized users toward motorized use in many situations, particularly more primitive settings. This is often one-sided or "asymmetric," with motorized users relatively unconcerned about encounters with non-motorized use.

- Conflicts may have a value-based component that is independent of actual encounters with motorized users (i.e., social values conflict; see Vaske et al., 1995).

- Research on conflicts between motorized and non-motorized use has looked at backgrounds and attitudes of users, economic impacts, safety, enforcement problems, and ecological effects on wildlife, plants, and water quality (Kuss et al., 1990). While these issues are interesting and important, they sometimes obscure the more central issue, which is the nature of contrasting experiences (Shelby, 1980).

- Most conflicts are addressed by separating uses in space or in time. The success of zoning solutions depends on whether they are perceived to be equitable. Few solutions will satisfy everyone, and some stakeholders will criticize any zoning compromise (particularly the "non-sensitive" users, who perceive few costs to sharing an area).

- User conflicts are typically conceived as a "zero sum game" (if one group wins, the other loses), so these issues can become politicized and possibly litigated. As with other contentious issues, focusing on interests rather than positions may help develop compromise solutions (Fisher et al., 1992; Spangler, 2003).

- Biophysical resource impacts are often used to justify motorized use restrictions. On the Kenai, potential biophysical issues include hydrocarbon pollution, turbidity, wildlife disturbance, and boat wake erosion, some of which have been addressed by existing motorized use regulations (e.g., Swan habitat non-motorized zone on the Middle River in early summer; 50 horsepower motor limits; four-

stroke engine regulations; Upper River non-motorized segment). Social experience issues may have been an underlying consideration with some of these regulations, and all clearly have impacts on experiences regardless of their basis.

- In many conflicts, the "sensitive" group develops long lists of safety, environmental, and experiential impacts from the "offending" group's use, hoping one or more may resonate among decision-makers and lead to regulations restrict the offending use in some times of places. Faced with these assertions, the "accused" group may develop similar lists about the first, and the conflict becomes less asymmetric (Graefe, 2004). Assertions on both sides may be difficult to validate, and sometimes "scapegoat issues" obscure underlying philosophical or value-based differences about which type of use is appropriate. We encourage all stakeholders to prioritize and be transparent about the impacts that matter the most to them. This provides agencies with the best chance of working out acceptable compromises that provide each group with adequate opportunities.

- Non-motorized river users from a study on Alaska's Delta River (Whittaker and Shelby, 2006) considered all 11 impacts from motorized use "important," while motorized users only rated four "important." Non-motorized users rated noise, the notion that motors are inappropriate in some places, and ensuring the availability of non-motorized experiences as their most important reasons. Of these, only noise was considered important for a majority of motorized users (discourteous behavior, boating safety, and biophysical impacts round out the motorized list). This highlights a fundamental difference between the two groups – non-motorized users may purposely seek out places or times with no motorized use, but that is not important for most motorized boaters.

- There is jurisdictional complexity with motorized/non-motorized issues on the Kenai because decisions could be driven by recreation experience, fisheries management, or biophysical impact considerations. In addition, decisions would probably affect facilities or lands managed by different entities. For example, existing drift-boat Mondays on the Lower and Middle River in July are a Board of Fish regulation, while non-motorized use zones on the Skilak end of the Middle River to protect swans in early summer are regulated by the US Fish and Wildlife Service. State Parks regulations create non-motorized zones on the Upper River and appear to have been developed for social experience purposes.

- Coordinated decision-making among all the major agencies could consider the full range of issues, consequences, and agency mandates, but this may be challenging. The KRSMA board offers an institutional opportunity to improve coordination and comprehensive planning, but different agencies and boards have their own decision-making processes and it is unclear which ones will take the lead on addressing these issues. Stakeholders may consider using any available legal or public relations "hook" to achieve their goals, so agencies (or stakeholders with differing positions) may find it preferable to approach such issues through a comprehensive process that reviews the full set of issues at stake to ensure that all are considered when making these major recreation management decisions.

Specific considerations for drift-only alternatives on the Kenai

- Existing drift-only Monday regulations apply to the Lower and Middle River for June and July, so stakeholders interested in additional non-motorized opportunities tend think in terms of extending those regulations to other days. However, more targeted sub-segments or time periods might improve acceptance, particularly if the restriction doesn't apply to both segments at the same time.

- Alternatives should clarify target seasons and segments. On the Lower River, drift-only stakeholders may focus on July because this is the season when powerboat use has largely displaced drift use (less than 2% of boats on the Lower River from Tuesdays to Sundays are non-motorized). However, there may also be interest in Lower River drift only opportunities during silver season. Most Lower River use on drift-only Mondays occurs from Centennial Park to Eagle Rock (or stationary drift boats at Beaver Creek). Regulations could target the area upstream of Eagle Rock or Pillars, leaving downstream segments motorized.

- In contrast, Middle River use during kings is low and may not be important to drift anglers (who have not been displaced by heavy motorized use). Agencies might explore drift-only days during the trout/Dolly/silver season in August and early September, and perhaps only for the Skilak to Kenai Keys segment (the focus of most non-motorized fishing).

- Alternatives that restrict motorized use for a portion of the day (e.g., the middle of the day) may be more acceptable. For example, a drift-only regulation from Skilak to Kenai Keys from 10 am to 4 pm could allow powerboats to access the segment to bank fish or drift with their motor off, but still provide a non-motorized opportunity during prime fishing hours.

- Alternatives that restrict "upstream use" or require "no wake speeds" (rather than a total motor restriction) may offer an alternative to drift-only regulations, providing a "less motorized" rather than non-motorized experience. A variation on the "mid-day non-motorized" example (above) could allow powerboats to use their engines for steering/holding in the current or cruising downstream as long as they didn't throw a wake. This creates a "downstream travel only" use pattern, which could reduce congestion and the impacts of powerboats that "run laps" without excluding all powerboat use.

- Another variation on a "less motorized" alternative could restrict powerboat use to one upstream trip per day in a segment; there is a similar regulation from Kenai Lake to Princess Lodge on the Upper River. It allows lake users to drift the first part of the river and motor back once in a day, but does not allow "running laps." There are enforcement challenges, but it also creates a "mostly downstream" use pattern that would probably reduce congestion.

- Alternatives that contemplate landowner exemptions for access (especially to properties that have no road access) are likely to increase landowner support without adding much motorized use. There may be legal challenges to such exemptions.

- Improving access to popular fishing areas downstream of Eagle Rock is critical for additional drift-only days to "work," particularly if drift only use levels reach 200 to 300 boats (as estimated earlier). This segment has roughly seven miles of good fishing water that is easily accessible to powerboats, but difficult to use in driftboats. Although drift anglers with property on Beaver Creek can access the confluence area and return, others must use upstream put-ins (e.g., Pillars, Eagle Rock) and fight tides and winds to reach take-outs below the Warren Ames Bridge. There are two possible approaches to improving access:

    1. Allow kicker or trolling motors for downstream travel on drift only days. Existing restrictions do not allow boats to carry an engine while fishing on drift-only Mondays, and some anglers park a vehicle with their outboard at Cunningham Park then swap it for their fishing gear in order to motor downstream legally. If additional drift only days are contemplated, they are likely to garner more support if kickers can be used 1) downstream from a certain point, 2) after fishing, or

3) for downstream travel only. While enforcement of more complicated regulations may be challenging, using kickers would help more evenly distribute use and reduce congestion.

2. Develop additional launch sites and associated parking, particularly on the lower seven miles between Eagle Rock and Warren Ames Bridge, to increase trip options and help distribute use. There is strong support for additional launches (see Chapter 11), but construction and environmental issues are substantial (e.g., steep bluff banks, wetlands, tidal zone mud, and cultural sites). Several Lower 48 rivers (as well as a few in AK) have friction-based ramps on steep banks that can be used by light craft such as driftboats and rafts, but these are not particularly efficient compared to drive-in ramps. Finding room for parking could be similarly challenging, because drift-only days require facilities that handle traffic at both put-ins and take-outs (powerboats need parking at only one ramp).

- Even with more launches or parking, drift-only days that include guided use will probably have much higher use than existing drift-only Mondays. The potential for crowding and congestion will increase, and the lesser mobility of drift craft (compared to powerboats) makes it more difficult for users to avoid each other and spread out. Compatibility of different king fishing techniques (drift vs. backtroll) may also remain an issue; some anglers will hold against the current or drift slowly downstream, but others will not. A few anglers may also use anchors, which may exacerbate "territorial" competition that sometimes occurs during silver season (where anchoring is common). There are already anecdotal reports of this becoming a problem on existing drift boat Mondays (discussion at KRSMA guide committee meeting, October, 2010).

- Adding drift-only segments or periods has the potential to increase crowding and congestion during powerboat use periods. Demand for powerboat-based angling is unlikely to decrease, but with fewer days available, densities will probably be higher. To the extent that powerboaters shift to drift use on drift-only days, this effect will be smaller.

- Any drift-only alternative will displace both guided and unguided powerboat use, but the effects on guided use will probably be greater (especially in king season, where there are existing restrictions on days and hours). To the extent that drift only alternatives minimize guide market and pricing effects, guides may be more willing to accept them.

14. Capacities and Use Limit Actions

*This chapter provides information from the **follow-up survey** about use limit actions and estimates of capacities. Questions asked respondents about philosophy toward use limits, user registration programs, parking time limits, and different types of limits on specific segments (using the 5-point support-oppose scale with "neutral" and "don't know" options). Other questions asked respondents to estimate boat capacities for the Lower and Upper River.*

Background

Capacities (and the use limit actions that implement them) are another approach – and perhaps the most direct – for addressing overuse. The capacity concept recognizes there is a limit to the amount of use that an area can accommodate without impairing natural resource or experiential values. Five decades of research suggests the links between use and impacts can be complex, but several visitor impact planning frameworks (e.g., C-CAP, LAC, VIM, and VERP) can be used to develop capacities (Stankey et al., 1985; Shelby and Heberlein, 1986; Graefe et al., 1990, Manning, 2008; Whittaker et al., 2010). Use limits are a powerful management strategy for dealing with some impacts, especially in geographically-concentrated areas such as river corridors.

Differences in the research literature, planning frameworks, "in-the-field" approaches, and court rulings have sometimes led to confusion or debate about the capacity concept. In a recent "state of knowledge" monograph (Whittaker et al., 2010), capacity is defined as the amount and type of use that is compatible with the "management prescription" for an area, which includes:

- Management goals and objectives for all important uses and values, including desired recreation opportunities to be provided.
- "Desired conditions" and the "mix" of resource uses and values to be managed for.
- Standards that quantitatively define appropriate levels for goals, objectives, desired conditions, and/or indicators.
- Planned management program and actions to meet goals and objectives, provide desired conditions, and avoid violating standards.
- Budget and personnel resources that will be used to implement management actions.

A capacity is a number specified by units of use, time, and location components (e.g. float trips per day on a particular reach, people at one time fishing in an area). Although it is common to speak of a single capacity for a river, many areas will have multiple capacities – for different types of uses, facilities, segments, seasons, or other managerially-relevant parameters. Use limit actions, the specific management actions that keep use from exceeding capacities, can be direct (e.g., permit systems) or indirect (e.g., managing parking lot sizes).

In general, managing use levels is more likely to be effective addressing social impacts such as encounter levels or competition for sites and facilities. In contrast, many biophysical impacts appear less directly related to use levels because initial or low levels of use may create proportionately larger impacts (Hammitt & Cole 1987; Kuss et al., 1990). For example, the first few groups to pioneer a campsite have the greatest impacts on vegetation loss; subsequent groups then camp in the same areas and typically cause less additional impact (Cole, 1987).

Philosophy toward use limits

In river settings like the Kenai, use limits are a potentially effective tool because several social impacts are related to use (Chapter 6). The trade-off is a reduction in access and a heavier managerial footprint. To assess opinion toward these trade-offs, respondents were asked a "philosophy toward use limits" question used in several previous river studies (including the 1992 Kenai study). Results for different groups are shown in Figure 14-1; comparisons between 2009 and 1992 are shown in Figure 14-2. More details are provided in the supplemental report.

> Would you accept having to compete for a limited number of permits to use parts of the river if it meant there would be fewer other people on the river when you use it?
>
> 1. Yes – some limits on use are needed
> 2. Maybe – it depends upon how the permit system works and how many permits would be available
> 3. Not at this time – maybe later if crowding gets worse
> 4. No – I'll always want unlimited access to the river

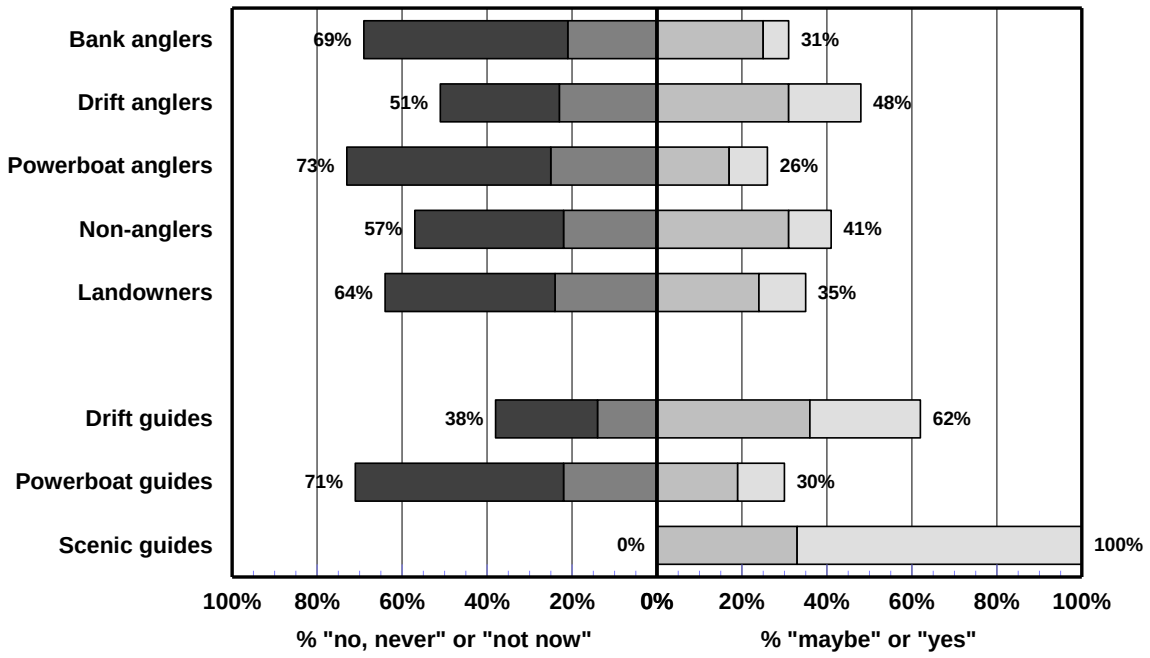

Figure 14-1. Responses about a permit system that reduces use.

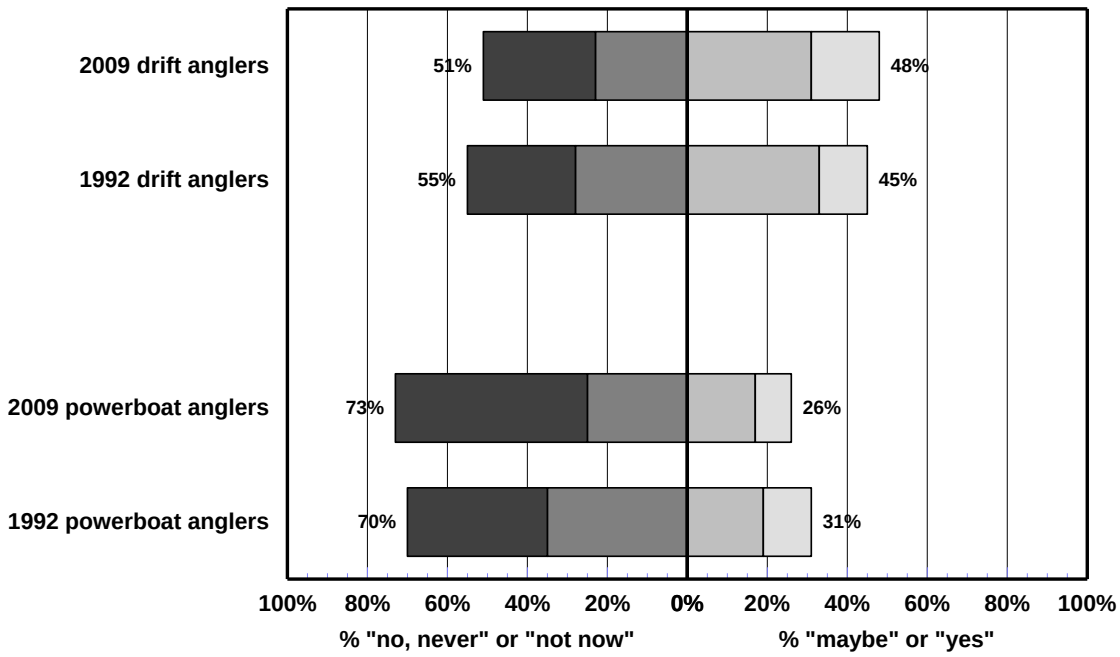

Figure 14-2. Comparing 1992 and 2009 responses toward a permit system that reduces use.

Findings include:

- Most user groups and powerboat guides oppose use limits. Nearly half of bank anglers, powerboat anglers, and powerboat guides always want unlimited access, while about a quarter oppose limits now, but might accept them later if crowding gets worse. Drift anglers were more divided, with 48% supporting limits now or in the future. However, less than 17% in any of these groups believe limits are needed now.
- Drift and scenic rafting guides are the only groups with majority support for use limits. They are also the only groups on the river that are currently limited (on the Upper River).
- Comparisons between 1992 and 2009 (Figure 14-2) suggest that "philosophies toward use limits" have been relatively stable over time, although drift anglers have slightly increased and powerboat anglers have slightly decreased their support.
- Results are similar to other rivers in Alaska, although multi-day non-motorized users were more inclined to support limits. On the Gulkana River in 1999, 56% of Upper River drift anglers supported or might support use limits, compared to 27% of powerboat anglers. On the Delta River in 2004, 67% of floaters supported limits, compared to 32% of motorized users.
- Taken together, findings suggest little support among Kenai users for limits. Any future support is probably contingent on worsening impacts and developing a fair system for distributing access.
- Powerboat and bank anglers are generally less likely to support use limits. There is little tradition for directly managing numbers of powerboats or bank anglers through permit systems.
- Drift anglers and drift guides are the most likely to accept a use limit system. In contrast to bank and powerboat anglers, drift anglers may have some familiarity with permit systems on drift-oriented rivers. There are about two dozen rivers in North America with limited permit systems and over 100 others have capacities identified but not yet reached or enforced (Whittaker and Shelby, 2008). Few are primarily day use rivers like the Kenai, but a couple (e.g., Oregon's Deschutes and Coloraod's Arkansas River) have similar high use levels.

- Many bank and boat anglers on the Kenai may not recognize that use levels at specific facilities (e.g., launches, state park units, anglers using the Ferry and Russian River day use parking lots) are managed consistent with their facility capacities, and may indirectly influence segment-wide capacities.

Should limits reduce, freeze, or increase use?

A follow-up question asked whether use limits should reduce, freeze, or increase use (see below). Responses are only given for those who support use limits (a minority of users) are given in Figure 14-3.

If a permit system were tried on one or more Kenai River segments, should it… *(Circle one number)*

1. ***Reduce*** use compared to current levels
2. ***Freeze*** use near current levels
3. Allow use to ***increase slightly*** (about 10 to 20% compared to current use levels)
4. Allow use to i***ncrease substantially*** (about 50% or more compared to current use levels)
5. I oppose permit systems, even if use and impacts increase

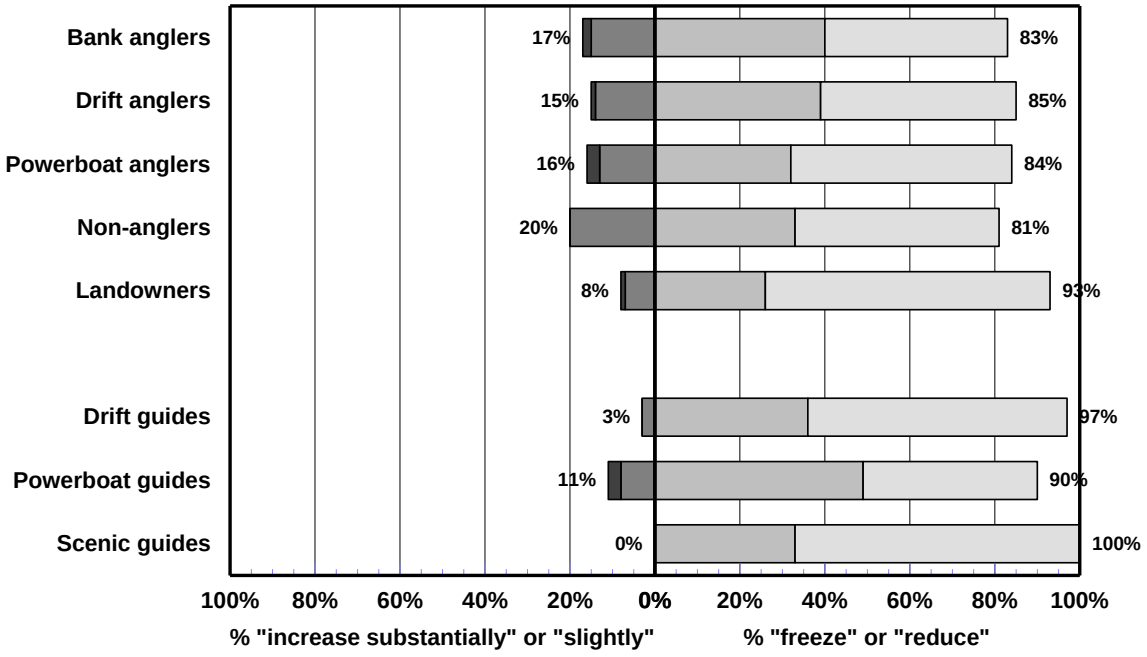

Figure 14-3. Percent who want use limits to reduce, freeze, or increase use among those who support a permit system.

Although most groups do not support a permit system (see Figure 14-1), those who favor limits prefer to freeze or reduce use levels (with over 80% in these two categories); for landowners, drift guides, and scenic guides, percentages in these categories is over 90%.

Opinion toward a daily boat registration program

Respondents were asked about a "daily boat registration" program, as described below. A similar system has operated on Oregon's Deschutes River for the past five years; it has substantially redistributed use away from high use days (Mottl, 2009). Responses for boating groups are given in Table 14-1.

> Some rivers require boaters to register every time they go boating. "Mandatory registration" could be developed for some segments of the Kenai, with the following characteristics:
> - boaters could register by phone or via the internet
> - boaters would identify which segment they intended to use
> - the number of boats that can register would **not** be limited
> - a webpage would keep a "running tally" of registered boats for every segment and day
>
> Do you think a mandatory registration program should be developed for the Kenai? (Check all that apply)

Table 14-1. Percent responding to statements about a boater registration program.

	Drift anglers	Powerboat anglers	Drift guides	Powerboat guides
No, because I'm opposed to mandatory programs like this.	31	46	19	52
No, because I'm concerned the program could lead to a use limit system (which I oppose).	26	39	26	44
No, this will be difficult to enforce.	21	30	17	29
No, this will cost too much to administer.	17	28	13	26
No, because this is unnecessary on the segments I use.	13	12	11	18
Maybe, but it depends on how easy it is to register.	15	14	13	7
Maybe, but it depends on which segment and season it applies to.	14	8	30	7
Yes, because this program could lead to a use limit system (which I support).	12	5	21	7
Yes, because information about the number of other boaters would help me plan my trips.	8	4	15	2

Findings include:

- Most respondents in all groups oppose the program; among boaters, only 20% of drift anglers and 9% of powerboat anglers thought this should be implemented.
- The only group that showed much support was drift guides (and support was qualified).
- The most common objections to registration programs are the mandatory requirement, concern that it could lead to use limits, and perceived difficulty to enforce and administer.
- Very few respondents said they would use information about the number of other trips to decide where and when they use the river, which is the chief benefit of the program.
- This system is unlikely to gain support from stakeholders or the public, and benefits might be marginal on the Kenai if it did not help redistribute use.

Opinion toward parking time limits

Respondents were asked about parking time limits at day use areas, which offer an indirect way of handling demand higher than capacity (by limiting trip lengths, thus cycling more people through the area). This is an issue during peak red salmon season. Question wording is given below; results for different groups are given in Table 14-2.

> Parking length limits at day use areas on the Lower and Middle River range from 4 to 12 hours (and some only apply during the late red salmon run). Do you support time limits to increase "turnover" during high use periods? *(Circle one number)*
>
> 1. No, day use parking should not have limits.
> 2. Yes, day use parking should have some limits.
> 3. Yes, and different lots should have different limits (depends on the site and its popularity).
> 4. This issue doesn't matter to me.
>
> If you think there should be some parking length limits, what is the most appropriate limit?
> _____ hours per visit

Table 14-2. Percent of responses related to day use parking length limits.

	All users	Landowners	Drift guides	Powerboat guides
No, day use parking should not have limits.	43	30	23	50
Yes, day use parking should have some limits.	21	18	18	16
Yes, and different lots should have different limits (depends on the site and its popularity).	16	21	23	6
This issue doesn't matter to me.	21	31	36	28
Average preferred length (hours)	12.1	10.0	12.1	12.2
Percent 8 hours or less	42	62	29	38

Findings include:

- All users show more opposition (43%) than support (37%) with 21% reporting "this issue doesn't matter" to them. There were small differences between user groups.
- Powerboat guides showed the strongest opposition, with 50% opposed, 22% support, and 28% "doesn't matter." Drift guides were more positive, with 23% opposed, 41% support, and 26% "doesn't matter."
- For those who identified a preferred limit, the average among users and guides was about 12 hours, and less than half thought limits should be 8 hours or less. The average among landowners was 10 hours.
- Survey data indicates average trip lengths are well under 8 hours, so limits between 10 and 12 hours are unlikely to induce substantial changeover (and they would probably reduce the quality of the few trips that are longer).

Specific use limit actions – Lower River

Figure 14-4 shows support for specific use limit actions on the Lower River (from focus groups and discussions with agencies and stakeholders). Details for groups are provided in the supplemental report.

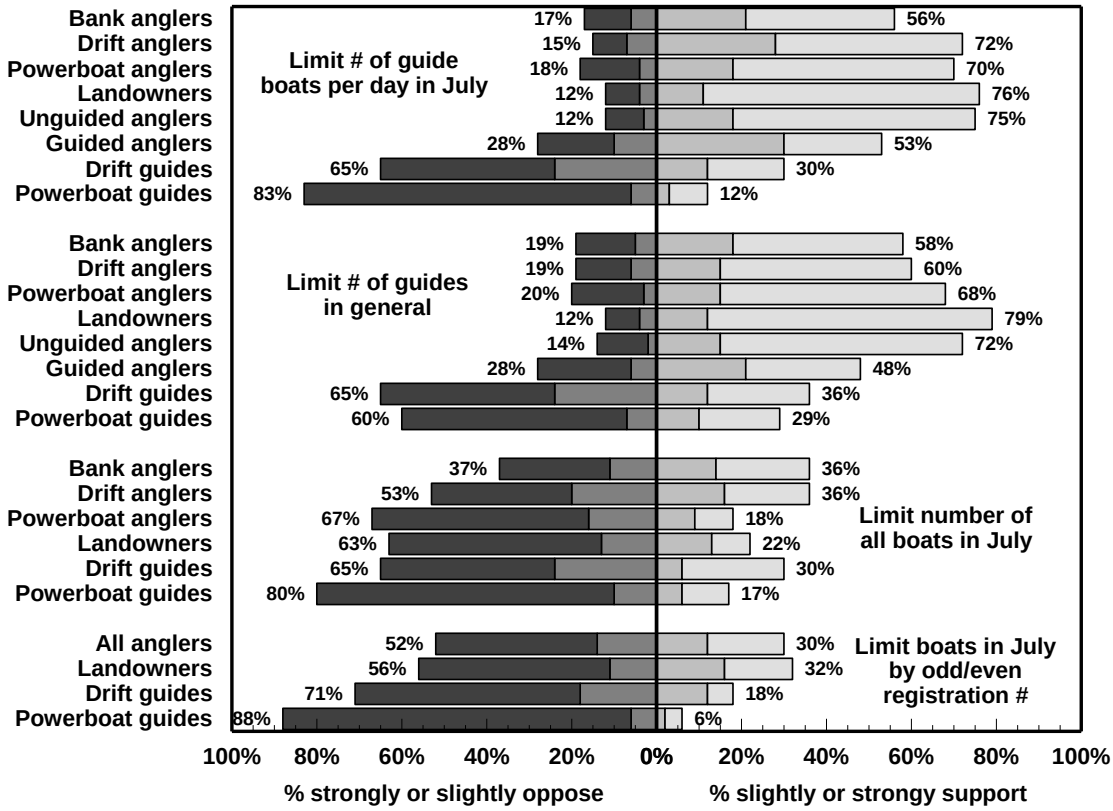

Figure 14-4. Percent support for use limit actions on the Lower River for different groups.

Findings include:

- Most user groups and landowners support limiting guide boats per day or the number of guides in general, with less than 20% opposed. The exception was guided anglers, where about half support limits and 28% are opposed. These are nearly identical to 1992 findings, suggesting that attitudes toward guide limits are stable.
- In contrast, most guides oppose these types of limits (with powerboat guides more strongly opposed). About one-third of drift guides support limits on guides.
- Most groups oppose per day limits on all powerboat use (guided and unguided), with powerboat anglers, guides, and landowners more strongly opposed.
- Bank anglers generally support limits on guides, were divided on limiting all boats, and opposed limiting boats on alternating days by odd/even registration numbers. Compared to other groups, bank anglers were slightly more likely to choose "neutral" responses, because these actions generally have fewer effects on their use.
- Taken together, results suggest that most groups respond to use limit actions consistent with their self-interest. For example, most unguided users support limits that would reduce guide use without restricting their own access, and most guides oppose actions that would limit themselves. For actions that might limit all users, no group showed majority support. Chapter 15 provides additional insight into attitudes related to guided and unguided use issues.

Specific use limit actions – Middle River

Figure 14-5 shows percentages supporting specific Middle River use limit actions (developed from focus groups and discussions with agencies and stakeholders). User group details are provided in the supplemental report.

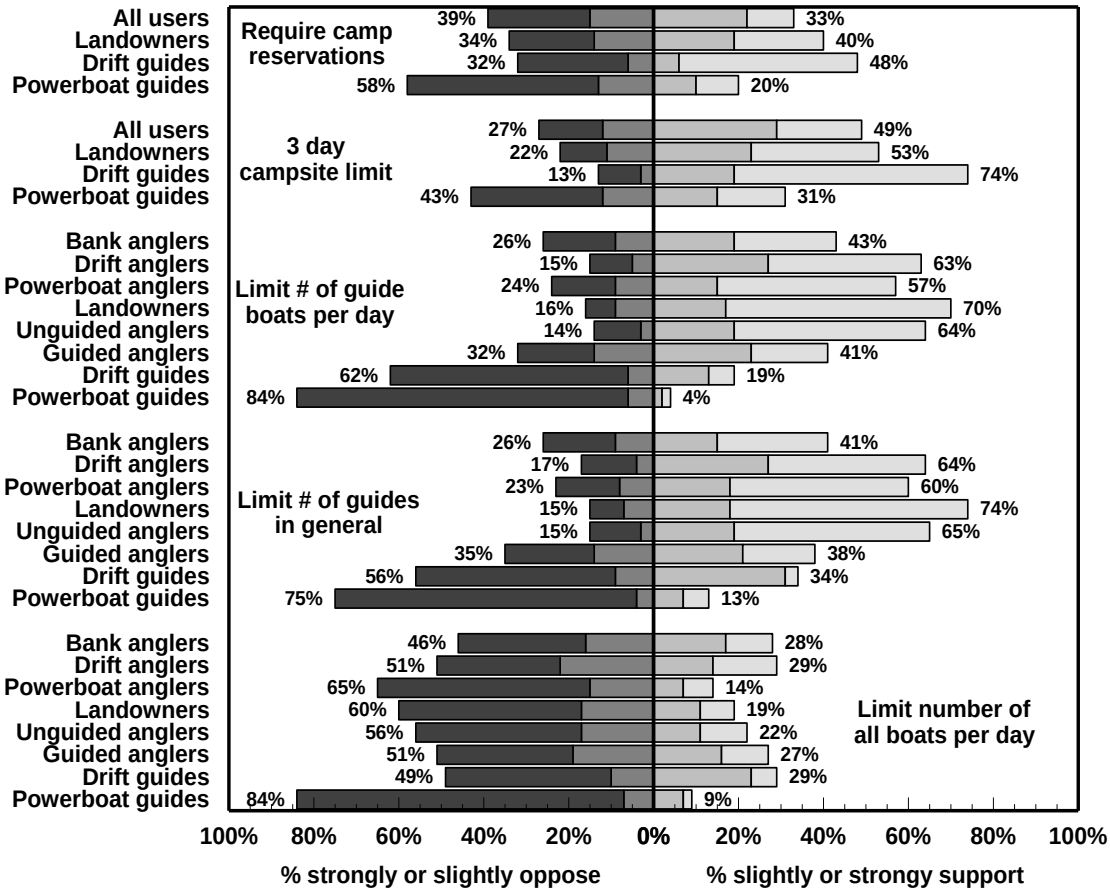

Figure 14-5. Percent support for use limit actions on the Middle River for different groups.

Findings include:

- Users and landowners are divided over reservations, but there is more support for a three day limit. Powerboat guides were more likely to oppose both measures, and drift guides were more likely to support them.
- As with the Lower River, most user groups and landowners support limiting guide boats per day or the number of guides in general, while most guides oppose these limits (with powerboat guides more strongly opposed).
- User and landowner support for guide limits (either option) are lower than for the Lower River, which is consistent with the lower use, crowding ratings, and impact levels on the Middle River.
- Most groups oppose per day limits on all powerboat use (guided and unguided), with powerboat anglers, guides, and landowners more strongly opposed.
- As with the Lower River, "reasonable self-interest" provides the best explanation for results. Users generally support guide limits that reduce use without restricting their own access, while guides generally oppose actions that would limit themselves.

Specific use limit actions – Upper River

Figure 14-6 shows percentages that support Upper River camp reservations and a limit on the number of all boats (developed from focus groups and discussions with agencies and stakeholders). The Upper River has limits on the total number of guides and "guided starts" per week from the Russian River to Skilak Lake. Powerboat use is generally not allowed on the Upper River, but some powerboat anglers (79) and powerboat guides (28) answered these questions because they take trips on the Upper River. More group information is provided in the supplemental report.

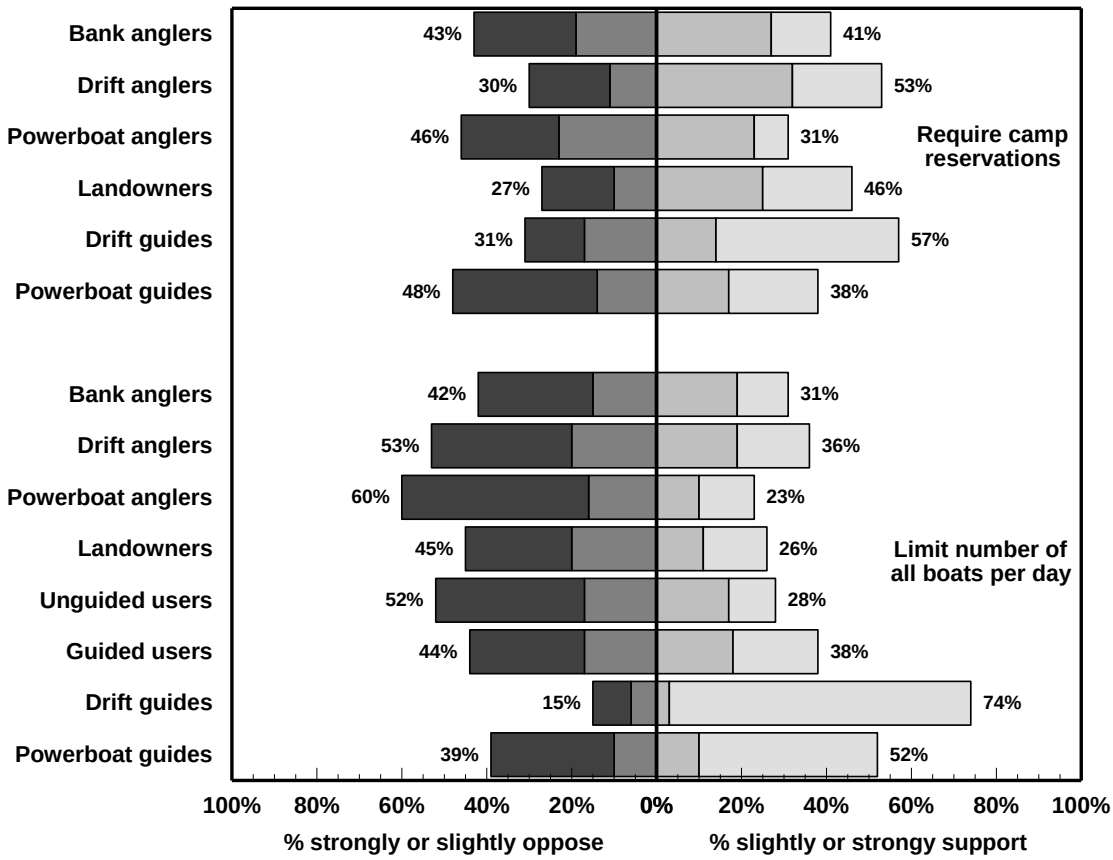

Figure 14-6. Percent support for use limit actions on the Upper River for different groups.

Findings include:

- Groups are divided over reservations for on-river camps. Most drift anglers and drift guides (the primary group with access to these camps) support camp reservations, but bank anglers were divided, and powerboat users and guides are opposed.
- There were no statistically significant differences between guided and unguided users for "require camp reservations," so those two groups were not shown.
- As with other segments, no group supports limits on all boats except drift guides (who are already limited). This is consistent with "reasonable self-interest" and equity concerns.

Estimating boat and guide boat capacities

Capacities refer to a number on a use level scale. On some rivers users and stakeholders are well-calibrated to use levels and have opinions about "how many is too many?" We were interested in assessing this for the Kenai, focusing on: 1) number of all boats on the Lower River; 2) the number of guide boats on the Lower River; and 3) the number of all boats on the Upper River (Sportsman's to Jim's Landing). Specific questions and findings are given below.

Lower River boat capacities

In the section about the Lower River, respondents were asked:

In recent years, Lower River counts indicate the number of boats at one time during ***prime hours*** in ***July*** are…

- Typically 200 to 300 boats early in the month
- Typically 300 to 400 boats later in the month
- May exceed 450 boats a few days each year (usually Tuesdays and Saturdays later in the month)
- Were generally lower in 2009 due to low king returns; few counts exceeded 300 boats
- Counts include boats that are fishing and traveling on the river
- Counts refer to 16 miles of river from Warren Ames Bridge (mile 5) to Sterling Hwy Bridge (mile 21)

Because boats are not evenly distributed and some users only fish a part of the river, people may encounter fewer boats than these counts. However, there is interest in "starting a conversation" about a "reasonable capacity estimate" for the Lower River – the number of boats at one time before the quality of trips is compromised. Can you make a capacity estimate for the Lower River in July? *(Check all responses that apply)*

- ❑ No, it depends on how the boats are distributed
- ❑ No, I'm concerned estimates will be used to limit boats, which I oppose
- ❑ No, the number of boats doesn't matter to me
- ❑ No, the number of boats doesn't matter to me as long as I'm catching fish
- ❑ No, I care about the number of boats, but I don't know how to estimate this
- ❑ No, it's too complicated
- ❑ Yes (please provide your estimates below)

If you checked "yes" above, please estimate the "reasonable capacity" for the Lower River – the number of boats at one time before the quality of trips is compromised. *(Circle one number per row; if you checked "no" responses, leave blank)*

On higher use days (such as Tues and Sat in late July)	100	200	300	400	500	600	800	1,000	1,500	Other:
On other days	100	200	300	400	500	600	800	1,000	1,500	Other:

Table 14-3 shows responses among users, landowners, and guides. Findings include:

- The proportion responding to the series of questions was 42% for all users, 66% for landowners, and 67% for guides, reflecting use of the Lower River and interest in the issue.
- For all groups, only about one-fifth of those who answered provided capacity estimates, so estimates should only be considered a "starting point" for discussion.
- Most users and landowners identified three main reasons for not estimating a capacity: 1) they weren't sure they could; 2) they were concerned that estimates might be used to limit boats (which they oppose); or 3) capacities depend on how boats are distributed.
- Among those willing to make estimates, there are some interesting findings:
  - Most estimated capacities no higher than typical high use levels at the end of July (about 400 boats). Although use did not reach those levels in 2009, it has exceeded this on some days in other years. Results suggest that current peaks may compromise experiences.
  - Average capacity estimates were about 250 to 300 boats for users and landowners, which is similar to the "rule of thumb" capacity estimates from crowding ratings (Chapter 6).
  - Guides on average reported higher capacity estimates than users (about 400 vs. 250-300); they may be less sensitive to crowding impacts or targeting a higher capacity to reduce the chance of lost access if a capacity were implemented).
  - Differences between capacities on high vs. low use days were small, suggesting such distinctions are less important.

Table 14-3. Percent of responses related to Lower River boat capacities.

	All users	Landowners	Guides
Percent answering capacity questions	42	66	67
Percent of those willing to provide capacity estimate	18	17	22
Reasons for not providing estimate:			
No, it depends on how the boats are distributed	23	30	27
No, I'm concerned estimates will be used to limit boats, which I oppose	26	26	39
No, the number of boats doesn't matter to me	8	7	23
No, the number of boats doesn't matter to me as long as I'm catching fish	5	7	6
No, I care about the number of boats, but I don't know how to estimate this	31	33	23
No, it's too complicated	10	9	15
High use days in July (average)	278	270	412
% who estimated 400 or less	88	96	78
Other days in July (average)	243	272	385
% who estimated 400 or less	89	91	78

Lower River guide boat capacities

Parallel questions asked about guide boat capacities on the Lower River (see below):

> The peak number of guide boats on the Lower River at one time during "guide hours" (6 am to 6 pm, Tuesday through Saturday) has varied over the years. In recent years in July, there are typically 100 to 150, with some peaks about 200. There are lower numbers in other months.
>
> Because guided boats are not evenly distributed and some users only fish a part of the river, boaters may encounter fewer guided boats than these counts. However, there is interest in "starting a conversation" about a "reasonable guide capacity estimate" for the Lower River – the number of guided boats at one time before the quality of trips is compromised. Can you make a "guided boat capacity estimate" for the Lower River in July? *(Check all responses that apply)*
>
> ❑ No, I object to defining a "capacity" for guided boats
> ❑ No, it depends on how guided boats are distributed
> ❑ No, I'm concerned estimates will be used to limit guided boats, which I oppose
> ❑ No, the number of guided boats doesn't matter to me
> ❑ No, the number of guided boats doesn't matter to me as long as I'm catching fish
> ❑ No, I care about the number of guided boats, but I don't know how to estimate this
> ❑ No, it's too complicated
> ❑ Yes (please provide your estimates below)
>
> If you checked "yes" above, please estimate the maximum number of guided boats that should be on the Lower River at one time. *(Circle one number per row. If you checked any of the "no" responses, leave this question blank).*

In July	50	100	150	200	250	300	400	500	600	Other:
In other months	50	100	150	200	250	300	400	500	600	Other:

Table 14-4 (next page) shows responses among users, landowners, and guides for these questions. Findings include:

- The proportion responding to this series of questions was 42% among all users, 65% for landowners, and 56% for guides, reflecting use of the Lower River and interest in the issue.
- Among respondents, 17% of the users, 31% of landowners and 16% of guides provided numerical capacity estimates, so they are only a "starting point" for discussion.
- Reasons for not providing an estimate among users were similar to those for "total boat capacities" (see above). However, 46% of the guides object to identifying a capacity for guide boats. This is consistent with their complaint that guides have been "singled out" to solve the Kenai's overuse problems.
- Among those willing to estimate a number:
  - Most estimated capacities no higher than "typical" high use levels at the end of July (about 150 guide boats). Although use levels did not reach those levels in 2009, it has exceeded this on several days in previous years. As with total boat capacity estimates, current peaks may compromise experiences.
  - Average capacity estimates were about 130 guide boats for users, but over 200 for guides, consistent with guides' higher tolerances for crowding impacts and lower support for use limits.
  - Differences between capacities on high vs. low use days were small, suggesting such distinctions are less important.

Table 14-4. Percent of responses related to Lower River guide boat capacities.

	All users	Landowners	Guides
Percent answering capacity questions	42	65	56
Percent of those willing to provide capacity estimate	27	31	16
Reasons for not providing estimate:			
No, I object to defining a "capacity" for guided boats	12	13	46
No, it depends on how the boats are distributed	16	14	25
No, I'm concerned estimates will be used to limit boats, which I oppose	12	8	34
No, the number of boats doesn't matter to me	7	4	25
No, the number of boats doesn't matter to me as long as I'm catching fish	5	4	6
No, I care about the number of boats, but I don't know how to estimate this	33	37	18
No, it's too complicated	9	5	10
High use days in July (average)	130	116	209
% who estimated 150 or less	80	79	55
Other days in July (average)	135	118	176
% who estimated 150 or less	83	89	67

Upper River boat capacities

Parallel questions asked about boat capacities on the Upper River from Sportsman's to Jim's Landing, the highest use segment (see below):

> Upper River boating counts have increased in recent years. For 2004, the latest year with accurate data, the number of boats passing the ferry per day in the fishing season…
> - averaged about 60 boats per day on weekdays
> - averages about 100 boats per day on weekends
> - peaked over 200 boats per day on high use weekends (during red salmon runs)
> - guided use is already limited on this segment, and typically ranges from 15 to 20 boats per day
>
> Because everyone travels downstream, there are multiple channels, and there are many daylight hours, people may encounter many fewer boats than these "per day" counts. However, there is interest in "starting a conversation" about a "reasonable boat capacity estimate" for the Upper River – the number of boats per day before the quality of trips is compromised. Can you make a capacity estimate for the Upper River (specifically from Sportsman's Landing to Jim's Landing)? *(Check all responses that apply)*
>
> ❑ No, it depends on how the boats are distributed
> ❑ No, I'm concerned estimates will be used to limit boats, which I oppose
> ❑ No, the number of boats doesn't matter to me
> ❑ No, the number of boats doesn't matter to me as long as I'm catching fish
> ❑ No, I care about the number of boats, but I don't know how to estimate this
> ❑ No, it's too complicated
> ❑ Yes (please provide your estimates below)
>
> If you checked "yes" above, please estimate the "reasonable capacity" on the Sportsman's to Jim's Landing segment – the number of boats per day before the quality of trips is compromised. *(If you checked any of the "no" responses above, leave this question blank).*

During red salmon runs	< 50	75	100	150	200	250	300	400	Other: _____
At other times	< 50	75	100	150	200	250	300	400	Other: _____

Table 14-5 (next page) shows responses for these questions. Findings include:

- The proportion responding to these questions was 58% for all users, 41% for landowners, and 31% for guides. Fewer in these latter two groups use the Upper River (guides are limited, there is less private land, and powerboats are prohibited).
- Among respondents, 18% of all users, 16% of landowners, and 46% of guides estimated capacities, so estimates are only a "starting point" for discussion. The high proportion of guides makes sense given that they are already limited (and probably have greater interest in limits on other users that wouldn not affect them).
- Among users, reasons for not providing an estimate were similar to those for the Lower River (see above): 1) they weren't sure they could; 2) capacities depend on how boats are distributed; and 3) they were concerned that estimates might be used to limit boats (which they oppose).
- Among those willing to estimate a capacity, findings include:
  - Most estimated capacities lower than 150 for red runs, much lower than existing peaks that may reach 200 per day. As with Lower River capacity estimates (and consistent with crowding and impact information from Chapter 6), existing peaks may compromise experiences.

- Average capacity estimates for red runs were about 160 boats for users, and 110 for guides. In contrast to the Lower River, users (rather than guides) may worry about losing access if use was limited (because guided use is already limited).
- Average capacity estimates on days outside the red runs were lower than 100, suggesting different capacities during and outside the red runs.

Table 14-5. Percent of responses related to Upper River boat capacities.

	All users	Landowners	Guides
Percent answering capacity questions	58	41	31
Percent of those willing to provide capacity estimate	18	16	46
Reasons for not providing estimate:			
No, it depends on how the boats are distributed	22	26	20
No, I'm concerned estimates will be used to limit boats, which I oppose	21	21	18
No, the number of boats doesn't matter to me	10	10	12
No, the number of boats doesn't matter to me as long as I'm catching fish	7	5	4
No, I care about the number of boats, but I don't know how to estimate this	36	34	21
No, it's too complicated	7	9	15
During red runs (average)	157	118	106
% who estimated 150 or less	61	86	97
During other times (average)	150	89	86
% who estimated 100 or less	79	86	97

Other comments on use limit actions

Taken together, findings show that most Kenai users, landowners, and guides are not enthusiastic about use limits that might restrict their own access, but many support limits that might reduce someone else's use. Users and landowners were particularly supportive of limits on guide boats or number of guides, while guides support limits on unguided boats on the Upper River (where guides are already limited).

Other results are broadly consistent with findings that show some times and segments have high use levels and associated impacts. Even though many respondents were unwilling to estimate capacities, those with an opinion typically estimated capacities lower than current peaks.

This is relevant for long-term planning because recreation use levels on the Kenai are unlikely to stabilize on their own. State, southcentral Alaska, and Kenai Peninsula populations will likely increase over the next two decades (a typical planning horizon for resource management plans), as will tourism-based visitation. Given the number of undeveloped residential lots on the river and the increase in retirees from the "baby boom" demographic, increased local use is another reasonable prediction. The likely result is increasing average and peak use levels which, left unmanaged, could translate into higher impacts and changed recreation experiences.

Some suggest that use increases are not inevitable and may "self-regulate," particularly if those sensitive to higher use or impacts reduce or stop their river use. This study suggests some displacement and "product shifts" are already occurring (see Chapter 9), but it is unclear whether this will displace enough use to prevent increases. More importantly, "self-regulation" of this sort creates interim degraded conditions (the "stagnation and decline" components of the classic "tourism life cycle" (Butler, 1980; Miller and Gallucci, 2004).

It is also possible that stable or declining fishing participation trends in the United States (USFWS, 2006) or Alaska (Romberg, 2006) may counter population or visitation increases. However, we doubt that these trends will apply to accessible streams in southcentral Alaska, or a river as popular as the Kenai. Research suggests the factors affecting fishing participation are complex (Aas, 1995; Fedler and Ditton, 2001; Romberg, 2006), and specific forecasts for the Kenai are beyond the scope of this study. But we are skeptical that Kenai angling-based use will stabilize or substantially decline due to national participation trends. A review of previous years use data suggests that Kenai angling use is affected by salmon fishery strength (low use in years with poor king or red runs) or regulation changes (e.g., personal use fishery has reduced rod and reel red fishing during the second run). But over the long term, the number and variety of users fishing, boating, or camping along the Kenai has generally increased with the Kenai Peninsula and southcentral Alaska population.

If use limits are eventually contemplated, it will be important to choose a capacity through a transparent process with public and stakeholder input. The survey provides a starting point for discussion, but a greater proportion of users will need to become calibrated to use levels to effectively debate "how much is too much." Without advocating for a process to define capacities on the Kenai, we note that capacity decisions are generally less contentious if they can be made before use approaches the levels under consideration and cutting back use is usually politically challenging. The Kenai may be past that point for some segments and seasons, but there are other segments and seasons where capacities are not exceeded now, but could be at risk in the near future (e.g., a typical planning horizon of 20 years). The sooner agencies explore this issue, the better the chance of developing consensus about the level of use the river should sustain and be managed for.

It is difficult to manage what you can't measure and discuss, so better information is a necessary step. Toward this end, we have made some use monitoring recommendations for river segments and seasons likely to receive management attention in the future (see list at the end of this chapter). Measured systematically and posted online, they could become useful information for anglers and stakeholders when planning their trips or evaluating what they experienced. In the same way that published sonar counts (even within an unknown level of imprecision) provide anglers with a metric to associate with fishing success and biological management goals, published use information could improve the debate about appropriate use and impact levels.

In the meantime, there is little support for "fully implemented" use limits (e.g., permit systems that limit people, boats, or camping groups per day). Nonetheless, there are other ways to indirectly influence use levels. For example, limiting parking spaces at bank angling access points constrains the number of bank anglers in an area like a State Park unit or the shore accessible by the Russian River Ferry. This is the primary management tool in place at several Upper and Middle River locations, many of which have fee parking and defined spaces. However, several of those sites probably allow too many vehicles when they are completely full, especially because anecdotal evidence suggests many anglers have learned to carpool or even take taxis to the parking lots, essentially increasing the people per parking space. To be effective, more explicit decisions about capacities are needed. Angler proximity standards, estimates of anglers per vehicle, and measurements of accessible shoreline for fishing can all help with this task for specific areas.

Another indirect use limit focuses on redistributing use through information. As discussed in Chapter 6, this strategy is less likely to be effective with powerboat anglers targeting kings, who may concentrate their use despite crowding or related impacts. But many other anglers may appreciate information about use levels, and may adjust their trips to avoid peak days and segments. Publicized use information has redistributed use information on Oregon's Deschutes River, and this might work to some extent on the Kenai as well.

Finally, limiting guided use is a common strategy on many rivers. This has been adopted on the Upper River and has been advocated by some unguided users and stakeholder groups for the Lower and Middle River. But limiting guides at (for example) current use levels will not stop growth if non-guided use continues to increase. The next chapter covers guided/unguided issues in greater detail.

Direct use limits (e.g., permit systems) involve trade-offs, including greater regimentation and administrative costs (Brunson et al., 1992). There are also choices about allocating use among different groups (e.g., commercial vs. non-commercial users, motorized vs. non-motorized users) and rationing method to use (e.g., reservations, lotteries, first-come/first-served). Information in the research literature explore use limit options (Shelby & Danley, 1980; Shelby et al., 1982; Shelby, Whittaker & Danley, 1989; EDAW, 1995; Whittaker and Shelby, 2008).

Recommended use level monitoring

The following use level data can be collected efficiently and provide indicators of use-related impacts on the Kenai. Some are already being collected, although others would require some investment. While it is beyond the scope of this study to estimates the costs of additional information collection efforts or distribution of that information, we believe there are opportunities for agency cost-sharing and integration, as well as potential private or NGO sponsorship. In all cases, it is important to make the information accessible in "near real time" (e.g., within a day or two on a website) so users can become "calibrated" to what they experienced or better plan future trips. Done well, we think this information will be appreciated by users, and an attraction that angling and boating websites would like to help publish.

Lower River

Collect and post daily during June and July and on Tuesdays, Thursdays, Saturdays, and Sundays from August 1 through September 15.

- Highest at one time ADF&G boat count for the entire Lower River on days when counts are conducted. Information should include all boats counted (not just those fishing), but should distinguish guided and unguided counts. These data are already being collected and "instantly" submitted electronically to ADF&G staff but they are not generally publicized.
- On ADF&G's non-counting days in July, consider contracting a single at-one-time count between about 8 and 10 am (the typical highest use period) using the same ADF&G protocols. This would provide a count for every day in the month.
- For August and early September, conduct at-one-time counts using ADF&G protocols on the four days per week schedule.

Middle River

Collect and post on Tuesdays, Thursdays, Saturdays, and Sundays from the start of the second red run (roughly July 10) through September:

- Boats launching from Bing's Landing. This is available from fee information, but is not systematically tallied by day.
- Boat trailers parked at Lower Skilak (at one time count between 2 and 4 pm). This would require new data collection. It might be contracted with shuttle drivers or guides who use the ramp most days.

Upper River

Collect and post daily during red runs (roughly June 10 to June 30; July 15 to Aug 10) and on Tuesdays, Thursdays, Saturdays, and Sundays through September 30:

- Boats launching from Cooper Landing per day. This is available from fee information, but not systematically tallied by day.
- Boats launching from Sportsman's per day. This is already available from USFWS concessionaires, but it is not published until the end of the season.
- Ferry passengers per day.
- Trailer count at Jim's Landing and across highway parking (at one time count between 2 and 4 pm). This would require new data collection, but might be contracted with guides or shuttle drivers who use the ramp most days.

For all data, it is important to develop clear protocols for counting methods. Once collected, data need to be made publically available in user-friendly form, thereby helping users develop better "calibration" between use levels and their experiences. As with other (e.g., ADF&G) Kenai data, quality control is important so those responsible for collecting, tabulating, or reporting/posting information need to be well-trained and conscientious.

15. Guided/Unguided Use Issues

*This chapter provides information from the **follow-up survey** about attitudes toward guide/unguided use issues. It focuses on responses to 12 statements about guides, unguided users, and resolving conflicts between them (on a 5 point agree-disagree scale, with a neutral option). The statements were developed from focus group comments about issues each group has with the other, reviewed by agencies and stakeholders to reduce bias. The chapter concludes with other differences between guided and unguided users and comments about addressing guided/unguided conflicts or limits.*

Statements about guides

Respondents were asked whether they agree or disagree with the following statements about guides or guided use:

- The total number of guided boats can detract from experiences.
- Some guides tend to be "more aggressive" (such as getting too close to others, controlling a hole, or cutting in front of other boats waiting to enter a drift).
- Aside from other issues, some people are envious that guided anglers catch more fish.
- Problems with guided use are mostly due to a few individual guides.

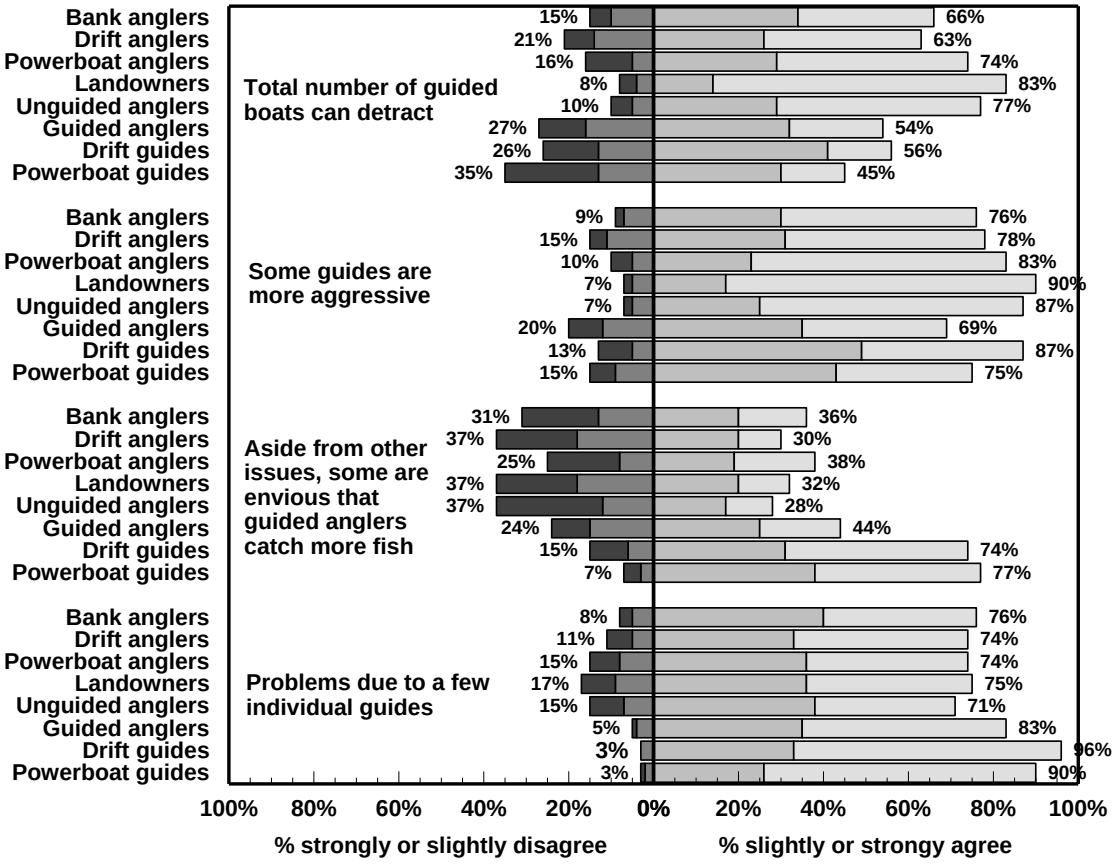

Figure 15-1. Percent agree/disagree with common statements about guided use.

Figure 15-1 provides results for different groups. Findings include:

- Most respondents in all groups except powerboat guides agree that the number of guided boats can detract from trips. This fits with other findings showing there are segments and seasons when use and impacts too high, but further suggesting guided use is part of the problem for many users (and even some guides).
- Group differences on "the number of guide boats detract" make sense; unguided users were more likely to agree. In addition, drift or bank anglers were less likely to agree, probably because they are more likely to use the Upper River (where guide boats are already limited).
- Sixty-nine to 90% of all groups agree that some guides can be "aggressive" on the river, and responses are highly correlated with "the number of guides can detract" ($r=0.67$, $p<.001$). The 1992 study discussed this issue (Whittaker and Shelby 1993), noting that guides have at the least a "serious public relations problem." These data suggest that problem has not gone away, although 2009 data do not quantify the amount aggressive behavior or the proportion of guides who engage in it. The Kenai Guide Academy initiative (a week-long course all guides are required to complete) has probably helped improve guide etiquette, but it seems clear that some guides continue practices that others resent.
- Users and landowners were divided over whether "envy" about higher guided catch rates helps explain antipathy toward guided use, although 74 to 77% of guides agree with this statement. ADF&G has reported striking differences in catch-rates per hour of effort between guided and unguided anglers in some years (ADF&G, 2009), but "catch-rate envy" is not widespread (or at least not reported) among the users presumed to possess it.
- Seventy-one to 96% of all groups agree that most guided use problems are caused by a few individual guides, but this was not correlated ($r=0.05$, $p=.254$) with concern about some guides' aggressive behavior. As discussed in the 1992 study, guides themselves are in the best position to identify and "sanction" fellow guides who practice aggressive behavior, and "failure to take up this challenge will probably increase the call for further guide restrictions." Even so, the perception among users is that aggressive behavior from guides is more widespread than "a few individuals."

Statements about unguided users

Respondents were asked to agree or disagree with the following statements about unguided use:

- Some unguided users do not have the appropriate boat / equipment to fish in higher density areas.
- Some unguided users disrupt fishing for others when they use inappropriate fishing techniques (such as drifting when others are back trolling or vice versa).
- Some unguided users don't know the "rules" for driving on the river and create safety hazards.
- Problems with unguided users are mostly due to a few individuals.

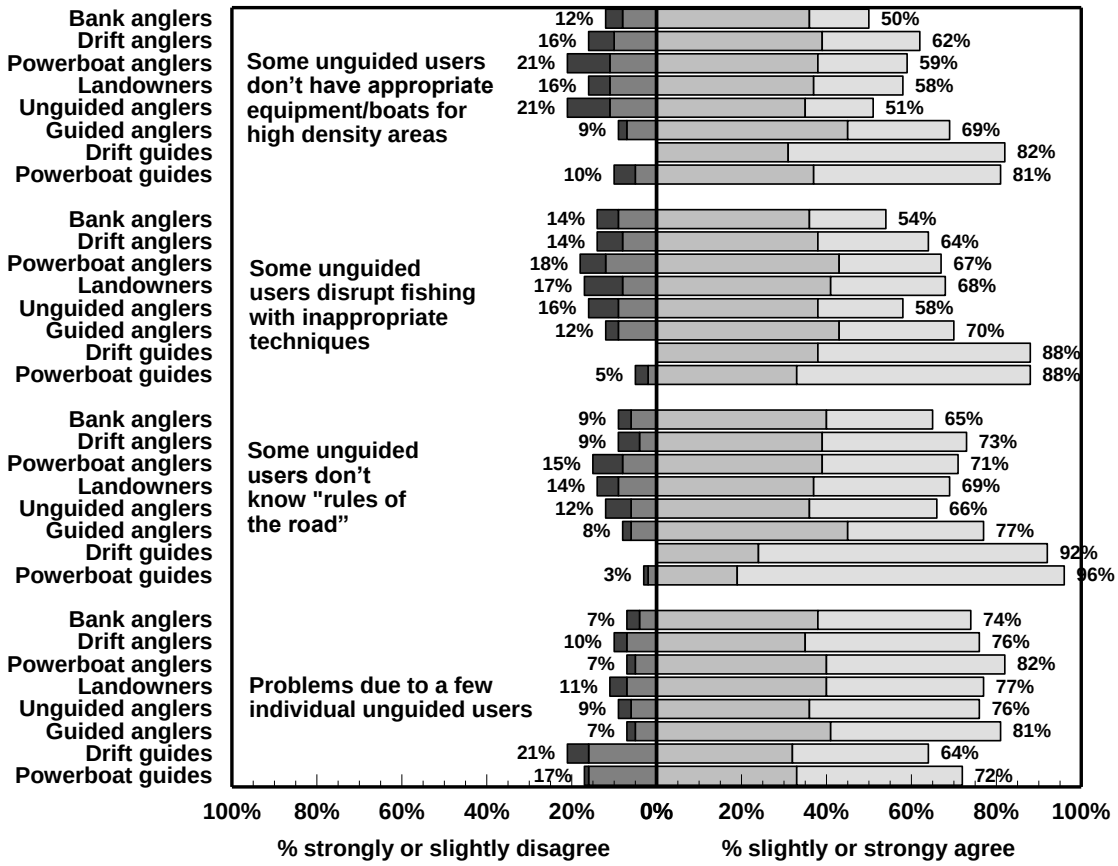

Figure 15-2. Percent agree/disagree with common statements about unguided use.

Figure 15-2 provides results for different groups; findings include:

- Most boating users agree that some unguided users lack the appropriate equipment or boats to fish in high density situations, and even more agree that some unguided users don't know the "rules of the road." Responses to the two statements were also correlated ($r=0.64$, $p<.001$). Guides agree with these statements more strongly still, confirming focus group discussion that this is a major source of friction from the guide perspective. It is not surprising that some unguided users have less river-running knowledge (or less capable boats/equipment) than guides, but widespread recognition of the problem provides support for increased boater safety education or regulations
- Most users and an even more guides agree that some unguided users disrupt others by using inappropriate fishing techniques. Responses to this statement were also highly correlated with "unguided users don't have appropriate boats/equipment" ($r=0.69$, $p<.001$) and "unguided users don't know rules of the road" ($r=0.77$, $p<.001$). Taken together, these findings imply that interference impacts can be reduced if more users improve their boats/equipment, learn to drive better, and fish in sync with others. Education efforts that encourage this are likely to receive support from both sides.
- Majorities (64 to 82%) of all groups agree that most unguided use problems stem from behavior of a few individuals, an analogous finding to the parallel question about guides. However, responses to this statement were only weakly correlated with others related to unguided use ($r < 0.13$). Identifying and improving that behavior through education or regulation would garner support from both groups.

Statements about other guided/unguided use issues

Respondents were asked to agree or disagree with four additional statements about guides or guided use:

- No one group is the problem, everyone needs to share the burden of reducing impacts.
- The burden of reducing impacts should be proportional to the group that is causing the impacts.
- Limiting guided use is a good way to reduce overall use.
- Local economic benefits from guided use are more important than overuse issues.

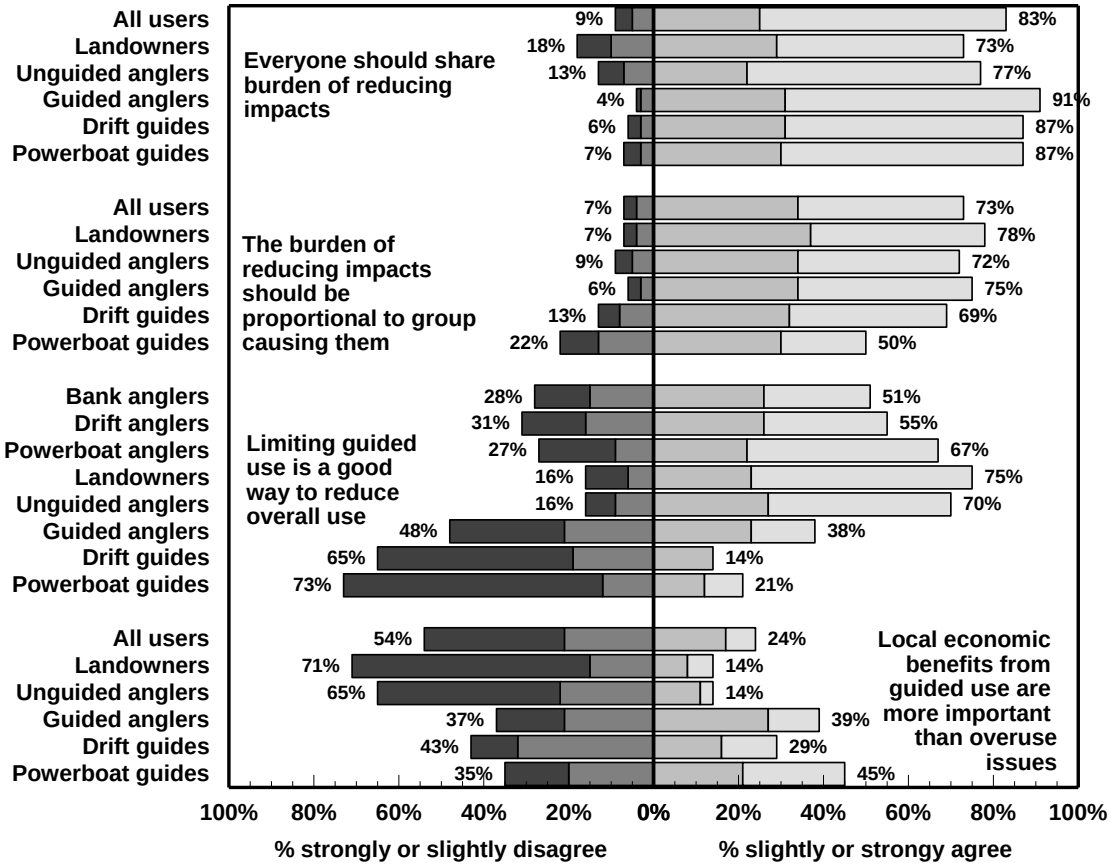

Figure 15-3. Percent agree/disagree with other statements about guided-unguided use issues.

Figure 15-3 provides results for different groups; findings include:

- Large majorities (73 to 91%) of all groups agree that "everyone should share the burden of reducing impacts." This proportion drops substantially for powerboat guides (to 50%) for the statement "the burden…should be proportional to the groups causing the impacts," probably reflecting concern that guided use will be limited more than others. Nonetheless, there is conceptual agreement that reducing impacts is important and should be shared.
- Differences between the two groups become more apparent regarding the concept of limiting guides to address overuse, and responses are consistent with rational self-interest. Limiting guides would reduce use and impacts at no cost to unguided users, and 70% support it, while guides see lost access for their group only. Guided users are more divided, but more disagree than agree (48% to 38%).

- Some of these differences are similar for the statement about local economic impacts from guided use being more important than overuse issues. Most users (particularly unguided users and landowners) do not think economic benefits "trump" overuse issues. This is also a rational position, as most would experience better conditions with few direct effects on their own situation. In contrast, guides are more divided, with powerboat guides more likely to agree than driftboat guides.

Other differences between guided / unguided users

Additional analysis explored other issues. Findings include:

- A model predicting agreement with "limiting guided use is a good way to reduce overall use" (R^2=.31) can be improved with other variables, but frequency of guided trips is still the biggest predictor:
  - Frequency of guided trips (r=-0.31); less guided use → more agreement on limiting guides.
  - Quality of trips over the years (r=0.31); more decline → more agreement on limiting guides.
  - Support for use limits in general (r=0.15); more support → more agreement on limiting guides.
  - Quality of management over the years (r=-0.11); less improvement in management → more agreement on limiting guides.
- The frequency of guided use was significantly correlated with many other variables, but mostly at low levels (e.g., less than 0.20). Those with higher correlations include:
  - Guided users reported less crowding, r=-0.20.
  - Unguided users have reduced/stopped use of some segments more often, r=-0.20.
  - Unguided users support limiting guided boats on Lower River in July more, r=-0.32
  - Unguided users support limiting total guides on Lower River more, r=-0.31
  - Unguided users support guide limits per day on Middle River more, r=-0.23
  - Unguided users support limiting the number of guides (in general) more, r=-.25

Other information about guided use

There are many ways to assess the amount of guided use, its contribution to overall use levels, and whether limiting guides or guide boats per day would be effective. In addition to information in Chapter 3 on use levels, we have assembled several graphs that approach the issue in different ways.

Figure 15-4 shows the number of commercial operator permits on the Kenai from 1982 to the present (from State Parks data base). The figure shows the number of powerboat guides, drift guides, non-fishing guides, fishing guides, and total guides. Note that some categories can overlap (a non-fishing guide could also be counted in the drift guide total). A companion figure (Figure 15-5) uses the same data to project guide numbers out to 2020, assuming long-term trends remain the same. Findings include:

- The total number of commercial operators is largely driven by the number of powerboat fishing guides. Powerboat guides make up 80 to 85 percent of all guides in recent years, and fishing guides make up 88 to 93% of all guides.
- Powerboat guides have increased over the long term, although there have been fluctuations for short periods and the last two years have been down (the 322 in 2009 was about 13% lower than the highest peak at 372 in 2007). A continued poor national economy and projected weak salmon runs appears likely to reduce this further in 2010. Another 6 to 7% drop would put powerboat guide numbers around 300, the 2000-04 level. (Note: October 2010 data from State Parks suggests powerboat guides have dropped to exactly 300).
- The number of drift guides has been about 60 to 80 over the past 25 years, and remains at 62 in 2010.

- The number of non-fishing operators (including boat rentals, shuttle operators, guided kayak tours on the lakes, and a horseback guide) has increased over the years, although at a slightly lower rate than powerboat guides.
- Applying long-term trends (using linear regression inherent in the graphics software program) to fit the historical guide numbers (Figure 15-5), the total number of commercial operations could approach 500 by 2020, of which about 470 would be fishing guides. Powerboat guides would approach 450, drift-based guides would slightly decline to 65, and non-fishing guides increase to about 60. These projections are meant to be simple illustrations of the long-term trend. Actual increases of this magnitude are unlikely to occur on that schedule given the reductions in last couple of years, but if the economy and fisheries rebound, we expect the long-term increasing trend to reestablish itself.

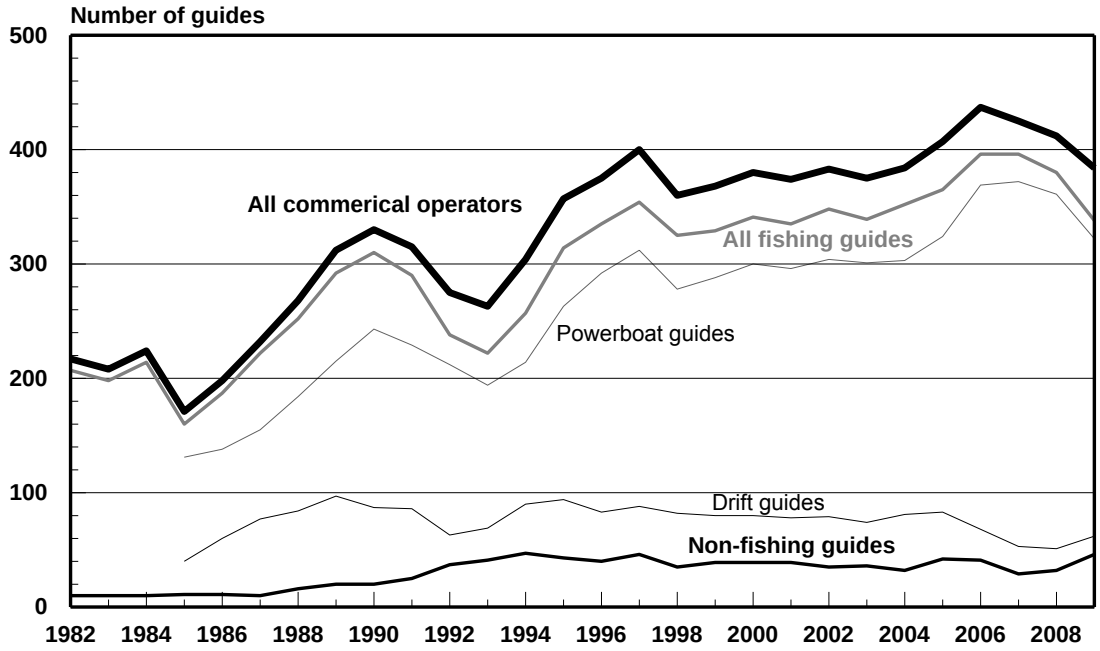

Figure 15-4. Number of commercial operators by category,1982-2009 (from State Parks).

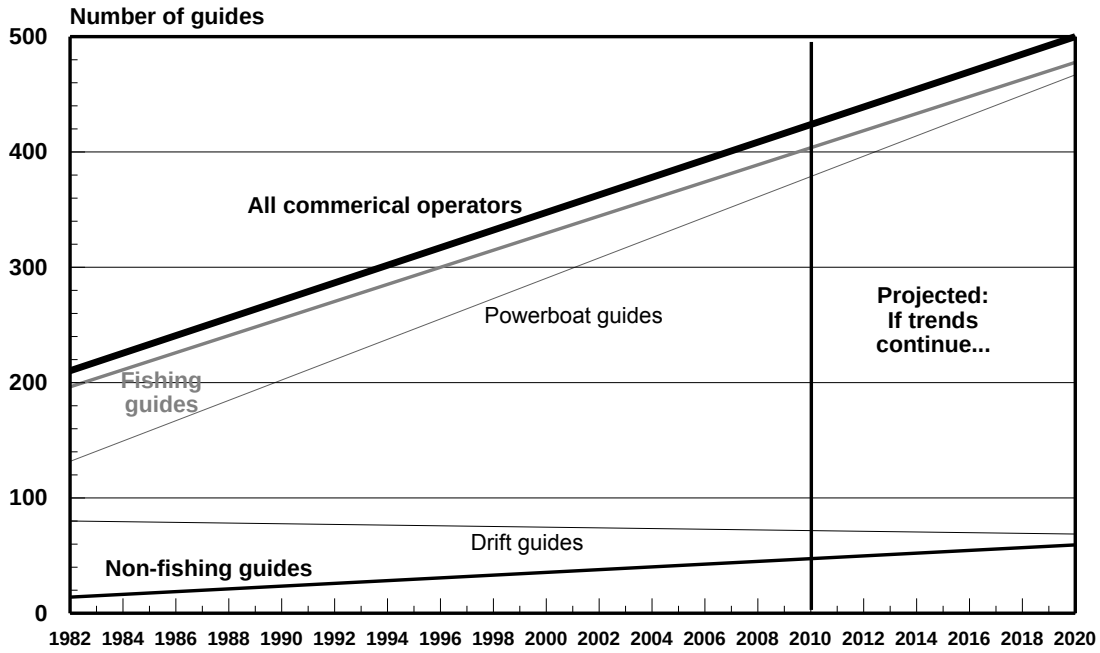

Figure 15-5. Historical trends for number of commercial operators by category (from State Parks).

The total number of guides may not be the best indicator of guided use levels on any segment or day, which is probably more important for management. Discussion about guide limits often focuses on the Lower River during July, when both kings and reds attract high use. ADF&G counts show that guided use makes up about 65% of at-one-time use when both guided and unguided users are on the river (6 am to 6 pm, Tuesdays through Saturdays). Does that proportion hold on highest use days (the days more likely to be "over capacity" and likely target for use limits on guides or all boaters)? Figure 15-6 shows the total number of boats during the four highest counts for each of the past five years, as well as the proportion of guided use during those counts.

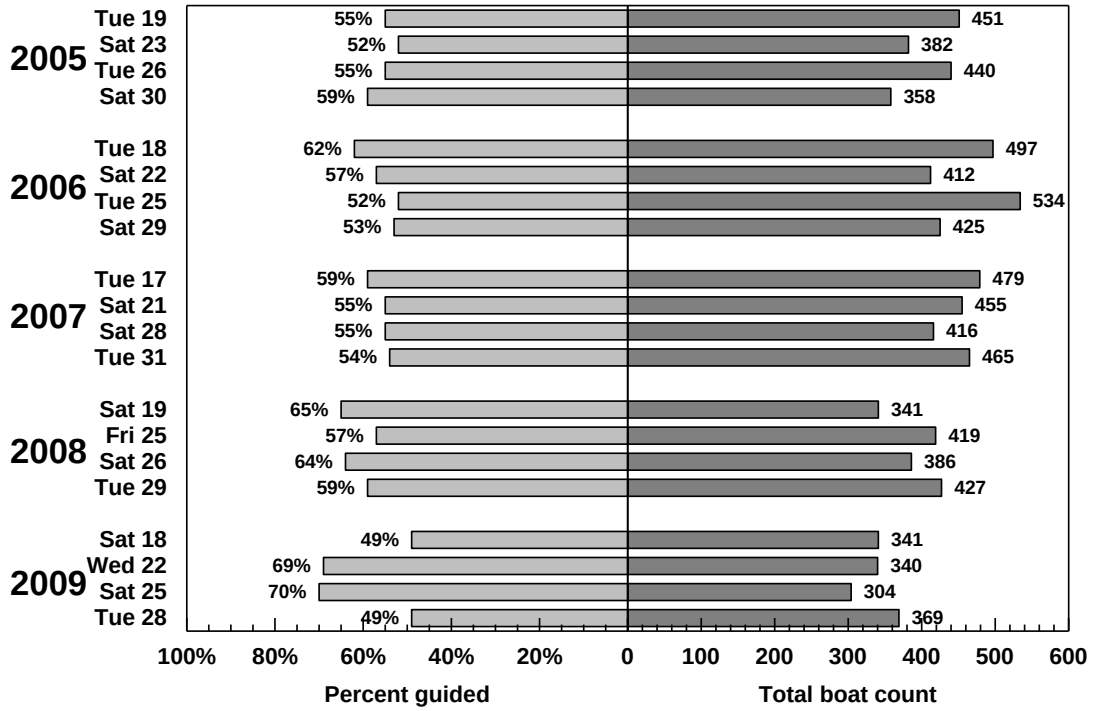

Figure 15-6. Total Lower River boat counts and percent of boats that were guided on high use days in July, 2005-2009.

Findings include:

- As discussed in Chapter 3, Lower River boating levels on high use days were higher from 2005-07 than in the past two years. High use in 2009 was generally less than 350 boats, while it commonly exceeded 400 to 450 in previous years.
- The percent of guided use varies across high use days. On some days it exceeds the July average of 59% (or the full season average of 65%), but on most days it is about 50 to 55%.
- Guided use provides the majority of use on high use days, but unguided use is variable and determines how high use will go.
- During the 1992 study, there were only 212 total powerboat guides, and the "rule of thumb" estimate was that guided use contributed about one-third of total use on the Lower River. In recent years, there have been as many as 372 powerboat guides, and the guided contribution is usually greater than 65% during the early king run, about 59% during July, and varies between 50 and 70% on high use days.

Similar data is not available for the Middle and Upper River, but most evidence (discussed in Chapter 3) suggests guide proportions are much smaller. On the Upper River, the number of guides and starts per

guide per week are limited, and 2004 photo data suggests less than a third of all boats are guided (with about half of guided trips scenic rather than fishing). On the Middle River, 2004 USFWS interview data from July and October suggest guided use is about 25% and 22% of all boats, respectively. 2009 data suggests this may be increasing to about 31%. This may be an area where future monitoring could help identify trends.

Residency of guides is often discussed as part of the guided/unguided debate. The proportion of guides with Alaskan residency shows it has varied between 68 and 81% over the years from 1982 to present, with an average of 76% (lowest in the late 1980s, 76% in 2009).

Other comments on guided / unguided use issues

Taken together, preceding information suggests some common ground. Education and regulation that improves 1) guide etiquette or 2) unguided craft, equipment, skills, and knowledge are likely to be supported by all sides. Similarly, most will support efforts to identify and sanction individual guides or unguided users responsible for problem behaviors. If these programs actually improve behavior on high use days, some friction will be reduced.

However, even significantly improved behavior (by guides) or improved skill and equipment (among unguided users) are unlikely to remove the fundamental tension between these groups, particularly on the Lower River during July. Guides are easily identified on the river, they make up the majority of use during "guide hours," they have a majority of clients from out of state, and their numbers have grown in the past two decades. It is not surprising that unguided users support guide limits that won't apply to them. Guides also represent a commercial use, and there is long tradition of restricting commercial recreation uses before all uses in recreation settings (Whittaker and Shelby, 2008).

Many guides are aware of this perspective and "push back" to protect their access. Common rebuttals include: 1) guided users are part of the public too; 2) guides offer opportunities to people without skill or equipment; 3) guides are skilled operators that can help establish "best practices" or help with rescues (when needed); 4) guided use produces local economic benefits; 5) guide access is already restricted to specific days and hours (and limited on the Upper River); and 6) unguided use has also increased over the years and should be part of any use limit effort.

These opposing perspectives will make it challenging to develop consensus opinion about the need for or appropriate level of guided use limits (or all user limits). If agencies contemplate guide limits to meet capacity goals, they should brace for contentious debates and possibly litigation. In these situations, a transparent decision-making process and extensive opportunity to engage stakeholders will be important to develop reasonable objectives, apply limits that accomplish those objectives, and treat different groups fairly.

To help work through such a process, agencies and stakeholders might consider the following:

- Guide limits are an issue on the entire river, but not all commercial use is growing and it is possible to target specific segments and seasons (as do Upper River guide limits). The Lower River in July is the most prominent segment/season where guide limits are a major issue, although unguided users support such limits on the Middle River too.
- Many rivers with substantial commercial use and overuse problems have limited guided use, often without limiting unguided use. But unless one expects all the growth in use to be guided, limits on guides alone will not solve the problem. On the Upper River, for example, limits on guides have probably slowed but not stopped increasing use.

- Unless guide limits are substantially lower than current levels, they are unlikely to dramatically reduce use levels. For example, during high use periods on the Lower River (e.g., peak counts over 400 boats per day), guided use may account for 200 to 250 boats, so a 20% reduction in guided use would only remove 40 to 50 boats (probably noticeable, but within current day-to-day variation experienced on the river).
- Guide limits for the Lower River in July are probably best viewed as a way to slow future growth of the largest use sector. If a freeze on guide numbers had been implemented in the early 1990s (when first proposed), there would be 30 to 40% less guided boats now. The open question is whether this long-term growth trends will continue going forward.
- Limiting the commercial sector first tends to pre-determine a "split allocation approach" if a full system is ever implemented. The advantages and disadvantages of "split allocation" vs. "common pool" approaches are complex and beyond the scope of this document, but these need to be carefully examined. A full discussion of river use allocation issues (not to be confused with fishery allocation) is in Whittaker and Shelby (2008).
- Although over 100 rivers in the country have guide limits specified (with many agencies actively managing the number of guides or other components of their use), including several federally-managed rivers in Alaska (e.g., Alsek, Gulkana, Upper Kenai, Karluk, Togiak Refuge rivers). The State of Alaska has a shorter history and different guide regulation structure that has focused more on certifying safe operations than regulating the amount of use.
- Many use limits (including limits on guides alone) on Lower 48 rivers were supported by existing guides who were concerned that rising use was degrading their trips. That support often rested on the assumption that existing guides would retain "grandfather rights" to operate, a legally unanswered question in Alaska.
- If guide limits are contemplated, consequences will vary depending upon the type of limit (e.g., the total number of guides vs. the number of guide boats for a specific segment or period). In general, limiting overall number of guides is a "broader" action. Many of the Kenai's overuse problems appear on the highest use days, so it makes sense to also target those periods.
- If a split approach is taken, one major challenge will be to determine an "appropriate" split (which may vary by segment, season, or time of day). Because current use on the Lower and Middle River is unrestricted, a fair assessment of market-driven demand is possible for these segments; once use is limited, assessing demand becomes nearly impossible leading to value-based debates and difficulty developing objectives-based decisions.
- It is always more challenging to reduce use rather than freeze it; reductions represent loss of income or access, while a freeze only prevents growth. Given that market conditions appear to be driving current guide numbers to roughly 2000-04 levels, there may be a "window" for an interim freeze to allow agencies, stakeholders, and the public to work through a range of management actions. Such a freeze would protect current guides, which is probably preferable to allowing growth and then deciding that reductions are necessary.

16. User Fees

*This chapter reports responses from the **follow-up survey** regarding user fees. Respondents were asked if they would be willing to pay user fees. Other issues related to fees in river settings are also reviewed.*

User fees are often used to help offset the costs of managing recreation areas. Various federal agencies have day use, camping, and boat launching fees at facilities across Alaska, although most are not for simple use of the river. On some rivers in the Lower 48 (e.g., Colorado River in Grand Canyon, Oregon's Deschutes, Idaho's Middle Fork and Main Salmon rivers), daily fees above and beyond facility use have been in place for many years and are widely accepted.

Opinions about user fees

2009 respondents were asked:

> Management of the Kenai River (facility maintenance, river patrols, etc.) is currently funded by state and federal budgets. Would you be willing to pay a "user fee" on the Kenai (beyond launch or other facility fees already charged), assuming that all revenues would be returned to help manage the river?
> ___ no ___ yes
>
> How much would you be willing to pay?
> _____ dollars per day
> _____ dollars per season

1992 respondents were asked a similar question:

> Would you be willing to pay a "user fee" on the Kenai if it were used to increase the quality of services provided?

The 1992 question was modified because 1) several new facility fees have been introduced since 1992; 2) agencies wanted to clarify that revenues from fees would be used to help manage the river; and 3) fees we wanted to ask about were above and beyond current facility-based fees. Despite these differences, it is useful to compare findings from the two different studies (Table 16-1).

Table 16-1. Percent willing to pay user fees and average amounts.

Users	All users	Bank anglers	Drift anglers	Powerboat anglers	Land-owners	Drift guides	Powerboat guides
% yes in 2009	48	47	55	38	30	39	26
% yes in 1992	61	61	75	57		not asked	
Average per day 2009	6	5	7	5	3	4	3
Average 1992 (inflation adjusted)	6 (10)	4 (6)	7 (11)	7 (11)		not asked	
Average per season 2009	49	40	59	49	48	107	32
Average 1992 (inflation adjusted)	18 (28)	17 (26)	20 (31)	17 (26)		not asked	

Note: Average fees in parentheses adjusted for inflation to 2009 dollars.

Findings include:

- Just under half of all users are willing to pay user fees; drift anglers were the only group with a majority reporting a willingness to pay. Powerboat anglers, landowners, and powerboat guides were least willing to pay.
- Substantially fewer users were willing to pay user fees in 2009 than 1992 (48% vs. 61%). Possible explanations include:
  1) The new preamble to the question changes how respondents interpreted the question (in particular, the 1992 question emphasized "improving quality" rather than collecting fees "beyond…facility fees").
  2) Several new day use fees have been added at State Parks or other recreation facilities on the river since 1992; this may have induced some "fee fatigue" among users.
  3) The downturn in the 2009 economy.
  4) General anti-government or anti-tax sentiment.
- Of those willing to pay in 2009, average amounts were $5 to 7 per day and $40 to 50 per season. Adjusted for inflation, per day amounts were lower than in 1992 but per season amounts were higher.
- 2009 differences between drift and powerboat anglers were similar to a study of 1999 Gulkana River users, where there was more willingness to pay among drift anglers (61%) than powerboaters (42%).
- Previous research suggests that fees associated with specific management actions (e.g., litter patrols, facilities development, etc.) are more likely to be supported than fees without specific associations (Puttkamer, 2001), which further explains potential differences in the 1992 and 2009 results.

Other fee considerations

When considering fees, planners should recognize that fee collection introduce a larger "management footprint" on trips. Fees may also dampen use levels, a potential way to redistribute use from higher to lower use areas. There is anecdotal evidence that variable launch fees affect use levels at Kenai launches (e.g., , and the Deschutes River in Oregon has effectively applied "congestion fees" (higher fees on weekends) to redistribute use from weekends to weekdays.

In addition to these direct effects on users, fee programs may also impact future management choices in subtle ways. If user fees lead to lower legislative appropriations for management, for example, agency revenue streams dependent on higher use levels could lead some agencies to favor higher density opportunities. Agencies might also become more interested in developed opportunities that typically feature higher fees and revenues. Taken together, fee programs run the risk of "commercializing" recreation experiences, with direct, indirect, and sometimes unintended consequences. Fee programs can be an important source of management revenue, but fees may be more appropriate for some situations than others, and deserve consideration beyond the issue of whether people are willing to pay them. Additional information about fees (their history, advantages, disadvantages, and public support for them) is available in an annotated bibliography on the topic (Puttkamer, 2001).

17. Non-Recreation Development Issues

*This chapter reviews responses from the **follow-up survey** about private land development (with a particular focus on the visual impacts of riverside development, which State Parks has some responsibility for). Respondents were asked about current development and permitting requirements.*

Preferred levels of development

Respondents were asked to identify the appropriate level of river front development (e.g., docks and fishing platforms) from a visual perspective. Specific wording for the question follows; it was asked for each of the three segments:

> Public and private land owners on the Kenai River are currently allowed to develop up to one-third of their riverfront property with docks or fishing platforms. For the entire river, at least 12% of the river's banks have been developed.
>
> Based on this information and your experience, how much development is appropriate from a visual perspective? (Please check one response for each segment you visit).
>
> ❑ Development should be reduced
> ❑ Keep it near current levels
> ❑ Allow it to increase slightly
> ❑ Allow it to increase substantially
> ❑ Allow it to double
> ❑ Allow it to triple
> ❑ I'm uncomfortable answering this (please specify why below)
>
> If you are uncomfortable estimating an appropriate level of bankside development, check all reasons that apply. *(If you identified a development level above, leave this question blank).*
>
> ❑ I just don't know
> ❑ I care about visual impacts but it is difficult to specify an appropriate amount.
> ❑ I care about visual impacts but the appropriate amount depends on the type / location of development.
> ❑ I don't care about visual impacts as long as there is "no net loss" of fish habitat.
> ❑ I don't care about visual impacts because property owners have a right to create recreation facilities.

Results for all users are given in Figure 17-1 and Table 17-1; additional information is in the supplemental report. Findings include:

- Most users favor current levels of development (about 55%) or reductions (about 20%). Of those favoring more development, most prefer slight increases, and less than 5% prefer doubling or tripling development (which current regulations allow).
- Differences for the three segments were small, suggesting a broader underlying attitude toward development (for most, "don't let development increase").
- Differences between groups were small.
- Among those uncomfortable identifying a preferred development level, 36 to 53% said it depends on the type and location of development. Several verbatim comments specified how some development was preferred to bank trampling (see supplemental report).

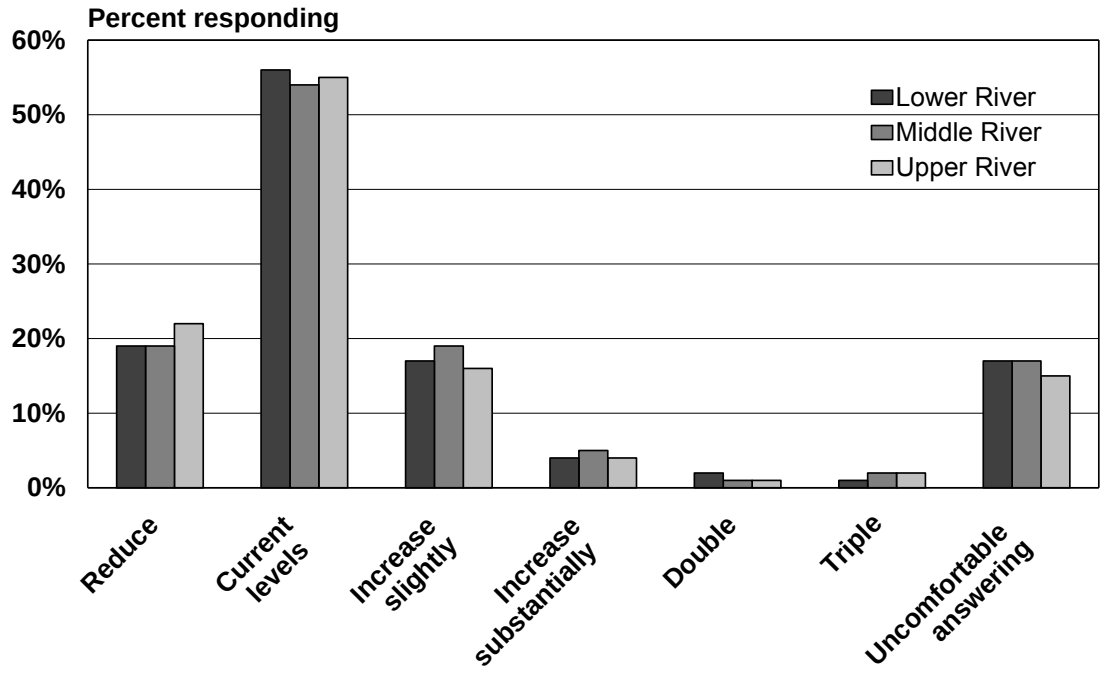

Figure 17-1. Preferred level of bankside development along Kenai River segments among users.

Table 17-1. For those uncomfortable answering development levels, percent identifying reasons.

	All users n=459[1]	All guides n=99[1]	Landowners n=98[1]
I just don't know	31	13	14
I care about visual impacts but the appropriate amount depends on the type and location of development.	36	51	53
I care about visual impacts but it is difficult to specify an appropriate amount.	27	32	23
I don't care about visual impacts because property owners have a right to create recreation access facilities.	10	14	17
I don't care about visual impacts as long as there is "no net loss" of fish habitat.	13	25	16

1. Among respondents in each group that identified any reasons.

Opinions toward land use regulations and permitting

Two questions asked respondents to agree or disagree on a 5 point scale with general statements about land use regulations and development along the Kenai. Results are shown in Figure 17-2.

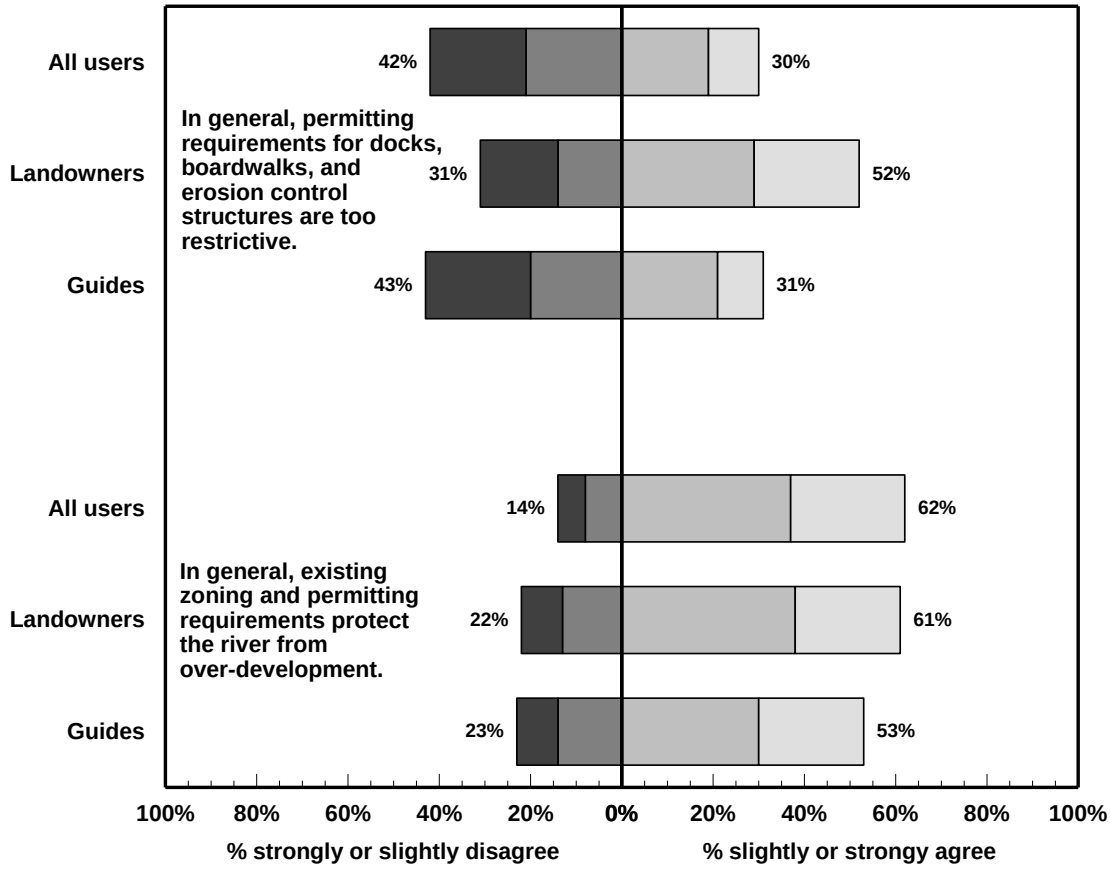

Figure 17-2. Percent agree/disagree with statements about permitting.

Findings include:

- Fifty-two percent of landowners find permitting requirements too restrictive, while users and guides are more divided. Landowners have first-hand experience with and may be responding to specific permitting requirements, while others may be interpreting the question through a broader perspective about whether restrictions seem fair.
- Fifty-three to sixty-two percent of all three groups agree that existing zoning and permitting requirements protect the river from overdevelopment, which fits with support for the status quo level of development (reported in Figure 17-1).

18. Concluding comments

The preceding chapters document use and impact levels on the Kenai River and support for management actions that might be used to address them. Taken together, the information supports a common narrative about the Kenai: there are times and places where use and impacts diminish the quality of experiences, and the river is "not what it used to be." Results also show considerable support for some actions (particularly facility development and education) to address these problems, but more divided opinion about several regulation options, changes in the type of use (e.g., more drift-only times/segments), or use limits (for guides or all users).

Implementing actions with greater support should be possible, contingent on agency budgets. But choosing among actions with less support is likely to be challenging, with extensive stakeholder and public debate. One goal of this report is to inform agencies, stakeholders, and the public about issues in these debates. We also offer the following comments based on our research and planning experience on other rivers and our interpretation of Kenai-specific information from studies in 1992 and 2009:

- Management on the Kenai River might be characterized as "mature." The river has been popular and heavily used for over five decades, and agencies have been concerned about impacts from that use for at least three of those decades. Along with planning and management activities by local and federal agencies, State-driven planning efforts have produced a comprehensive management plan in 1986 and a revision in 1998. These existing plans provide general direction for addressing overuse problems, as well as constraints on what can be done. It's unlikely that a major overhaul of these plans is needed, and most initiatives can be developed with "step-down" plans or amendments to the existing Comprehensive Plan.
- It is important that new initiatives be considered in a comprehensive manner and coordinated with relevant partner agencies and stakeholders. One can liken this to a doctor's prescription to an aging athlete: the prescription may include exercise, diet, and training advice, in addition to vitamins or drug therapies. But the athlete can't expect high performance unless all the advice is taken; focusing on just one part of the prescription is likely to be ineffective (and possibly harmful).
- The KRSMA advisory board offers an institutional mechanism for prioritizing and considering initiatives in a comprehensive fashion. The board and its related Guide, Habitat, and River Use Committees have representation from multiple agencies and stakeholders, with a structure for reviewing ideas, considering information, and formulating a reasonable range of management alternatives to address a problem. Agencies could then review and refine alternatives, conduct additional analysis as needed, and present options for public review. Utilizing KRSMA as the initiation point for this process ensures better cross-agency and stakeholder coordination. But committees made up of multiple and sometimes opposing groups often have difficulty developing strategies that go beyond the "least common denominator" (easier actions with consensus support or uncomplicated actions). In our experience, leadership from a lead agency can be crucial in overcoming this disadvantage.
- The KRSMA board typically meets from fall through spring, and chooses issues through an *ad hoc* or reactive process. A more systematic prioritization of issues conducted in early fall might help organize the scope of issues they will tackle each year. Study results about issue priorities might provide a useful starting point. Without a commitment to particular issues, it is too simple to "punt" on challenging problems.

- This study provides considerable information for addressing several issues, but other issues may still not be "ripe" for resolution without continued monitoring or longer-term attention from the public. For example, even if there were support for boating use limits, it is challenging to set a definitive capacity for some segments because data are not reported and is difficult for users to associate use levels with impacts they care about. This study provides information about potential standards for social impact indicators (e.g., perceived crowding, bank angling proximity, boating interference incidents, fishing competition), but broader acceptance of capacities is more likely if users become familiar with the use levels that would start to violate those standards. Developing an efficient but meaningful measure of use, then collecting and publicizing that information is important to educate everyone about use-impact relationships.
- Chapter 14 described the probability of increased use over the long-term and recognition that use may not become "self-regulating." Kenai recreation use is a classic "tragedy of the commons" situation, where there are few incentives for individuals or groups to constrain their own growing use, even though the collective impacts will inevitably degrade the resource. The solution to this problem, as discussed in the economics and recreation literature (Hardin, 1968; Shelby & Heberlein, 1986; Manning, 2007), is always some variation of "mutual coercion, mutually agreed-upon" – collective actions that limit all groups in equitable ways. The history of resource management (whether applied to fish, forests, or recreation use) suggests a "line in the sand" will be needed at some point. If there is not sufficient public interest or political will to define that line now, good management should at least inform agencies, stakeholders, and the public about current conditions, how they may worsen in the future, and what is needed to stabilize or improve them.
- Ultimately, we hope agencies, stakeholders, and the public use information from this study to make conscious decisions about the kind of recreation opportunities and conditions they want on the Kenai River. The goal should be "management by design" rather than "management by default." Higher density opportunities are not inherently better or worse than lower density ones, but Disneyland is different from wilderness. Obviously the Kenai falls between these two extremes, but more recreation development or regulation may be needed to handle the volume of use if there is no political will to limit use. The challenge is to make deliberate and well-informed decisions about "what kind of place the Kenai River will be, and what mix of recreation opportunities it should provide."

19. Supplemental Report Sections

Additional information from the study is provided in a separate electronic report. Sections in that report include:

1. Onsite surveys – copies of the survey instruments for drift anglers, powerboat anglers, bank anglers, and non-anglers.

2. Follow-up surveys – copies of the survey instrument for users, landowners, and guides.

3. Fieldwork notes – information from 2009 fieldwork.

4. Focus group notes – notes from 8 focus groups used to develop the survey instruments.

5. Use observation forms – copies of the use and impact observations forms used to collect information from on the river.

6. 2009 use level information – additional graphs and tables from use data provided by other agencies and studies (collected in one place for convenience).

7. Use observation results – additional tables with use data for comparisons in future years.

8. Onsite survey results – additional tables and analyses for sub-groups and segments.

9. Follow-up survey results – additional tables and analyses for sub-groups and segments.

10. Verbatim comments – open ended comments from onsite and follow-up surveys by group and topic.

11. Study technician observations – a summary of observations from the Upper River technician, with particular attention to Jim's Landing congestion issues.

12. Excerpts from Forest Service Report on Upper River bear-human incidents.

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