SEX WEIGHTED POINT SYSTEM REGULATES GRIZZLY BEAR HARVEST 1985 TO 1988

November 1989

Bernard L. Smith

Yukon
Renewable Resources

Final Report

SEX WEIGHTED POINT SYSTEM REGULATES GRIZZLY BEAR HARVEST, 1985 TO 1988.

Bernard L. Smith
Fish and Wildlife Branch
Department of Renewable Resources
Government of Yukon

Approved:

Director, Fish and Wildlife Branch

Senior Big Game Biologist

November 1989

ABSTRACT

A system that provided outfitters guiding non-resident hunters with a 3:1 incentive to take male over female grizzly bears was tested in 20 outfitting areas in the Yukon Territory between 1985 and 1988. This system replaced annual quotas, 1980-1984, that had been criticized as being too small, too inflexible, and lacking incentive for male-selective or dispersed harvest. This new system was implemented in each outfitting area. Sex was confirmed through compulsory inspection of "male" pelts with attached bacula. Most other regulations were unchanged.

Most of the 20 outfitters modified hunting operations and behaviours. The behavioural changes most likely to increase male harvest were increased upland hunting, spring hunting, small plane use and hunting over "gutpiles". Generally, the kill increased, sex ratios changed little, the proportion of older bears taken increased, and the head size of bears taken increased. Future increases in male harvest are expected, but will require training of hunting guides. Outfitters ranked flexibility, opportunity to increase harvests if male proportions increased, frank individual discussions with biologists, increased potential harvest, and new population estimates, as the most beneficial attributes of this program. Int. Conf. Bear Res. and Manage. 8:00-00

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

INTRODUCTION

Wildlife managers have difficulty protecting females from excessive harvest in many northern interior grizzly bear populations. These populations are typically sparse, produce few young (Bunnell and Tait 1981) and can sustain very limited harvest, particularly of adult females (Stirling et al. 1976; Bunnell and Tait 1980, 1981; Miller this volume). Delayed first litter production and litter losses leave about 60% of females aged 2+, and 50% of adult females aged 7+ available to hunters each fall (Reynolds and Hechtel 1988, Smith 1989), when most hunting occurs. Because hunters are not particularly selective (Pearson 1975), and grizzly bears lack obvious secondary sexual characteristics, excessive unintentional harvest of females can occur during the fall hunting season.

Pearson (1975) identified the high proportion of females harvested as a management concern when he first obtained kill sex data in the central Yukon in 1968. Seasons were long then and outfitters could take as many grizzlies as they wished (Pearson 1975). Twenty-one big game outfitters controlled all hunting by non-resident hunters, within individual guiding territories that ranged from 2,150 to 36,350 km^2. Non-residents took 75% of the reported grizzly kill. Subsequent harvest analyses revealed high adult female kill proportions, high kill densities, and declining hunter success, indicating overharvest (Lortie and McDonald 1977). Annual quotas were subsequently prescribed to regulate non-resident harvests of grizzly bears within each outfitting area (Lortie 1978). The harvest quotas generated much controversy and stimulated additional reviews (Sidorowicz and Gilbert 1981) before being implemented in 1980 (Mychasiw

1981). During the quota period (1980-1984), controversy about grizzly bear management continued because most outfitters believed the quotas were too small, either because populations were actually larger than those upon which the quotas were based, or because the 2 to 3% harvest rates prescribed by the Yukon Fish and Wildlife Branch (YFWB) (Lortie 1978) were too conservative.

Additionally, annual quotas did not allow outfitters to maximize their bear harvests, resulting in many unused quotas each year. For example, an outfitter who received a quota of 4 bears, but guided 25 hunters annually would have to limit the number of hunters afield with bear tags, especially after 2 or 3 bears had already been taken. Problems arose with clients when outfitters could not deliver promised bear hunts, and outfitters were frustrated by a system that typically resulted in 25% unused bear quotas each year. Finally, the quota system did not encourage sex-selective or dispersed hunting.

Through discussions with Yukon outfitters, a new system of managing bear harvests was developed. This paper describes this new system, which is based upon sex-weighted harvest points that restrict harvest rates as the female proportion of the harvest increases. It describes how outfitting businesses have adjusted to this new system and how bear harvest patterns have changed. Finally, it evaluates the program's success and areas for improvement.

I thank Yukon's big game outfitters for their cooperation in this experiment, particularly J. Ostashek, P. Jensen, and D. Young who were involved in its development. B. Pelchat and K. Gustafson contributed

much to the design of the system. H. Monaghan and W. Klassen are thanked for their willingness to experiment in harvest management. P. Merchant and district Conservation Officers collected the harvest information. J. Carey and T. Fox assisted in the implementation of the program and analyses. J. Tousignant provided valuable assistance in the design of the 1989 survey and the analysis. Editing by J. Carey, B. Pelchat, J. Tousignant and 3 anonymous reviewers, and typing by E. Gustafson and D. Milne were much appreciated.

PROCEDURES

Design

We wanted to achieve an optimal balance between high hunting flexibility for outfitters and a highly dispersed, sustainable harvest of bears. A weighting system based upon sex was the simplest and most easily applied, and it addressed our greatest management concern, localized overharvesting of females. It was also easily enforced because all male pelts had to be submitted for inspection and removal of attached bacula. Any pelt not submitted or without an attached baculum was regarded as a female. Point values of 1 for males and 3 for females were used because: 1) this value difference related to the desired 6% male and 2% female harvest rates; 2) there was minimal risk of excessive harvests at each end of the harvest sex composition spectrum (Fig. 1); 3) this value difference provided reasonable incentives to develop hunting strategies selective for males; and, 4) outfitters could easily calculate their remaining points.

Three-year point totals were allocated to individual outfitting areas based on the amount of the estimated sustainable yield, by sex, remaining after allowing for anticipated resident sport kills and kills in defense of life and property (Fig. 2). To disperse hunting, the 4 largest outfitting areas were each subdivided into 2 or 3 blocks with individual points allocated to each block. Outfitters could use points at any time during the 3-year period, points being deleted from their totals as bears were harvested, but faced a $5,000 penalty if they harvested grizzly bears when no points remained. They could exceed allotted point values

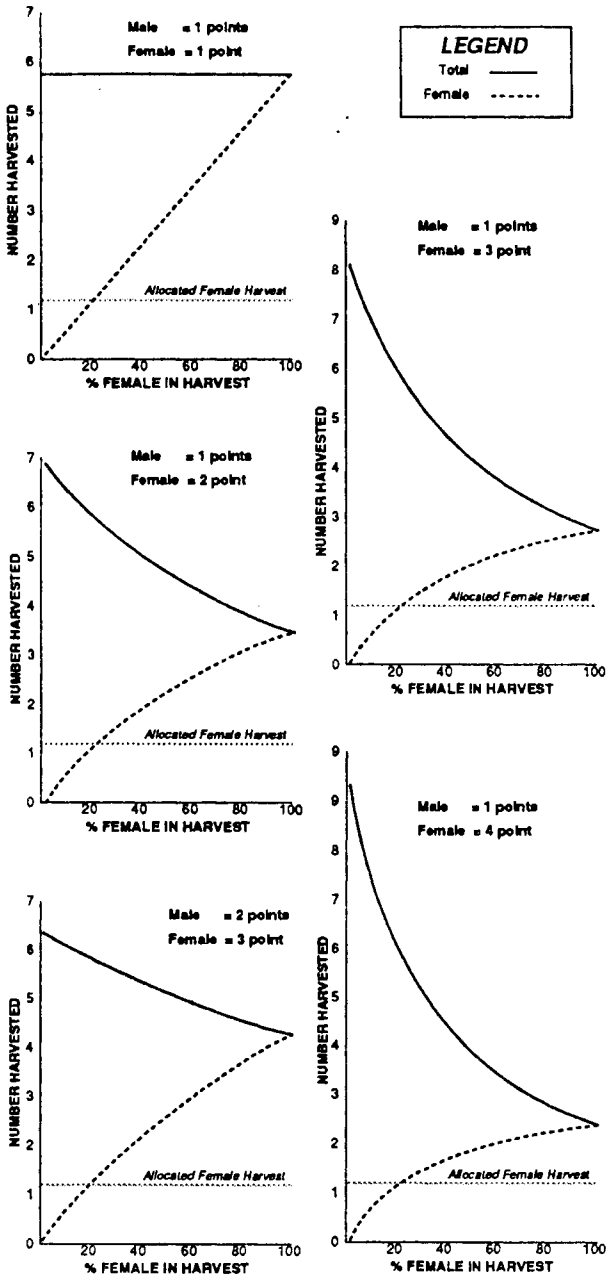

Fig. 1 Female and total harvest versus proportion of females in the harvest, under 5 different male:female point value scenarios. We selected 1 point for males and 3 points for females because the female curve was closest to the 1.2 females allocated and , to a lesser extent, because the male curve was closest to the 4.5 males allocated, over the 20 to 60 percent female range in the harvest that we anticipated.

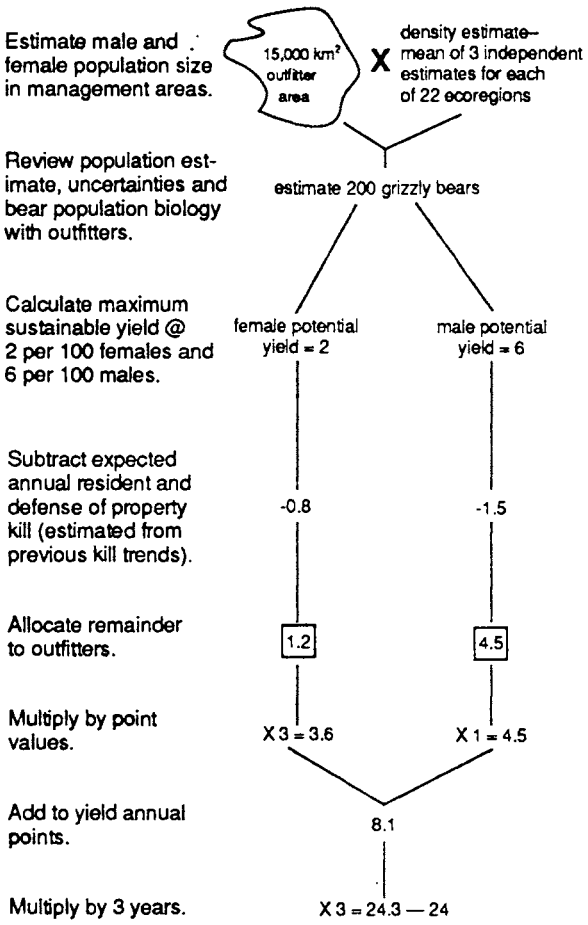

Fig. 2 Procedures involved in determining point values within a typical outfitting area. [Note the extension to 1989 was calculated before the 1987 season by multiplying the 8.1 annual points by 5 years (1985-89) and deducting the points used in 1985 and 1986.]

by 2 if the last bear taken was a female. All grizzly bears taken by non-residents associated with an outfitting operation were included.

Implementation

In spring 1985, half-day meetings were held with individual outfitters to outline the new management system and to assign harvest points covering the period 1985 to 1987. Bear density, cub production and survival, movements and feeding habits, and bear hunting strategies were discussed. Outfitters were asked to give a population estimate; in most cases these were within 20% of the estimate derived by the YFWB (Smith and Osmond-Jones 1989). Outfitters participated in all calculations that resulted in their point values (Fig. 2), including examples on how the point system would operate under various harvesting scenarios. Meetings were again held in 1987 when the points were extended to cover the 1987 to 1989 period, 1987 being an overlap year to maintain the multi-year flexibility requested by outfitters. During all meetings, hunting plans were discussed. Summary notes of all meetings were sent to outfitters.

In 1985, hunting guides were provided with a brochure describing differences in morphology and behaviour of male and female grizzly bears. The following distinguishing characteristics were stressed: 1) large males walk more slowly and with heads lower; 2) large males have relatively small ears and square heads; 3) males were more often dark coloured and lanky-looking; 4) old males were swaybacked; 5) males were more active in the late afternoon and evening; 6) adult males were more often taken at the remains of hunter-killed ungulates and in the spring;

and, 7) large bears were usually males. Notebooks were also provided to guides for recording their grizzly bear observations.

Evaluation

This new management system was evaluated by comparing harvest statistics and outfitter hunting behavior during the last 4-years of the 5-year quota period (1981-1984) to the following 4-year period when harvest points were used (1985-1988). To the greatest degree possible, regulations were unchanged from 1981 to 1988. Changes not associated with the point system included changing the bag limit from 1 per lifetime for non-residents to 1 per 3 years, and the introduction of opportunities for outfitters to guide bear hunters in an area in the southwest Yukon where it was hoped that greater bear harvests would reduce bear predation on moose calves. Two of the 20 outfitters chose to market their spring bear hunts in this reduction area, thereby conserving harvest points on their concession. Data from this bear reduction area are not included in this analysis.

Shifts in outfitter operations were monitored through compulsory biological submissions (age and sex of bears taken) and compulsory outfitter reports (location and chronology of hunting effort). As well, outfitters were interviewed in 1987 and surveyed in 1989 to identify quota to point system shifts in hunt administration, area management, guide management and hunting methods. Hence, for each outfitter we created behaviour perception variables such as how they hunted, how many hunters they had and how much they hunted over gutpiles, and compared these to performance variables such as average bear age and size and sex

ratios. There were behaviour and performance variables where ranking was used because absolute data were not available, for example, "more, less, or the same" effort was spent hunting over gutpiles in the point system years compared to the quota system years. During the 1989 survey, outfitters were asked to rank, by sorting cards, 9 attributes of the new management system that they considered most beneficial to their operations.

The sighting notebooks were not taken seriously by most guides and outfitters. The information collected had little value, and no subsequent efforts were made to collect sighting information from outfitters.

RESULTS AND DISCUSSION

Changes in Hunting Operations

Outfitters managed grizzly bear hunting differently under the 2 management systems. The direction and magnitude of these changes varied among the 26 behaviours that we examined (Table 1). The 5 most frequent changes are outlined below.

Fourteen of 20 (70%) outfitters had more fall grizzly bear hunters. On average 6.1 hunters (range 0.5-14.5) sought grizzlies each fall in each outfitting area under the quota (Q) system versus 9.7 (range 0-28.8) in the point (P) system, a 159% increase. This increase was most directly related to the 132% overall increase in their total fall clientele, likely due to the improving U.S. economy, and the 183% increase in the potential grizzly bear harvest allocated to outfitters (Q system total annual quota = 74, P system total annual allocation 103o 33^{o} converted into points as per Fig. 2).

The next most frequent change involved greater spatial dispersion of grizzly bear hunting by about 70% of the outfitters. The proportions of grizzlies taken in the point system from newly built camps averaged 30.76%.

One encouraging change involved 10 outfitters who estimated that fewer of their clients took the first legal grizzly they encountered in the point versus quota system. Overall, outfitters estimated that half of the hunting parties took the first legal grizzly bear that they encountered during the point system. Pearson (1975) observed outfitter hunting

Table 1. Change in 26 dimensions of outfitter hunting behaviours between the quota and point management periods.

Dimension	n	% Yes	% Same	% No
more fall bear hunters	20	70.0	0	30.0
more hunting from new camps	17	70.6	23.5	5.9
dispersed grizzly kills	20	70.0	20.0	10.0
took fewer blonde bears	20	65.0	5.0	30.0
passed up more bears	16	62.5	31.3	6.2
used more horses	17	52.9	a	47.1
increased trophy fees	17	52.9	a	47.1
took more bears after 1600 h	20	45.0	10.0	45.0
more spring bear hunters	20	40.0	50.0	10.0
fewer combination hunts	16	37.5	50.0	12.5
rewards to guides with males	16	37.5	a	62.5
used spotting scopes more	17	29.4	a	70.6
explored "many" new habitats	17	29.4	a	70.6
more grizzly guiding by outfitter	16	25.0	62.5	12.5
penalties to guides with females	16	25.0	a	75.0
less upland hunting	17	23.5	70.6	5.9
more gutpile hunting	17	23.5	52.9	23.6
closer stalks	17	23.5	58.8	17.7
returned to camp later	16	18.8	75.0	6.2
used more float/wheel/ski planes	17	17.6	a	82.4
increased trophy fees for females	17	17.6	a	82.4
used more pack-dogs	17	17.6	a	82.4
greater blonde grizzly trophy fee	17	17.6	a	82.4
used more all-terrain-vehicles	17	11.8	a	88.2
used more dog teams	17	5.9	a	94.1
used more skis	17	5.9	a	94.1

[a] Questions worded "we now more frequently hunt grizzly bears using ...(horses, dogs)."

parties in the Yukon between 1969 and 1972, and concluded that most hunters took the first legal grizzly they encountered. Outfitters reported varying degrees of success discouraging hunters from this non-selective hunting. Outfitters were asked to identify characteristics of legal bears that they passed up: 28 characteristics were identified by 17 outfitters. Fourteen of these were "small bears", 6 were "blonde" or "light coloured" bears, and the remaining 8 responses were described as "rubbed", "fast moving", "preprime", "alpine", and "not large" bears. Harvest data revealed that guides responded strongly to the colour advice as evidenced by declines in the percentage of blonde bears taken in 13 of 20 (65%) outfitting areas.

Outfitters indicated that hunters who took grizzly bears paid higher fees to the outfitter in the P system versus the Q system in 9 outfitting areas. They saw high post-hunt trophy fees for successful hunters as a way to encourage selective hunting (e.g., to attract hunters who would take a trophy only if it was larger than one they already had), to allocate grizzlies among clients, and to increase revenues. Three outfitters charged higher fees for females (up to $2,000), and one charged higher fees for hunters taking blonde bears.

Changes in the Harvest

Changes in the harvest between the 2 management regimes were described in terms of totals (e.g., number taken), means (eg., trophy score), or proportions (e.g., % female) during the 4-year periods 1981-84 (Q system) and 1985-88 (P system). Differences in these harvest statistics were analyzed in 2 ways: 1) differences between means across time periods

Table 2. Changes in the mean annual non-resident harvest between the Q and P periods. For example, non-resident hunters on average took 48 grizzlies each year in the 4 quota years and 67.25 each year during the 4 point years, an increase that was significant at $p < 0.01$. Sample sizes vary slightly due to absence of cementum age data and skull size data for a few bears.

Characteristic	Q	P	P/Q	Z	
total	48.00	67.25	1.40	-3.18	(p<0.01)
fall	38.50	56.50	1.47	-4.11	(p<0.001)
spring	9.00	10.75	1.19	-0.85	
male	31.00	40.75	1.31	-1.94	
female	17.00	26.50	1.55	-4.61	(p<0.001)
trophy score	19.39	19.95	1.03	-2.67	(p<0.01)
male age	7.93	9.53	1.20	-2.25	(p<0.05)
female age	8.15	9.75	1.20	-1.71	

Table 3. Changes in harvest patterns based on outfitters' means between Q and P periods. For example, outfitters on average took 9.30 grizzlies each during the 4 quota years and 13.65 each during the 4 point years, an increase that was significant at $p < 0.001$ and that was seen in 16 of 20 outfitting areas.

Harvest Pattern and Trend	Q	P	P/Q	Z	Outfitters that Increased
greater total kill	9.30	13.65	1.47	4.31 (p<0.001)	16 of 20
greater male kill	6.30	8.55	1.36	2.82 (p<0.05)	12 of 20
greater female kill	3.40	5.05	1.49	2.46 (p<0.05)	10 of 17
greater fall kill	7.80	11.45	1.47	3.27 (p<0.01)	13 of 20
greater fall female kill	3.00	5.10	1.70	3.74 (p<0.001)	11 of 16
greater fall male kill	4.80	6.35	1.32	2.06 (p<0.05)	11 of 20
increased % female	32.10	44.57	1.39	2.76 (p<0.05)	13 of 20
increased % female in fall kill	33.06	49.75	1.50	3.15 (p<0.01)	14 of 19
increased subzones harvested	4.60	6.50	1.41	3.67 (p<0.001)	14 of 20
increased skull length (mm)	308.36	319.77	1.04	3.17 (p<0.05)	14 of 20
increased trophy score	19.09	19.73	1.03	2.80 (p<0.01)	14 of 20
increased % trophy score >22	8.42	16.44	1.89	3.12	8 of 12
increased hunt days/fall kill	34.62	39.84	1.16	0.68	12 of 19
increased % adult	41.78	44.15	1.06	0.41	7 of 18

based on the entire non-resident kill ('non-resident means')(Table 2), and 2) differences between means across outfitters ('outfitters' means')(Table 3). Significance was determined using a 2- tailed Z-test (Pagano 1981) as the entire population was available and measured. We assumed periods 1981-1984 and 1985-1988 were independent because outfitter turnover occurred in 7 out of 20 areas over the 1981-1988 period.

During the P system, non-resident hunters took significantly more bears, particularly in the fall, and more female bears (Table 2). They also took significantly larger bears and older males. These patterns are consistent with increased numbers of fall hunters, and increased avoidance of small bears.

Differences in the outfitter means between the 2 periods showed similar patterns (Table 3). Significant increases were seen in their total harvests, fall harvests, male and female harvests, in the percentage of females taken, and in the percentage of large bears taken. The days spent hunting per grizzly taken increased, although not statistically significant, reflecting the reduced likelihood that hunters took the first legal bear that they encountered.

The difference in kill composition between the 2 time periods was significant (Table 4). Unexpectedly, this was not due to a significant increase in the proportion of females (Q=36.0%, P=39.6%), but rather to a significant increase in the proportion of adults (Q=48.8%, P=64.0%) (p=0.005). These findings suggest that females composed a relatively high proportion of the bears that hunters did not pass up. The extent and

Table 4. Number and percent of adults (age ≥ 7 yrs) and subadults (age 2-6) by sex, taken in the Q and P periods, by non-resident hunters. Difference is significant at p = 0.01 using the Chi-squared test.

	SUBADULT				ADULT			
	Male		Female		Male		Female	
	n	%	n	%	n	%	n	%
Quota	58	33.7	30	17.5	52	30.2	32	18.6
Point	51	20.4	38	15.2	100	40.0	61	24.4

type of behaviour changes were not adequate to change sex ratios of the harvest. More effort and training will be required to alter kill composition and continued close monitoring of the kill will be essential. ANURSUS population modelling (Taylor et al. 1987) predicted a reduction of about 1% in potential harvests due to the observed changes in harvest composition between the Q and P periods. This was largely due to the sensitivity to small shifts in adult female survival, similar to that described in previous bear population projection modelling (Stirling et al. 1976; Bunnell and Tait 1980, 1981; Knight and Eberhardt 1985; Taylor et al. 1987; Harris and Metzgar 1987). This is not yet a serious concern, however, because outfitters realized only 80% of their female harvest allocations, and the 2% female harvest target is below the 2.5% estimated to be sustainable (using the ANURSUS model and the point system kill composition).

The P harvest came from 130 of 296 game management subzones, compared to 92 in the quota years. This 140% greater dispersion was almost exactly the same as the increase in the total kill, suggesting that kill densities were unchanged.

Relationship between Changes in Hunt Behaviours and the Harvest

To aid in the development of future educational programs we undertook correlation analyses between behaviour and performance variables. In the first analysis we considered changes between the 2 periods. For example, outfitters were asked if they hunted over gutpiles more, less, or the same during the P years compared to the Q years, giving a corresponding +1, 0, -1 value for this behaviour change. These values for outfitter behaviour were correlated with the values of P:Q ratios for performance variables derived, for example, by dividing each outfitter's average bear skull size during the P years by his average bear skull size in the previous Q years. The significant Spearman rank correlations are listed in Table 5. Some correlations were expected, for example, the larger trophy scores and more male kills in the fall associated with increased hunting over gutpiles. Such positive correlations were anticipated because larger male bears were expected to defend the remains of moose and caribou. Other significant correlations, particularly those based on differences between harvested bears in the 2 periods (e.g., greater % blonde bears vs. greater % adults), are vulnerable to small kill sample sizes in many outfitting areas, particularly in the Q period. For this reason, we calculated Pearson correlations that were solely based on data from the P period (Tables 6 and 7). Small plane use in this analysis was estimated on a 0 to 5 scale based on outfitter interviews, since exact hours were unknown. It was frequently positively correlated with improvements in performance variables (e.g., % males in total kill and fall kill, % adults in kill, subzones harvested and fall male kills). Although we

Table 5. Spearman correlation coefficients and associated probabilities related to changes in behaviour and performance between the P and Q periods.

Behaviour	Performance	n	r	prob>|r|
fewer combination sheep/grizzly hunts	fewer male kills in fall	17	.62	0.0083
	fewer fall kills	17	.56	0.0187
	better sex identification	16	.73	0.0012
	greater % males in fall	16	.56	0.0226
more upland hunting	more fall kills	18	.52	0.0284
improved ability to judge sex	greater % adult males	13	.69	0.0095
	greater male age	17	.52	0.0323
	greater % males	17	.48	0.0534
bears taken at closer range	greater male age	18	.51	0.0290
greater % taken over gutpiles[a]	more male kills in fall	18	.49	0.0374
	more fall kills	18	.57	0.0136
	larger trophy score	18	.48	0.0459
greater spring hunt days	fewer male kills in fall	8	.73	0.0396
	fewer % male in fall	7	.83	0.0212
greater fall hunt days	greater % adults	18	.52	0.0282
	greater female age	17	.61	0.0089
more subzones grizzlies hunted	more subzones grizzlies killed	20	.68	0.0009
greater % kills after 16:00	greater fall days/kill	16	.53	0.0360
greater % blonde	greater % adult male	14	.74	0.0027
	younger female age	15	.57	0.0277
	greater male age	17	.51	0.0384
	greater fall male kills	17	.50	0.0413
	more fall kills	17	.50	0.0390

[a] 'gutpiles' consist of viscera, skins, non-recovered meat and skeletons from moose and caribou previously taken by hunters.

Table 6. Pearson correlation coefficients and associated probabilities related to measured behaviour and performance measures in the P period.

Behaviour	Performance	n	r	prob>|r|
subzones hunted	subzones harvested	20	0.87	0.0001
	spring female kills	20	0.78	0.0001
spring hunt days	spring male kills	20	0.83	0.0001
	spring female kills	20	0.81	0.0001
	subzones harvested	20	0.70	0.0006
	% adult males in kill	20	0.59	0.0061
	average trophy score	20	0.48	0.0313
% blondes in kill	average male age	20	0.63	0.0029
fall hunt days	subzones harvested	20	0.61	0.0040
	fall male kills	20	0.52	0.0188
	fall kills	20	0.52	0.0190
% kills after 16:00	% adults in kill	20	0.48	0.0326
	fall days per kill	19	0.49	0.0352

Table 7. Spearman correlation coefficients and associated probabilities related to ranked and estimated behaviour variables and measured performance variables during the point years. Small plane use was ranked 1 to 5, based on outfitter interviews in 1985, 1987, and 1989.

Behaviour	Performance	n	r	prob>|r|
small plane use	% males in kill	20	0.77	0.0001
	subzones harvested	20	0.76	0.0001
	% males in fall kill	19	0.62	0.0045
	spring female kills	20	0.60	0.0054
	average trophy score	20	0.57	0.0091
	spring hunt days/kill	7	-0.84	0.0175
	% adult males in kill	20	0.52	0.0200
	fall male kills	20	0.50	0.0232
	fall kills	20	0.50	0.0256
shooting distance	% blonde bears taken	18	-0.77	0.0002
% hunters taking 1st legal bear	average female age	17	-0.63	0.0066
	spring male kills	18	-0.56	0.0146
	% adults in kill	18	-0.50	0.0355

could attribute this correlation to some outfitters illegally using aircraft to direct hunting parties to male bears, our interpretation is that personal aircraft allowed outfitters to survey efficiently and become much more familiar with hunting opportunities in their areas, and landing on small lakes and gravel bars allowed much greater flexibility in the distribution of hunting parties. This interpretation is supported by the lack of a significant negative correlation between small plane use and days spent hunting per bear taken and by field observations of outfitters that had and did not have aircraft. These correlations suggest that outfitters can improve performance by using small aircraft, by reducing the likelihood of hunting parties taking the first legal bear encountered, by hunting more in the spring, by improving guides' abilities to select male bears, and by increasing evening hunting in the autumn. The collection of data on how individual bears were hunted would allow stronger tests.

Outfitter Satisfaction with the Point System

After 4 years operating under the P system, outfitters generally remained pleased with the new management approach. Of 9 attributes of the P system, flexibility was ranked by outfitters as being the most beneficial to their operations. Other attributes, in order of decreasing perceived benefit were: different weighting for males and females, more comprehensive discussions regarding bears and their harvest, new population estimates, and our comments on hunting plans (Table 8). Least beneficial attributes were: the allocation policy, the offers of camp visits, and information provided on other kills in their areas. The

Table 8. Perceptions of 15 outfitters regarding the relative benefit of 9 attributes of the new management system to their operations.

Attribute	Average Rank	% in top four ranks	% in bottom four ranks
Flexibility	2.4	87	7
Female/male weighting	3.3	80	20
More comprehensive regarding bear behaviour and distribution	4.1	53	27
New population estimate	4.7	40	47
Allocated greater potential harvest	4.8	60	33
Biologist's comments on bear hunt plans	5.1	47	47
Biologist's offer to visit area	6.1	7	60
Information on resident and control kills	6.5	20	67
Allocation policy	7.2	13	80

greatest convergence in outfitter ranks occurred with "flexibility", which 8 out of 15 (53.5%) ranked first; with "female/male weightings", which 7 out of 15 (46.7%) ranked second; and with "allocation policy", which 8 out of the 15 (53.3%) ranked last. The least convergence was in rankings involving "new population estimate" and "allocated more bears." This was expected since there were great differences in the size of point allocations awarded to outfitters (1.9 to 25.6 per year) and the range in the proportion of their allocated harvests that outfitters realized (females 18 - 172%, males 5 - 98%).

Most outfitters were frustrated over the shortage of guides with the adequate motivation and skill to hunt male grizzly bears selectively.

Most now realize that increasing male kill proportions will take more than changes to hunt fees and guide salaries; it will require dispersed hunts, solutions to access problems in the spring, new hunting methods, and better trained guides. All outfitters surveyed identified the need for training materials.

Significantly, outfitters now ask different questions about grizzly bears. The lengthy arguments over bear abundance common during the Q years have been replaced with questions about bear behaviour and distribution, particularly sexual segregation in fall habitat use. Requests for more points followed greater-than-expected female harvest in several areas. We responded with offers to help these outfitters locate potential spring hunting areas and by preparing a report summarizing information on factors that influenced the sex of bears taken by hunters (Smith 1990).

Several complaints emerged regarding the 3-point value for older and, in the outfitters' opinions, reproductively senescent females. Because reproductive senescence approximates physical longevity (Reynolds and Hechtel 1986), we have been reluctant to make changes. No complaints were received about the requirement for male pelt inspection or regarding damage to pelts arising from decomposing bacula attached to pelts.

Benefits from a Bear Management Perspective

Although we have seen little shift in sex ratios to date, we believe the management approach tested offers significant benefits when compared to

annual quotas. Most importantly, we left behind an adversarial relationship with outfitters regarding bear management. In this individualized, more cooperative mode of management, we have learned much about bears, bear hunting, and other wildlife concerns. Outfitters have accepted sharing a larger part of the responsibility for managing bear harvests.

The management system has led outfitters, guides and hunters to be more conscious of "bears" as males and females having different values to conservation efforts. We believe this will have long-term benefits to bear populations. We will learn much more about the dynamics of the hunter/bear system as outfitters continue to experiment in order to realize the incentives provided under the point system.

The point system resulted in lower than allocated harvest levels of females in 14 out of 20 outfitting areas, and in lower than allocated harvest levels of males in all 20 areas. This is a little misleading, however, since point allocations were from 1985-89 and several outfitters would have to reduce harvests in 1989 to avoid exceeding point allocations. One outfitter who had the potential to exceed 6% male harvest rates did not do so out of concern for the future availability of trophy males. The use of separate point totals in portions of hunting blocks has effectively reduced the localized harvest in 2 areas.

No evidence was found that any females taken by hunters were abandoned. Hunters and guides are keen to keep any bear taken. One outfitter levies

a $2,000 surcharge for males and a $4,000 surcharge for females, but does not believe this would cause his guides or hunters to abandon a female. The additional $2,750 fee faced by such a hunter taking a female instead of a male (outfitter fee plus $750 government trophy fee) would add about 20% to a hunter's total costs.

Finally, the more intensive the selection for males by hunters, the greater the possibility of monitoring population status through trends in harvest sex ratios (Bunnell and Tait 1980). Current sex ratios in the harvest provide relatively insensitive indicators of population status (Harris and Metzgar 1987).

Disadvantages from a Bear Management Perspective

There was surprisingly little incentive in this system to promote spring hunting of grizzly bears, even though males are more vulnerable to harvest then. The industry remains oriented towards multi-species fall hunts. Outfitters found it was more attractive to increase the proportion of fall clients that were offered grizzly bears than to overcome the problems with access, guides, and marketing associated with hunting in the spring.

Finally, small annual point allocations, under 4 per year, were troublesome. While the multi-year allocation provided flexibility, unexpected female harvest could require sudden changes in hunt plans. Annual quotas offer little improvement. Spring-only hunting may be the most effective way to handle small harvest allocations.

CONCLUSION

The point system we have tested is seen by big game outfitters as a major improvement from an earlier system of annual quotas, and, while short-term benefits to the harvest composition have not been observed, we believe that long-term benefits are likely. The great improvement in working relationships between outfitters and government offers much promise for cooperative management programs.

The point system will continue, but with greater emphasis on guide training. Where there are harvest concerns, outfitters will receive a 3-year allocation. Where there are no concerns, a 5-year allocation will be used.

Point system approaches have potential application in situations where hunters or hunting businesses have a strong vested interest in maintaining hunting access to game, where kills can be verified, and where there is no cause to believe that abandonment of kills would occur. Different values could be applied to members of groups within game populations based on their size, location, sex, behaviour, and future contribution to the population.

LITERATURE CITED

BUNNELL, F.L., and D.E.N. TAIT. 1980. Bears in models and in reality - implications to management. Int. Conf. Bear Res. and Manage. 4: 15-23.

_____, and _____. 1981. Population dynamics of bears - implications. Pages 75-98 in C.W. Fowler, and T.D. Smith, eds. Dynamics of large mammal populations. John Wiley and Sons, New York. 477pp.

HARRIS, R.B., and L.H. METZGAR. 1987. Harvest age structures as indicators of decline in small populations of grizzly bears. Int. Conf. Bear Res. and Manage. 7:109-116.

KNIGHT, R.R., and L. EBERHARDT. 1985. Population dynamics of Yellowstone grizzly bears. Ecology 66(2): 323-334.

LORTIE, G.M. 1978. The quota - a new management system for Yukon grizzly bear. Yukon Wildl. Branch Tech. Rep. 15pp.

_____ and J. MCDONALD. 1977. Game harvest report and summary of the questionnaire analysis. Yukon Game Branch Tech. Rep. 13pp.

MILLER, S.D. 1990. Population management of bears. Int. Conf. Bear Res. and Manage. 8:00-00.

MYCASHIW, L. 1981. A system to regulate commercial big game hunting (outfitting) in Yukon Territory. Can. Wildl. Admin. 7:40-41.

PAGANO, R.R. 1981. Understanding statistics in the behavioural sciences. West Publ. Co., Los Angeles. 567pp.

PEARSON, A.M. 1975. The northern interior grizzly bear, Ursus arctos L. Can. Wild. Serv. Rep. Ser. 34. 84pp.

REYNOLDS, H.V., and J.L. HECHTEL. 1986. Population structure, reproductive biology, and movement patterns of grizzly bears in the north Central Alaska Range. Alas. Dep. Fish and Game. Fed. Aid in Wildl. Restoration Final Rep. Proj: W-21-2, W-22-2, W-22-3, and W-22-4. 53pp.

_____, and _____. 1988. Population dynamics of a hunted grizzly bear population in the north central Alaska Range. Alas. Dep. Fish and Game. Fed. Aid in Wildl. Restoration Rep. Proj. W-22-5. 52pp.

SIDOROWICZ, G.A., and F.F. GILBERT. 1981. The management of grizzly bears in the Yukon, Canada. Wildl. Soc. Bull. 9(2): 125-135.

SMITH, B.L. 1990. Factors influencing the sex of grizzly bears taken by hunters in the Yukon. Yukon Fish and Wildl. Branch Tech. Rep. 24pp.

_____, and E.J. OSMOND-JONES. 1990. Grizzly bear abundance in Yukon ecoregions. Yukon Fish and Wildl. Branch Tech. Rep. 35pp.

STIRLING, I., A.M. PEARSON, and F.L. BUNNELL. 1976. Population ecology studies of polar and grizzly bears in northern Canada. Trans. North Am. Wildl. and Nat. Resour. Conf. 41: 421-430.

TAYLOR, M., F.L. BUNNELL, D. DEMASTER, and J. SMITH. 1987. An overview of ANURSUS: A population evaluation and management system for polar bears (Ursus maritimus). Int. Conf. Bear Res. and Manage. 7:117-125.