

A Survey of Applicant Preferences for Black Bear Hunting Opportunities in Wisconsin

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About this Report

This report presents results from a survey of 1,800 Wisconsin bear harvest permit applicants conducted in 2017. It examines applicants' current satisfaction with and preferences for black bear hunting opportunities in the state. The study was conducted to support the Wisconsin Department of Natural Resources' wildlife management program. This report presents study findings, interprets the information within pertinent contexts, and may identify potentially useful lines of additional inquiry. This report does not, however, include specific recommendations or policy prescriptions.

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Executive Summary

Detailed findings can be found in the “Results” section but the key findings are presented here.

1. Eighty-six percent of applicants are male. The average age of an applicant is 48 years old. Two-thirds of current applicants are over the age of 40.
2. About half (51%) of the current applicants have previously hunted black bears in Wisconsin (Figure 2). Twenty-nine percent of these applicants have received a tag once before, and 23 percent have been awarded a tag two or more times in the state in the past. Seventeen percent of applicants have hunted black bears in Canada or other states.
3. Most applicants regardless of whether they have hunted black bears in this state or elsewhere have participated in a variety of bear hunting related activities. Eighty-five percent of survey respondents have eaten bear meat. About two in three (65%) have read about bear hunting in books or magazines. Fifty-six percent have placed bait and 55% have scouted for black bear sign. Four percent currently or previously owned bear dogs, and 18 percent of applicants have participated in bear hound chases.
4. Eighty-three percent of applicants have “favorable” or “very favorable” attitudes toward black bears.
5. For those who have hunted black bear in Wisconsin in the past, the frequency of zone selection for these applicants’ most recent harvest tags, respectively, was A (36%), B (19%), C (27%) and D (17%) (Figure 3). Nine in ten applicants have a bear zone in mind for which they would like to hunt the next time they receive a tag (Figure 4). Over three out of four applicants with past bear hunting experience in a zone indicated they would likely select that zone again with their next harvest tag.
6. Overall, applicants choose to hunt black bears where they have roots such as a residence, second home, friends or family, or familiar hunting land. A high proportion of applicants across all four zones report having lodging and/or private land access within the zone they would most like to hunt. Relative to these features, the perceived opportunity to kill a black bear and presence of wait times are relatively less important.
7. Among applicants who have previously received a bear harvest permit in the state, 84 percent reported that they sat over a baited site during their last hunt; 19 percent hunted with the aid of hounds (Note: these are not mutually exclusive options). Most (72%) past black bear hunters did their own baiting (Figure 5). About one in five got baiting assistance from a hunting partner and 16 percent hired someone else to bait for them. Among those that used hounds during their last black bear hunt, eighty-three percent used hounds owned by friends/family member for their black bear hunt and eleven percent hired a guide to pursue bears with them (Figure 6).
8. Most respondents seeking opportunity in Zone A, B or D told us that black bears were “abundant” or “very abundant” (Table 3). A majority of those waiting for Zone C (53%)

indicated that black bears were “present, but not abundant.” While applicants perceived black bears to be abundant in Zones A, B and D, the modal response was to maintain those populations at about the same level. Those interested in hunting Zone C were most likely of any of the zones to support increases in black bear populations—four in ten applicants want bear numbers increased.

9. A majority (54%) of the black bear hunting applicants said they were satisfied with the overall regulation framework governing bear hunting in the state. One applicant in five was dissatisfied with the overall regulations and the remainder (26%) were neither satisfied nor dissatisfied. Those who have not yet hunted bears had a slight tendency to report feeling neutral about the regulations. Those who have received a harvest permit in the past were more likely to report feeling satisfied with the regulations.
10. Almost all applicants (94%) said decisions about black bear management in the state were important to them. Nearly two in three (64%) said management decisions were “very” important.
11. Regarding specific potential regulation changes tested in this survey, most did not receive strong support. A majority (54%) of applicants favored the opening of bear hunting season remain as is (Figure 10). Roughly nine in ten applicants ratified the use of bait materials that are currently legal and widely used among those who place bear bait (Table 9). However, nearly seven in ten (69%) of respondents did support making the use of fish and fish oils legal for baiting. Most respondents (52%) also felt that the length of the baiting season should remain the same (Figure 11). Lastly, support for opening parts of Zone C to hound hunting ranged from 40 percent in the northern part of the zone to 34 percent in southeastern part of the zone that is primarily not considered black bear range (Table 10).
12. Most hunters who would prefer to hunt Zones A, B and D felt the wait time was “too long.” Almost half of Zone C hunters felt the wait was about right. Across all zones, we found that applicants think three to five years is a reasonable time to wait for a black bear harvest permit. Those who have accrued more points generally accept longer wait times because they have already invested more time and think others with fewer points should have to wait as well.
13. Relatively few differences of opinion were found between those who hunt with the aid of dogs and those who exclusively use baited sites. Hound hunters were understandably more likely to say that hunting with dogs was an important motivation to bear hunt. No other differences in motivation were found between these groups. Among potential regulation changes, hound hunters were significantly more likely (69%) than bait sitters (49%) to support maintaining the length of baiting as currently allowed (Sig. $p < 0.001$).
14. Few differences of opinion were found among respondents based on their zone of interest. Those interested in hunting Zone C were most likely of any of the zones to support increases in black bear populations. Zone C hunters are also significantly more likely to be influenced in their zone selection by the short wait time in zone C, whereas other zone hunters are more heavily influenced by residency or land familiarity.

15. Our discrete choice model echoed many of the other findings from this report and revealed that the major tradeoff for applicants was between the number of preference points required to draw a permit and the likelihood of successfully harvesting a black bear. All else being equal, most applicants preferred the current structure over any hypothetical alternatives presented to them.

Introduction

Wisconsin is home to an estimated 28,000 black bears (*Ursus americana*) that live in forested habitats of state. Historically associated with the northern third of the state, bears now occupy approximately two-thirds of the state, and are considered rare or absent in only the primarily urban swath of counties in the southeastern part of the state (Figure 1; MacFarland 2009, Dennison et al. 2017). It is estimated that the current bear population is three times higher than when the Department last wrote a bear management plan in the early 1980's (Dennison et al. 2017). As a result, the Wisconsin Department of Natural Resources (Wisconsin DNR) has undertaken a review and update of the state's black bear management plan, including two surveys of those residents who live near and interact with bears. One of these surveys focused on Wisconsin residents and found widespread support for the size and distribution of the current state black bear population (Petchenik et al. 2018). This current report summarizes results from the second survey and reflects the experiences and opinions of those who may interact with bears the most—black bear hunters.

Black bears are managed to maintain population levels that are socially acceptable while providing an annual hunting opportunity in the fall. Several hunting websites and magazines herald Wisconsin as one of the best states to hunt black bears in the country (e.g., Barringer 2016, Honeycutt 2017). Wisconsin's black bear harvest is among the highest in the nation; harvests have exceeded 4,000 bears annually in eight of the last nine years and topped 5,000 animals in 2010 (Dhuey et al. 2017). By comparison, Wisconsin hunters take more black bears annually than those in neighboring Minnesota and Michigan combined (Frawley 2017, Garshelis and Tri 2018). Wisconsin also leads the nation in Boone and Crockett black bear skulls with more registrants than the second and third states combined (Pennsylvania and Alaska) (Honeycutt 2017).

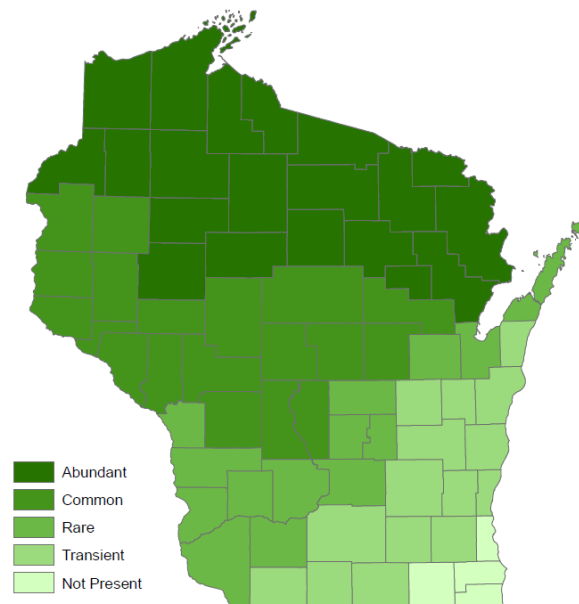


Figure 1.

Wisconsin black bear density by county.

As the Bureau of Wildlife Management undertakes a review and updating of the department's black bear management plan, it is important that hunters, as one of the primary beneficiaries of the current framework, are consulted on their opinions and experiences. We were asked by the department's carnivore specialist to design and administer a scientific survey of current bear permit applicants to assess their current satisfaction with and preferences for black bear hunting opportunities in the state.

Methods

We developed a 12-page questionnaire on a range of important bear management topics generated with input for the department's Bear Advisory Committee, a group comprised of agency staff and representatives from several bear hunter organizations. Questions on the survey were focus group tested with a group of bear hunters and then vetted by agency administration before being mailed to a random selection of 1,800 applicants in fall 2017. We followed the standard 3-contact survey administration process and achieved a 69 percent response rate. This report details the major findings of the survey. Prior to diving into the results, we provide a summary of bear hunting and related regulations for those not familiar with the current framework. This overview provides a context for understanding why we asked the questions we did, and what the results tell us about permit applicants preferences in the state.

Background Context

Interest in black bear hunting remains very strong. At a time when license sales for most types of hunting show declines, the number of people seeking black bear harvest permits has increased steadily over the last decade (Wisconsin DNR license data). The annual demand for bear harvest tags always exceeds the available harvest quota, so the department implements a drawing for tags based on preference points that applicants accumulate over several years. The current black bear harvest permit application process, which closes December 10 each year, allows customers to enter to receive a preference point or declare for a harvest tag in one of four different bear management zones. Applicants who declare for a harvest tag and who are not selected in the draw are automatically awarded a preference point. Points can be saved and retained if an individual applies for a harvest permit at least once every three years or until he/she is successfully drawn for a permit.

In 2017, over 112,00 individuals submitted black bear harvest permit applications. Of these, 27,694 applied to receive a harvest permit; the remainder requested a preference point. The allocation of black bear hunting opportunities in Wisconsin is predicated on a trade-off between relatively long wait times and very high harvest success. Dhuey and Lohr (2018) documented a 54 percent success rate among bear hunters in 2014 and 44 percent in 2017. The minimum number of preference points needed to be drawn in 2017 for zones A, B, C and D respectively was 7, 10, 1 and 4 (Table 1). To emphasize, holding the minimum number of points in a zone was no guarantee of being selected; most applicants holding the minimum number of points were not selected in three of the four zones in 2017 (Table 1). It should also be noted that there are customers with excess points in each zone every year that do not seek a harvest tag for reasons that are open to speculation. Many of these customers may be those who apply to maintain the option to hunt black bears or transfer a black bear tag to a youth hunter in the future.

Table 1. Preference points and permit approval by black bear management zone from the 2017 hunting season.

Zone	Minimum points awarded a harvest tag in 2017	Number of permits requested	Number of permits issued	% of applicants receiving a permit with minimum number of points
A	7	7,326	1,925	55%
B	10	5,490	1,275	21%
C	1	9,405	7,050	31%
D	4	5,433	2,600	22%

The bear hunting season in Wisconsin opens each fall on the Wednesday following Labor Day. “Hound hunters” and “bait sitters” alternate which group gets to hunt the first week of the season exclusively each year; both methods are allowed beginning the second week of the season. Wisconsin is one of 18 states that allow the use of hounds to chase and tree bears (legal in three of the four bear zones in Wisconsin; not in Zone C). Wisconsin also allows the use of baiting, a technique that many hound hunters also use to start their dogs on a scent. Past research on black bear harvest permit holders has documented that most (90%) hunt bears with bait and only about 13 percent use hounds (Dhuey and Lohr 2018). Current regulations cap the amount of bait to ten gallons per site. There is no restriction on the number of bait sites that can be maintained. Wisconsin prohibits the use of fish, meat, and meat by-products in bear baits. Baits must also be covered to exclude deer and other animals. The baiting season begins on April 15. It is legal to run hounds on bears for training from July 1 through the end of August. Black bear harvest permit holders have the choice of using archery equipment or a firearm to pursue bears.

Results and Discussion

Applicant Profile

Eighty-six percent of applicants were male. The average age of an applicant was 48 years old. Two-thirds of current applicants were over the age of 40. About half (51%) of the current applicants had previously received a tag to hunt black bears in Wisconsin (Figure 2). Seventeen percent of applicants had hunted bears in Canada or other states. Almost all (94%) said decisions about black bear management in the state were important to them. Nearly two in three (64%) said management decisions were “very” important.

Most applicants regardless of whether they had hunted bears in this state or elsewhere had participated in a variety of bear hunting related activities. Eighty-five percent of survey respondents had eaten bear meat. About two in three (65%) had read about bear hunting in books or magazines. Fifty-six percent had placed bait and 55 percent had scouted for black bear sign. Four percent currently or previously owned bear dogs, and 18 percent of applicants had participated in bear hound chases.

Among all applicants, 29 percent had received a harvest permit once before, and 23 percent had been awarded a tag two or more times in Wisconsin (Figure 2). The frequency of zone selection for these applicants' most recent harvest tags, respectively, was A (36%), B (19%), C (27%) and D (17%) (Figure 3). Sixty-one percent of applicants who received one tag in the past had successfully harvested a bear in Wisconsin. Of those who have received two tags in the past, 71 percent had harvested a bear. Ninety-one percent of hunters who had received three or more tags had killed a bear.

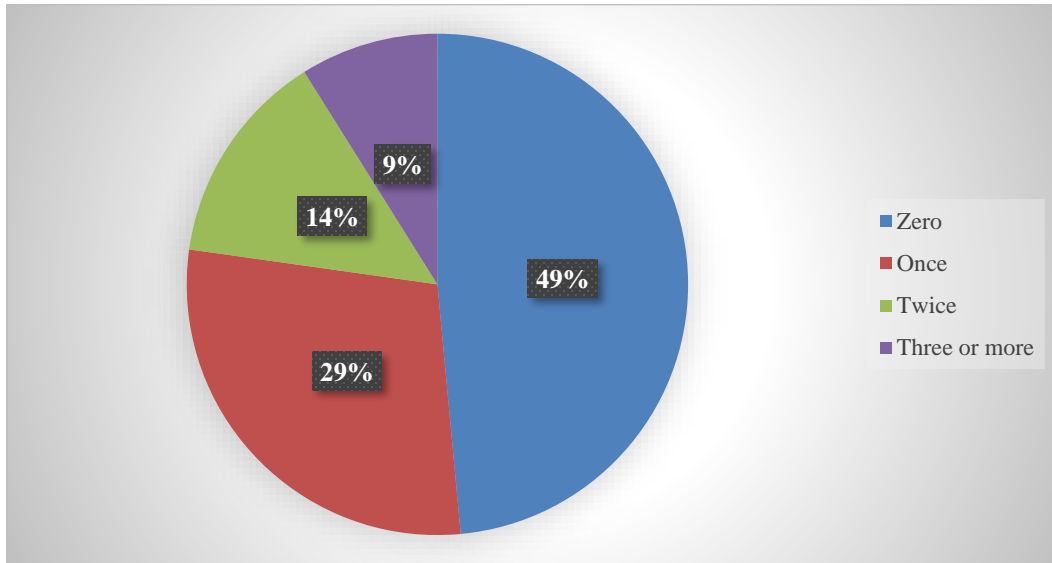


Figure 2. Past number of black bear harvest permits received by current applicants.

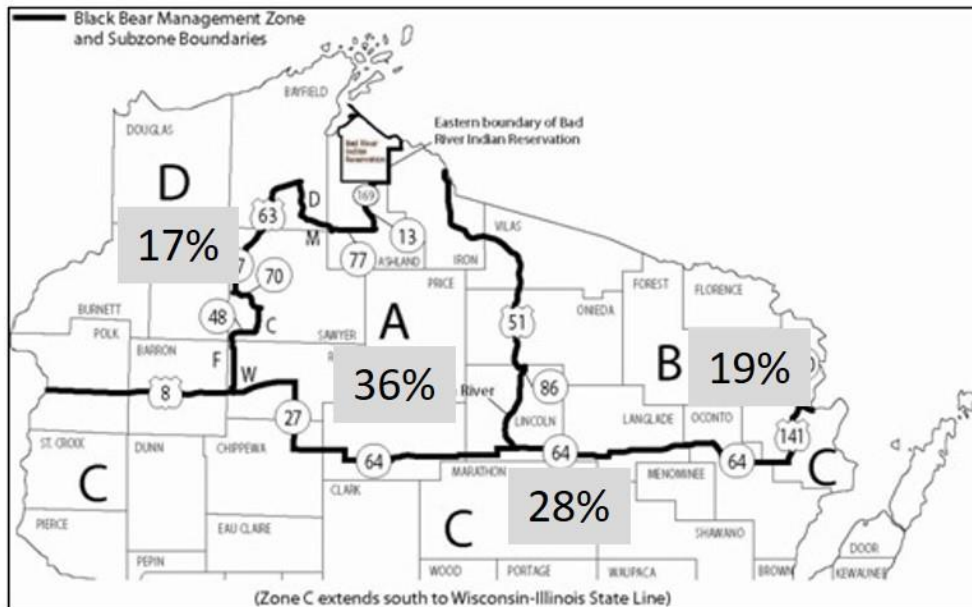


Figure 3. The percentage of zone selection among black bear harvest permit applicants who had previously received bear harvest tags in Wisconsin.

For those who had previously received harvest tags, 84 percent reported that they sat over a baited site during their last hunt; 19 percent hunted with the aid of hounds (note: these are not mutually exclusive options). Most (72%) past bear hunters did their own baiting (Figure 4). About one in five got baiting assistance from a hunting partner and 16 percent hired someone else to bait for them. Those who own bear dogs comprised three percent of the current applicant pool, but these hunters serviced many other bear tag holders each year. Among those that used hounds during their last bear hunt, 83 percent used hounds owned by friends/family member for their bear hunt (Figure 5). In addition, 11 percent hired a guide with hounds to pursue bears with them. Harvest permit holders who own their own dogs represented 16 percent of all people that hunted with hounds in any given year.

Figure 4.

The percentage of hunters using bait who placed the bait themselves versus those who relied on the assistance of others.

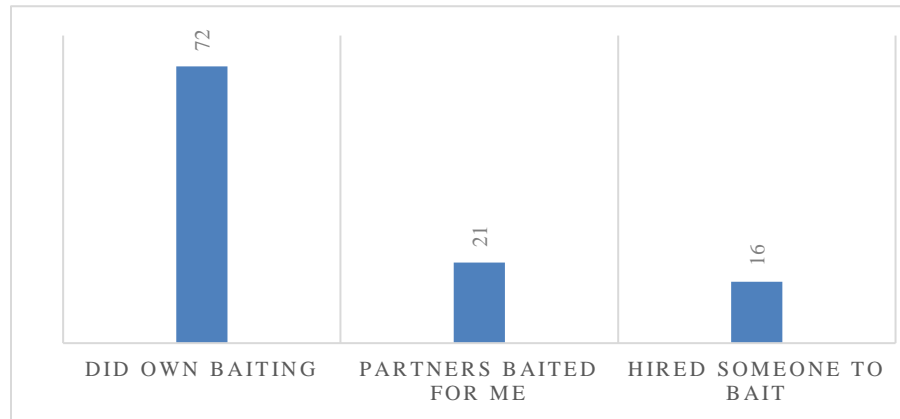
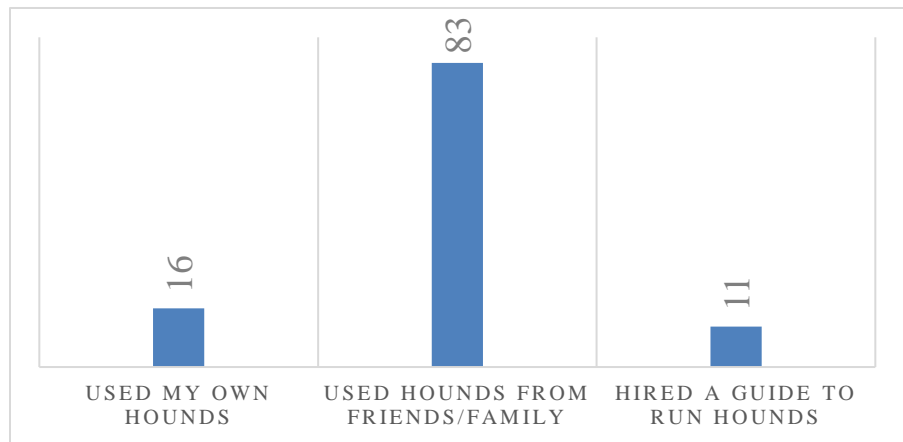


Figure 5.

The percentage of hound use among black bear harvest permit applicants who previously hunted bears in Wisconsin.



Among current applicants, 95 percent submitted their own application and 77 percent intended to get a bear harvest permit for themselves. Fourteen percent of applicants were unsure of whether they would seek a bear harvest permit in the future but were keeping their options open. About one in ten applicants had the intention of transferring their tag to an eligible hunter (e.g., a youth) in the future. Nine in ten applicants had a black bear zone in mind for which they would like to receive a tag (Figure 6). The distribution of preferences for zones among the survey respondents was similar to choices submitted by hunters who applied for designated zone harvest permits in 2017 (Figure 6). The biggest disparity between respondent zone preferences and actual 2017

declared harvest tags appeared in Zone C where our respondents significantly underrepresented the actual demand within the pool. The underrepresentation of Zone C applicants in these data does not wind up mattering much, however, because our subsequent analysis found relatively few differences of opinion among respondents based on their zone of interest.

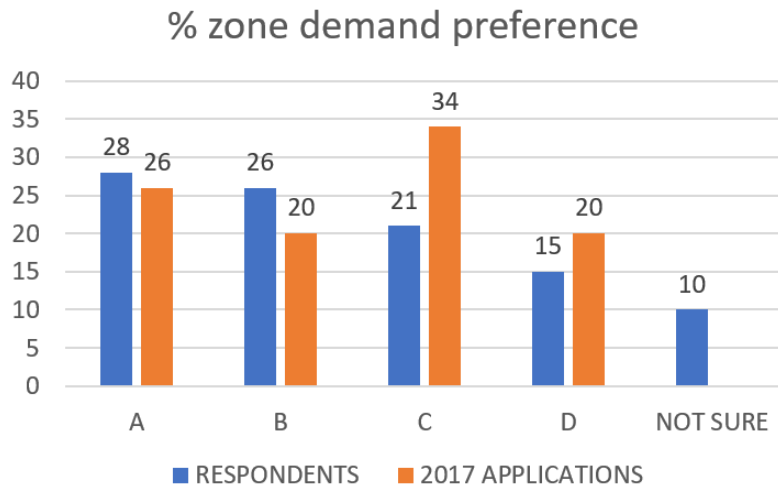


Figure 6. A comparison of the zone preferences of survey respondents and 2017 applicants who declared for a harvest tag.

Very Positive Black Bear Attitudes

Unsurprisingly, survey respondents were very positive about black bears. Eighty-three percent of applicants had “favorable” or “very favorable” attitudes toward bears. Solid majorities of applicants “agreed” or “strongly agreed” with several additional items that measured attitudes towards black bears, and the results converge with two other studies conducted over a similar period (Table 2; Petchenik et al. 2018, Dhuey and Lohr 2018).

Table 2. A comparison of bear attitude results from black bear harvest permit applicants, the general public (Petchenik et al. 2018) and black bear harvest permit winners in 2017 (Dhuey and Lohr 2018).

Attitude statements	% agreeing with statement		
	Permit applicants	General public	Permit winners
Bears deserve our admiration.	79%	81%	77%
Black bears are generally not a danger to people.	88%	70%	80%
Bears keep nature in balance.	66%	77%	61%
We ought to strive to have as many bears as the habitat will support.	56%	55%	53%

Black Bear Populations

Applicants were asked their opinion about the relative number of black bears occurring in the zone where they most wanted to hunt and their preference for managing the number of bears there. Most respondents seeking opportunity in Zone A, B or D told us that black bears were “abundant” or “very abundant” (Table 3). A majority of those waiting for Zone C (53%) indicated that black bears were “present, but not abundant”.

While applicants perceived black bears to be abundant in Zones A, B and D, the modal response was to maintain those populations at about the same level (Table 4). In Zone A, seven in ten applicants wanted the same number of black bears or more than current levels. For Zone B and D, 64 and 65 percent, respectively, wanted black bear numbers to increase or stay the same. Those interested in hunting Zone C were most likely of any of the zones to support increases in bear populations—four in ten applicants wanted bear numbers increased.

The percentage of applicants who wanted to see black bear numbers decrease ranged from 28 percent in Zone B to 12 percent in Zone C. There was a tendency among applicants who perceived black bears as being “very abundant” to support decreasing bear density in those zones (Figure 7). Two out of three applicants who said bears were very abundant in their zone of interest, supported a decrease in the number of bears in that zone.

Overall, applicants’ preference for bear populations statewide was strongly correlated ($R^2=.51$) with their zone-specific preferences, suggesting that they are differentiating differences in social or ecological limiting factors between zones. Thirty-five percent of respondents wanted to maintain black bear populations at their current level statewide. Thirty-two percent preferred that black bear numbers increase and 18 percent wanted to see a decrease in statewide bear numbers.

Table 3. Black bear harvest permit applicants’ opinions about current black bear densities in the management zone where they intended to hunt next.

Rating	Zone A	Zone B	Zone C	Zone D
Very abundant	17%	23%	8%	23%
Abundant	49%	44%	28%	46%
Present, but not abundant	28%	27%	53%	23%
Rare/ very rare	1%	1%	6%	1%
Unsure	5%	6%	5%	7%

Table 4. Black bear harvest permit applicants’ preferences for managing the size of the black bear population in the zone where they intended to hunt next.

Rating	Zone A	Zone B	Zone C	Zone D
Greatly increase	7%	6%	12%	6%
Slightly increase	23%	21%	28%	24%
Maintain about the same	41%	37%	36%	35%
Slightly decrease	15%	19%	10%	20%
Greatly decrease	5%	9%	2%	6%
Unsure	9%	8%	12%	10%

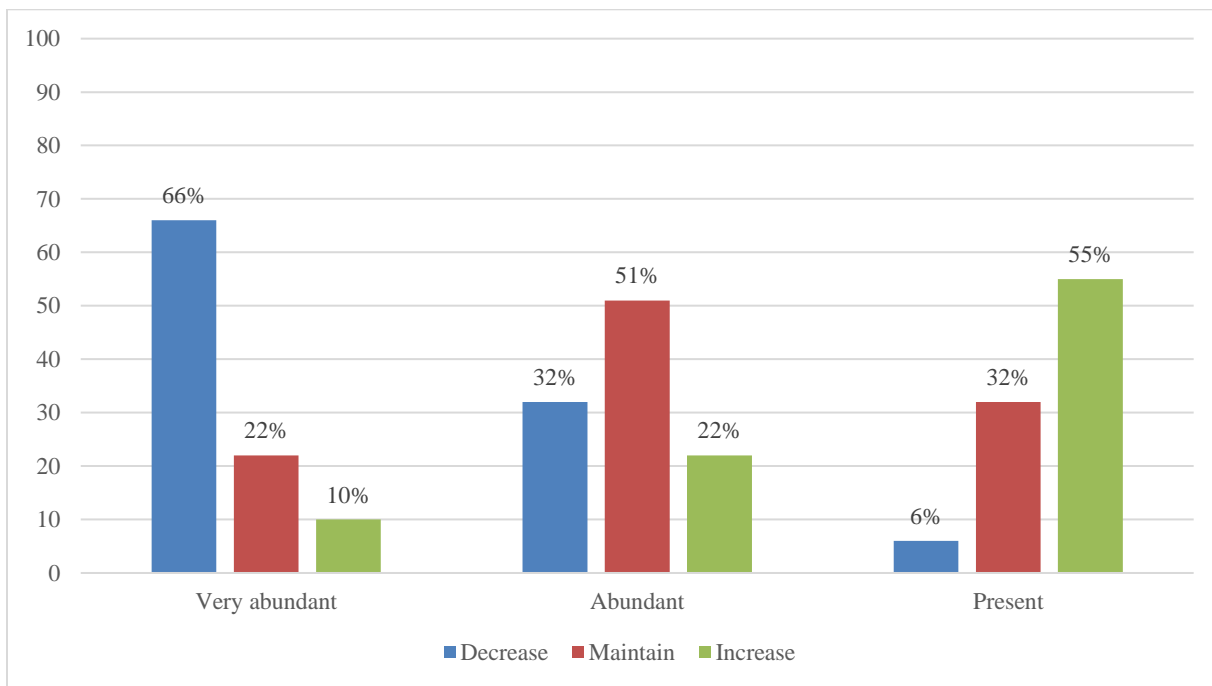


Figure 7. A comparison of black bear harvest permit applicants’ population preferences based on their perceived abundance of bears.

Determinants of Zone Preference

The four hunting zones within the state each offer very different black bear hunting opportunities when one considers bear densities, availability of public lands, wait times for tags, harvest success, availability of mast and agricultural crops as food sources and the allowance of hounds for hunting (legal in zones A, B, and D). We sought to identify the factors driving zone selection. A comment we heard during a focus group pre-testing of the questionnaire proved prophetic when a bear hunter said, “We don’t choose a zone, a zone chooses us.” The implication of this comment is that all things being equal, people choose to hunt black bears where they have roots—a residence, a second home, or friends/family in a zone, especially if those connections include private land hunting access (Table 5). A high proportion of hunters reported having lodging or private land access in the zones where they were seeking to hunt (Figure 8). Relative to these features, the perceived opportunity to kill a black bear and presence of wait times were relatively less important with a couple of exceptions reviewed below.

Table 5. The percentage of black bear harvest permit applicants indicating select factors that influenced their preference for the black bear hunting zone they were wanting to hunt next (Sig. $p < 0.001$).

Factor influencing zone preference	Zone A	Zone B	Zone C	Zone D
I live in this zone	21%	18%	66%	33%
I have a secondary residence or play to stay	53%	62%	37%	43%
I do other kinds of hunting in this zone	52%	64%	77%	56%
I believe this zone offers best chance to kill a bear	47%	34%	16%	49%
Zone allows use of hounds.	19%	14%	na	17%
I own property I can hunt in the zone	35%	32%	44%	37%
Zone has shorter wait time to get a tag	5%	0%	39%	7%
Zone does not allow use of hounds	na	na	30%	na
I have friends and family that hunt bears in this zone	60%	54%	49%	60%
There is public land available in this zone	51%	62%	36%	46%
I have access to private land owned by someone else in this zone	51%	45%	54%	50%
I have bear hunted this zone in the past	50%	33%	41%	40%

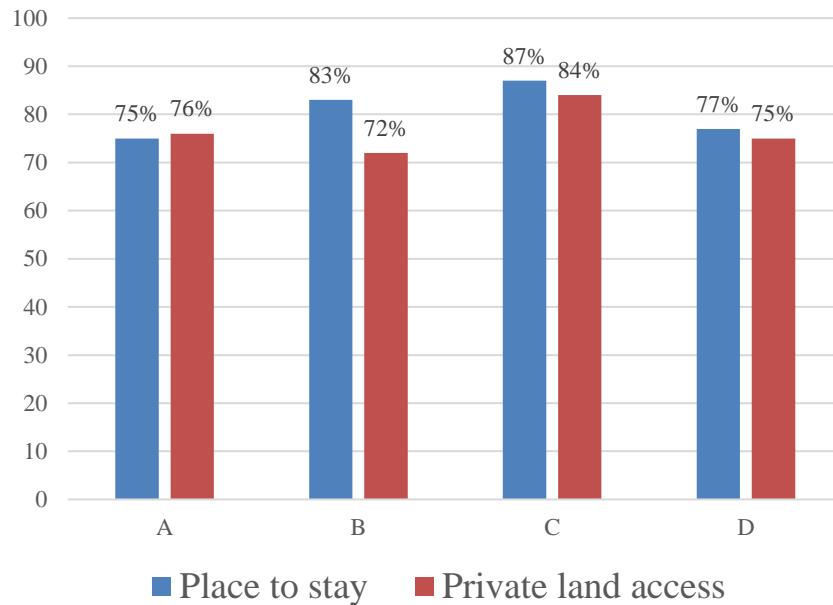


Figure 8. Percentage of applicants who have a place to stay and private land access in the zone where they would like to hunt black bears.

Black bear harvest permit applicants waiting for Zones A and D were more likely than those interested in B and C to indicate their preference was influenced by the best chance to kill a bear (Table 5). However, perceived chance of success was secondary compared to other factors like those mentioned already, even in Zones A and D.

Harvest permit applicants were significantly more likely to seek Zone A (19%) because they can use hounds than Zone D (17%) or B (14%). However, this difference was substantively small both compared to responses in other hound-friendly zones and when compared to other zone selection influential factors (Table 5).

Finally, about four in ten black bear harvest permit applicants (39%) seeking Zone C were influenced by its shorter wait time. Being able to hunt close to home (66%) or having access to private lands (54%) were more frequently selected by applicants wanting to hunt Zone C. Additionally, three in ten (30%) applicants want to hunt Zone C because of the prohibition on using hounds there (Table 5).

There also appeared to be strong fidelity of black bear hunters to management zones, as most with past hunting experience in a zone indicated that they would likely select that zone again with their next harvest tag (Figure 9). Over three out of four applicants who previously hunted black bears in Wisconsin said they intended to return to the same zone as last time. Zone B showed the highest zone fidelity with 89 percent of those who hunted previously saying they would return. These percentages underscore the point that applicants were choosing to hunt black bears where they had established ties and land access and not necessarily where bear numbers

were highest or where regulations differed. The biggest indicator of site fidelity among zones was that most applicants told us they would still select the zone they were waiting for even if wait times between zones were equal (Table 6). There is a slight exception among Zone C applicants where 58 percent said they would still pursue Zone C, but 11 percent would opt for Zone A and B respectively, and another 18 percent were unsure.

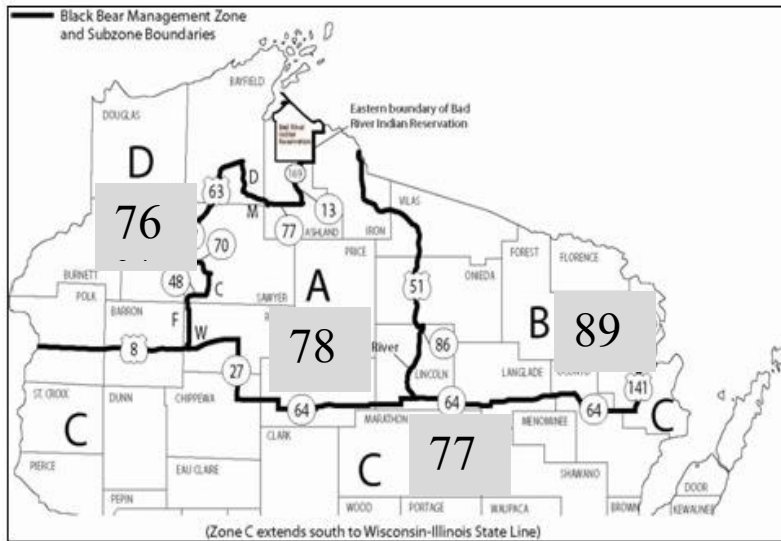


Figure 9. Percentage of hunters who plan to return to a zone where they hunted previously.

Table 6. Comparison of black bear harvest permit applicants’ zone selection and how it might change if wait times were somehow equal.

		Which zone will you most likely select for your next bear harvest tag?					Total
		Zone A	Zone B	Zone C	Zone D	Not sure	
What bear hunting zone would you most like to hunt if wait times were the same in each zone?	Zone A	80%	2%	11%	4%	18%	27%
	Zone B	2%	90%	11%	3%	18%	29%
	Zone C	3%	1%	58%	3%	12%	15%
	Zone D	2%	1%	2%	80%	5%	14%
	Not sure	12%	6%	18%	11%	48%	15%
Total		100%	100%	100%	100%	100%	100%

Applicant Motivations

Most of the black bear harvest permit applicants rated seven of eight motivations as “somewhat” or “very” important to their interest in going black bear hunting (Table 7). Eighty-eight percent of harvest permit applicants said the challenge was an important motivation for them. Hunting with family and friends and black bear meat were the second and third most frequently selected motivations. Hound hunters rated all eight motivations important, owing to obvious connection of their activity to watching dogs work.

Table 7. Relative importance of select motivations for wanting to hunt black bears among all survey respondents.

Motivation	Very important	Somewhat important	Neither important, nor unimportant	Somewhat unimportant	Very unimportant
For the challenge	51%	37%	9%	1%	1%
To participate with friends/family that bear hunt	44%	37%	12%	3%	3%
For the bear meat	44%	36%	15%	4%	3%
For the chance at a large bear	39%	43%	15%	2%	2%
To experience the pre-hunt process (setting up baits, trail cameras, etc.)	36%	42%	17%	3%	2%
To assist with managing/controlling bear population	24%	45%	23%	5%	4%
To get a bear rug, taxidermy mount, or other remembrance	19%	40%	26%	7%	7%
For the enjoyment of seeing hounds work	8%	10%	28%	8%	46%

Seventy-two percent of hound hunters said that hunting with dogs was an important motivation. There were no other significant differences between hound hunters and bait sitters on motivation, nor did harvest permit applicants across the four zones differ. Harvest permit applicants who had not hunted black bears in the state before were significantly more likely than those who had hunted in Wisconsin before to indicate that getting a bear rug or taxidermy mount was “very important” to them.

Applicant Satisfaction with Regulations

A majority (54%) of the black bear harvest permit applicants said they were satisfied with the overall regulation framework governing black bear hunting in the state. One applicant in five was dissatisfied with the overall regulations and the remainder (26%) were neither satisfied nor dissatisfied. We found a slight tendency for those who have not yet hunted to be neutral about the regulations, which makes sense because they have less direct experience in the system (Table 8). About half (49%) of those waiting to receive their first tag said they were satisfied, while one in three among this segment was neutral. Comparatively, hunters who had received a harvest permit previously were significantly more likely to report satisfaction with the regulations, though those with the most experience (3 or more harvest permits) also showed a slight increase in dissatisfied respondents (Table 8). Sixty-nine percent of those who had received a harvest permit in the past were satisfied with the regulations. There were no significant differences in satisfaction ratings based on method of hunting (baiting or hounds), number of current preference points held or hunter zone preference.

Table 8. A comparison of satisfaction rating with overall black bear hunting regulation framework based on past hunting participation in Wisconsin (Sig. $p < 0.001$).

Past harvest tags in state	Very satisfied	Satisfied	Neither satisfied nor dissatisfied	Dissatisfied	Very dissatisfied
None	14%	35%	33%	14%	5%
1	13%	44%	23%	17%	5%
2	17%	45%	17%	15%	6%
3 or more	13%	50%	9%	20%	8%

Support for Status Quo

Given the relatively high satisfaction levels with the overall regulation framework, it is probably not surprising that a number potential regulation changes we tested did not receive strong support. Diurnal visitation of black bears to bait sites can be impacted by the availability and timing of both natural forage (e.g., acorns, berries) and maturation of agricultural crops such as corn. Some have suggested that the opening of black bear season could be moved to make it easier to attract bears to bait sites. Our results found that a majority (53%) of black bear harvest permit applicants favored the opening of black bear hunting season remain as is (Figure 10). Only about one in five permit applicants preferred an earlier start; eight percent wanted bear season to begin later than it currently does.

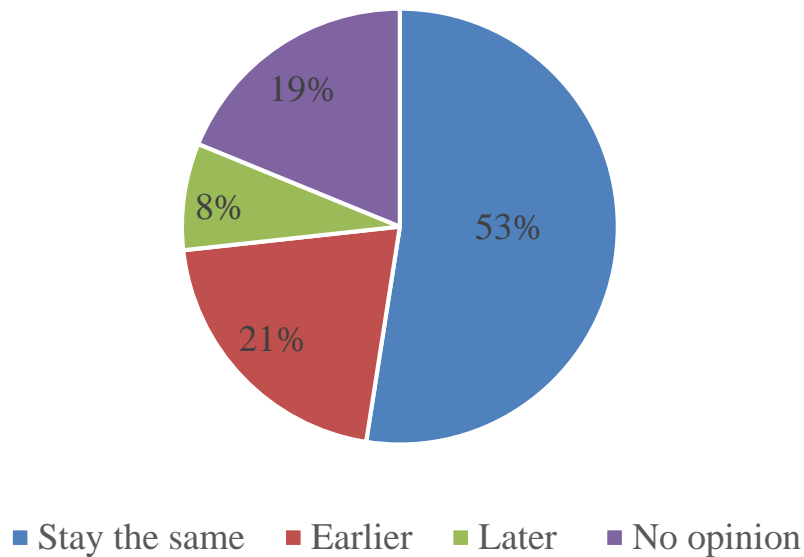


Figure 10. Frequency of black bear harvest permit applicants' support for opening date of the black bear hunting season.

Roughly nine in ten applicants ratified the use of bait materials that are currently legal and widely used among those who place black bear bait (Table 9). When asked about making meat products or animal carcasses legal to use, respondents were split between support and opposition, and neither type of bait received a majority support. However, nearly seven in ten (69%) of respondents did support making the use of fish and fish oils legal for baiting.

A majority of respondents (52%) also felt that the length of the baiting season should remain the same (Figure 11). Hound hunters were significantly more likely (69%) than bait sitters (49%) to support maintaining the length of baiting as currently allowed (Sig. $p < 0.001$). Support for shortening the baiting season was highest (only 25%) among applicants who thought black bear populations should be decreased on a statewide level (Sig. $p < 0.001$).

Harvest permit applicants were also asked for their opinions about opening parts of Zone C to hound hunting for black bears (Figure 12). Support for that idea ranged from 40 percent in the northern portion of the zone to 34 percent in the portion of Zone C that is not primarily considered black bear range (Table 10). About three in ten respondents were unsure about all three areas, indicating that respondents probably have not thought much about this idea before receiving the survey.

Table 9. Frequency of support and opposition among black bear harvest permit applicants for allowing several types of bear bait to be used.

Bear bait substance	Currently allowed	Should be allowed	Should NOT be allowed	No opinion
Processed grains (donuts, breads, etc.)	Yes	90%	2%	8%
Sweets (candy, syrups, frosting)	Yes	88%	4%	9%
Unprocessed grains like shelled corn	Yes	88%	3%	9%
Fish and fish oils	No	69%	15%	17%
Meat and meat byproducts	No	40%	38%	22%
Animal carcasses	No	37%	43%	20%

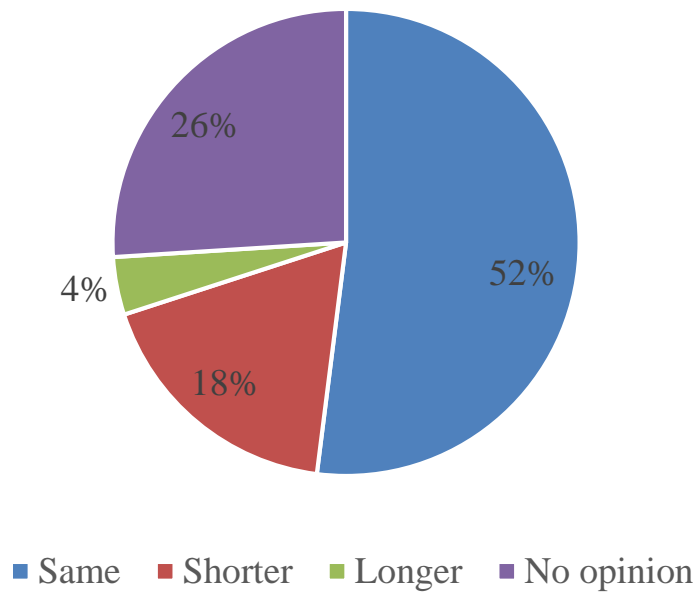


Figure 11. Frequency of black bear harvest permit applicants' opinion about length of the baiting season.

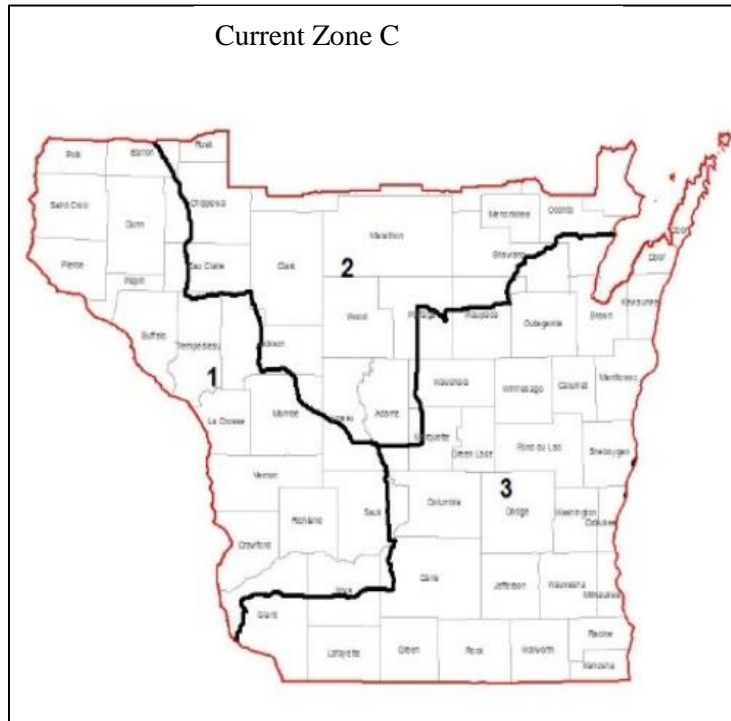


Figure 12. Proposed areas for use of hounds in Zone C that were tested on questionnaire.

Table 10. Frequency of support and opposition among all black bear harvest permit applicants to allowing hunting of bears with hounds in three areas of Zone C.

	Area 1	Area 2	Area 3
Support	39%	40%	34%
Unsure	31%	30%	31%
Oppose	30%	30%	35%

From time to time, there have been suggestions about adjusting black bear management zone boundaries to refine the managers’ ability to control bear populations in accordance with objectives like reducing human-bear conflicts. We tested that rationale and others to see whether black bear harvest permit applicants would support the basis of such changes. To be clear, we did not present particular ideas or proposals for boundary changes, we simply offered reasons for considering changes in general. None of the five rationales we offered achieved majority support from harvest permit applicants (Figure 13). Only one in four black bear harvest permit applicants felt that establishing a method-specific hunt zone was a reason to change boundaries. Only one in

three thought that shifting boundaries to better reduced bear-human conflicts was reasonable. The reason that drew close to majority support (45%) was to increase harvest success. Eighteen percent of respondents said “None” of the reasons provided were reasonable rationales for adjusting bear management zone boundaries.

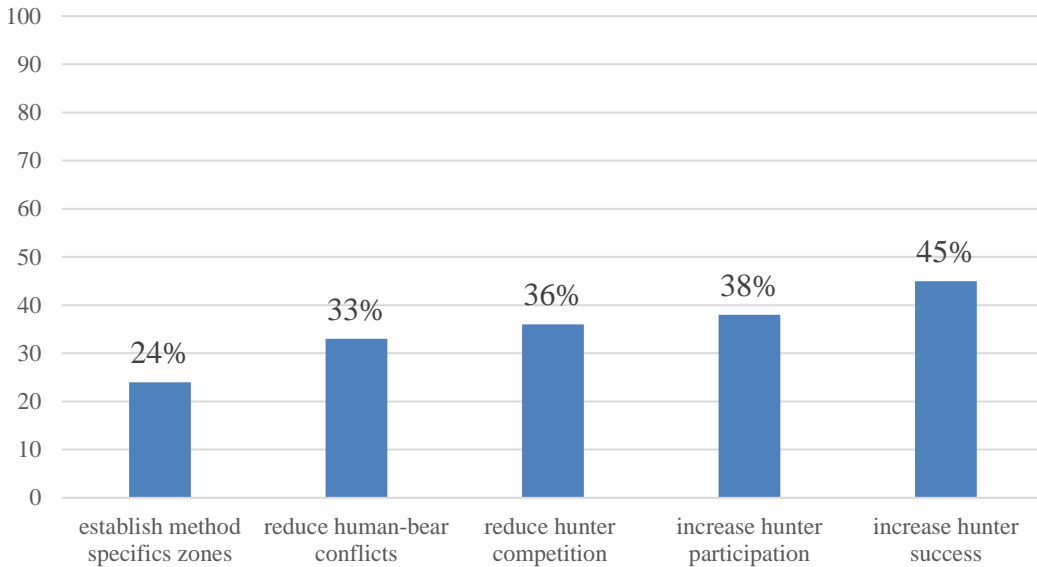


Figure 13. Frequency of support for various justifications for changing black bear management zone boundaries.

Dissatisfaction with Wait Times

Wisconsin DNR staff frequently hear comments from black bear hunters that it takes too many years to receive a harvest permit. These survey data confirm that sentiment and clarify just what harvest permit applicants’ expectations are relative to wait times in the four black bear hunting zones. For this analysis, we sorted respondents by the zone where they intended to apply for a harvest permit and then asked them three questions about wait times:

1. *How many preference points are typically required to draw a permit in your zone?*
2. *What is your opinion about the acceptability of that wait time?*
3. *What is a reasonable amount of time to expect to wait in that zone?*

Zone A applicants had the most accurate understanding of the current wait time they were facing (Table 11). Seven years was both the mean and modal response among this group and that lines up with the minimum number of preference points required to draw in 2017. Over half of the applicants for Zones A and B correctly identified the number of preference points at a plus or minus one degree of accuracy. Most Zone B applicants also correctly identified ten years as the likely wait time. Hunters waiting for Zones C and D had the least accurate prediction of current wait times. In both cases, mean and modal results for these zones were longer than actual wait

times in 2017. In both zones, the average respondent was expecting a wait that was two years longer than necessary. Only 18 percent of Zone D hunters correctly identified the wait time for their zone.

We next asked applicants about acceptability of the wait time relative to what they told us they expected. Most hunters waiting to hunt in Zones A, B and D said the wait time was too long in their respective zones (Table 11). Given that Zone B hunters face the longest wait, it is not surprising that they were most likely (82%) to say the wait was “too long.” Almost half (49%) of Zone C hunters said the wait was about right; and 23 percent said it was too long. The percentage in Zone C who thought the wait is “too long” could be reduced if they learned that most hunters are currently waiting one or two years.

We found that permit applicants thought three to five years was a reasonable amount of time to wait for a black bear harvest permit (Table 11). Most Zone C hunters told us three years is reasonable, while most in Zone B said five years. Sizeable majorities of permit applicants in the four zones thought the wait time in their zone should be less than five years.

In addition to zone of interest, we also explored how harvest permit applicants’ current number of preference points might impact their expectations about what is reasonable. Those who had accrued more points generally accepted longer wait times, though that relationship plateaus at the seven to nine preference points with a preference of about five years wait (Figure 14). This finding which is revisited in the next section of results indicated that those who had invested more time thought that those with fewer points should also have to wait to some degree.

Table 11. Black bear harvest permit applicants’ understanding and expectations of wait times by management zone.

	Zone A	Zone B	Zone C	Zone D
Current wait time				
Mean (years)	7.1	9.4	3.6	6.7
Mode (years)	7	10	3.0	7
% correct	54%	57%	42%	18%
Opinion about wait time				
Too long	74%	82%	23%	65%
About right	19%	10%	49%	24%
No opinion	7%	8%	21%	9%
Too short	0%	0%	8%	2%
Reasonable amount of time				
Mean (years)	4.2	5.1	2.8	4.0
Mode (years)	4	5.0	3.0	4.0
% who think wait should be < 5 years	86%	66%	97%	88%

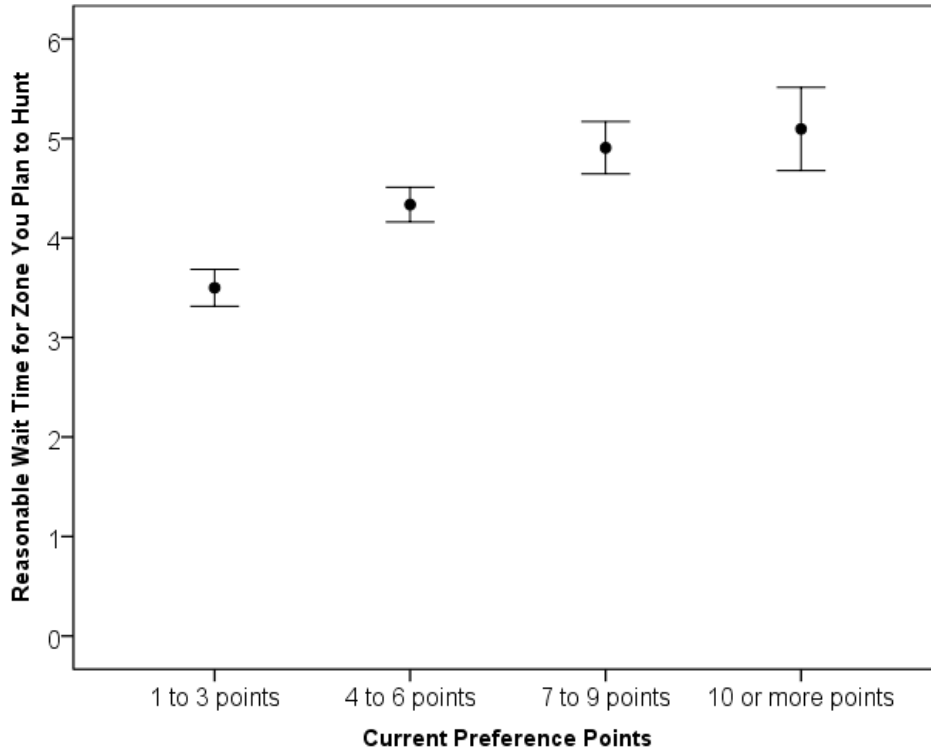


Figure 14. The relationship of how current preference point standing influences opinion about what is a reasonable wait time.

Black bear harvest permit applicants’ expectation for reasonable wait times presents a paradox for the wildlife management program. The simplest way to reduce the backlog in wait times would be to significantly increase harvest quotas for several years to allow more people to hunt. One likely outcome of such an approach would be a decline in black bear densities and a corresponding drop in harvest success. This would represent a tradeoff of some success for greater participation. As a potential solution, this idea may be met with opposition given that harvest permit applicants said they wanted black bear populations to remain unchanged. We asked a series of questions that sought to understand the extent to which a trade-off between reducing wait times and reducing success rates might be agreeable. The results present a mixed picture (Table 12). Sixty-eight percent of harvest permit applicants agreed that increasing permits would eventually reduce hunter success. A slight majority (51%) said they were willing to accept a lower black bear population in exchange for being able to hunt more often. On the other hand, an even higher percentage (56%) agreed that the high harvest success made it worth the wait for a tag. Finding that “sweet spot” between acceptable waiting time and harvest success, as well as other attributes of the hunting experience, were explored through a modeling procedure described in the next section.

Table 12. Black bear harvest permit applicants’ attitudes about statements depicting trade-off between success rates and frequency of participation.

Statements	Strongly agree	Agree	Neither agree, nor disagree	Disagree	Strongly disagree
A high harvest success rate makes it worth the wait for tag.	12%	44%	26%	16%	3%
Hunters would become more selective (shoot fewer small bears) if they didn’t have to wait so long to receive a bear hunting permit.	30%	48%	12%	9%	1%
Increasing the number of permits issued each year would eventually reduce hunter success rates.	13%	45%	29%	12%	1%
I would rather hunt bears more often even if it means my chances of getting one were lower than the current system.	8%	36%	28%	24%	4%
The opportunity to hunt is more important to me than harvesting a bear.	17%	43%	24%	14%	2%
I would accept a lower bear population in the zone I prefer to hunt if more tags were available each year.	10%	31%	28%	24%	7%

Exploring Applicant Preferences for Hunting Regulations

The concluding section of the survey comprised a discrete choice experiment designed to estimate hunter preferences given an inherent tradeoff between access to hunting opportunities (e.g., wait times, season structure, baiting options) and expected harvest success. In this approach, a statistical design plan (see Appendix A) was used to create 36 different “choice sets” or combinations of policy and outcome attributes that were then divided into eight survey versions. In each survey, respondents were given four unique choice sets of management options for the bear management zone where they would be most likely to hunt.

Aggregating the choice set responses from all respondents allows us to model the importance (positive or negative) of various attributes to the choice selection of an individual. The model coefficients, called part worth utilities (PWU), provide a common, but unitless, estimate of respondent preference. The power of this approach is that it allows us to compare effects that different attributes have on applicant preferences; we can indeed “compare apples to oranges!”

For our experiment, each choice set presented the respondents with three hypothetical management structure alternatives as well as the status quo and an option for none of the above (Figure 15). Respondents were asked to indicate their preference for one of the hypothetical options provided. The three alternative structures were comprised of different arrangements of five attributes, four of which described bear management regulations, while the fifth provided

information on the expected likelihood of a hunter successfully harvesting a bear. Table 13 outlines all potential levels of each of the five attributes.

	Option 1	Option 2	Option 3	Current	None
Minimum preference points for a harvest tag:	2 points	4 points	12 points	Varies by zone	
Season Structure:	Two 3-week seasons	Single 5-week season	Three 2-week seasons	Single 5-week season	
Start date for preseason baiting:	July 1st	August 1st	April 15th	April 15th	None of these options are acceptable
Bait types allowed:	All animal and plant products (e.g., animal carcasses)	Processed animal products (e.g., dog food) and all plant products	Unprocessed plant products (e.g., corn)	Processed and unprocessed plant products (e.g., corn, sweets)	
Bear harvest success:	1 in 2 hunters is successful (50%)	1 in 3 hunters is successful (33%)	1 in 2 hunters is successful (50%)	Varies by zone	
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

MOST PREFERRED OPTION →

SV:1 CS:1

Figure 15. Example of a choice set with three hypothetical black bear management alternatives, the status quo and an option for none of the above.

Table 13. Attributes and attribute levels used for the contingent choice experiment.

Attribute Category	Attribute	Levels
Access to Opportunity:	Minimum number of preference points needed:	0 points
		2 points
		4 points
		6 points
		8 points
		10 points
		12 points
	Season Structure	Single 5-week season
		Three 2-week seasons
		Two 3-week seasons
Baiting Regulations:	Start of Preseason Baiting Period	April 15th
		July 1st
		August 1st
		August 15th
	Bait Composition	Unprocessed plant products (e.g., corn)
		Unprocessed and processed plant products (e.g., baked goods, sweets)
		Processed animal products (e.g., dog food) and all plant products
		All animal and plant products (e.g., animal carcasses)
Outcome:	Bear Harvest Success:	1 in 20 hunters is successful (5%)
		1 in 10 hunters is successful (10%)
		1 in 5 hunters is successful (20%)
		1 in 3 hunters is successful (33%)
		1 in 2 hunters is successful (50%)
		2 in 3 hunters is successful (67%)
		4 in 5 hunters is successful (80%)

Results in Brief

- Corroborating findings from other sections of the survey, overall, hunters preferred the status quo for the black bear management zone they would most likely hunt. They also tended to prefer options that included the currently allowed bait composition and the current season structure.
- Some attributes, however, indicated preferences for changes in regulations. Respondents on average preferred to delay the start of baiting until August 15.
- As may be expected, hunters preferred scenarios in which harvest success rates were higher; however, improving harvest success at low levels had a greater impact on hunter preferences than a similar improvement when success rates were already high.
- Overall, applicants' preferences for the minimum number of preference points required to get a harvest permit followed a negative relationship, but only above four points, the average number of points currently held by the applicants in our sample.
- While the discrete choice experiment is useful for understanding the relative preferences for different black bear management tools and outcomes outlined above, its primary strength is in allowing managers to explore how combinations of tools designed to achieve a given management objective are likely to be received by hunters. To this end, a gaming tool was developed in Microsoft Excel.

Detailed Discrete Choice Model Results

Figure 16 summarizes the part worth utility (PWU) values for the model intercepts (e.g., new option vs current vs none of the above) as well as specifically for each of the five attributes. While the model estimates for each attribute provide insights into harvest permit applicant preferences, giving applicants their most preferred outcomes for all aspects may not be possible, let alone sustainable. For example, ensuring high hunter harvest success while simultaneously providing harvest permits to all interested hunters would not be possible. The primary strength of this modeling approach is that PWUs are directly comparable. A decrease in one attribute can be compensated by an equivalent PWU increase in another attribute to achieve the same overall preference for a given management option.

All else being equal, the model intercepts indicate that hunters were more likely to indicate the current situation in their preferred management zone as their preferred option over one of the alternative options or the “none of the above” option (Figure 16; See Table 14 in Appendix A for standard errors and statistical significance.). While all attributes had statistically significant effects on respondent choices, the dominant tradeoff revealed by the discrete choice experiment was between the minimum number of preference points needed to receive a harvest permit and the likelihood of successfully harvesting a black bear. Preferences for both attributes were nonlinear, with diminishing marginal returns. In other words, the preference for increasing success rates by a given percentage depended on the initial success rate—if hunting success is

low, a ten percent increase is more valuable to hunters than the same ten percent increase if hunting success is already high.

Harvest permit applicants preferred, all else being equal, a minimum of four points (Figure 16), a number that corresponds highly to the average number of points currently held by harvest permit applicants in our sample. Having put their efforts into collecting preference points, applicants are averse to providing hunting opportunities to those who have not. This finding suggests that issues of equity would need to be addressed should preference point requirements be lowered in the future. As the required number of preference points increases, however, the harvest permit applicants' preferences decrease rapidly. A change from twelve to ten points would be better received than a two-point change from six to four points.

Preference for higher rates of hunter success were also non-linear, and showed diminishing returns as success increased. An increase in likelihood of success from zero to twenty percent showed a comparable increase in hunter utility as a 40 percent increase in success rate from twenty to sixty. Above 80 percent, the utility associated with increasing hunter success remains nearly flat (Figure 16).

The preference for the status quo indicated by the intercepts also carried over in the parameter estimates for bait composition and season structure, both of which indicated that the current regulations were preferred over the alternatives (Figure 16). That said, harvest permit applicants felt more strongly about bait composition than they did about the season structure, as indicated by the relative magnitude of the estimates for these attributes.

Interestingly, harvest permit applicants most preferred an August 15 start to pre-baiting significantly more than the current date of April 15. An August 1 start was least preferred. One should note, however, that while these differences were statistically significant, the overall effect size for this attribute was small relative to the effects of other attributes in the discrete choice experiment.

To account for the inherent tradeoffs of managing the resource, the choice model was built into a gaming tool in Excel that allows wildlife managers to explore harvest permit applicants' preferences for different scenarios of interest (Figure 17). For example, one can focus on the primary tradeoff between the minimum number of preference points and hunter success, the results of which are presented in Figure 18. As this figure shows, 80 percent of applicants are likely to prefer a black bear management zone that requires two to six preference points for a harvest permit, but can also provide a harvest success rate, with a threshold of 55 percent of hunters harvesting a black bear in a zone requiring four points. The threshold, however, rises to a success rate of 80 percent in zones requiring six points. By contrast, even at a 90 percent success rate, fewer than half of respondents would choose a zone that required more than ten preference points.

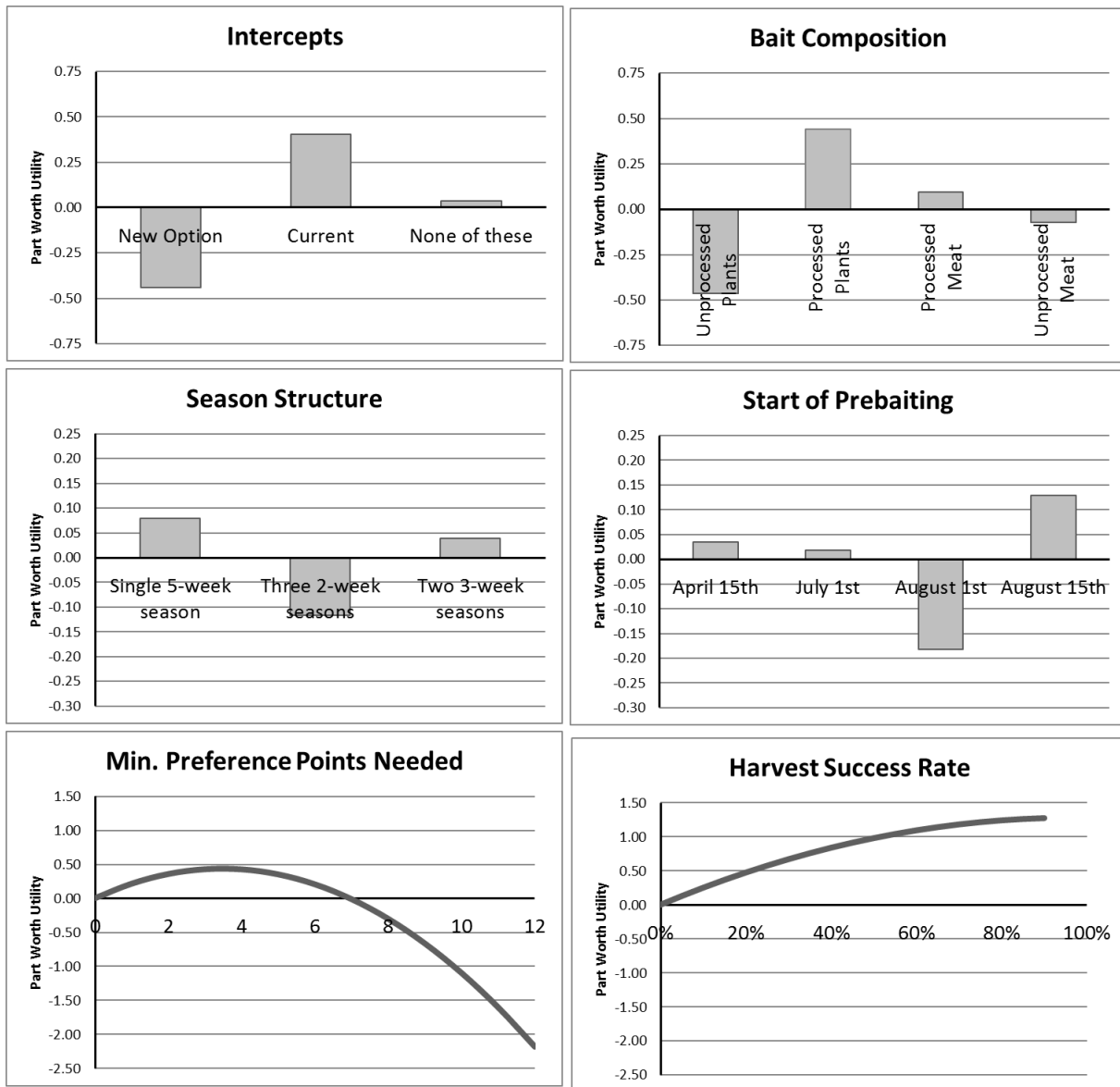


Figure 16. Hunter preferences for management attributes of their preferred Bear Management Zone. The part worth utility scale estimates the contribution of a given value of the attribute to the selection of an option, and provides a common scale to measure the relative preference for each attribute.

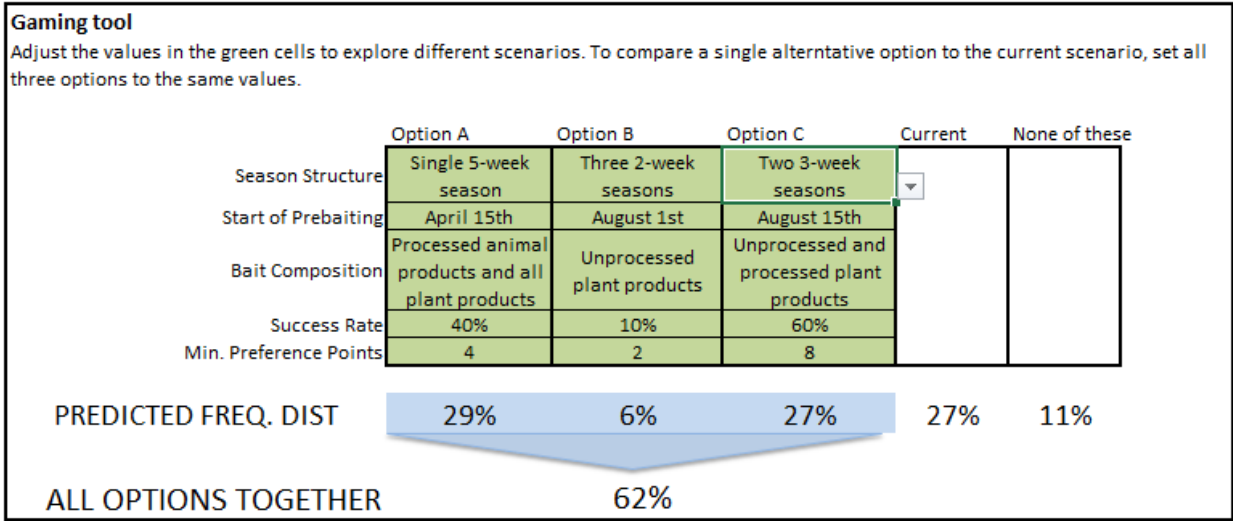


Figure 17. Interface of the gaming tool that allows users to explore different options for black bear management.

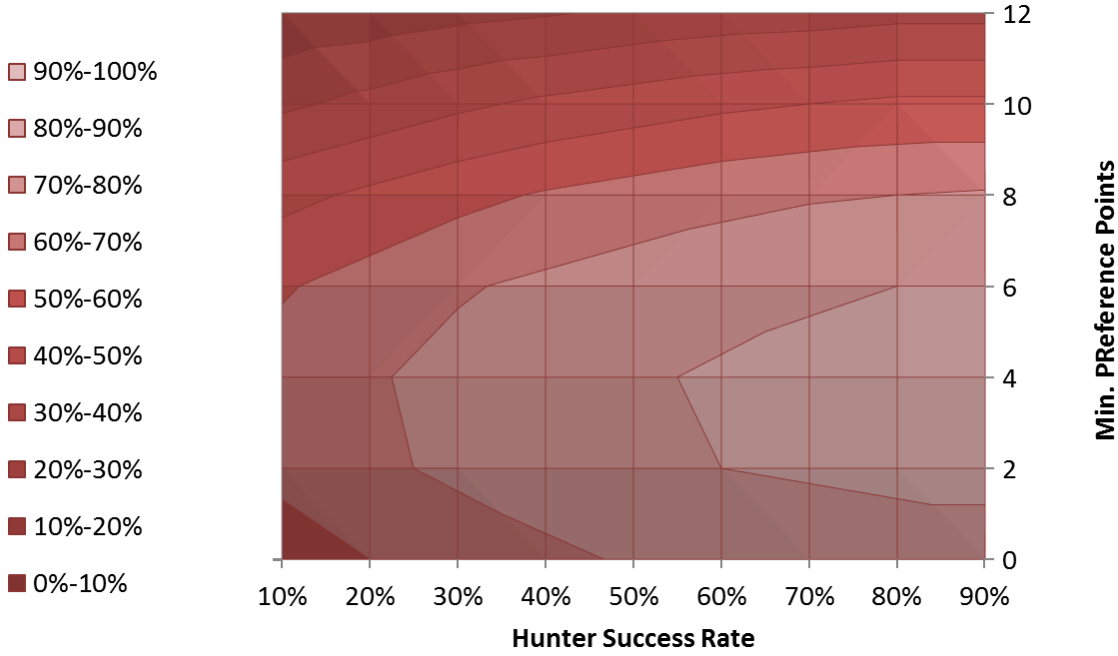


Figure 18. Hunter preference for the minimum number of preference points needed to receive a harvest permit given different success rates. All other parameters in the model were set to reflect current regulations.

Appendix A: Discrete Choice Experiments 101

Experimental Design

A statistical design plan was used to create 36 different combinations of hypothetical policy or outcome attributes. The three alternatives to the current structure that were presented in each choice set were described by five attributes, four of which described bear management regulations, while the fifth provided information on the expected likelihood of a hunter successfully harvesting a bear. The four regulatory attributes focused broadly on two important approaches to managing bear hunting: managing the availability of opportunities to hunt, and regulating baiting activities for bears. Specifically, the two attributes that control hunting opportunity are: the minimum number of preference points required to be issued a harvest permit, and the structure of the hunting season. The other two attributes that work to regulate baiting activities are: the start date for preseason baiting and the composition of allowable baits.

The statistical design underlying how the attribute levels are combined into choice sets plays a key role in ability of this approach to provide insights into hunter preferences. A key aspect of the design is to ensure that attribute levels both within and among alternatives remain independent of one another. A full factorial design, in which every possible combination of attribute levels is represented is not practical due to the sheer number of possible combinations. For example, creating scenarios from these five attributes (two attributes with seven levels, two attributes of four levels each, and one attribute of three levels) amounts to a $7^2 * 4^2 * 3^1$ full factorial design totaling 2,352 possible combinations. Therefore, a fractional factorial design plan was chosen that allowed estimation of main effects (Louviere et al. 2000) using just 32 replications. To further reduce the burden on each respondent, each survey included just 4 choice sets, and the total of 32 choice sets were divided into eight survey versions that were randomly and equally assigned across the pool of respondents.

Analysis

To analyze the discrete choice experiment, a multinomial logit model based on the behavioral assumptions of random utility theory (McFadden 1974) was used. This kind of choice modelling has been applied extensively in the fields of applied decision making and market research (Adamowicz et al. 1994). By aggregating the responses from all the respondents, it is possible to derive part worth utility functions for each attribute. These part worth utilities demonstrate the importance of various attribute levels to the choice selection of an individual, and being jointly estimated, provide a common metric to compare effects of changing different attributes.

Theoretical Basis

The theoretical basis for stated choice research lies in random utility theory in which a person's utility (i.e. benefits derived from a given alternative) is described by the following function (sometimes referred to as a conditional indirect utility function):

$$U_{in} = V_{in} + \varepsilon_{in} . \tag{1}$$

The benefits (U) gained by person n from alternative i is made up of an observable component (V) and random error (ε) (Adamowicz et al. 1994, 1998). To fit a multinomial logit model, the random error is assumed to be independently and identically distributed (McFadden 1974), and the ratio of choice probability for any two alternatives is unaffected by addition or deletion of alternatives (Carson et al. 1994, p. 354). In simpler terms, the IIA requires that alternatives are independent¹.

An individual will choose alternative i over alternative j if and only if the utility of i is greater than that of j ($U_{in} > U_{jn}$), and the probability that person n will choose alternative i over alternative j proportionate to the magnitude of the difference in utility between the two alternatives. In other words, the better one alternative is, relative to the others, the more likely it will be selected. If the IIA assumption holds, then this probability can be calculated using the equation (McFadden 1974):

$$\text{Prob}(i) = \frac{\exp^{\mu v_i}}{\sum_{j \in C} \exp^{\mu v_j}} \quad , \quad (2)$$

which represents the standard form of the multinomial logit model (MNL).

¹ This assumption is important for correctly applying the resulting model to predict hunter response to new options. To illustrate this importance, consider this classic example from the field of transportation provided by Train (2009). Imagine you are provided the following options for how you commute to work. You may choose either to take a car, a train, a red bus, or a blue bus. If you are indifferent to all of these options, then each has an inherent probability of being chosen equal to 25%. The options, however, do not meet the assumption of IIA, because the color of the bus is irrelevant. The real alternatives are car, train and bus, each of which, all things being equal, has a probability of 33% of being chosen. The red and blue busses are likely to split the bus share, receiving 16.5% each. The elimination of one of the four options, changed the ratio of the choice probabilities among the remaining options.

Model Parameter Estimates

Table 14. Multinomial Logit Model of bear hunter preferences.

	Attributes	Coeff.	s.e.	p-value
Intercept	New Option	-0.442	0.054	0.000
	Current	0.404	0.051	
	None of these	0.038	0.043	
Season Structure	Single 5-week season	0.079	0.031	0.001
	Three 2-week seasons	-0.117	0.032	
	Two 3-week seasons	0.039	0.032	
Start of Prebaiting	April 15th	0.035	0.040	0.000
	July 1st	0.018	0.040	
	August 1st	-0.182	0.041	
	August 15th	0.130	0.038	
Bait Composition	Unprocessed plant products	-0.464	0.045	0.000
	Unprocessed and processed plant products	0.441	0.036	
	Processed animal products and all plant products	0.097	0.039	
	All animal and plant products	-0.073	0.040	
Success	Linear	2.644	0.424	0.000
	Quadratic	-1.364	0.480	0.005
Min Preference Points	Linear	0.249	0.025	0.000
	Quadratic	-0.036	0.002	0.000

Literature Cited

- Adamowicz, W., P. Boxall, M. Williams, and J. Louviere. 1998. Stated preference approaches for measuring passive use values: Choice experiments and contingent valuation. *American Journal of Agricultural Economics* 80:64-75.
- Adamowicz, W., J. Louviere, and N. Williams. 1994. Combining revealed and stated preference methods for valuing environmental amenities. *Journal of Environmental Economics and Management* 26:271-292.
- Barringer, B. 2016. 5 Best Bear Hunting States. Game and Fish Magazine website. Available online at www.gameandfishmag.com/tips-tactics/5-best-bear-hunting-states/.
- Dennison, C.C, N.M. Roberts, and D.M. MacFarland. 2017. Black bear population analyses, 2017. Wisconsin Wildlife Reports. 6 pp. Wisconsin DNR, Madison. Available online at <https://dnr.wi.gov/topic/WildlifeHabitat/documents/reports/bearpop.pdf>.
- Dhuey, B., and J.R. Lohr. 2018. Black Bear Hunter Questionnaire, 2018. Wisconsin Wildlife Reports. Wisconsin DNR, Madison. Available online at <https://dnr.wi.gov/topic/wildlifeHabitat/reports.html>.
- Dhuey, B., S. Walter, and B. Koele. 2017. Wisconsin black bear harvest report, 2017. Wisconsin Wildlife Reports. 11 pp. Wisconsin DNR, Madison. Available online at <https://dnr.wi.gov/topic/WildlifeHabitat/documents/reports/bbharv17.pdf>.
- Engstrom, P., B. Willging, and D. Ruid. 2017. Black bear damage and nuisance complaints, 2017. Wisconsin Wildlife Reports. 4 pp. Wisconsin DNR, Madison. Available online at <https://dnr.wi.gov/topic/WildlifeHabitat/documents/reports/bbeardamnuiscompl.pdf>.
- Frawley, B.J. 2017. 2016 Michigan Black Bear Hunter Survey. Wildlife Division Report No. 3641. Michigan Department of Natural Resources, Lansing, MI.
- Grashelis, D., and A. Tri. 2018. Status of Minnesota Black Bears, 2017: A Final Report to the Bear Committee. Minnesota Department of Natural Resources, St Paul, MN.
- Honeycutt, J. 2017. Top 10 states for Boone & Crockett black bear hunting. Realtree: Family, Friends and the Outdoors website. Available online at www.realtree.com/big-game-hunting/articles/top-10-states-for-boone-crockett-black-bear-hunting.
- Louviere, J.J., D.A. Hensher, and J.D. Swait. 2000. *Stated Choice Methods: Analysis and Applications*. Cambridge University Press, New York.
- McFadden, D. 1974. Conditional logit analysis of qualitative choice behaviour. In P. Zarembka (ed.) *Frontiers in Econometrics*. Academic Press.

MacFarland, D.M. 2009. Population estimation, habitat associations and range expansion of black bears in the Upper Midwest. Ph.D. dissertation. University of Wisconsin, Madison.

Petchenik, J., L. Bradshaw, and R. Holsman. 2018. Public Awareness of and Attitudes Towards Black Bears and Their Management in Wisconsin. Wisconsin Department of Natural Resources, Madison, WI

Train, K.E. 2009. *Discrete choice methods with simulation*. Cambridge University Press, New York.