Remote & Dispersed Visitor Use Estimation by Aerial Survey Transects

Final Report for Lou Waller,

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1. Introduction

The National Park Service Units of the Alaska Region are the largest parks in the National system of protected areas, are difficult or impossible to access by conventional road or trail, and are visited by relatively few recreationists (compared to park Units in the lower 48 States). These remote and dispersed recreation characteristics pose unique challenges to park managers when attempting to determine visitor numbers and distribution. The workshop of the Visitor Use Estimation Working Group, held in March 2002, recommended the examination of four methods for sampling and estimating visitor use in units of the Alaska NPS System that are characterized by remote and dispersed patterns of recreational use:

1. Internal visual observations at specific locations by NPS personnel (stationary)
2. Indirect estimation using incidental business permits and visitor registration
3. Aerial surveys
4. Compliance checks

This report details a study of the feasibility of using the third of these approaches – direct counting by aerial surveys. The approach is considered for three NPS units:

1. Gates of the Arctic National Park
2. Yukon-Charley Rivers National Preserve
3. Katmai National Park & Preserve

2. Approach

The numbers of visitors to, and their distribution within, a NPS unit are determined by conducting systematic flight surveys of established sample units. The effectiveness of visitor counts and distribution at discrete locations by aerial survey in predicting spatial distribution of recreation requires validation and calibration against data collected by internal visual observations on the ground, indirect estimations, and random compliance checks.

Using stratified network sampling (Thompson 1992) we focused sampling efforts at well-defined gateways (WDG) and along visitation corridors most likely to support recreation activity. Flight survey transects were stratified for sample allocation based on proximity to WDG, access corridors, and park attractions since these features likely had the greatest effect on probability of recreational use across user groups. These features were identified based on NPS GIS layers and consultation with NPS Unit recreation managers. By maximizing sample effort along transects most likely to be used by recreationists (Becker et al. 1998) we will be able to identify the majority of dispersed recreation in a NPS Unit.

Eighteen systematic flight surveys will be conducted between June 1 and August 31. This 14-week period supports the majority of summer recreation use in Alaska NPS Units and is also suitable for flight operations due to adequate daylight. Three days of survey flights will be conducted during each four-week period. In order to capture the greatest

magnitude of recreation use, two of these surveys will occur on weekends (Friday-Sunday and holidays), and for complete temporal coverage one on weekdays (Monday-Thursday). Survey days will be separated by at least three days to ensure independence of sampling.

Flight time is expected to be less than 4 hours and planes will fly predetermined and repeatable routes within Park units. Flight paths will be validated using on-board Trimble GPS units which will actively record the position of the plane and time once every 10 seconds throughout the entire flight. Each plane will have a two- or three-person team, the pilot and one or two observers. Observers will enumerate and map locations of all observed recreationists on 1:63000 topographic maps. Activity will be quantified into three classes (1) *foot / hiking,* (2) *water / boating* and (3) *aircraft supported* (helicopter and fixed wing).

3. Questionnaire Survey on remote and dispersed visitor monitoring

A brief questionnaire survey as recommended by the 2002 Workshop was administered to residents of, and visitors to, Alaska to assess the attitudes and likely compliance of visitors toward remote and dispersed visitor measurement. The survey was conducted at the Anchorage Visitor Center (to target visitors) and several locations around Anchorage (Anchorage Museum, International Hostel, AK Railroad Depot, UAA, APU, Anchorage International Airport) and Eagle River (Jitters and Carrs). The survey questions and summary of results are attached in Appendix 1.

Of the 301 respondents interviewed 38% were resident and 72% non-residents while 72% had either visited or were intending to visit a NPS Unit. The major purposes of a visit to a NPS Unit were to stay at a lodge (76%), for wildlife viewing (64%), hiking (63%), boating (26%), or camping (18%). The primary means of entry to the NPS Unit were motorized boat (71%), car (70%), non-motorized boat (46%), aircraft (23%), and on foot (5%). The most preferred methods of visitor monitoring were aircraft observation (91%) or registration at NPS Unit Headquarters (89%). The least preferred methods were enforcement patrols (5%), self-reporting (10%), or ranger observations (16%).

In general, while quantitative data regarding attitudes were not systematically collected, both visitors and residents expressed positive attitudes toward small aircraft overflights in Alaska NPS Units (and Alaska more generally) during conversations. To visitors, small planes were part of the "Alaskan Experience". Most referred to the vastness they perceived in the landscape and the lack of roads, thus, by necessity, travel occurred by small plane. Many referred to stories they had read as children (or to their children) about 'bush life' in the 'last frontier'. Residents viewed small planes more pragmatically as simply a way to get around the landscape and access areas of customary use to them. Almost all residents stated they knew of someone who piloted a small plane or how to gain access to one (e.g., via a company).

4. Proposed overflight transects for remote and dispersed visitor counts

4.1 Yukon-Charley Rivers National Park

A single transect of 462km was delineated from Eagle to Circle that follows the Yukon River with two side-flights respectively up the Kandick River and the Charley River. The transect includes the major river corridors of the national park and visitation sites including a pass over the landing strips and historic mining sites of Coal Creek and Woodchopper Creek. The entire transect is shown in Figure 1 (1:800,000) while a more detailed depiction of the central part of the park is shown in Figure 2 (1:400,000).

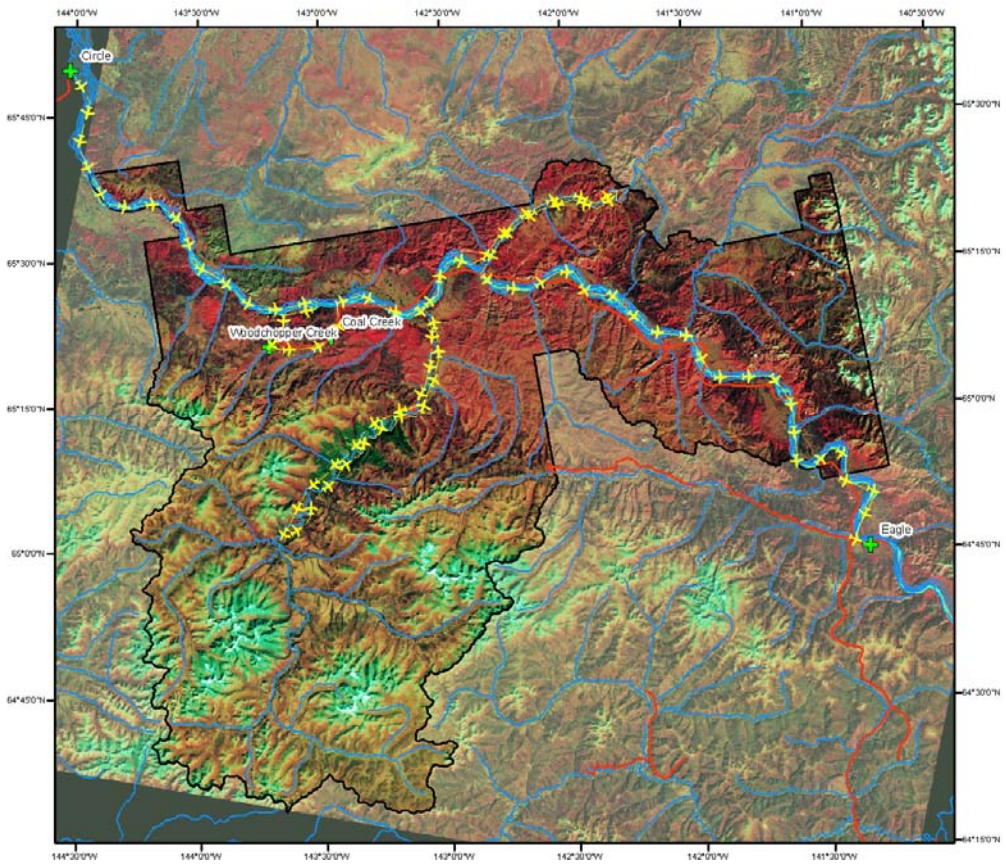

Figure 1: Map of Yukon-Charley National Park at 1:800,000 showing overflight transect between Eagle and Circle for remote and dispersed visitor counts.

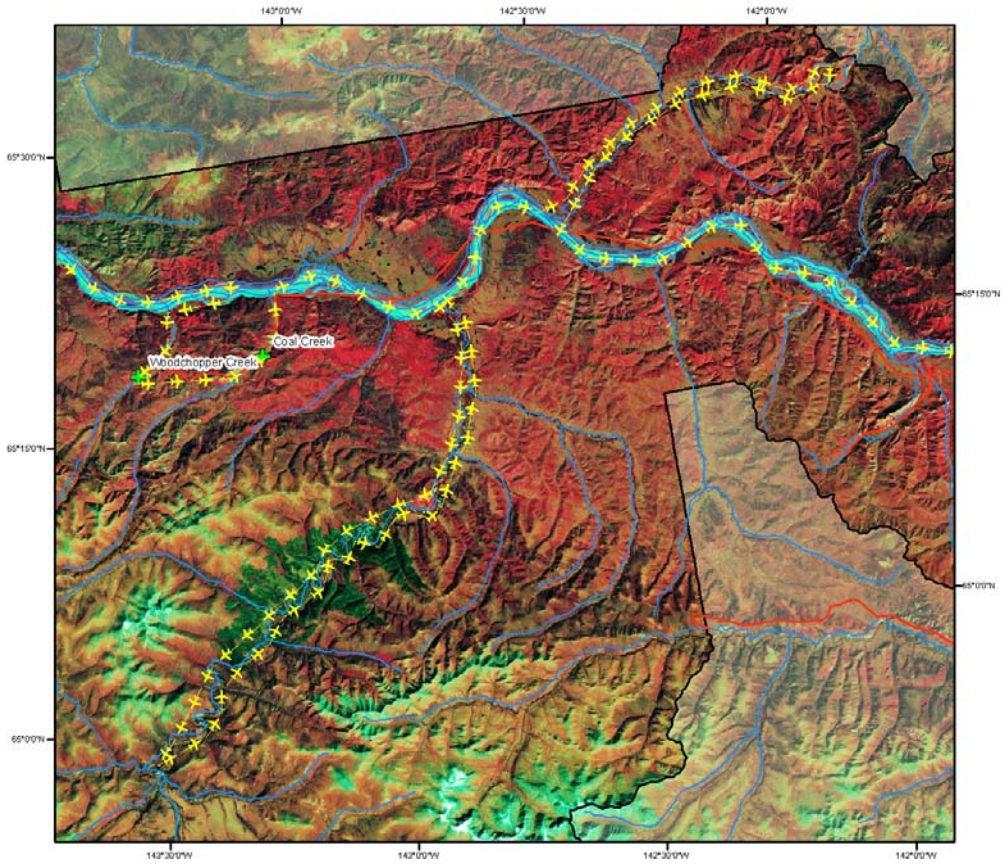

Figure 2: Map of part of Yukon-Charley National Park at 1:400,000 showing part of overflight transect between Eagle and Circle in vicinity of Charley and Kandick Rivers for remote and dispersed visitor counts.

4.2 Katmai National Park

Two transects were delineated for Katmai National Park – one overfight route for the lakes and rivers of the park, and one marine route for the coastline and anchorages of the park. A single overflight transect of 514km was delineated from King Salmon that follows the shorelines of Naknek Lake, Valley of 10,0000 Smokes, Savonski River, lakes Grosvenor and Colville, American River, Nonvianuk and Kulik Lakes, Kukalek Lake and Alagnak River. The transect includes the fishing lodges and major floatplane landings in the national park as well as key visitation sites such as Brooks camp and Valley of 10,0000 Smokes. The entire transect is shown in Figure 3 (1:800,000) while a more detailed depiction of the central part of the park is shown in Figure 4 (1:400,000).

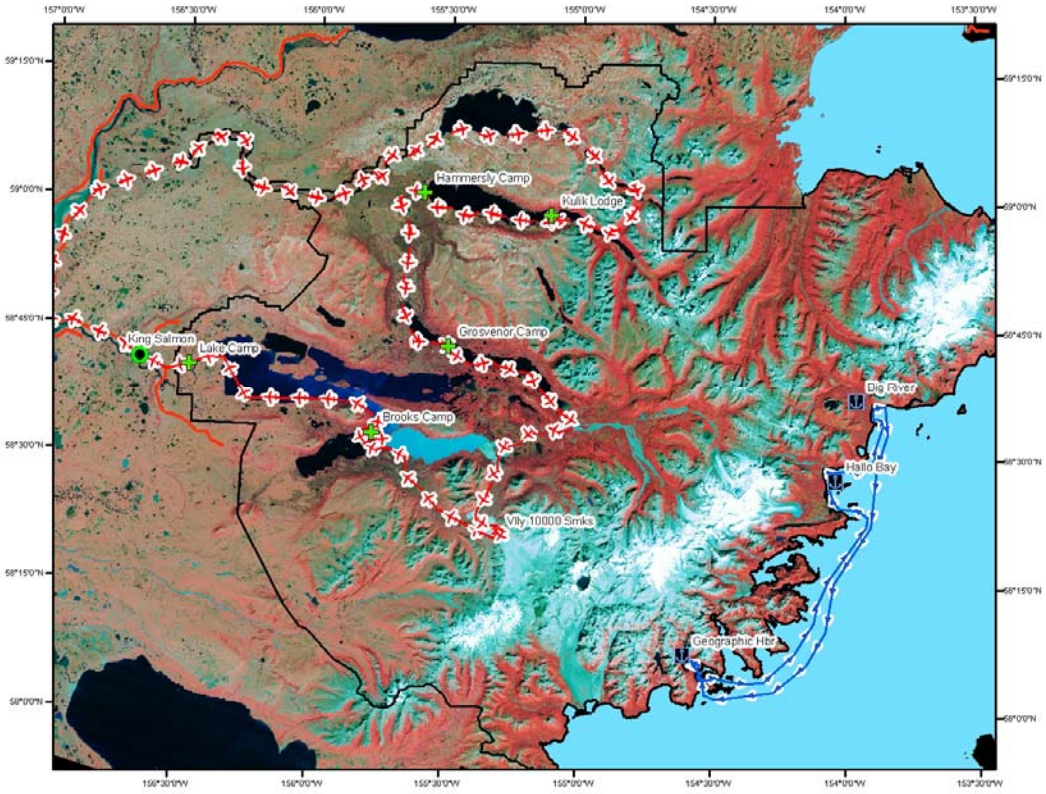

Figure 3: Map of Katmai National Park at 1:900,000 showing overflight and marine transects for remote and dispersed visitor counts.

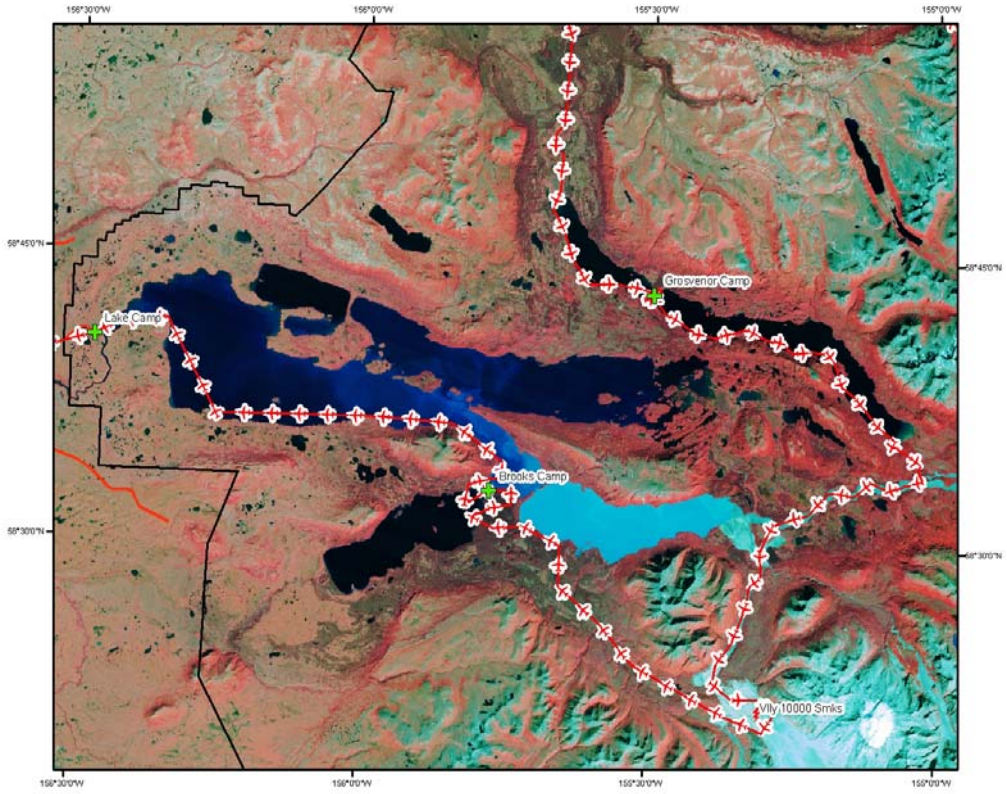

Figure 4: Map of part of Katmai National Park at 1:400,000 showing part of overflight transect from King Salmon in vicinity of Brooks Camp and Valley of 10,000 Smokes for remote and dispersed visitor counts.

A single marine transect of 203km was delineated from Geographic Harbor that follows the coastline north to Hallo Bay and the mouth of Big River. The entire transect is shown in Figure 3 (1:800,000) while a more detailed depiction of the route is shown in Figure 5 (1:400,000).

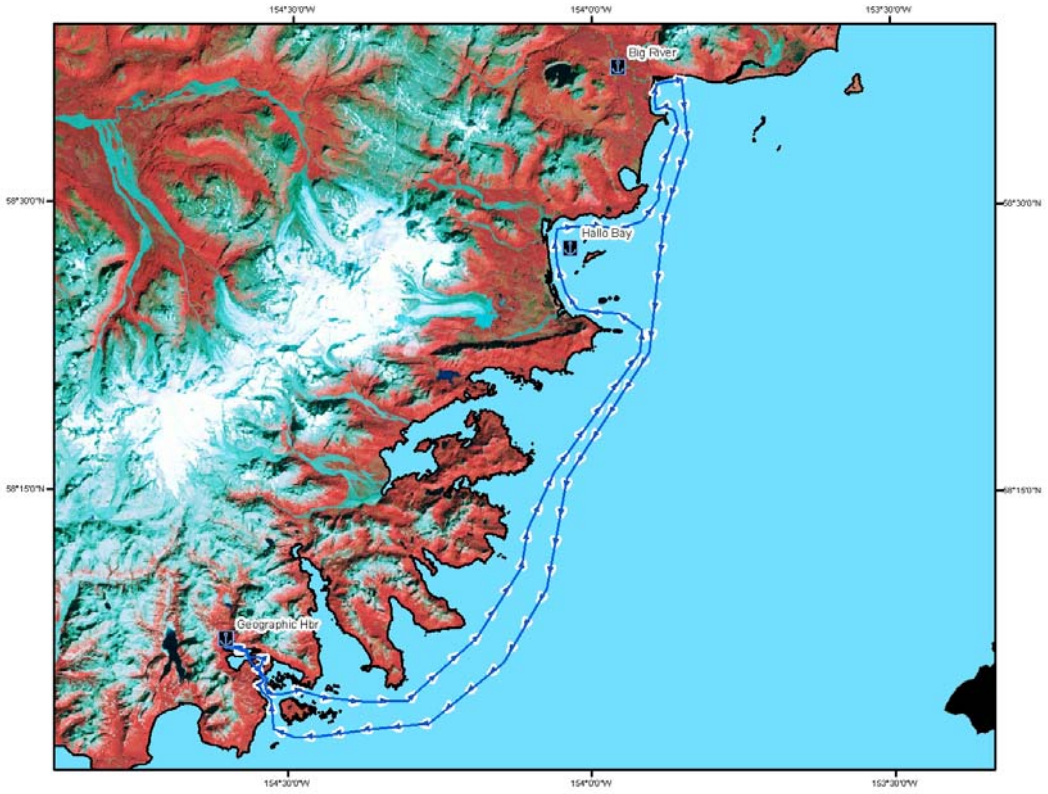

Figure 5: Map of part of Katmai National Park at 1:400,000 showing marine transect from Geographic Harbor in vicinity of Hallo Bay and Big River for remote and dispersed visitor counts.

4.3 Gates of the Arctic National Park

Three overflight transects were delineated for Gates of the Arctic National Park following the major access and river corridors for the park. Two overflight transects originate from Anaktuvuk Pass: the John – Alatna – Killick Rivers loop of 715km via Bettles, and; the Koyukuk – Tinayguk Rivers loop of 305km. A third overflight transect of 464km in the western portion of the park originates from Kobuk and traverses the Kobuk – Noatak Rivers loop passing Walker Lake. These transects include the major landing strips, lodges and canoeing corridors in the national park. The transects are shown in Figure 6 (1:1,400,000) while a more detailed depiction of the Anaktuvuk Pass vicinity of the park is shown in Figure 7 (1:500,000).

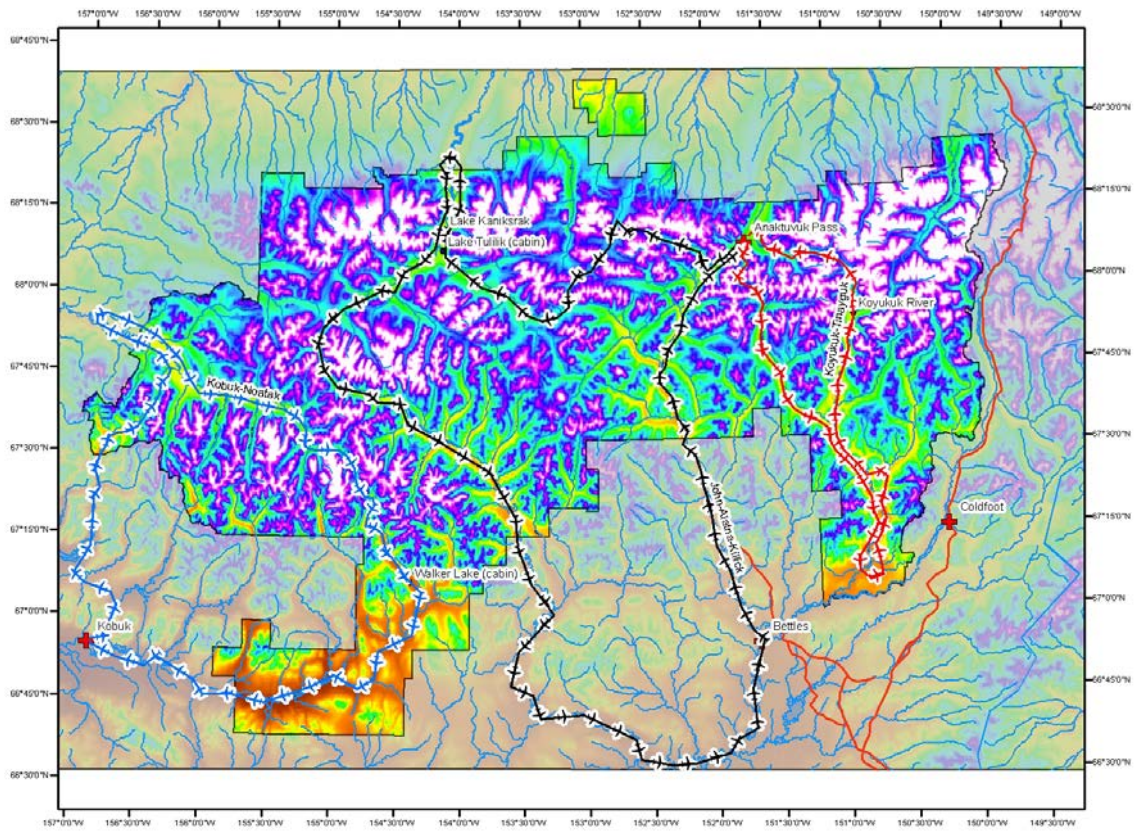

Figure 6: Map of Gates of the Arctic National Park at 1:1,400,000 showing overflight transects from Anaktuvuk and Kobuk for remote and dispersed visitor counts.

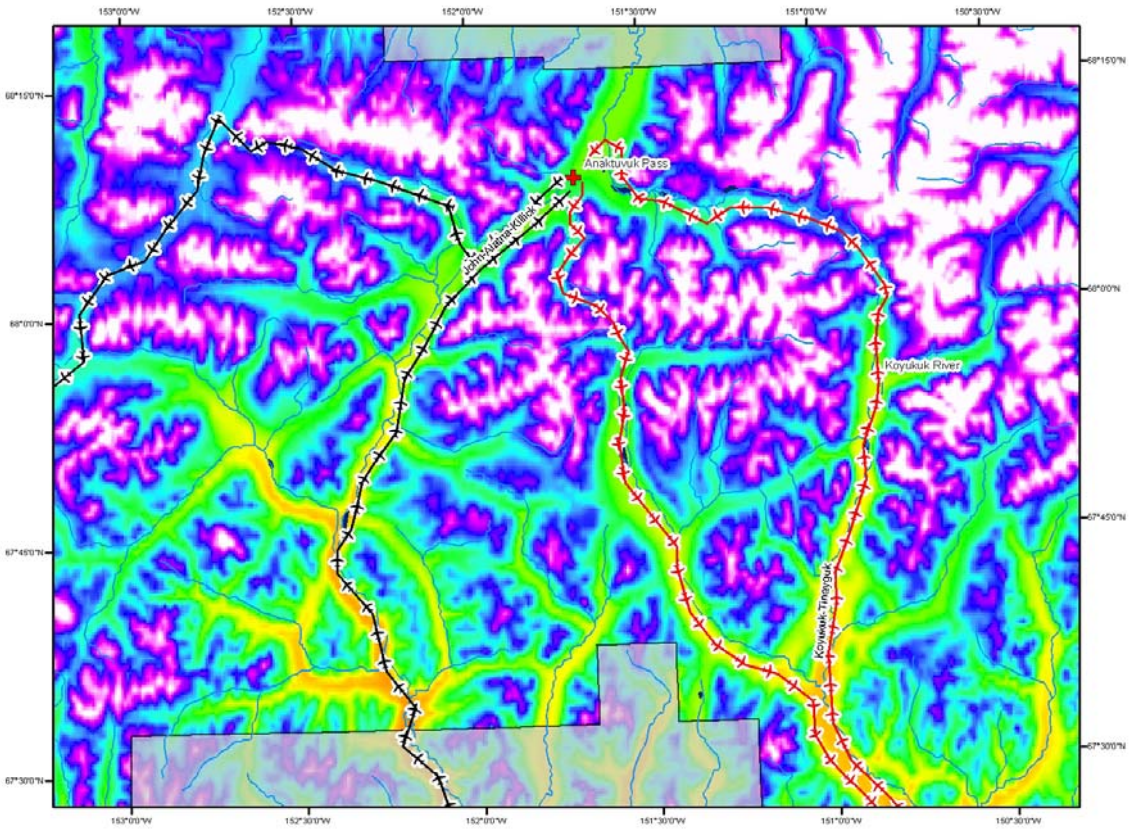

Figure 7: Map of part of Gates of the Arctic National Park at 1:500,000 showing parts of overflight transects in vicinity of Anaktuvuk Pass for remote and dispersed visitor counts.

5. Alternative methods to aerial survey transects

5.1 Posted Ranger Observations

Direct observations can be undertaken at WDG identified during the workshop. This approach has the benefit of allowing additional demographic and qualitative data to be collected. Drawbacks of this ground-based count is that it relies on a fixed position, the likelihood of missing passer-bys is high, the numbers counted could be too small to extrapolate or be statistically significant, and the approach requires personnel committed to a single point throughout the season.

5.2 Guide Reporting

Benefits of this using registered guide reporting and records are that numbers can be extrapolated from advanced bookings. However counts may or may not reflect park use proper outside the sphere of influence of in-holdings. Because data are not directly obtained, but a secondary source, much less effort is required however this is at the expense of data reliability and coverage.

6. The use of overflights to estimate, monitor and spatially reference visitors to Alaska NPS Units

The proposed overflight transects (section 4) and the temporal sampling strategy (section 2) will provide a method for acquiring continuous data which can better aid the prediction of park use. Cooperation with and inclusion of rangers, while ideal, is not always feasible, thus a stand-alone method which allows direct observations of visitors, their numbers and distribution in the park is critical. The use of independent counts by the range of alternative approaches (e.g., Appendices 2 – 4) is necessary for calibration and validation of aerial survey counts.

We propose that the overflight approach can provide a better understanding of how changes in use patterns over time may result in cumulative effects which are manifested at the regional scales in a NPS Unit. It utilizes an integrated approach to mitigate the significant challenges of accurately monitoring a heterogenous system by making the following assumptions:

1. Visitors use “corridors”, these consist of terrain which enables feasible travel and includes major rivers, mountain passes, roads and coastlines.
2. Guides and residents utilize familiar terrain.
3. Visitors not using guides will rely on information obtained regarding previous successful trips.

7. Extrapolation of overflight data to mapping the coupled social ecological space

The mapping of cSES hotspots is an emerging tool in the modeling and management of specific highly valued natural resources (Brown et al., 2004; Alessa et al., in prep). It allows us to identify the major resource value-use hotspots in a locality, which, in and of itself, is a novel and valuable dataset. Mapping the relationships between human social values and their biophysical setting identifies spatially-explicit and tightly coupled social ecological spaces (cSESs). A detailed analysis of each hotspot can provide useful data on can subsequently be incorporated into management response to extensive use at fine, local scales. It also allows the NPS to build a cohesive database which provides a time series. Using the cSES method, dynamics of future hotspots can be anticipated through the use of user preference surveys. In addition, cSES hotspots mapping may be integrated with indigenous community needs and desires and state and federal policies for the spatial representation of legal, visitor, local-traditional and other use using qualitative data collection coupled with cartographic approaches.

References

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Becker, E. F., M. A. Spindler, and T. O. Osborne. 1998. A population estimator based on network sampling of tracks in the snow. Journal of Wildlife Management 62: 968–977.

Brown, G., Smith, C., Alessa, L., Kliskey, A. 2004. A comparison of perceptions of biological values with scientific assessment of biological importance. Applied Geography, 24, 161-180.

Prendergast, D. 2001. Backcountry Visitor Use Report. Gates of the Arctic National Park & Preserve.

Prendergast, D. 2001. 2001 Yukon-Charley Rivers National Preserve Yukon River Use in the Slaven's Roadhouse Area. Yukon-Charley Rivers National Park & Preserve.

Thompson, S. K. 1992. Sampling. John Wiley and Sons, New York City, NY. 367 pp.

Appendix 1: Results of Pilot Survey

1. Will you visit/have you visited a National Park in Alaska? Yes/No
2. What is your purpose for this visit?
3. How will you enter the park?
4. Of the following methods, which would you prefer to be used to help us understand how many people visit Alaska's National Parks?
    a. Registration at Park Headquarters
    b. Self-reporting via mail, email, on-line form or phone
    c. Enforcement patrols
    d. Ranger observations
    e. Observations by small planes flying overhead
    f. Guide reports on client numbers

	Visit National Park	Purpose	Entry	Preference
Yes	72%			
No	12%			
Not Sure	16%			
Hiking		63%		
Rafting/Kayaking/Canoeing		26%		
Lodge (limited movement)		76%		
Fly Fishing		13%		
Personal Development		11%		
Wildlife Viewing		64%		
Technical (e.g., mountaineering)		9%		
Camping (limited movement)		18%		
Motorized Boating/Driving			71%	
Plane			23%	
Boat			46%	
Car			70%	
Foot			5%	
Register				89%
Self-Report				10%
Enforcement				5%
Ranger observations				16%
Aircraft observations*				91%

Total surveyed: 301
Male: 57%, Female: 43%
Resident: 38% Non-resident: 62%

Appendix 2: Visitor Use Estimates and Information From: Random Sampling Data, Slaven's Roadhouse, Yukon-Charley Rivers National Preserve, 2001

During the summer season of 2001 use on the Yukon River was observed from Slaven's Roadhouse according to a random sampling schedule. Twenty-four days between June 1, 2001 and September 30, 2001 were selected at random (23 days were actually observed). Sampling was restricted between 1000 hours and 2230 hours and divided into five two and a half-hour blocks which were also randomly selected. Information noted included: number of craft in each group, type of craft, number of people in each craft, total number of people, whether the traffic was recreational or local user, and the direction of travel.

50	total individuals counted
2.174	average for each day for one time period
10.87	estimation for each day
1326	estimation for 122 day season

Table 1. Estimates for daily use and seasonal use (June 1 - September 30).

Craft	%craft	people/craft	%people
canoe	58%	2.00	56%
motor	29%	2.14	30%
raft	8%	3.00	12%
kayak	4%	1.00	2%

Table 2. Relative use and capacity of various craft noted at Slaven's.

	Total	days	est.
Jun	12	7	257
Jul	32	5	960
Aug	3	7	64
Sep	3	4	113

Table 3. Use level by month.

Time Period		Total	Average
1000	1230	4	2.00
1230	1500	3	1.00
1500	1730	19	2.11
1730	2000	22	3.67
2000	2230	2	0.67

Table 4. Use by time of day.

Appendix 3: Visitor Use Estimates and Information From: Visitor Observation Log, Slaven's Roadhouse, Yukon-Charley Rivers National Preserve, 2001 (D. Prendergast)

Observations of river use along the Yukon were made and recorded by Carl L. Stapler, Interpretive Ranger from Slaven's Roadhouse during the summer season of 2001. Carl kept meticulous notes and analysis of them yields a wealth of information. His entries begin on May 26 and end on October 2, 2001 (a few days longer than our arbitrarily set seasonal dates of June 1 through September 30). There were 207 entries on 84 days for the whole season. For our purpose calculations use only the 205 entries on 82 days during June through September except where noted. Data collected included: number of people, number of NPS people, type of craft, number of people in craft, put in point, take out point, nights stayed at Slaven's, place stayed, visitor's home, and comments.

	Observed			Estimated
	Days	**Visitors**	**NPS**	**Visitors**
June	17	65	4	115
July	23	149	40	201
August	24	89	57	111
Sept	18	102	21	170
Total	82	405	122	603

Table 1. Monthly visitor use observations and estimation of visitor use.

Estimates are extrapolations of the data in the visitor observation log. This is speculative since the days with no observations could be due to no use or missed observations. These estimates assume the latter, that use did occur at the same rate throughout the month.

Appendix 4: Backcountry Visitor Use Estimates From: Voluntary Registration and Hunter Monitoring, Gates of the Arctic National Preserve, 2001 (D. Prendergast)

The data indicate that with a 95% confidence level for the 1997-1999 seasons there were between 436 and 750 groups and 1332 and 1796 individuals in the Gates of the Arctic National Park and Preserve as recreational users. This excludes all subsistence use, all NPS presence, and sport hunting/fishing on the Kobuk and Itkillik Rivers.

Backcountry data (excluding Kobuk)	***1997***		***1998***		***1999***	
	Groups	Individuals	Groups	Individuals	Groups	Individuals
Contacts that were registered	11	39	5	21	12	54
Contacts that were not registered	20	66	21	54	32	84
Total contacts of known registration	31	105	26	75	44	138
Contacts of unknown registration	12	14	11	22	3	6
Total contacts	43	119	37	97	47	144
% registered of know registration	35%	37%	19%	28%	27%	39%
% unregistered of known registration	65%	63%	81%	72%	73%	61%
# in Visitor Registration Report	164	596	142	489	158	525
Estimated # in field	462	1605	738	1746	579	1342

Table 1. Visitor use estimate calculations from voluntary Visitor Registration Reports and Backcountry Patrol Reports 1997-1999.

	1997	***1998***	***1999***	***Average***	***95% confidence***
Estimated Individuals	1605	1746	1342	1564	1564+/-232
Estimated Groups	462	738	579	593	593+/-157
Group size from estimates	3.5	2.4	2.3	2.7	2.7+/-.7
Group size from observations	2.8	2.6	3.1	2.8	2.8+/-.3

Table 2. Estimated number of individuals, groups, and group size 1997-1999.

Kobuk River Hunter Monitoring efforts began in 1996. Reports from the years 1997, 1999, and 2000 indicate the average number of subsistence users is 24, while the average number of sport hunters/fishers is 48. The average group size of sport hunters/fishers is three. It appears that while sport hunting and fishing levels are stable that subsistence use is declining. On the Itkillik River there are less than 20 hunters each year.

Data on backcountry use from the Dalton Highway was collected form fifty-four parties between 7/1/93 and 7/19/93 and 6/7/94 and 8/17/94. These data indicate average trip length was seven days, and the group size averaged 2.5, so that the average visitor days per trip was 18.9 (number of visitors times number of days in trip). Assuming these time

periods to be typical over one hundred people access Gates backcountry from the Dalton Highway each year.