

Hunters` satisfaction as affected by ptarmigan density and hunting practice

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Abstract

After the hunting season of 2006 I through questionnaires studied the individual satisfaction of 1 803 ptarmigan (*Lagopus lagopus*) hunters in 23 different areas with estimated ptarmigan densities. When asked, the hunters answered that it was most important to see many ptarmigan, beautiful scenery and to hit well, but it was least important to bag many birds. In spite of this, the satisfaction increased with number of shot ptarmigan. When the number increased from 0 to 4 bagged ptarmigan per day, the satisfaction increased from 47 to 87 %. Probably, shot birds are more the result of a good hunt than the aim of one. There was a small and not significant ($p = 0.07$) increase in satisfaction when the density increased from 6 to 27 ptarmigan per km^2 . The number of ptarmigan shot per hunter and day was not related to the ptarmigan density in the area.

Overall satisfaction was also affected by factors indicating that the hunter did plan and prepare the hunt early. These factors, applying early for permit and use the same area from year to year, did increase the satisfaction. Two other factors that involved sportsman's skills, namely hunting with pointing dogs and participating in shooting competitions, did decrease the satisfaction. This is probably because of higher expectations to oneself and the dog when being active throughout the year. Hunters that bagged other species next to ptarmigan were more satisfied. Overall satisfaction was related to the hunter's perception of terrain quality and crowding, and satisfaction decreased with the hunter's age.

Harvest per day is not related to density. Daily bag limits in order to preserve the population, are needed only when population surveys show low densities. Since the hunters at all densities have a low average take per day, a bag limit must be set extremely low to have any effect. As satisfaction strongly increases related to number of shot ptarmigan per day, low bag limits will lower the hunters' possibility to obtain full satisfaction, and reduce the perceived value of the hunt.

Sammendrag

Etter jaktseasonen 2006 undersøkte jeg, på bakgrunn av spørreskjemaer, den opplevde tilfredsheten til 1 803 rypejegere (*Lagopus lagopus*) i 23 forskjellige områder med målt rypetetthet. Jegerne oppga at de syntes det viktigste var å se mange ryper, vakkert terreng og å skyte godt, mens det var mindre viktig å få stor fangst. Til tross for dette øker tilfredsheten med antall ryper som ble skutt. Når dette tallet øker fra 0 til 4 skutte ryper pr dag, øker tilfredsheten fra 47 til 87%. Antakelig er skutt fugl mer et resultat av en god dag på jakt enn formålet med jakturen. Det er en liten og ikke signifikant ($p=0.07$) økning i tilfredsheten når rypetettheten øker fra 6 til 27 ryper per km². Antallet ryper skutt per dag har ikke statistisk sammenheng med rypetettheten i området.

Generell opplevd tilfredshet påvirkes også av faktorer som indikerer at jegeren planlegger jakta i god tid og forbereder seg godt. Disse, som er tidlig søking om jaktrett og det å jakte i samme område år etter år, øker opplevd tilfredshet. To andre faktorer, mer knyttet til et konkurranseaspekt, nemlig jakt med stående fuglehund og deltakelse i konkurranseskyting, reduserer den opplevde tilfredsheten. Dette henger antakelig sammen med høye forventninger til seg selv og til hunden. Jegere som skjøt annet vilt i tillegg til rype var generelt mer tilfredse. Generell tilfredshet øker med jegerens oppfatning av terrengets egnethet, og reduseres med jegerens alder og med høy tetthet av jegere.

Fangst per dag henger ikke sammen med målt tetthet av ryper. Daglige bag-limits for å bevare rypebestanden er bare nødvendig der tellingene viser lav tetthet. Ettersom jegerne, ved alle målte tettheter, har et lavt gjennomsnittlig uttak, må en bag-limit settes ekstremt lavt for å ha effekt. Når tilfredsheten øker sterkt i samsvar med antall skutte ryper per dag, vil så lave bag-limits redusere jegerens muligheter til å få en fullt ut tilfredsstillende jakt, og dermed minske den opplevde verdien av jakta.

1.Introduction

1.1 Norwegian ptarmigan hunting

Willow ptarmigan (*Lagopus lagopus*) and rock ptarmigan (*Lagopus mutus*) are the most important small game species for hunters in Norway (Pedersen et al. 1999) regarding number of hunters, as well as annual bag (Statistics Norway 2007). Willow ptarmigan has great cultural and economic importance (Hörnell-Willebrand 2005). All together 54 029 Norwegians harvested 217 002 willow and 95 189 rock ptarmigan (Statistics Norway 2007) during a hunting season from 10 September till the end of February (15 March in the northern counties). 2/3 of all hunting takes place in the first ten days after the opening of the season (Kastdalen 1992). This is before most of the broods break up and start dispersing (Hörnell-Willebrand 2005), and the groups sit for a pointing dog.

Use of pointing dogs is common when hunting ptarmigan in Norway. Hunters who use pointing dogs normally prefer to search for willow ptarmigan at altitudes from 800-1100 m.a.s.l., as willow ptarmigan usually sits harder for a dog than the rock ptarmigan. When hunting strictly for rock ptarmigan, often in rocky terrain on higher altitudes, use of pointing dogs is less common.

Ptarmigan populations have high annual fluctuations, and the main focus in ptarmigan research so far has been to understand the population dynamics (Mougeot et al. 2003) that until the mid 80`s came in a steady 3-4 year cycles highly correlated with small rodent population fluctuations (Pedersen et al. 2001). Recently it has been shown that fluctuations have become less regular than previous (Hörnell-Willebrand 2005). There are still large differences in densities of ptarmigan both between years and areas ranging in August between 1 and 105 ptarmigan per km² reflecting the great variation in areas regarding habitat quality and other factors affecting the local ptarmigan population (Solvang et al. 2004, 2007).

When a species fluctuation pattern becomes less predictable it becomes even more important to measure the population density and reproduction rate each year before the hunting season starts. This will help both to avoid over harvesting by giving a chance to establish extraordinary management imposed regulations in low density areas. You can also direct

hunters to areas that are more likely to sustain a high hunting pressure without lowering next years breeding population, and to give good hunting experiences for the hunters. This you can do even before the beginning of the season. How densities affect the hunting experience is not yet documented, but the common and logic belief is that hunters will experience higher satisfaction with higher densities of ptarmigan in the hunted area. The management of ptarmigan has till now had focus on making the land produce dense game populations (Leopold 1933, Gigliotti 2000, Hjeljord 2008).

Based on research during 1930-40 both Olstad (1953) and Steen (1989) claimed that Norwegian hunters usually harvest about 10% of the autumn population, and that this mortality was compensatory. More recent research has shown that hunters locally have been able to shoot more than 50% of autumn population (Kastdalen 1992). Harvest at this level might not be totally compensated by lower natural mortality during winter and can therefore lead to lower breeding population next spring (Pedersen et al. 1997). Many areas have experienced increased levels of hunting over the last 20 years (Mortensen 1994). This puts a big responsibility on hunters, and especially managers of ptarmigan hunting grounds, not to harvest ptarmigan in an unsustainable way. The major benefit extracted from ptarmigan hunting is the recreational value achieved while hunting; the ultimate objective of resource management is the provision of human benefits (Stankey et al. 1973).

1.2 Hunting as recreation

Today's ptarmigan hunters come from both rural and urban backgrounds. Their motivation for hunting may be different, but it is more likely to be due to recreational purposes than because they need ptarmigan meat. Only seven out of ten small game hunters in Norway manage to actually bag game (Statistics Norway 2007). An average ptarmigan hunter shoots less than one bird per day, which implies that the net income of meat is less than half a kilo per day spent in the field. So there must be other reasons why ptarmigan hunting is the most popular form of small game hunting in Norway.

Pedersen (1997) and Bjerke (1993) point at the recreational value of ptarmigan for the hunters as well as the economic value of the meat and spin-off products from the hunt. Hayslette et al. 2001 found that dove hunters were more strongly motivated by non-success based satisfaction and less by obtaining a bag limit than were other types of hunters. Vaske et al. (1986) point

out that there is a variety of hunter types, and these need to be evaluated individually to determine what is of relevance in determining reasons for satisfaction.

1.3 Society and hunting

A high level of acceptance in the society is important if hunters are to keep up hunting in the future. Today Norwegians are generally positive towards hunting, 54 % state that they are positive while only 14% are negative (Stokke 2004). Even if most Norwegians are pro hunting, studies from Sweden and USA suggest that the motivation for hunting is important for how likely society is to be supportive. In Sweden 81% of respondents were in favour of hunting for food, while only 33% in the same survey was pro hunting for recreation and sport. The same patterns are found in USA (Heberlein and Willebrand 1998). Urban citizens are more negative towards hunting than rural (Heberlein and Ericsson 2005). As society becomes more and more urbanized it will become more difficult for hunters to find acceptance. However urban citizens did become more and more positive towards hunting the more contact they had with the countryside (Heberlein and Ericsson 2005). As more than half of the ptarmigan hunters in this study are from cities with more than 10 000 citizens, which probably reflect the real share of urban ptarmigan hunters, this might help urban citizens to stay in contact with rural values and thereby help build positive values towards hunting even if the hunt itself might be motivated more by sport than nourishment issues.

1.4 Description of the thesis

This master thesis is part of the Norwegian ptarmigan project 2006-2011, which ultimately seeks to produce a management manual for *Tetraonidae* in Norway that is scientifically based, sustainable and profitable for proprietors (Norskog 2008). An important part of this project is a large scale questionnaire based survey done among ptarmigan hunters that were active in the 2006/2007 season.

In this paper I inspect the responses from 1803 hunters from 23 different areas with known ptarmigan density ranging from 6-60. I will try to identify key elements regarding the hunters' experienced level of satisfaction for various aspects of the hunt. I investigate the correlation between ptarmigan densities in the hunted areas and the experienced level of satisfaction for the hunters, as well as how the daily take affects satisfaction and how density affects the daily

take. I separate the hunters into different groups, according to various characteristics, and check whether there are differences in how these different groups experience an equal situation or density.

1.5 Hypothesis from pre-study

Before the start of the ptarmigan 2006-2011 project I made a pre- study (N=115)(Faye-Schjøll 2006). I found significant differences between those who hunted with dogs and those who hunted without, and also that hunters from areas with imposed daily bag-limits were less satisfied than those hunting in areas without bag-limits. Hunter's satisfaction were also found to increase with higher densities of ptarmigan in the area (8-86), but no significant increase in satisfaction were found within a normal density range for Norway (8-40). In the current paper I will check whether this last conclusion from the pre-study is verified by the results from this larger scale study where a majority of the censured areas have densities below 30 ptarmigan per km² (Solvang et al. 2007).

2.Methods

2.1 Data collection

Data were collected through a mail survey among hunters that bought a ptarmigan hunting licence during 2006. Addresses for the hunters were collected from buyer's lists from the managers of different areas where the ptarmigan density was estimated in August of the same year. 2885 different addresses gathered from 23 different areas where in the beginning of March 2007 used to send a letter containing information about the survey, the questionnaire, a printed sheet of different habitat pictures, and a pre-paid return envelope. The questionnaire was structured according to the Total Design Method (Dillman 1978). The questionnaire was developed based on experiences with previous studies on attitudes toward recreational fishing, wildlife (Bjerke *et al.*, 2005), ptarmigan hunting (Willebrand & Paulrud, 2004; Aas & Vinsand, 1996) and general harvesting from nature. A draft questionnaire was tested on a small sample before final modifications were made for the main study.

In the first mailing 137 questionnaires came in return due to unknown addresses. A short reminder was sent out two weeks after the initial mailing. May 3 2007 we sent 1263 letters similar to the initial mailing to non-respondents, with a deadline of May 20. Twenty eight questionnaires were returned with unknown address in this round. The effective sample size after adjusting for the undeliverable letters and two recent deaths was 2688 questionnaires. When the survey closed on May 20 we had received 1841 answers. This gives a final rate of response of 67,8%. Thirty eight answers were unreadable, leaving a final sample size of 1803. Data is not weighted for differences between respondents and non-respondents, as we did not suspect any differences between these groups.

In this thesis I use the responses from hunters in 23 different areas in Hedmark, Oppland, Buskerud, Hordaland, and Sør-Trøndelag counties in Norway, where willow ptarmigan densities had been estimated in August 2006 (Solvang et al. 2007).

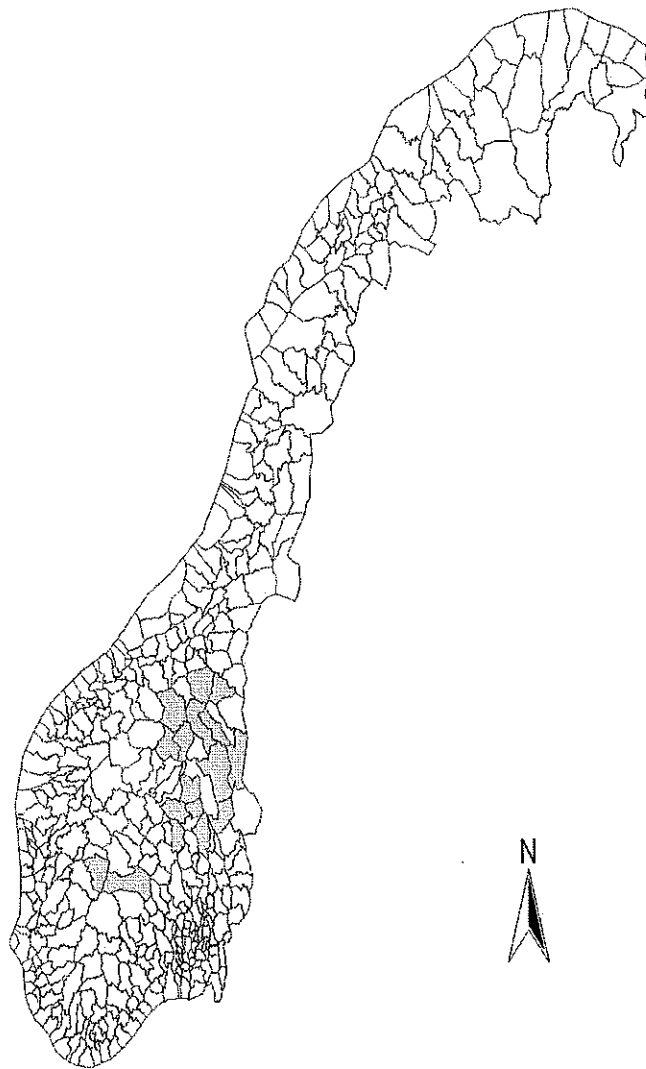


Figure 1 Municipalities where the respondents in this survey hunted

This thesis is based on the responses from 1803 respondents. This constitutes 3.33 % of all ptarmigan hunters that were active during the 2006/2007 hunting season.

At densities above 27 (33, 33, 39, 40 and 60) ptarmigan per km² there were relatively few observations (N= 68). These observations influenced my results relatively stronger than the other observations (N=1735), I therefore excluded these observations from the analysis of how densities influence satisfaction. All calculations on how density affects satisfaction for hunters are thus done within the density range from 6-27 ptarmigan per km².

Respondents were instructed to rank their level of satisfaction with the hunting period in total on a scale from 0-100. The level of satisfaction expressed in this way has been used as the response variable in all calculations.

The questionnaires were digitally scanned using the program Verity Teleform v9. Afterwards I manually went through all answers the program could not interpret to make them correct. The finished dataset has been saved and handled in Microsoft Excel.

In addition to the postal survey directed at hunters from areas with known densities an internet survey was also conducted. The 1215 answers to this survey are not used in this thesis, as my focus is on how densities influence the hunting experience.

2.2 Description density estimate - Distance

Density estimations for ptarmigan have been conducted in Norway since 1995 (Solvang et al. 2006) using the method distance sampling and program Distance (Buckland et al. 1993; Pedersen et al. 1999; Buckland et al. 2001) on walked transect lines with the help of trained pointing dogs in beginning of August. Distance sampling is a well working method and is proposed used in a future national population estimation program for ptarmigan I Norway (Brainerd et al. 2005). Transect lines are placed in the terrain with primary focus on capturing variation in the willow ptarmigan populations.

In august 2006 the density was measured in 113 different areas (Solvang et al.2007). There were 17 different densities in the 23 areas ranging from 6 willow ptarmigan per km² at the least to 60 willow ptarmigan per km² at the most. Ptarmigan densities above 30 ptarmigan per km² are rare in Norway (Solvang et al 2007). This was reflected in my dataset with only 68 out of 1803 responses being returned from hunters that had been hunting in five different areas with ptarmigan densities above 27, which I have chosen to exclude them from the density related analysis(Fig. 3 and 5).

2.3 Analysis

The hunters were asked to rank their perception of importance to different statements given. The mean values are shown in Figure 2, a column chart from Microsoft Excel.

Data was analyzed in SAS 9.1. I did logistic regression analysis to check how satisfaction was influenced by densities. I also divided respondents into groups of hunters with the same characteristics to check for possible differences in their perception of the hunt. Both density related differences and non-density related ones were investigated.

I have also built a model in SAS 9.1 to explain hunters' satisfaction. I used a PROC REG procedure with overall satisfaction as the response variable. Then I did a backwards selection: All relevant predictor variables available in the survey were investigated. The variables least influencing satisfaction were ruled out one by one till left with only significant influencing factors (Tbl. 1).

3. Results

3.1 Survey, basic responses

For the average hunter it is important to see game. Seeing game has the highest average score in Figure 1, just above having a well functioning dog and missing few shots. Being familiar with the terrain seems to be of high importance, as well as hunting in a terrain with beautiful scenery. Nice weather and not being rushed for time is also ranked high. Not seeing other hunters while having many hunting opportunities in an easily walked terrain seems to suit the hunters fine. The factors of least importance, as stated by the hunters, are easy access to the hunting terrain, high standard housing and bagging many ptarmigan.

Factors affecting the hunting experience

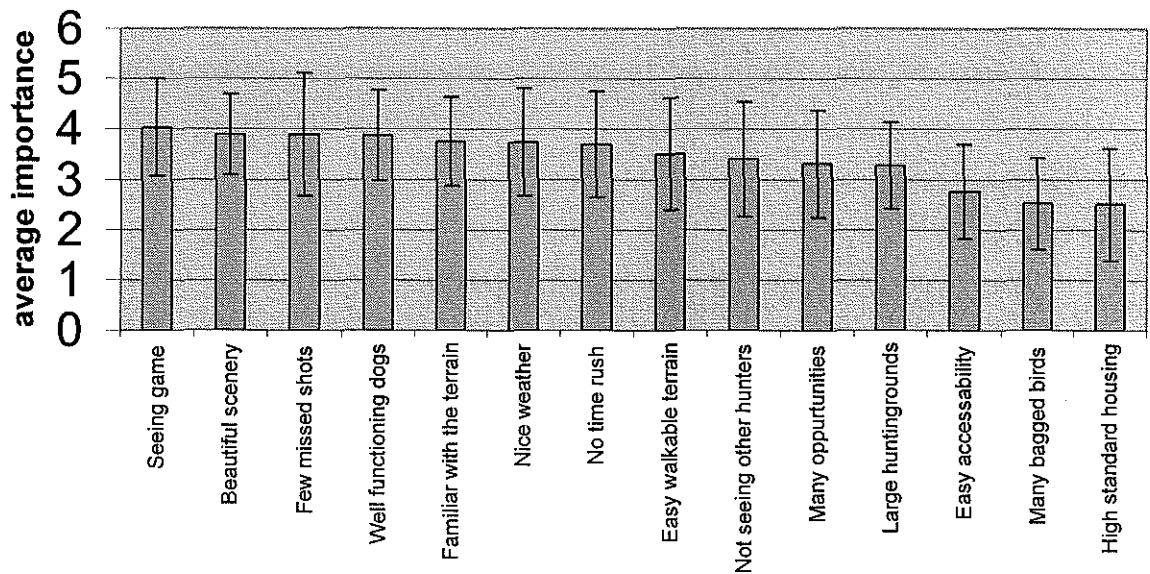


Figure 2. How hunters rank the importance of factors influencing their hunting experience

3.2 Correlations with density and satisfaction

There was a small increase in the satisfaction reported for the hunting period with increasing densities (Fig.2), although not statistically significant ($p=0.07$). The reported total level of satisfaction for the hunting period increased from on average approximately 60 at the lowest densities (6) to 65 at the highest (27).

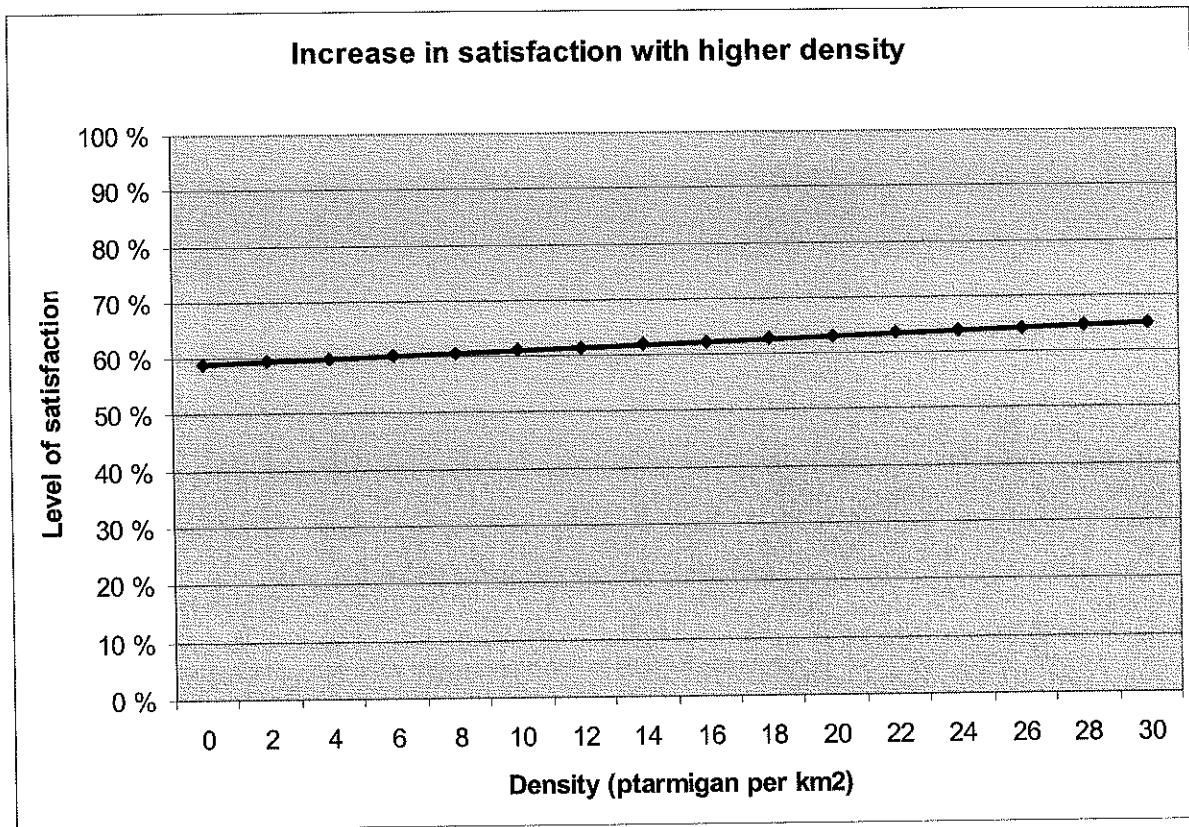


Figure 3 How increased density affects hunters satisfaction

The more ptarmigan a hunter shoots per day, the higher he/she scores on satisfaction (Fig. 4) ($p=0.01$). Only eight hunters have shot on average five or more ptarmigan per day (5* 5.0; 5.25; 6.67; and 10.3). The average hunter shoots 0.8 ptarmigan per day.

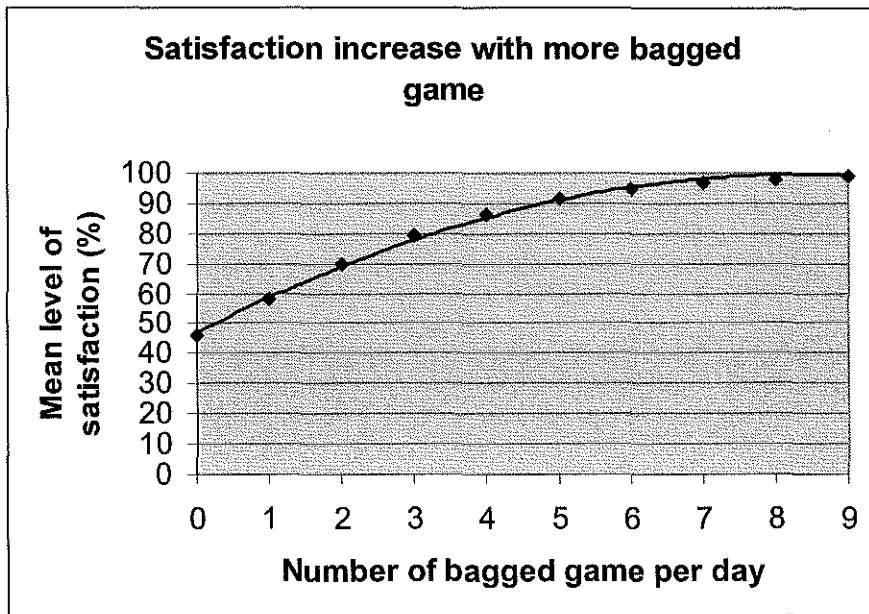


Figure 4 Satisfaction increase with higher number of ptarmigan bagged

There was no effect of density ($p=0.95$) on number of bagged ptarmigan per day. Hunters bag about 0.8 ptarmigan per day independent of density.

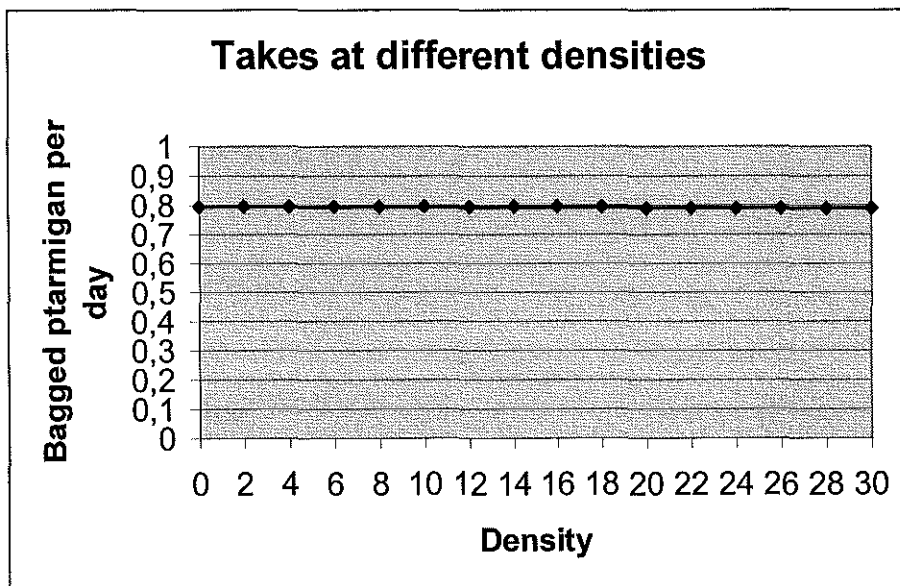


Figure 5 Number of bagged ptarmigan per day at different densities.

3.3 Differences between classes of hunters

There was no significant difference between sexes in achieved level of satisfaction. But the women seem slightly more satisfied ($p=0.55$) under the same conditions as men, but this was not statistically significant. There was, however, a relatively big and statistically significant ($p=0.01$) difference in how many ptarmigan women had shot per day on average (0.3) compared to men (0.9).

There were no difference in satisfaction between local hunters and visiting ones ($p=0.55$). There were no differences in hunting efficiency between these two groups ($p=0.55$).

Larger groups of hunters shot more per person per day, although not significantly ($p=0.34$). There is also a borderline significant increase in satisfaction ($p=0.05$) with increased group size.

Those hunting with pointing dogs were slightly less satisfied than those who did not ($p=0.01$) even if they shot significantly more birds per day (0.9) than those who hunted without a pointing dog ($p=0.01$). Hunters that hunted without a pointing dog shot on average 0.8 ptarmigan per day while those who sometimes went with and sometimes without shot only 0.7 birds per day on average.

3.4 Different factors and their effect on satisfaction

Table 1 Variables, parameter estimates, standard error and p-values included in the model.

Variable	Pointing dog	Shooting experience	Estimate	Std. Error	p-value
Intercept			57,9403	6,3313	<0,0001
ptarmigan per km2			0,1639	0,0686	0,017
Age			-0,286	0,0466	<0,0001
Pointing dog	Sometimes		-3,8813	2,0232	0,0553
	With		-6,0895	1,4459	<0,0001
	Without		0		
Early appliance for permit			3,0161	1,3428	0,0249
Years in the same area			2,6332	0,5708	<0,0001
Shot additional species			5,1359	1,8044	0,0045
Ptarmigan shot in total			0,4351	0,0694	<0,0001
Valueation of terrain qualities			-4,2069	1,1249	0,0002

Number of huntable situations per day			0,6989	0,1356	<0,0001
Number of seen ptarmigan per day			0,1456	0,0423	0,0006
Degree of hunter crowding			-2,4317	0,5783	<0,0001
Need to bag at least 1 ptarmigan			-2,8548	0,4636	<0,0001
Acceptance to shoot fewer birds			2,1175	0,6217	0,0007
Terrain selection based on available information			-1,886	0,5979	0,0016
Shooting experience		Hunting only	7,9545	3,7912	0,0361
		Competition shooters	0		

The most parsimonious model to explain hunter satisfaction ($F_{16, 1295} p=0.0001$) after my criteria includes; ptarmigan density, age, with/without pointing dog, early appliance for permit, years in the same area, additional species shot, ptarmigan shot, valuation of terrain qualities, number of huntable situations per day, number of seen ptarmigan per day, degree of hunter crowding, need for bagging a bird, acceptance to shoot fewer birds if necessary, usage of available information and shooting experience (Tbl. 1). The most negative factor was being a competition shooter. Those who were competitors scored on average close to 8 % lower than those who only shoot when hunting. Those who used pointing dogs in their hunt scored on average 6 % lower than those who did not. Shooting additional species in edition to ptarmigan had a strong positive effect, more than 5 %. An increase in ptarmigan density with one bird per km^2 did only increase average satisfaction with 0.16 %, while each year of higher age reduced the satisfaction with 0.28 %. Those who applied early for their hunting licenses, before 1 April, will score on average 3 % higher than those who have gotten their license in another way. Hunting in the same area for a long period will have a positive effect, 2.6 % increase in satisfaction per year in the same terrain. Satisfaction will increase with 0.4 % per ptarmigan shot in total, with 0.7 % per huntable situation per day and 0.15 % per seen ptarmigan per day. The hunters own evaluation of the terrain they hunt in logically affects satisfaction, with 4.2 % lower results for each negative step in the survey. Degree of crowding affects 2.4 % negative for each step in the survey. The more eager the hunters are to bag a bird the more negative they score on satisfaction, minus 2.8 % per step in the survey. On the other hand, the more willing the hunters are to shoot fewer birds if necessary the higher they score on satisfaction, 2.1 % per step in the survey. The more affected hunters were of information about the ptarmigan densities before the start of the season the lower they scored. 1.8 % less per step in the survey.

To check whether expectations was an explanation for the absent effect of ptarmigan density on satisfaction I separated the hunters in two groups. Hunters from areas with a decrease in

ptarmigan densities from the previous year scored on average 62% on satisfaction while the hunters from areas with an increase from the previous year scored on average 52%

4. Discussion

4.1 Adventure and experiences is the Product

The main reason people want to hunt ptarmigan today is recreation. Whether a hunting trip is regarded as a success is more dependent on other factors, such as social and excitement reasons, than on the number of game bagged. Bagging game is actually ranked as the least important factor by the hunters in this survey (Fig. 2). It is important for proprietors and managers to be aware of this, as game management up till now to a large degree has been seen as "the art of making the land produce wildlife" (Leopold 1933). The assumption that hunters will be satisfied as long as there is enough game to hunt in their terrain is no longer valid. Other factors affecting the hunt are more important to the modern hunter than game density. The satisfaction perceived by the hunters, and their good memories from the hunting period, is actually the product that the hunters buy and the proprietors sell. The ultimate objective of resource management is the provision of human benefits (Stankey et al. 1973). These good memories are surprisingly independent of ptarmigan density in the hunted terrain.

Arlinghaus and Mehner (2005) define satisfaction as the perceived fulfilment of the expected outcomes of the activity. Satisfaction is the fulfilment of a need or a want (Merriam-Webster 1983). In my thesis I used the term satisfaction as a measure of the pleasure or contentment in relation to expectations, derived from all aspects of the hunting period in question, as the hunters remember and appreciate them at the time of the survey.

4.2 Observations

This survey is the biggest ever done among ptarmigan hunters in Norway, probably in the world. The dataset consists of answers given from 3,3% of all the 54.000 ptarmigan hunters that were out hunting in the 2006/2007 season. The number of shot ptarmigan in Norway varies annually from about 300.000 to 750.000. The 2006/2007 season had the lowest number of game bagged in Norway since the counting started in 1971 (Statistics Norway 2007). The dataset probably reflects the real variation among Norwegian ptarmigan hunters pretty well.

823 hunters state that they are from towns with less than 10.000 citizens, 736 hunters state that they are from towns with more than 10.000 citizens. 110 of the respondents are women, 1467 are men. 4% of Norwegian hunters are women (Statistics Norway 2007), which gives a higher than normal participation from women in my dataset. So there is a larger proportion of women in my dataset than in hunting all together in Norway, which probably is a result of the accessibility and low threshold to start ptarmigan hunting compared with other forms of hunting.

Ptarmigan density affects hunters' satisfaction (Fig. 2) less than expected. The results show no significant increase in satisfaction with higher densities within the span from 6-27 ptarmigan per km². It is surprising that a five time increase did not affect satisfaction, or how many ptarmigan hunters shoot per day.

I expected that the lack of difference in satisfaction level could be due to expectations, that hunters from areas with high or low densities were used to these amounts of game because they had been in the same area before and experienced almost the same amount of game the previous or other years before. Expectations regarding the hunting experience affects perceived enjoyment and evaluations of the quality of the experience (Hazel et al. 1990) Therefore I separated the areas in two groups, one with an increase in ptarmigan density from the previous year and one with a decrease in ptarmigan density. Very surprisingly the hunters from areas with a decrease in ptarmigan densities from the previous year scored on average higher (62%) on satisfaction than the hunters from areas with an increase from the previous year (52%). So the expectations from previous years can not be used as an explanation for the lack of effect from density on satisfaction.

Hunters shoot about just as many ptarmigan per day independent of population density. My results actually shows a minimal decrease (-0,00028) in number of game bagged with every extra ptarmigan per km² in the terrain as a whole. Small populations are more vulnerable for extinction than large ones (Ranta et al. 2006). When hunters are just as efficient in bagging game at low densities it becomes even more important to restrict or redirect hunters in low density areas, to protect the local ptarmigan population.

Even if Manfredo et al. 2003 found that level of income, urbanization, and education affected Americans view on utilitarian use of nature, I could not find any significant differences between these different groups of hunters in relation to degree of satisfaction with their hunt.

There are probably differences between different groups of hunters in how they perceive satisfaction. Hazel et al (1990) stated the importance of studying hunting groups of diverse species in order to understand more fully the satisfaction people derive from hunting.

It is clear that hunter satisfaction is complex and consists of many dimensions, several of which are more important to most hunters than bagging game (Potter et al. 1973.)

4.3 Explanations for changes in satisfaction

“...many fish and wildlife managers still operate under the notion that harvest success and satisfaction are equivalent” (Gigliotti 2000). However, Norwegian ptarmigan hunters were not very interested in harvest success. Bagging many birds are ranked the least important of a variety of factors by the hunter themselves (Fig. 2), and each additional ptarmigan bagged counted for less than half a point difference around a mean of 58 on the 1-100 scale for satisfaction (Tbl.1).

The one factor explaining the largest variation is whether one are a active competitive shooter or just shoots when hunting (Tbl 1). The active competitors score almost 8 points lower on satisfaction.

Hunter crowding counts 2.43 points negative on satisfaction for each step more crowded the hunter states to have felt on a six step scale from “no other hunters” to “very high.” Areas with very high degree of crowding, even if only periodically, resulted in hunters that were 15 points less satisfied than areas where hunters felt alone. Heberlein and Kuentzel (2002) stated that crowding is supposed to decrease the positive recreational experience and lead to lower levels of satisfaction for deer hunters. For the deer hunters there was however a threshold value of other hunters in the area on which satisfaction peaked. Hazel et al. (1990) concludes that many turkey hunters in USA would be more satisfied with lower chances of social contact with people outside their own hunting party.

Hunters who hunt with a pointing dog score 6 points lower than those who do not. This is unexpected as they, although insignificantly both see more ptarmigan per day ($p=0.06$) and experience more huntable situations ($p=0.33$) than those who go without a dog. Both seeing and experiencing hunting situations counts in positive on the satisfaction scale (Tbl. 1) Hunters with dogs also bag more ptarmigan per day than those without ($p=0.01$), another factor contributing positively in Table 1, even if it is with less than half a point per each additional ptarmigan bagged.

Bagging different game than ptarmigan however, increases satisfaction with more than 5 points. 114 hunters had bagged a mountain hare (*Lepus timidus*), 219 had bagged some other grouse (*Tetrao tetrix*, *Tetrao urogallus*, or *Bonasa bonasia*) and 35 had bagged a duck, probably mostly mallards (*Anas platyrhynchos*).

Hunters who have visited the same area for many years score higher on satisfaction (2.6 points per year) than those who visit the hunting terrain for the first time. Those who have applied for their hunting license in spring, usually before 1 of April, score 3 points higher than hunters who have gotten their license in a different way.

Hunters were asked to state to what degree they agreed with the statement; "I am not satisfied with a hunting trip without bagging at least one ptarmigan." For each additional step on the 1-5 step scale the respondent agreed with this statement, total satisfaction would be lowered with 2.8 points. Decker et al. (1980) found that highly satisfied hunters ranked getting out-of-doors the most important component of the hunt while minimal satisfied hunters ranked getting shots at deer highest.

Each hunter shoots on average 0,8 ptarmigan per day.

4.4 Apparent paradoxes

In figure 1 I have calculated the average values on a 1-5 scale that hunters put on different aspects of their hunt. I find this to be an illustrative way of presenting the actual answers given. In addition to the high importance of hunting in "beautiful scenery", hunters rank "seeing game" the highest. This is closely followed by "few missed shots during the hunt." What might be seen as a paradox is that "many bagged birds", which would be a natural

consequence of the two highest ranked parameters "few missed shots" and "seeing game" put together is ranked the very lowest. Nature qualities such as weather, easy walked terrain and beautiful scenery are important factors to the hunters. High standard housing and easy accessibility from road are the only factors together with shooting much game to be valued beneath 3 on average by the hunters.

4.5 Density, bagged game and satisfaction

My results show only a weak and insignificant correlation between ptarmigan density and hunters satisfaction within the density range from 6-27. This seems to indicate that the Leopold (1933) definition "the art of making land produce sustained annual crops of wildlife" might no longer be valid. An alternative and maybe better way to look at this is that wildlife management is only one of many aspects of hunting management. Tremendous effort has to be made if a manager is to increase the ptarmigan population levels high enough in an area for it to have any noticeable effect on hunters' satisfaction. Success at harvesting game is not necessarily the most important determinant of satisfaction (Vaske et al. 1986). Wagar (1964) claimed that the goal of recreation management should be the provision of satisfying experiences. Other ways than increasing ptarmigan densities for achieving increased levels of satisfaction for Norwegian ptarmigan hunters must be considered to a higher degree by managers.

Ptarmigan density in the range from 6-27 seems to have no effect on how many birds hunters shoot on average per day (Fig.5). Hörnell-Willebrand (2005) found that catch per unit effort, hunter success rate, was only partly affected by changes in grouse density and the catchability increased as the population decreased. This tells us among other things that one should treat harvest statistics with caution (Hörnell-Willebrand 2005) especially when it comes to small populations.

The alternative prey hypothesis (Begon et al. 1990) is suggested as likely to be a mechanism contributing to the cyclic pattern in many alpine species (Hörnell-Willebrand 2005). When hunters do not limit their harvest according to these mechanisms (Krebs et al. 2001) as other alpine predators, and hunting pressure is high over time in an area, this could influence the cyclicity pattern for ptarmigan in an area. Harvest might alter the dynamics of populations, and the dynamical consequences of harvesting should be considered (Aanes et al. 2002).

4.6 Class differences

There is a close to significant ($p=0,053$) increase in satisfaction with larger group sizes. Hunters seem to be a bit more efficient in shooting game the more hunters that go together, although not statistically significant ($p=0.34$) and only plus 0.01 ptarmigan per person per day. This might contribute to their higher levels of satisfaction, but the social aspects of hunting are a more likely factor to contribute. The hunters in a party consider the success of the group, and may be more likely to be satisfied even without individual success (Hammit et al. 1990)

4.7 Society

Support for hunting on the part of non-hunters is essential for the activity to continue, as less than 10 % of the general population participates (MacKay and Campbell 2004). The public supports different types of hunting in various ways. Hunting for food is generally more accepted and supported than hunting for trophies. The new urban leisured class has in the last half of the 19th century changed the nature of hunting from subsistence to sport (Heberlein and Ericsson 2005). Ptarmigan hunting in Norway today must be seen as sports hunting, which has low support in large parts of the population (MacKay and Campbell 2004).

4.8 Bag limit

Bag-limit is a common management restriction on ptarmigan hunters, mostly set to a specific number of birds allowed shot per day. Number of bagged game in my dataset is on average 0.8 ptarmigan per day per hunter independent of density in the area. Imposing bag limits would only have a noticeable effect on the ptarmigan population if set very low, one ptarmigan per day. Hunters' satisfaction increases with number of ptarmigan bagged per day, those few who have shot many ptarmigan per day are significantly more satisfied than those who bag few ptarmigan. A bag-limit would diminish the dream and chances of bagging many birds for the hunter. Also, my pre-study (Faye-Schjøll 2006) showed that bag-limits lower satisfaction significantly.

4.9 Management advice

Norwegian ptarmigan hunters state that high standard housing is one of the least important attributes to them. Attributes such as scenery and nice weather, factors management can not control, are more important. Providing the hunters with large hunting grounds with few other hunters is a way of increasing satisfaction, but this will most likely lead to lower income for proprietors. Finding a way to improve the hunters shooting capabilities or the dogs hunting capabilities before the hunt would probably be a good way to increase hunter's satisfaction, but will be difficult for managers to control. If the main goal is to shoot less ptarmigan in an area and keep up hunting in some form in the same area even though, allowing strictly women would according to my results lead to the same or higher levels of achieved satisfaction for the hunters while far less ptarmigan would be shot.

Even if several studies has suggested that hunting does not negatively affect grouse populations (Hörnell-Willebrand 2005), managers of areas with low ptarmigan densities must be aware of the risk of over-harvesting. When the amount ptarmigan harvested is not well enough regulated through density dependent mechanisms for human hunters, it leaves the ones managing the hunt with a larger responsibility for avoiding over-harvest. Rimpi (2005) points out that harvest rates may easily risk to over exploiting the (ptarmigan) populations at small population sizes. Hörnell-Willebrand (2005) stated that to limit the number of hunters in an area is a more efficient way of regulating harvest that to impose bag-limits.

Bagging other huntable species next to or instead of ptarmigan increases satisfaction significantly (Tbl. 1). Including different habitats in the same hunting area, or other locally easy adaptable measures, to make hunting opportunities for different species more likely could be a way for management to increase satisfaction.

Distance sampling is a well working method for density estimations and is proposed used in a future national population estimation program for ptarmigan in Norway (Brainerd et al. 2005). Even so, the data shows that the hunters' take is not affected by densities ($p=0.95$). The number of seen ptarmigan per day ($p=0.01$), as well as the number of huntable situations per day ($p=0.048$) will increase with increased densities. It seems surprising that, with more spotted game and more chances per day, the take itself is still not affected by densities. Reasons why this is so will in this thesis only be speculations. One reason might be that the

hunters are as little concerned with bagged game as they state (Fig. 1), and will end their hunting effort for the day after bagging a certain (low) number of birds. Hunters from low density areas might put higher effort into each hunting day. This would not be revealed by my data. It could be that when hunting in high density areas, the hunters get more stressed and therefore miss more shots, or miss more shots for some other reason. It could be that hunters find habitats in the hunting terrain where there are ptarmigan even when there are low overall densities, and therefore do not experience the density as low. The difference in spatial scale between the censured area, and the area covered by the hunter, diminishes the experienced differences in density to a lower range than 6-27.

My data suggests that bag-limit as a way of preserving the ptarmigan population is not an efficient management tool unless set extremely low. Few hunters would have to restrict their take even if the limit were set to one ptarmigan per day. Imposing such a low bag-limit is very likely to lower the experienced satisfaction by the hunters and should therefore in my opinion not be used.

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Literature

Arlinghaus, R. and Mehner, T. 2005. Determinants of management preferences of recreational anglers in Germany: Habitat management versus fish stocking. *Limnologia* 35: 2-17

Begon, M., Harper, J.L., Townsend, C.R. 1990. *Ecology: Individuals, populations and communities*. Blackwell Scientific Publications.

Bjerke, T., Thrane, C., & Kleiven, J. 2005. Outdoor recreation interests and environmental attitudes in Norway. *Managing leisure*, 11, 11.

Brainerd, S.M., Pedersen, H.C., Kålås, J.A., Rolandsen, C., Hoem, S.A., Storaas, T., and Kastdalen, L. 2005. Lokalforankret forvaltning og nasjonal overvåking av småvilt. En kunnskapsoppsummering med anbefalinger for framtidig satsing. NINA rapport 38. 78 s.

Buckland, S.T., Anderson, D.R., Burnham, K.P., Laake, J.-L. 1993. *Distance sampling. Estimating abundance of biological populations*. Chapman and Hall, London.

Buckland, S.T., Anderson, D.R., Burnham, K.P., Laake, J.-L., Bochers, D.L. and Thomas, L. 2001. *Introduction to Distance Sampling. Estimating abundance of biological populations*. Oxford University Press Inc. New York.

Decker, D.J., Brown, T.L., Gutiérrez, R.J. 1980. Further insight into the multiple-satisfaction approach for hunters management. *Wildlife society bulletin*. 8.

Faye-Schjøll, E. 2006. Tilfredse jegere? En spørreundersøkelse blant jegere i takserte områder. Bachelor i utmarksforvaltning, Høgskolen i Hedmark, Koppang.

Dillman, D. A. 1978 *Mail and Telephone Surveys: the Total Design Method*. John Wiley, New York

Gigliotti, L. M. 2000. A classification scheme to better understand satisfaction of Black Hill deer hunters: The role of harvest success. *Human Dimensions of wildlife*, 5: 32-51.

Hammit, W.E., McDonald, C.D., Patterson, M.E. 1990. Determinants of multiple satisfaction for deer hunting. *Wildlife society bulletin*, 18: 331-337.

Hazel, K.L., Langenau, E.E. Jr., Levine, R.L. 1990. Dimensions of hunting satisfaction: Multiple-satisfactions of Wild Turkey Hunting. *Leisure science*. 12: 383-393

Heberlein, T.A. and Willebrand, T. 1998. Attitudes towards hunting across time and continents. *Game & Wildlife science*. 15 (3): 1071-1080

Heberlein, T.A. and Kuentzel, W.F. 2002. Too many hunters or not enough deer? Human and biological determinants of hunter satisfaction and quality. *Human dimensions of wildlife*, 7:229-250.

Heberlein, T.A. and Ericsson, G. 2005. Ties to the countryside: Accounting for Urbanites Attitudes toward Hunting, Wolves, and wildlife. *Human Dimensions of Wildlife*, 10: 213-227

Hjeljord, Olav 2008. *Viltet-biologi og forvaltning*. Tun forlag.

Hörnell-Willebrand, M. 2005. *Temporal and Spatial Dynamics of Willow Grouse Lagopus lagopus*. Doctoral thesis. Swedish University of Agricultural Science. Umeå.

Kastdalen, L. 1992. *Skogshøns og jakt*. – Norges Bondelag. Rapport. 38 s. Oslo.

Krebs, C.J., Boutin, S., Boonstra, R. 2001. *Ecosystem Dynamics of the boreal forest*. Oxford University Press. P. 253.

Leopold, A. 1933 *Game management*

MacKay, K.J., Campbell, J.M. 2004. An examination of residents' support for hunting as a tourism product. *Tourism Management* 25: 443-452.

Mortensen, A.J. 1994. Rypejaktas betydning for bestanden og jaktutbyttet over tid: En studie av 20 års jaktstatistikk i områder med sterkt varierende jakttrykk. Fåberg:[A.J.Mortensen]

Mougeot, F., Redpath, S. M., Moss, R., Matthiopoulos, J., Hudson, P. J. 2003. Territorial behaviour and population dynamics in red grouse *Lagopus lagopus scoticus*. I. population experiments. *Journal of animal ecology* 72 (6): 1073 - 1082.

Norskog 2008. 11. februar

<http://www.skoginfo.no/?module=Articles;action=Article.publicShow;ID=4922>

Olstad, O. 1953. Ringmerking av lirype i Øyer. Ringmerkingsresultater VI. Statens viltundersøkelser. 71 s.

Pedersen, H. C. 1997 Jakt som mortalitetsfaktor hos lirype – et litteraturstudium. – NINA oppdragsmelding 388. 28 s.

Pedersen, H.C., Steen, H., Kastdalen, L., Svendsen, W., and Brøseth, H. 1999. Betydningen av jakt på lirypebestander. Framdriftsrapport 1996-1998. NINA Oppdragsmelding 578: 1-43.

Pedersen, H.C., Steen, H., Kastdalen, L., Svendsen, W., Brøseth, H. 2001. Lirypejakt - høsting av et overskudd eller forbruk av kapital? *Vilt og ferskvannfisk*. s 55-63. Norges forskningsråd, Oslo

Potter, D.R., Hendee, J.C., Clark, R.N. 1973. Hunting satisfaction: game, guns, or nature? *Transactions of the thirty-eight north American wildlife and natural resource conference* 38. pp 220-229.

Ranta, E., Lundberg, P., Kaitala, V. 2006. *Ecology of populations*. Cambridge University press.

Rimpi, C. 2005. The effect of hunting ground experience for hunting success of willow grouse (*Lagopus lagopus*). Department of animal ecology, Swedish university of agricultural science, Umeå, Sweden. Examensarbete I ämnet skoglig zooekologi, 2005:13

Solvang, H., Pedersen, H. C., Storaas, T., Moa, P. F., Breisjøberget, J. I. Annual report of willow ptarmigan census 2006, Rypeforvaltningsprosjektet 2006-2011. Høgskolen i Hedmark. Oppdragsrapport nr. 2-2007

Stankey, G.H., Lucas, R.C., Ream, R.R. 1973. Relationships between hunting success and satisfaction. *Transactions (North American Wildlife and Natural Resources)*.38: 235-242.

Statistics Norway 2007. 8. august 2007 © Statistisk sentralbyrå;
<http://www.ssb.no/emner/10/04/10/srjakt/>

STOKKE, E. 2004. Nordmenns holdninger til jakt. Masteroppgave, Institutt for naturforvaltning, Norges landbrukshøgskole.

Ås. 70 s. <http://www.nlh.no/ina/studier/oppgaver/2004-Stokke.pdf> [8.3.2005]

Vaske, J.J., Fedler, A.J., Graefe, A.R. 1986. Multiple determinants of satisfaction from a specific waterfowl hunting trip. *Leisure Science* 8 (2): 149-166.

Wagar, J.A. 1964. The carrying capacity of wild lands for recreation. *Forest science Monograph* 7;; Society of American Foresters.

Webster's ninth new collegiate dictionary. Merriam- Webster 1983. USA

Willebrand, T. & Paulrud, A. (2004). Småviltjakt i Jämtland 2003. Så tycker jägarna, Rep. No. 9. SLU. Umeå.

Aanes, S., Engen, S., Sæther, B-E., Willebrand, T., Marcström, V. 2002. Sustainable harvesting strategies of willow ptarmigan in a fluctuating environment. *Ecological Applications*, 12(1). pp. 281-290.

Aas, Ø. & Vinsand, G. (1996). Grouse hunters in Northern Norway: Hunting behaviour and opinions about State forest grouse hunting management, Rep. No. 27. Eastern Norway research institute.