

**AN ANALYSIS OF ASSOCIATIONS BETWEEN COMPONENTS OF
WATERFOWL HUNTING AND VIOLATIONS OF HUNTING REGULATIONS
IN PRAIRIE CANADA**

by

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A Practicum Submitted in Partial Fulfillment
of the Requirements for the Degree,
Master of Natural Resources Management

Natural Resources Institute
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requirements of the degree of Master of Natural Resources
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ABSTRACT

Data collected during the Prairie Waterfowl Harvest Program from 1979 to 1983 were examined to identify relationships between components of waterfowl hunting and violations of waterfowl hunting regulations. Non-compliance of hunting regulations was recorded by researchers who observed hunters from spy blinds as well as by interviewing hunters in the field. Analyses were restricted to violations of regulations which were common to all three Canadian Prairie Provinces. Observed and expected frequencies of hunting trips where one or more violations were recorded were compared among a number of components of waterfowl hunting. Statistically significant differences were identified, while discussion focused on differences which had practical significance. Significantly more violations were recorded during direct observation of hunters than during hunter interviews. Other findings included: an excessive frequency of various violation hunts among over-water hunters, more violation hunting trips than expected by large (3 or more hunters) hunting parties and fewer violation hunts than expected among hunting parties which were better equipped for waterfowl hunting. This study's findings have important implications for waterfowl managers, wildlife enforcement officers, policy makers and for the hunting public.

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CHAPTER 1: INTRODUCTION

1.1 PREAMBLE

The hunting of migratory game birds in Canada, and in the United States of America, is regulated by various federal and provincial or state laws. These regulations are designed and enforced to limit the harvest of waterfowl, to provide safety for hunters and to maintain the quality of the hunt. While most hunters agree that regulations are necessary, many have broken at least one of the laws sometime in their hunting past (Canadian Wildlife Service, 1986). Furthermore, recent studies have shown that one of the leading causes of dissatisfaction among migratory bird hunters is the, often illegal, behaviour of inconsiderate or unethical hunters (Schole, 1973; Jackson, Norton and Anderson, 1979b; Fillion and Parker, 1984).

There have been very few studies which were specifically designed to examine violations of migratory game bird hunting regulations by directly observing hunts in progress. The majority of previous studies have estimated the rate of violations only from bag checks of hunters (Kaczynski, 1967; Kimball, 1969 and 1972; Mikula, Martz and Bennett, 1972; Hopper, Geis, Grieb and Nelson, 1975; Nieman, Hochbaum, Caswell and Turner, 1987). These studies provide a limited examination of the problem.

Migratory game bird hunting regulations in Alberta, Saskatchewan, and Manitoba remained unchanged from 1979 to 1983. A five year study of the recreational harvest of migratory game birds was undertaken during this period. The absence of any annual changes in the hunting regulations provided a unique opportunity for research. The following report provides a detailed examination of the violations of migratory game bird hunting regulations during the 1979 to 1983 period of stabilized hunting regulations in Prairie Canada. The data were recorded during both hunter observations and post hunt interviews by researchers from the Canadian Wildlife Service and from the resource agencies of the three Prairie provinces.

1.2 THE PROBLEM

The practical significance of associations between components of waterfowl hunting and violations of waterfowl hunting regulations was unknown. An assessment of the relationships between specific violations and the conditions under which they occur was needed. This information is important for government policy development, law enforcement efforts and other related methods of waterfowl management.

1.3 OBJECTIVES

This study examined data collected by waterfowl researchers during the 1979 to 1983 "Hunter Performance in Prairie Canada" program administered by the Canadian

Wildlife Service. The **primary objective** was to identify hunting components which were associated with violations of migratory game bird hunting regulations in Prairie Canada. The practical significance of all associations were discussed. **Secondary objectives** of this research included:

- 1) producing information to aid migratory game bird hunting enforcement efforts.
- 2) Providing information which would be helpful in making hunters aware of situations during which violations of hunting regulations may occur. This may help the hunter to avoid such situations and, ultimately, result in a reduction of violations.
- 3) Recommending strategies for future management programs.

1.4 DEFINITION OF TERMS

For the purposes of this research, the following terms were defined.

Bag Check: The act of a wildlife official, or a researcher, recording the number and species of birds found in the possession of a migratory game bird hunter (Canadian Wildlife Service, 1986).

Hunt: To chase, pursue, worry, follow after or on the trail of, lie in wait for or attempt in any manner to capture, kill, injure, or harass a migratory bird, whether

or not the migratory bird is captured, killed or injured (Migratory Birds Convention Act, 1986).

Hunting Party: A group of one, two or more persons hunting migratory game birds together.

Migratory Game Bird: (a) Anatidae or waterfowl, including brant, wild ducks, geese, and swans. (b) Gruidae or cranes. (c) Rallidae or rails. (d) Limicolae or shorebirds. and (e) Columbidae or pigeons (Migratory Birds Convention Act, 1986).

Nonviolation Hunt: Waterfowl hunting trip during which no violation of any hunting regulation was detected.

Prairie Canada: The Canadian Provinces of Alberta, Saskatchewan and Manitoba (Canadian Wildlife Service, 1986).

p-value: The probability of obtaining a larger value of a computed statistic, given a known probability distribution (Fleiss, 1981).

Size of a Hunting Party: The number of hunters in a hunting party.

Type of Hunt: Differentiated between over-water hunting and field hunting.

Violation Hunt: Waterfowl hunting trip during which at least one violation of a hunting regulation was detected.

Waterfowl Hunter: Anyone in the process of hunting one or more migratory game birds (Migratory Birds Convention Act, 1986).

Waterfowl Hunting Regulation: Any law expedient to the protection of migratory birds under the Migratory Birds Convention Act or the Provincial Wildlife Acts of Alberta, Saskatchewan and Manitoba (Migratory Birds Convention Act, 1986).

1.5 HYPOTHESES

The following null hypotheses were tested to determine the significance of the relationships between violation hunts and the indicated component of hunting:

H1: Violation hunts are independent of the type of hunt.

H2: Violation hunts are independent of the size of the hunting party.

H3: Violation hunts are independent of the hunting party's use of a dog(s).

H4: Violation hunts are independent of the hunting party's use of decoys.

H5: Violation hunts are independent of the hunting party's use of a boat(s).

H6: Violation hunts are independent of the week of the season.

H7: Violation hunts are independent of the time of day of the hunt.

These hypotheses were tested for each of the following violation hunts: all violations combined, exceeding-daily-bag-limit, hunting-after-legal-time, failure-to-retrieve, hunting-protected-species, and two categories of violation hunts (Birds-Involved and No-Birds-Involved, see Table 3.1, page 29).

1.6 LIMITATIONS

Out-of-season kill and exceeding the legal possession limit violations were not studied. Data on these offenses were not collected during the Prairie Waterfowl Harvest Program.

Often it was not possible for observers in spy blinds to distinguish between goose or duck hunters. As a result, conditions specific to violations by goose hunters, separate from those related to duck hunters, were not identified.

The number of violations reported in this study were, in most instances, lower than the actual occurrences. The researchers were not enforcement officers and thus they had no authority, for example, to order someone to produce a hunting license, or to check for unplugged shotguns. Also, violations were likely missed because the researchers were attempting to gather large amounts of data on other aspects of the hunt. In addition, observers used a large amount of discretion in deciding whether or not a specific action constituted a violation (Nieman, Hochbaum, Caswell and Turner, 1987).

CHAPTER 2: LITERATURE REVIEW

The recreational harvest of migratory game birds in North America, as well as in the rest of the world, has been extensively studied and reviewed. Although few studies have specifically focused on associations between components of hunting and violations of hunting regulations, a review of the published literature on recreational hunting aided the present research. A number of issues were relevant to my research. Wildlife / waterfowl regulations, enforcement and violation of laws, and hunter education are highlighted in the following discussion.

2.1 WILDLIFE REGULATIONS

The first official regulations governing the recreational harvest of game in North America came into existence in the late 1800's (Martin and Carney, 1977; Cooch, 1979; Rogers, Nichols, Martin, Kimball and Pospahala, 1979; Brace, Pospahala and Jessen, 1987). The development of regulations affecting migratory game bird populations has been particularly difficult (Lampio, 1982a; Lampio, 1982c). As the name implies, this form of game migrates, not only from one province or state to another, but from one country to another. Thus, proper management of waterfowl requires collaboration and cooperation between many different governing bodies.

In North America, the management of migratory birds became an international responsibility in 1916 when the Migratory Bird Treaty between Great Britain, on behalf of Canada, and the United States was signed (Brace et al., 1987). This agreement was drafted during a period of serious drought in the Prairie parkland regions of Canada and the United States. This drought largely contributed to significant declines in waterfowl populations. Over the years, such crises have often led to new legislation for the protection of North American waterfowl (Geis, Martinson & Anderson, 1969).

Resource managers in different political jurisdictions have always agreed that the preservation of waterfowl habitat is of high priority. However, appropriate restrictions on waterfowl hunting have been the subject of much debate in the past (Brace et al., 1987). From the 1940s through the 1970s, waterfowl hunting regulations in North America changed almost annually. The changes ranged from very restrictive to somewhat liberal hunting regulations in response to scientific estimates of the annual fall flight of migratory game birds (Geis et al., 1969; Brace et al., 1987). Species-specific hunting regulations were also developed during this period as data were compiled on specific species of waterfowl. One such system of regulations, widely adopted in the U.S. during the 1970s, was the point system of hunting regulations. Under this

system, each species and sex of waterfowl is assigned a point value. A hunter reaches his bag limit when his/her last bird shot results in the total point value of all birds shot equalling or exceeding an amount specified by the regulations (Mikula, Martz and Bennett, 1972). Like many waterfowl hunting regulations, this system has been met with both opposition and acceptance.

In recent years the ideal of annual changes in hunting regulations corresponding to anticipated fall flight sizes has come under scrutiny. Caswell, Hochbaum and Brace (1985) reported on the effect of restrictive hunting regulations in Manitoba between 1973 and 1978 - a period of generally improving breeding habitat conditions. They concluded that survival rates of adult mallards generally increased during this period in southern Manitoba but not in other regions of Prairie Canada where hunting regulations remained at liberal levels (Caswell et al., 1985). This conclusion supported an earlier finding by Rogers et al. (1979) who believed that waterfowl hunting regulations were effective in influencing recovery rates and harvest rates of ducks (Rogers, Nichols, Martin, Kimball and Pospahala, 1979). The United States Fish and Wildlife Service and the Canadian Wildlife Service, however, agreed in 1979 that waterfowl hunting should not be further curtailed unless duck populations decreased to the point where their recovery was threatened (Boyd, 1983). This decision was made partly because of scientific studies

during the 1970s which concluded that environmental influences were controlling duck populations regardless of removal by hunting (Brace et al., 1987).

Studies during the 1970s also indicated that there were a number of problems with the development of sound waterfowl management programs. The usual practice of developing hunting regulations tailored to fit the current status of breeding duck numbers and production was identified as one problem (Brace et al., 1987). Consequently, in 1979 the provinces of Alberta, Saskatchewan, and Manitoba initiated a five year period of stabilized waterfowl hunting regulations in order to study relationships between environmental factors, hunting regulations and duck population characteristics (Can. Wildl. Ser., 1986).

A recent North American Wildlife and Natural Resources Conference addressed the question: "Can ducks be managed by regulation?". Perhaps the question should have been: "Can duck hunters be regulated so as to perpetuate the sport of duck hunting?" (Patterson, 1979). Boyd (1979) observed that a problem in Canada is that there has always been some disagreement over who has the power to make laws concerning wildlife - Federal or Provincial governments (Boyd, 1979). Also, he stated that the Canadian Wildlife Service developed regulations with the primary purpose of preserving stocks of birds, while the provinces were concerned with maintaining hunter opportunities. This should not be so (Boyd, 1979).

Cooch (1979) concluded that waterfowl in Canada cannot be managed by Canadian regulations alone. Restrictive regulations in Canada will largely be ineffective unless similar restrictions are adhered to by other users of the resource, namely United States and Latin American hunters (Cooch, 1979).

Hunting regulations and their manipulation have possibly received more attention than any other game management instrument (Weaver and Mosby, 1979) and they will probably continue to receive much study. Tamisier (1985) states that specific fundamental requirements of waterfowl must be considered before the needs or desires of hunters. Furthermore, he believes that arguments of "tradition" in favour of some hunting activities cannot carry weight in new hunting regulations. The biological impact on waterfowl populations must be the only factor to be considered in developing hunting regulations (Tamisier, 1985).

2.2 ENFORCEMENT AND VIOLATION OF LAWS

2.2.1 Violations and Related Problems

The Canadian Wildlife Service used hunter observation and post hunt bag checks of Prairie Canada waterfowl hunters, during the 1979 to 1983 hunting seasons, to assess hunting regulation violations. This was just one of many objectives of an extensive research program labelled:

The Prairie Waterfowl Harvest Program. Nieman and Smith (1986) reported on the Saskatchewan portion of the Prairie Waterfowl Harvest Program. They reported that 21 different migratory game bird hunting regulations were violated, by at least one hunting party, over the five year study period. The most common violations were: failure to retrieve downed birds, hunting without a federal permit, hunting protected species, hunting in restricted areas, and exceeding legal daily bag or possession limits. The authors emphasized, however, that the violations recorded during this study be regarded as a minimum of the number that actually occurred. This was because the researchers were not enforcement officers. They could not demand to see hunting permits, check for unplugged shotguns, or record other violations which could not be detected by hunter observation or by post-hunt bag checks. Some violations were also probably not detected because of attempts to gather large amounts of data on other aspects of the hunt. The observers also used a great deal of discretion in deciding whether or not a specific action constituted a violation (Nieman and Smith, 1986).

Similar limitations of hunter observations were noted by Martin and Carney (1977) in their examination of 1965 to 1972 Hunter Performance Survey data for the United States. A significant problem related to collecting data by observing hunter is that close attention, accurate observation and

sound judgement are all needed by the observers and these qualities may be highly variable among observers (Martin and Carney 1977). Martin and Carney (1977) also indicated that their survey "lacked many of the advantages of random sampling, suffering particularly from the lack of representativeness which is typical of small, unstratified samples from large, heterogeneous populations". They reported that the observed rate of unretrieved kill - those ducks that hunters bring down within their sight but fail to retrieve - varied among states and among years. However, they estimated an overall proportion of 19% of all ducks shot were unretrieved. This definition of unretrieved kill appears to include both, what the present study defines as, crippling loss (when an attempt is made to retrieve a fallen bird but it is unsuccessful) and failure-to-retrieve (when no attempt to retrieve a downed bird is made).

A report by Boyd (1971), based on data collected by the Canadian Wildlife Service Hunter Performance Surveys of 1968 and 1969 in Ontario and the other eastern provinces, also commented on some of the difficulties of researchers observing in-progress duck hunts. These difficulties included: 1) determining how many shots are fired in a burst by one hunting party; and 2) keeping track of birds which are seen to be hit but do not fall at once and then verifying whether or not these birds are retrieved and included in the hunter's bag. Analyses may also be

complicated by the fact that many Canadian hunters operate in small parties, rather than singularly, and they often pool their kills. Consequently, should each hunter be the unit on which data are collected and analyzed or should a "hunting party" be the base unit?

Results by Boyd (1971) included: 1) hunters with dogs failed to retrieve ducks just as often as hunters without a dog; 2) there were no differences in success rates for hunting parties of different sizes; and 3) hunters using decoys fired more shots, had more opportunities and bagged more birds than did other hunters (Boyd, 1971).

Hochbaum and Walters (1984) studied waterfowl hunting and kill on the Delta Marsh, Manitoba in 1974. They discovered that, although most hunters believe that ducks are readily attracted to decoys during windy, wet, cloudy days, there was little correlation between quantitative measures of weather and vulnerability. Trost et al. made a similar conclusion in their 1987 report (Trost, Sharp, Kelly, and Caswell, 1987).

A report on the 1973 kill of Canvasback ducks at Delta Marsh, Manitoba detailed the susceptibility of this species to hunters using decoys. In addition, despite restrictive regulations, partially aimed at protecting Canvasbacks, hunters were unable or unwilling to refrain from shooting at this species (Hochbaum and Caldwell, 1977).

A study by Mikula et al. (1972) compared the merits of three systems of regulating duck harvest in a Michigan State Game Area in 1969. The three systems were: 1) a point system, which set point values for different species and sex of duck. The daily bag limit for a hunter was reached when the point value of the last bird shot resulted in the total point value of all birds bagged that day to reach or exceed 60 points; 2) a simple two bird daily bag limit; and 3) the 1969 species oriented Mississippi Flyway wide hunting regulations. Hunters participating in the study were asked to follow one of these three systems. The primary objective of this study was to assess the harvest of ducks under each of these regulatory systems. However, observations of hunter performance provided estimates of violation rates and hunter selectivity in shooting. The observers found it impractical in the field to determine which hunters shot which ducks. Therefore only the illegal behaviour of hunting parties was recorded. Undoubtedly this minimized the actual rate of technical violations that occurred (Mikula et al., 1972). The entire hunt was observed in most cases, but biases existed such as: observations were made only where the greatest bird activity was expected and about half of the observations were made in just the first two weeks of the hunting season. Results of the study indicated that more hunter parties violated the flyway regulations (33%) than the point system (16%) or the two bird limit regulation

system (18%). Most violations under each system were for over-bagging or attempted over-bagging. Discarding birds was also a significant violation, particularly in the point system and in the flyway regulations system (Mikula et al., 1972).

Studies in several U.S. states, dealing mostly with bag limit regulations, reported that 12 to 14 percent of hunting parties committed hunting violations (Kaczynski, 1967; Kimball, 1969 and 1972). Hopper et al. (1975) found the migratory bird hunting regulation violation rate to be 18 percent in Colorado. State and federal United States Fish and Wildlife agents in Louisiana, where one quarter of North American ducks spend their winters, believe that the illegal harvest of ducks far exceeds the number killed legally (Anderson, 1988).

2.2.2 Enforcement of Hunting Regulations

Sigler (1980) observed that early pioneers in North America found wildlife in such abundance that they considered it inexhaustible. This disregard for wildlife has carried down to the present day and has necessitated the development of wildlife laws. Since all people do not voluntarily comply with all laws, law enforcement has become essential to achieving wildlife management objectives (Sigler, 1980). Law enforcement involves a system where all components, public support being the most important, must

work together in order to achieve an effective law enforcement program. Law enforcement policies can be divided into two categories: 1) those dealing with administration and internal management procedures, and 2) those providing guidance to individual officers. The greatest attention should be paid to the latter category (Sigler, 1980).

Enforcement of waterfowl, particularly duck, hunting regulations is extremely important at present, given the declining waterfowl populations and the conclusion of many researchers that duck hunting is a form of additive mortality (Hall, 1987). The problem is how to effectively conduct enforcement of waterfowl hunting regulations.

It is widely believed that more in the field presence of conservation officers is needed and that the use of spy blinds is perhaps one of the best methods of law enforcement by conservation officers in the field (Nieman and Caswell, 1989; Sparrowe, 1989; Hall, 1987; Sparrowe and Patterson, 1987; Sigler, 1980). Spy blind techniques involve observers watching a hunt in progress either by concealing themselves from the hunters or by playing the role of hunters. The value of in the field presence of conservation officers is supported by findings of Nieman and Smith (1986). They observed that few violations occurred in hunting areas where enforcement effort was usually visible and predictable. In other regions, where limited enforcement occurred,

violations were numerous and often flagrant (Nieman and Smith, 1986).

There are other factors to consider in the enforcement effort. Studies have revealed that in most areas of North America a low percentage of the hunters are responsible for the majority of the annual kill. Furthermore, a more successful hunter is one who hunts in more than one area during a season (Sen, 1984). Jackson et al. (1979b) reported that the greatest probability of a hunting violation occurs when there is a small chance of getting caught, such as when the hunter(s) have security and knowledge of the hunting area or self control of the land or know the landowner (Jackson, Norton and Anderson, 1979b).

For many years wildlife enforcement personnel have stressed the importance of simple, sensible regulations that are easy to understand and easy to comply with (Hughlett, 1975; Boyd, 1979; Hall, 1987, Beattie, 1989). Waterfowl hunting laws which are not understood by the public, are beyond the ability of a large segment of the public to comply with, are accepted rebelliously or which create a strong incentive to cheat will not receive a high level of compliance regardless of the enforcement effort (Hughlett, 1975). Unfortunately, public acceptance of a regulation is difficult to measure (Psikla, 1979). The effectiveness of law enforcement, however, could be judged through surveys of the hunting and non-hunting public which determine a

public's perception of wildlife law enforcement activities (Sigler, 1980).

Hall (1987) believes that one of waterfowl management's greatest problems is the lack of understanding by hunters and game managers of the need for law enforcement components in research studies. Also, there is a reluctance by wildlife researchers to consider such components (Hall, 1987).

2.3 HUNTER EDUCATION

Many researchers believe that hunter education is one of the best means of improving recreational hunting, both from the viewpoint of conservation, which includes compliance of hunting regulations, and hunter satisfaction (Schole, 1973; Jackson, 1981b; Lampio, 1982b; Heberlein and Klepinger, 1984; Briggs, Maher and Davey, 1985; Hall, 1989;). Recreational hunting often has many traditions and rituals incorporated into it. Most of these activities have evolved over a great number of years. Unfortunately some of these traditional hunting activities have become illegal with changes in regulations, but it is not easy for people to discontinue or to change traditions. This is why hunter education is an important and necessary component in the future of recreational hunting (Jackson and Norton, 1980a, Jackson and Norton, 1980b, Decker and Mattfeld, 1988). Hunter education can change traditional views and ritual activities of hunting, which are no longer compatible with

existing hunting guidelines, faster and more efficiently than using legislation to bring about change (Heberlein and Klepinger, 1984).

Another major issue in hunting is the area of human ethics. Ethical viewpoints vary greatly among individuals, particularly when they concern recreational hunting (Smith and Roberts, 1987; Story, 1989). Hunter education can play an important role in this aspect of the sport. Robert M. Jackson, a psychologist at the University of Wisconsin-La Crosse, has done a great deal of research in hunter ethics and the development of hunter education programs (Jackson and Norton, 1979a; Jackson et al., 1979b; Jackson and Norton, 1980b; Jackson, 1981a; Jackson, 1989). His work, along with other human dimensions research, has led to hunter safety programs being changed to more thorough hunter education courses (Smith, 1984; Decker and Mattfeld, 1988). Valuable work continues in the area of hunter education / ethics which will benefit the future of recreational hunting and wildlife management programs.

2.4 THE VALUE OF HUNTER SURVEYS AND HUNTING REGULATIONS

A report by Boyd (1983) suggested that perhaps the extensive monitoring of the effects of hunting in North America has been a waste of time and money. This conclusion is based on the observation that a much higher proportion of the European fall flight of ducks is harvested, as compared

to the North American proportion, without a catastrophic effect on the European duck population. Boyd further commented in his 1983 report that, "while it is proper and desirable to question how much effort should be devoted to the administration and enforcement of regulations and to monitoring the effects of regulations on hunters, it is less certain that North American waterfowl management should be discarded so completely".

The greatest merit of the waterfowl harvest surveys being carried out in the United States and in Canada is that they tell the waterfowl researchers more about hunters than about waterfowl (Boyd and Finney, 1978). A concern for a lack of studies of waterfowl hunters was also expressed by Hughlett (1975). He commented that:

we have for many years neglected the study of the principal species with whom waterfowl management deals with - man. Much of waterfowl management involves regulations and their enforcement, in other words the control of human behaviour, yet waterfowl researchers have, in the past, concentrated on virtually all aspects of the life history of every species of waterfowl and on the population dynamics of major gunning species (Hughlett, 1975).

Hughlett applauded, at the time, the recently initiated studies that were designed to learn something about the typical hunter. He saw these "as the beginning of a better

approach to adult conservation, improved regulations and more effective wildlife law enforcement" (Hughlett, 1975). Hughlett's concerns were later addressed by Sanderson et al. (1979). They stated that "knowledge about attitudes toward wildlife is limited - wildlifers must work closely with sociologists and psychologists to develop our own expertise in these fields" (Sanderson, Ables, Sparrowe, Grieb, Harris and Moen, 1979).

2.5 CONCLUSION

There have been previous studies of North American waterfowl hunters where data were collected by observing hunts in progress. Most examined violations of hunting regulations, although this was often not the primary objective of some of the studies (Kaczynski, 1967; Kimball, 1969 and 1972; Mikula et al., 1972; Hopper et al., 1975; Martin and Carney, 1977; Nieman and Smith 1986; and Nieman et al. 1987). The discussion in the literature of the difficulties and limitations encountered during previous observational hunter performance studies was valuable to the present research.

A significant concern was identified with failure to retrieve violations. It is one of the more serious violations observed and yet it is probably underestimated during hunter observational studies. It is difficult for researchers spying on a large hunting party to accurately

record the number of birds hit, and subsequently retrieved, during a sudden and large outburst of gunfire (Boyd, 1971). This shortcoming could possibly be avoided through the use of high quality small video cameras which are presently being manufactured. Such cameras could be used to film the observed hunt and used to verify, confirm or add to the data recorded by another researcher observing the same hunt. They can also possibly be effective aids to hunter education programs (Hall, 1989).

Relevant to the present study are the concerns expressed by Nieman and Smith (1986) regarding the fact that not all violations of waterfowl hunting regulations can be recorded by scientific researchers during hunter observations alone. Legal authority to stop and inspect hunters as they leave a hunting site is needed. A hunter observation followed by a thorough inspection of a hunter's bag and equipment should produce the most complete enumeration of violations possible.

CHAPTER 3: METHODS

3.1 THE DATA

Data collected during the cooperative Prairie Waterfowl Harvest Program (PWHP) from 1979 to 1983 were analyzed. The PWHP was conducted by researchers from the resource agencies of the three Prairie provinces and by researchers from the Canadian Wildlife Service. It included an assessment of waterfowl hunter performance. The study areas in Alberta included popular hunting areas near Edmonton, Red Deer, Calgary, and in the east-central region of the province. In Saskatchewan, data were collected throughout the southern half of the province. Manitoba studies were concentrated in the Delta marsh area, with a few observations coming from near Brandon, Dauphin and from north of Winnipeg (Canadian Wildlife Service, 1986).

Data were collected using spy blinds (Appendix A) and by interviewing (Appendix B) hunters upon the completion of their hunt. The spy blind method of data collection involved direct observations of hunters. Researchers either played the role of hunters, or remained concealed from hunters until the observed hunt terminated. Some hunters who had been spied upon were approached by a researcher upon completion of their hunt and asked to complete the questionnaire. Also, hunters who were not spied upon but who were encountered as they terminated their hunts were asked to complete the questionnaire.

The data for each province was entered onto two separate computer files. One file contained information collected during spy blind observations (Spy Blind File) while the second file consisted of hunter interview data (Interview File). Although these two files together contained all of the observations and interviews conducted, each record was not complete. The violation information had been abstracted from these files and placed separately on a third computer file (Violation File). Thus, the records on the Spy Blind and Interview files could not be used to compare violation and nonviolation hunting trips without first linking the violation information file to the spy blind records file and to the hunter interview records file. The records on the two latter files would then contain information on whether or not a violation had been recorded. Since no unique identifier existed on each file the violation records were matched to the spy blind and hunter interview records according to the following variables: Province, Year, Month, Day, Time, Number of Hunters, Type of Hunt, Use of a Dog, and Use of a Boat. This computer matching successfully linked 98 percent of the violation records. An attempt to resolve the remaining unlinked violation records by hand was not successful.

The spy blind and hunter interview files often contained multiple records for a single hunting trip. First of all, if there was more than one violation observed or

recorded then a separate record was coded for each violation. A second reason for multiple records was that during spy blind observations, and during hunter interviews, data were collected on each encounter with waterfowl.

The data utilized for the analyses included: province; date of each observation; starting and ending times of each observation; all violations recorded; time of each violation; time of the hunter interview; self reported length of the hunt; number of hunters in the party; use of decoys, dogs, and boats; and type of hunt.

3.2 DATA EDITING

The raw data were closely examined for omissions and errors. Frequency distributions of the values of the variables highlighted any false recordings. Errors were corrected, if possible, by the author in consultation with a researcher at the Canadian Wildlife Service.

The following steps were taken in preparation for data analysis. The data were pooled over the entire study area and over all five years. Because analyses were restricted to those regulations which were common to all three Prairie provinces and since the hunting regulations remained the same in each year of the study period, pooling of the five year data was reasonable. Furthermore, separate provincial analyses of the data produced results which were similar (results not shown). This indicated that there were no

significant differences in components related to violation and nonviolation hunts between the three provinces in the study. Consequently, the data were pooled over the three provinces in order to provide a larger data base of violation and nonviolation hunts, thereby increasing the power of the statistical tests performed.

Spy blind observations and hunter interview data were combined for the analyses of the following violation hunts: any-violation, hunting-protected-species, exceeding-daily-bag-limit, hunting-after-legal-time, and the two violation categories. Spy blind observations only were used in the analysis of failure-to-retrieve violation hunts because these infractions could not be detected from hunter interviews.

Nonviolation hunts and violation hunts were identified by simultaneously examining all of the records pertaining to a single hunting trip. If none of the records indicated a waterfowl hunting regulation violation then the hunting trip was classified as a nonviolation hunt. The following example demonstrates how a violation hunt was identified. If at least one of the records pertaining to the same hunting trip indicated a failure-to-retrieve violation then this hunting trip was identified as a failure-to-retrieve violation hunt. If there were violations other than failure-to-retrieve violations recorded for a hunting trip then this hunting trip was not used in the analysis of failure-to-retrieve

violation hunts. Similar methodology was applied in the analyses of the other violation hunt classifications.

The hunting season was divided into two week intervals for analysis. The amount of hunting normally follows a steady progression from a high level during the first two weeks of each season to small numbers of hunters at the season's end.

The time of the day of the hunt was grouped into early and late morning hunts (the majority of hunting occurred during these times), mid-day hunts, and late afternoon / early evening hunts.

The size of the hunting party variable was divided into four levels : single hunters, two hunters, three hunters, and more than three hunters.

The waterfowl hunting regulation violations were grouped into the following categories: 1) **Birds-Involved:** violations which directly resulted in the killing or injuring of one or more birds, and 2) **No-Birds-Involved:** violations which did not directly result in the killing or injuring of a bird. Table 3.1 below shows in detail the categorical division of the violations observed during this study.

Table 3.1

Categorization of the Violations of Migratory Game Bird
Hunting Regulations in Prairie Canada Between 1979 and 1983

<u>Category</u>	<u>Violation</u>
Birds- Involved	Failure to retrieve Failure to kill a wounded bird upon retrieval Exceeding daily bag limit Failure to leave a feathered wing on a bird Discarding game Herding geese with a vehicle Hunting a protected species Shooting with a rifle
No-Birds- Involved	Hunting without a federal permit Hunting without a provincial license Hunting with an unsigned federal permit Hunting on posted land Hunting while under the influence of alcohol Hunting with an unplugged shotgun Hunting with two shotguns

3.3 DATA LIMITATIONS

As previously mentioned, the number of violations recorded during this study was less than what actually occurred. The recording of violations was not the only objective of the Prairie Waterfowl Harvest Program. Researchers collected a great deal of other information regarding waterfowl hunting, in addition to violations of hunting regulations. Thus, some violations were likely missed in the attempt to gather other information. In addition, no observations or hunter interviews were conducted on Sundays.

Out-of-season-kill violations were not recorded. Spy blind observations and hunter interviews were conducted only during the hunting seasons, making the recording of out-of-season-kill violations impossible. Pre-season kill could be recorded by conducting spy blinds and bag checks prior to hunting season opening dates. This violation may be occurring often and having a significant effect on waterfowl populations and on the enjoyment of the sport by legal hunters.

The researchers made little attempt to record exceeding-the-legal-possession-limit violations. The only viable way to record such violations would be with hunter interviews where a hunter would be asked if she/he had birds in excess of the legal possession limits. Honest responses to such a direct question may not be obtained.

A failure-to-retrieve violation is one of the more serious offenses committed by waterfowl hunters. It could result in unnecessary suffering by injured birds and in hunters killing more birds than the daily limit. The recording of failure-to-retrieve violations in this study was not complete. The researchers who observed hunts in progress were not always able to accurately determine how many birds were knocked down in sudden and large outbursts of gunfire. Consequently, they were not always able to detect if all birds were retrieved.

Data on the number of encounters with protected species per observation was not collected during the Prairie Waterfowl Harvest Program. This information would have been useful for standardizing violation rates. For example, suppose there were 20 hunting-protected-species violations recorded during both field and over-water hunts. If each of these 20 violations resulted from the same number of encounters with protected species then we could conclude that there was no difference in the violation rates between field hunts and over-water hunts. However, if there were, say, three times as many encounters among over-water hunts as among field hunts then we might conclude that there was a difference. The rate of hunting-protected-species violations per encounter among field hunts would be three times greater than the rate among over-water hunts.

Pooling of the spy blind and hunter interview data may have caused spurious results since the violation detection rate was much higher for spy blind observations than it was for hunter interviews. If the sampling of a component of hunting was not in the same proportion for spy blind observations and hunter interviews, results of the analyses could be artifacts of the pooled data. Analyses of the use of decoys component was possibly subject to this problem (see Appendix C).

3.4 ANALYSIS

Data analyses were performed using the SAS, Version 5, software on the University of Manitoba's Amdahl 5850 computer. Separate analyses were performed on the following violation hunts: any-violation (a grouping of the violation hunts common to all three Prairie provinces), failure-to-retrieve, hunting-protected-species, exceeding-daily-bag-limit, hunting-after-legal-time, and the violation hunt categories as defined in Table 3.1. All other individual waterfowl hunting regulations, with the exception of no federal permit violations, were violated less than 20 times over the entire study.

Cross tabulations were generated showing the observed and the expected frequency of violation hunts, and nonviolation hunts, among the levels of the following hunting components: Type of Hunt, Size of the Hunting Party, Use of Dog(s), Use of Decoys, Use of Boat(s), Week of the Season, and Time of the Day of the Hunt. No-Federal-Permit violations were also analyzed but no statistically significant results were obtained and the results are not reported. A Pearson chi-square statistic was computed for each cross tabulation. The chi-square statistic was used to test each null hypothesis of no difference between the distribution of nonviolation hunts and the distribution of violation hunts.

CHAPTER 4: RESULTS and DISCUSSION

As discussed previously, data for these analyses were collected using two methods: 1) hunter interview, and 2) spy blind observations. Table 4.1 shows the frequency of the different violation hunts recorded during each of the two methods used for collecting the data for this research. There were 214 different violation hunts recorded from the total of 1007 hunts observed using the spy blind technique. This produced a ratio of one violation hunt for every 4.7 hunts observed. Researchers interviewing hunters, on the other hand, collected data from 17 different hunts, on average, before a violation was recorded. Assuming no difference in the frequency of violations among hunters interviewed and hunters spied upon, the spy blind technique of collecting data on waterfowl hunting trips was more successful in recording violations than the hunter interview method.

Table 4.1
 Observed Distribution of Violation Hunts by
 Method of Data Collection. Prairie Canada. 1979-1983.

Hunt	Method of Data Collection	
	Hunter Interview	Spy Blind
Nonviolation Hunts.....	3955	793
Violation Hunts:		
Failure-to-Retrieve	13	73
Hunting-Protected-Species	18	54
Exceeding-Daily-Bag-Limit	53	7
Hunting-After-Legal-Time	8	27
All Others	<u>156</u>	<u>53</u>
Total Violation Hunts.....	248	214
	----	----
Total Hunts	4203	1007
Percentage of hunts which were violation hunts.....	6%	21%

4.1 SUMMARY OF RESULTS

Analyses of the data revealed that some waterfowl hunting components were associated with violations of waterfowl hunting regulations. The results are summarized in Table 4.2. The type of hunt used by hunters in Prairie Canadian was associated with a number of different violations. Over-water hunting was related to a higher than expected occurrence of violations which directly involved killing or injuring a bird, particularly hunting-protected-species violations. Persons hunting over-water also experienced an elevated number of hunting-after-legal-time violations. Field hunting was associated with an increased

number of violations which did not directly involve killing or injuring a bird.

Large hunting parties (3 or more hunters) experienced an elevated frequency of failure-to-retrieve violation hunts. There was also a higher than expected occurrence of violations which did not directly involve killing or injuring a bird among hunting parties of more than three hunters.

In general, hunters who were better equipped were involved in fewer violations than expected, while less equipped hunters committed proportionally more violations than expected. Hunters not using decoys or dogs were associated with elevated frequencies of violation hunts.

The first and second weeks of the hunting season were associated with an excessive frequency of violation hunts. There were more birds-involved, any-violation, and hunting-after-legal-time violation hunts than expected during the first two weeks of the hunting season.

Early morning or late afternoon were the only times of the day during which waterfowl hunting regulations were violated more often than expected. There were more failure-to-retrieve violation hunts than expected between 0530 and 0730 hours. The frequency of any-violation hunts, particularly hunting-protected-species violation hunts, after 1630 hours was significantly greater than expected.

TABLE 4.2
Summary of the Analyses of Associations Between
Hunting Factors and Violation Hunts¹

Hunting Component	Any Violation	Type of Violation Hunt				Birds Involved Category	No-Birds Involved Category
		Hunting Protected Species	Over the Bag Limit	Hunting After Legal Time	Failure to Retrieve		
Type of hunt	ns	**	ns	**	ns	*	**
Size of the hunting party	+	ns	ns	ns	*	ns	**
Week of the season	*	ns	ns	**	+	**	*
Time of the day	*	*	ns	N/A	*	+	ns
Use of decoys ²	**	**	*	**	+	**	ns
Use of dog(s)	**	ns	ns	ns	ns	ns	*
Use of boat(s)	*	ns	ns	**	**	ns	ns

¹ - Differences between the distribution of nonviolation and violation hunts were tested for statistical significance. The symbols in the body of the table indicate the statistical significance of each corresponding association:

** : p-value < 0.01 * : 0.01 ≤ p-value ≤ 0.05
 + : 0.05 < p-value ≤ 0.15 ns : p-value > 0.15

² - Results may be spurious due to sampling differences (see Appendix C).

4.2 DETAILED RESULTS

4.2.1 Components Describing the Hunt

The variables examined in this study which described the hunt included: the type of hunt, the size of the hunting party, the time of the hunt, and the week of the season during which the hunt occurred. In summary, the analyses of these components revealed more violations than expected among:

- hunting parties of 3 or more persons
- over water hunts
- hunting trips which were early or late in the day, and
- hunts during the first two weeks of the season.

There were fewer violations than expected among single hunters, field hunts, hunting between the hours of 0731 and 1000, and hunts during the third and fourth weeks of the season .

(i) Type of Hunt

Tables 4.3a and 4.3b compare the distribution of nonviolation and violation hunts between over water hunting and field hunting. They reveal that over-water hunting was related to higher frequencies of hunting-protected-species and hunting-after-legal-time violation hunts.

Table 4.3a
 Distribution of Nonviolation and Failure-to-Retrieve Violation
 Hunts by Type of Hunt. Spy Blind Data.
 Prairie Canada. 1979-1983.
 (Figures in brackets are total number of hunts¹)

	Type of Hunt		Chi-Square ²
	Over Water	Field	
Nonviolation Hunts (793)	45%	55%	
Failure-to-Retrieve Violation Hunts (72)	49%	51%	0.19 ns

¹ - Nonviolation and violation hunt totals do not always exactly agree between tables due to missing values for one or more of the variables in question.

² - Differences between the distribution of nonviolation and violation hunts were tested for statistical significance. The symbols following each chi-square value represent :

** -> p-value < 0.01
 * -> 0.01 <= p-value <= 0.05
 + -> 0.05 < p-value <= 0.15
 ns -> p-value > 0.15

Table 4.3b
 Distribution of Nonviolation and Violation Hunts by
 Type of Hunt. Spy Blind and Hunter Interview Data.
 Prairie Canada. 1979 - 1983.
 (Figures in brackets are total number of hunts¹)

	Type of Hunt		Chi-Square ²
	Over Water	Field	
Nonviolation Hunts (4748)	52%	48%	
Violation Hunts:			
Any Violation (462)	54%	46%	0.49 ns
Hunting-Protected-Species (70)	80%	20%	9.57 **
Exceeding-Daily-Bag-Limit (60)	48%	52%	0.23 ns
Hunting-After-Legal-Time (35)	80%	20%	9.61 **
Birds-Involved Violations (255)	59%	41%	4.99 *
No-Birds-Involved Violations (188)	41%	59%	9.57 **

¹ - Nonviolation and violation hunt totals do not always exactly agree between tables due to missing values for one or more of the variables in question.

² - Differences between the distribution of nonviolation and violation hunts were tested for statistical significance. The symbols following each chi-square value represent :

** -> p-value < 0.01
 * -> 0.01 <= p-value <= 0.05
 + -> 0.05 < p-value <= 0.15
 ns -> p-value > 0.15

The higher than expected frequency of hunting-protected-species violation hunts among over water hunts may be related to opportunity. In most cases, field hunts occur where only a few varieties of legal game species had been previously observed feeding. Persons hunting on marshes or on lake shores, however, encounter a wide variety of species of birds, including legislatively protected species. Thus, more frequent encounters, resulting in a greater opportunity to shoot a protected species by an over-water hunter, may explain the higher than expected frequency of hunting-protected-species violations among over-water hunts.

The preceding discussion may also explain the slightly higher frequency of birds-involved violation hunts among over-water hunts. Again, this may be a result of more encounters with waterfowl by over-water hunters than by field hunters.

The significantly higher number of hunting-after-legal-time violation hunts than expected during over-water hunts may again largely be due to opportunity. Waterfowl hunting is most successful when a hunter can conceal himself in a location where birds will be likely to accumulate after the hunter's arrival as opposed to trying to get within shooting range of waterfowl which have already accumulated at some site. It is common practice for waterfowl to return from feeding areas, which are often agriculture fields, to resting areas on water late in the day. Hunters are usually

aware of the location of popular evening resting areas. Consequently, the majority of hunts which are initiated late in the day, and thus have the potential of resulting in hunting-after-legal-time violations, are over-water hunts at these popular nighttime waterfowl resting areas. These sites will provide a better opportunity for a successful evening hunt than would a field hunt because a hunter can position himself at such sites before many of the birds start to arrive. A field hunt initiated late in the day, however, would involve trying to get within shooting range of birds already gathered in a field or attempting to entice birds into a field when they are seeking water. Neither situation is likely to result in a successful hunt.

(ii) Size of the Hunting Party

Table 4.4a reveals a significantly higher than expected observed frequency of failure-to-retrieve violation hunts among hunting parties consisting of three or more hunters. The observed frequency of failure-to-retrieve violation hunts among single hunters was lower than expected.

Table 4.4a
 Distribution of Nonviolation and Failure-to-Retrieve Violation
 Hunts by **Size of the Hunting Party**. Spy Blind Data.
 Prairie Canada. 1979-1983.
 (Figures in brackets are total number of hunts¹)

	Number of Hunters				Chi-Square ² Value
	1	2	3	> 3	
Nonviolation Hunts (781)	28%	40%	18%	14%	
Failure-to-Retrieve Violation Hunts (72)	18%	33%	28%	21%	9.50 *

¹ - Nonviolation and violation hunt totals do not always exactly agree between tables due to missing values for one or more of the variables in question.

² - Differences between the distribution of nonviolation and violation hunts were tested for statistical significance. The symbols following each chi-square value represent :

** -> p-value < 0.01
 * -> 0.01 <= p-value <= 0.05
 + -> 0.05 < p-value <= 0.15
 ns -> p-value > 0.15

Spy blind observations and hunter interview data were used to examine the relationships between the size of the hunting party and violation hunts other than failure-to-retrieve violations (Table 4.4b). Hunting parties of greater than three people had significantly more No-Birds-Involved violation hunts than expected, while single hunters had fewer No-Birds-Involved violation hunts than expected.

Table 4.4b
 Distribution of Nonviolation and Violation Hunts by
 Size of the Hunting Party. Spy Blind and Hunter Interview
 Data. Prairie Canada. 1979 - 1983.
 (Figures in brackets are total number of hunts¹)

	Number of Hunters				Chi-Square ²
	1	2	3	>3	Value
Nonviolation Hunts (4677)	17%	43%	21%	19%	
Violation Hunts:					
Any Violation (460)	15%	42%	21%	24%	7.02 +
Hunting-Protected-Species (68)	15%	53%	10%	22%	1.03 ns
Exceeding-Daily-Bag-Limit (60)	17%	43%	20%	20%	0.23 ns
Hunting-After-Legal-Time (35)	23%	46%	23%	8%	3.05 ns
Birds-Involved Violations (253)	15%	44%	19%	22%	1.03 ns
No-Birds-Involved Violations (188)	9%	40%	17%	34%	24.0 **

¹ - Nonviolation and violation hunt totals do not always exactly agree between tables due to missing values for one or more of the variables in question.

² - Differences between the distribution of nonviolation and violation hunts were tested for statistical significance. The symbols following each chi-square value represent :

** -> p-value < 0.01
 * -> 0.01 <= p-value <= 0.05
 + -> 0.05 < p-value <= 0.15
 ns -> p-value > 0.15

(iii) Week of the Season

Tables 4.5a and 4.5b display the distributions of nonviolation and violation hunts by week of the hunting season. Analyses of nonviolation and violation hunts by week of the season indicated that there were more hunting-after-legal-time violation hunts than expected during the first two weeks of the season and fewer violations than expected during the latter part of the hunting season.

Table 4.5a

Distribution of Nonviolation and Failure-to-Retrieve
Violation hunts by Week of the Season. Spy Blind Data.
Prairie Canada. 1979-1983
(Figures in brackets are total number of hunts¹)

	Week of the Season				Chi-Square ²
	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	Value
Non-Violation Hunts (793)	29%	36%	28%	7%	
Failure-to-Retrieve Violation Hunts (72)	42%	22%	26%	10%	7.65 +

¹ - Nonviolation and violation hunt totals do not always exactly agree between tables due to missing values for one or more of the variables in question.

² - Differences between the distribution of nonviolation and violation hunts were tested for statistical significance. The symbols following each chi-square value represent :

** -> p-value < 0.01
* -> 0.01 <= p-value <= 0.05
+ -> 0.05 < p-value <= 0.15
ns -> p-value > 0.15

Table 4.5b
 Distribution of Nonviolation and Violation hunts by
 Week of the Season. Spy Blind and Hunter Interview Data.
 Prairie Canada. 1979-1983
 (Figures in brackets are total number of hunts¹)

	Week of the Season				Chi-Square ²
	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	Value
Non-Violation Hunts (4748)	25%	36%	30%	9%	
Violation Hunts:					
Any Violation (462)	30%	30%	32%	8%	8.63 *
Hunting-Protected- Species (70)	26%	36%	35%	3%	3.84 ns
Exceeding-Daily- Bag-Limit (60)	33%	32%	28%	7%	2.33 ns
Hunting-After- Legal-Time (35)	63%	23%	9%	5%	26.87 **
Birds-Involved Violations (255)	33%	32%	30%	5%	11.61 **
No-Birds-Involved Violations (188)	25%	26%	38%	11%	8.87 *

¹ - Nonviolation and violation hunt totals do not always exactly agree between tables due to missing values for one or more of the variables in question.

² - Differences between the distribution of nonviolation and violation hunts were tested for statistical significance. The symbols following each chi-square value represent :

** -> p-value < 0.01
 * -> 0.01 <= p-value <= 0.05
 + -> 0.05 < p-value <= 0.15
 ns -> p-value > 0.15

Opening dates for waterfowl hunting seasons across Canada are set according to a number of different factors. One factor is the migrational pattern of ducks and geese. Opening dates will usually correspond closely to the start of the annual migration of birds through each area. Consequently, there are usually more birds, of various species, in any given hunting area during the first two weeks of each waterfowl hunting season than during the latter periods of a season. Also, there are more hunters afield during the first part of the season than during the last few weeks of the season in Prairie Canada. Therefore, a large number of birds present, combined with many hunters afield may lead to a greater number of hunter - waterfowl encounters and thus to more situations during which a bird-involved violation could be committed. This may explain the observed higher than expected frequency of Birds-Involved violation hunts which were recorded during the first two weeks of the hunting seasons.

(iv) Time of the Day

The time of the day of the hunt was associated with failure-to-retrieve violation hunts. There were more failure-to-retrieve violation hunts than expected during the period 0530 to 0730 hours and fewer violation hunts than expected between 0731 and 1000 hours (Table 4.6a).

Table 4.6a
 Distribution of Nonviolation and Failure-to-Retrieve
 Violation Hunts by Time of the Day. Spy Blind Data.
 Prairie Canada. 1979 - 1983.
 (Figures in brackets are total number of hunts¹)

	Time of the Day (Hrs.)				Chi-Square ² Value
	0530- 0730	0731- 1000	1001- 1630	>1630	
Nonviolation Hunts (717)	38%	29%	8%	24%	
Failure-to-Retrieve Violation Hunts (68)	56%	19%	6%	19%	8.14 *

¹ - Nonviolation and violation hunt totals do not always exactly agree between tables due to missing values for one or more of the variables in question.

² - Difference between the distribution of nonviolation and violation hunts was tested for statistical significance. The symbol following the chi-square value indicates that the p-value was between 0.01 and 0.05.

The time of the day was also associated with any-violation, and hunting-protected-species violation hunts (Table 4.6b). There were significantly more any-violation and hunting-protected-species violation hunts than expected after 1630 hours. There were fewer of these two violation hunts than expected during the period 0731 to 1000 hours .

Table 4.6b
 Distribution of Nonviolation and Violation Hunts by
 Time of the Day. Spy Blind and Hunter Interview Data.
 Prairie Canada. 1979 - 1983.
 (Figures in brackets are total number of hunts¹)

	Time of the Day (Hrs.)				Chi-Square ² Value
	0530- 0730	0731- 1000	1001- 1630	>1630	
Nonviolation Hunts (4377)	41%	32%	14%	13%	
Violation Hunts:					
Any Violation (426)	40%	25%	13%	22%	8.21 *
Hunting-Protected- Species (67)	36%	24%	15%	25%	8.79 *
Exceeding-Daily-Bag- Limit (58)	41%	40%	12%	7%	3.04 ns
Birds-Involved Violations (241)	46%	27%	10%	17%	7.02 +
No-Birds-Involved Violations (166)	42%	28%	15%	15%	0.87 ns

¹ - Nonviolation and violation hunt totals do not always exactly agree between tables due to missing values for one or more of the variables in question.

² - Differences between the distribution of nonviolation and violation hunts were tested for statistical significance. The symbols following each chi-square value represent :

** -> p-value < 0.01
 * -> 0.01 <= p-value <= 0.05
 + -> 0.05 < p-value <= 0.15
 ns -> p-value > 0.15

Cover of darkness may have accounted for the greater than expected number of any-violation hunts, specifically hunting-protected-species violation hunts, which were observed after 1630 hours. Species identification is more difficult for the hunter as darkness approaches and visibility decreases. The greater than expected number of failure-to-retrieve violation hunts that were recorded between 0530 and 0730 hours may have also been related to dim light. Lower levels of light early in the morning may contribute to a greater number of birds being knocked down without the hunter seeing them fall. This may result in a proportionally higher frequency of failure-to-retrieve violations at such times of the day. In addition, the number of encounters with waterfowl is usually higher during early morning hours or in the early evening. Thus, hunters are more reluctant to immediately retrieve birds during such times because they do not want to risk the chance of missing a shooting opportunity.

4.2.2 COMPONENTS DESCRIBING THE HUNTER

The information collected and analyzed during this study which described the hunter all related to the use of so-called "aids" for hunting waterfowl. Whether or not decoys, boat(s) or dog(s) were used was recorded for each hunt.

Analyses of the data revealed that, in general, hunters who were better equipped, i.e hunters who used decoys or dogs, were involved in proportionally fewer violation hunts than expected. Hunters who did not use these "aids" committed more violations than expected.

(i) Use of Decoys

Tables 4.7a and 4.7b summarize the analyses of the "use of decoys" component. The analyses revealed that the use of decoys was strongly associated with violations of waterfowl hunting regulations. There were significantly more violation hunts than expected among hunters who did not use decoys for each of the violations examined, with the exception of exceeding-daily-bag-limit violation hunts. Hunters who used decoys committed more exceeding-daily-bag-limit violations than expected.

These results may be spurious due to differences in sampling intensities between hunter interviews and spy blind observations (see Appendix C). Therefore, caution needs to be exercised in the interpretations and implications of this study's findings for the "use of decoys" component of waterfowl hunting.

Table 4.7a
 Distribution of Nonviolation and Failure-to-Retrieve
 Violation Hunts by Use of Decoys. Spy Blind Data.
 Prairie Canada. 1979 - 1983.
 (Figures in brackets are total number of hunts¹)

	Decoys Used?		Chi-Square ²
	Yes	No	Value
Nonviolation Hunts (793)	11%	89%	
Failure-to-Retrieve Violation Hunts (60)	18%	82%	2.18 +

¹ - Nonviolation and violation hunt totals do not always exactly agree between tables due to missing values for one or more of the variables in question.

² - Differences between the distribution of nonviolation and violation hunts were tested for statistical significance. The symbols following each chi-square value represent :

** -> p-value < 0.01
 * -> 0.01 <= p-value <= 0.05
 + -> 0.05 < p-value <= 0.15
 ns -> p-value > 0.15

Table 4.7b
 Distribution of Nonviolation and Violation Hunts by
 Use of Decoys. Spy Blind and Hunter Interview Data.
 Prairie Canada. 1979 - 1983.

(Figures in brackets are total number of hunts¹)

	Decoys Used?		Chi-Square ²
	Yes	No	Value
Nonviolation Hunts (4748)	49%	51%	
<u>Violation Hunts:</u>			
Any Violation (453)	34%	66%	32.27 **
Hunting-Protected-Species (67)	13%	87%	31.17 **
Exceeding-Daily-Bag-Limit (57)	65%	35%	5.43 *
Hunting-After-Legal-Time (32)	6%	94%	21.07 **
Birds-Involved Violations (224)	31%	69%	25.52 **
No-Birds-Involved Violations (181)	46%	54%	0.11 ns

¹ - Nonviolation and violation hunt totals do not always exactly agree between tables due to missing values for one or more of the variables in question.

² - Differences between the distribution of nonviolation and violation hunts were tested for statistical significance. The symbols following each chi-square value represent :

** -> p-value < 0.01
 * -> 0.01 <= p-value <= 0.05
 + -> 0.05 < p-value <= 0.15
 ns -> p-value > 0.15

The higher than expected frequency of hunting-protected-species violation hunts among hunters who were not using decoys may have been related to opportunity. The majority of these hunters were pass and jump shooters. Such hunters are opportunistic. They commonly position themselves at some point of land where they can fire upon birds which, often suddenly, come into sight and into range of their gunfire. This method of hunting does not allow the hunter(s) very much time for species identification. Decoy hunters, on the other hand, often use decoys in combination with carefully constructed blinds. This method of hunting usually makes it possible for the hunter(s) to view waterfowl as they approach from almost any direction thereby giving the decoy hunter time to identify the birds. Also, decoy hunters will often give their prey an opportunity to circle the decoys, or to be attracted down low over the decoys, before firing upon them. This again gives a decoy hunter a greater opportunity to identify the birds as compared to a pass or jump shooter.

The elevated frequency of hunting-after-legal time violation hunts among hunters who did not use decoys may be related to the length of time available to a hunter in the evening. A hunter who decides to go afield in the evening after work has, at best, a couple of hours before the sun goes down. Most hunters probably feel that it is not worth the time and effort in setting out, and collecting decoys

for hunts initiated in the evening. Consequently, the majority of evening hunts, which have the potential of resulting in hunting-after-legal-time violations, are by hunters not using decoys.

Several studies have reported on exceeding-daily-bag-limit violations (Kaczynski, 1967; Kimball, 1969 and 1972; Boyd, 1971; Mikula et al., 1972, Nieman and Smith, 1986). Most have observed that decoy hunters have had more opportunities to bag waterfowl and a higher success rate in achieving daily bag limits than other methods of hunting. This was also the case in this study (Nieman et al., 1987) and it probably best explains the higher than expected exceeding-daily-bag-limit violation hunts among decoy hunters which was reported in the present analysis.

(ii) Use of Dog(s)

Tables 4.8a and 4.8b show the distribution of nonviolation and violation hunts by Use of Dog(s). It reveals that the use of one or more dogs by a hunting party was not strongly associated with violation hunts. Although the difference between the distribution of nonviolation hunts and any violation hunts was statistically significant the practical significance of the reported difference is less obvious.

Table 4.8a
 Distribution of Nonviolation and Failure-to-Retrieve
 Violation Hunts by Use of Dogs. Spy Blind Data.
 Prairie Canada. 1979 - 1983.
 (Figures in brackets are total number of hunts¹)

	Dogs Used?		Chi-Square ² Value
	Yes	No	
Nonviolation Hunts (793)	13%	87%	
Failure-to-Retrieve Violation Hunts (72)	15%	85%	0.11 ns

¹ - Nonviolation and violation hunt totals do not always exactly agree between tables due to missing values for one or more of the variables in question.

² - Differences between the distribution of nonviolation and violation hunts were tested for statistical significance. The symbols following each chi-square value represent :

** -> p-value < 0.01
 * -> 0.01 <= p-value <= 0.05
 + -> 0.05 < p-value <= 0.15
 ns -> p-value > 0.15

Table 4.8b
 Distribution of Nonviolation and Violation Hunts by
 Use of Dog(s). Spy Blind and Hunter Interview Data.
 Prairie Canada. 1979 - 1983.
 (Figures in brackets are total number of hunts¹)

	Dogs Used?		Chi-Square ² Value
	Yes	No	
Nonviolation Hunts (4748)	17%	83%	
<u>Violation Hunts:</u>			
Any Violation (462)	11%	89%	8.21 **
Hunting-Protected-Species (70)	10%	90%	1.80 ns
Exceeding-Daily-Bag-Limit (60)	18%	82%	0.02 ns
Hunting-After-Legal-Time (35)	11%	89%	0.38 ns
Birds-Involved Violations (255)	13%	87%	2.65 ns
No-Birds-Involved Violations (188)	11%	89%	4.44 *

¹ - Nonviolation and violation hunt totals do not always exactly agree between tables due to missing values for one or more of the variables in question.

² - Differences between the distribution of nonviolation and violation hunts were tested for statistical significance. The symbols following each chi-square value represent :

** -> p-value < 0.01
 * -> 0.01 <= p-value <= 0.05
 + -> 0.05 < p-value <= 0.15
 ns -> p-value > 0.15

There were fewer observed violation hunts than expected among hunters in this study who used dogs. This may be a general indication that better equipped and prepared hunters are less likely to violate hunting regulations. A hunter who takes the time to train, and use, a dog for waterfowl hunting is probably keenly interested in the recreational aspect of hunting, as well as being able to legally pursue wildfowl for his/her dinner table. They are also likely concerned with the conservation of waterfowl species and will respect the legislation which has been put in place to protect and preserve the sport.

(iii) Use of Boat(s)

The analyses of the "use of a boat" component was limited to those hunting situations where a boat could be used, namely, over water hunts. This represented approximately 50% of all hunts recorded over the three provinces.

Table 4.9a presents the distributions of nonviolation hunts and Failure-to-Retrieve violation hunts among hunters who used and did not use a boat. There were significantly more failure-to-retrieve violation hunts than expected among hunters who used a boat.

Table 4.9a
 Distribution of Nonviolation and Failure-to-Retrieve
 Violation Hunts by Use of a Boat. Spy Blind Data.
 Prairie Canada. 1979 - 1983.
 (Figures in brackets are total number of hunts¹)

	Boat Used?		Chi-Square ²
	Yes	No	Value
Nonviolation Hunts (358)	21%	79%	
Failure-to-Retrieve Violation Hunts (35)	46%	54%	9.64 **

¹ - Nonviolation and violation hunt totals do not always exactly agree between tables due to missing values for one or more of the variables in question.

² - Differences between the distribution of nonviolation and violation hunts were tested for statistical significance. The symbol following the chi-square value indicates that the p-value was less than 0.01.

Table 4.9b presents the distribution of nonviolation hunts and the other violation hunts studied, among hunters who used and did not use a boat. It reveals that there were more Hunting-After-Legal-Time violation hunts than expected among hunters not using a boat.

Table 4.9b
 Distribution of Nonviolation and Violation Hunts by
 Use of a Boat. Spy Blind and Hunter Interview Data.
 Prairie Canada. 1979 - 1983.
 (Figures in brackets are total number of hunts¹)

	Boat Used?		Chi-Square ²
	Yes	No	Value
Nonviolation Hunts (2483)	39%	61%	
<u>Violation Hunts:</u>			
<u>Any Violation</u> (259)	31%	69%	6.69 *
Hunting-Protected-Species (56)	32%	68%	0.78 ns
Exceeding-Daily-Bag-Limit (29)	34%	65%	0.08 ns
Hunting-After-Legal-Time (28)	14%	86%	6.06 **
Birds-Involved Violations (151)	34%	66%	1.04 ns
No-Birds-Involved Violations (77)	34%	66%	0.72 ns

¹ - Nonviolation and violation hunt totals do not always exactly agree between tables due to missing values for one or more of the variables in question.

² - Differences between the distribution of nonviolation and violation hunts were tested for statistical significance. The symbols following each chi-square value represent :

** -> p-value < 0.01
 * -> 0.01 <= p-value <= 0.05
 + -> 0.05 < p-value <= 0.15
 ns -> p-value > 0.15

The excessive frequency of Hunting-After-Legal-Time violation hunts among hunters not using a boat may again be a factor of limited hunting time in the evenings. Given the short length of time available to an evening hunter, it is likely not worth the time and effort to load and unload a boat. And, hunts initiated late in the day often occur only when hunters perceive the opportunity to bag waterfowl as being very good without a great deal of effort necessary.

The association between failure to retrieve violations and the use of a boat is interesting. It was opposite to the majority of the associations between violation hunts and the other components describing the hunter. The increased frequency of Failure-to-Retrieve violation hunts among hunters who used a boat may be a result of how boats are used for waterfowl hunting in Prairie Canada. Commonly, hunters will shoot from a boat which has been positioned in thick reeds. It is usually somewhat difficult and time consuming to move the boat out of, and then back into, its hiding place. Consequently, the hunter(s) will often leave downed birds to be retrieved later, when the hunt terminates for example. A failure to make an immediate attempt to retrieve a downed bird, however, constitutes a failure to retrieve violation.

CHAPTER 5: CONCLUSIONS and RECOMMENDATIONS

5.1 CONCLUSIONS

This research discovered a number of statistically significant associations between components of waterfowl hunting and violations of hunting regulations. Components describing the hunt, as well as components related to the hunter, were examined. The components which described the hunt were: type of hunt used, how large the hunting parties were, and when the hunt took place. The type of hunt and the week of the season during which the hunt took place were associated with the greatest number of violations. Over-water hunting and hunting in the first and second weeks of the season resulted in proportionally higher numbers of violation hunts than field hunting or hunts during the third and fourth weeks of the season.

The components related to the hunter dealt with the use of decoys, dogs, or boats. It was discovered that, in general, hunters who used these aids for waterfowl hunting were involved in fewer violations than expected, while hunters not using them committed more violations than expected.

Specific conclusions of this research include:

1. Over-water hunts in Prairie Canada between 1979 and 1983 were associated with increased frequencies of the following: hunting-protected-species violation hunts and hunting-after-legal-time violation hunts.

2. Field hunting resulted in more violations which did not directly involve killing or injuring a bird (no-birds-involved violation hunts) than expected.

3. The week of the season during which a hunt took place was associated with birds-involved and no-birds-involved violation hunts, and with hunting-after-legal-time violation hunts.

4. Hunting parties of three or more people were associated with elevated failure-to-retrieve violation hunts and elevated no-birds-involved violation hunts. Single hunters had fewer of these violations than expected.

5. The time of the day during which a hunt took place was associated with failure-to-retrieve violation hunts, hunting-protected-species violation hunts, and with all-violations-combined violation hunts.

6. The use of a boat by waterfowl hunters was associated with an elevated occurrence of failure-to-retrieve violation hunts, but with fewer hunting-after-legal-time violation hunts.

5.2 RECOMMENDATIONS

Based on the preceding analyses and interpretations of the results the following recommendations are offered:

1. Enforcement efforts using spy blind techniques of observing hunts in progress should be increased because of the greater success in detecting violations by this method as compared to spot checks of hunters.

2. The elevated occurrence of various regulation violations among over-water hunts must be dealt with. There should be increased enforcement at popular over water hunting sites, particularly during the early evening hours. This study found significantly more hunting-after-legal-time violations than expected among over-water hunts. Furthermore, hunters who intend to hunt over water should be informed that 1) they will likely encounter a wide variety of species of waterfowl, and 2) they will need to be able to identify each. These measures could both be accomplished through provincial hunter education efforts.

3. Enforcement effort during the first two weeks of the hunting season should be emphasized as a result of this study's finding of a greater than expected frequency of numerous regulation violations during the first quarter of the hunting seasons.

4. Enforcement of regulations is an important component of hunter education. This role should be further utilized by including summary statistics of the previous year's

convictions, and fines collected, with each hunting license sold.

5. Failure to retrieve violations are serious offenses and they are, to a large extent, going undetected. Adoption of my first recommendation will help to alleviate this problem. However, future researchers should indicate whether a failure to retrieve violation is a result of a hunter making no attempt at all to retrieve a downed bird, or whether the violation results from a hunter's delayed effort to retrieve. Furthermore, if the retrieval is delayed then the researcher should indicate whether or not the eventual retrieval was successful. Often hunters will delay their retrieval because they believe the downed bird may act as an additional decoy or because the hunter does not want to miss another shooting opportunity by being out of his hiding place and exposed to incoming waterfowl. The legislation states that a hunter must make an immediate effort to retrieve any birds hit and downed by his gun fire. Thus, making no attempt at all to retrieve and, delaying a retrieval, both technically result in a violation of the regulation. The biological consequences of the former, however, may be quite different than the latter.

6. A summary of this study's findings should be disseminated to the hunting public through popular publications. Examples are: NRO Newsletter, Manitoba Wildlife Federation Bulletin, and Western Wildlife Report.

7. From a practical standpoint, observation for research purposes might be accomplished more easily using an unobtrusive method of observing hunters during their hunts. The **spy blind technique** utilized in this study is highly recommended for future research.

8. Continuing research is needed in the area of waterfowl hunting regulations violations. The present descriptive study represents an initial analysis of the associations between waterfowl hunting components and violations. Further comprehensive research is needed to replicate this study's findings and to attend to the limitations discussed earlier in this report. Research designs, chosen for their ability to explain observed phenomena, would aid policy-makers and enforcement officials in determining the causes of violations and ultimately leading to greater regulatory compliance.

9. Future observational studies should employ the use of compact portable **video equipment** in order to fully record all violations, especially failure-to-retrieve violations. This could be accomplished by researchers later viewing the film and then comparing the violations observed on film with those counted during in person observations.

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APPENDIX A : SPY BLIND DATA COLLECTION FORM

SPY BLIND OBSERVATIONS - continued

[illegible]

COMMENTS:

APPENDIX B : HUNTER INTERVIEW QUESTIONNAIRE

HUNTER QUESTIONNAIRE AND BAG CHECK

I Background Information

Party No. Province 645 Observer

Date

 Time

Did you hunt M.G.B. today? Yes=1 No=2 ☐

How many hunters were in the party? 2

What was the name of the nearest town where you hunted M.G.B.?

What type of hunting did you practice?

MARSH=1 FIELD=2 POTHOLE=3 ☐ PASS=4 JUMP=5 DECOY=6 ☐

Did you use: A DOG? ☐ DECOYS? ☐ CANOE? ☐
YES=1 NO=2

THE FOLLOWING IS CONDUCTED ONLY IF THE HUNTING PARTY
WAS NOT PREVIOUSLY OBSERVED BY A "SPY BLIND"

11 Hunter Interview

Type: INDIVIDUAL-1 GROUP-2

1) About how many hours did you spend hunting Migratory Game Birds here today?

2) Do you plan to hunt M.G.B. any more today? Yes=1 No=2 ☐

3) Let's talk about your M.G.B. hunting here today:

(a) How many birds did you kill and retrieve? DUCKS

GEESE

(b) We know that hunters sometimes have difficulty in retrieving birds that are shot. About how many birds did you shoot and not retrieve?

DUCKS	1	GEESE	1
-------	---	-------	---

(PROBE) Does this loss include SAILERS, UNFOUND birds and UNDESIRABLE birds?

(continue to 4) in next column)

4) Did you hunt M.G.B. anywhere else today? YES=1 NO=2 ☐

(a) Did you kill and retrieve any birds? YES=1 NO=2

How many DUCKS? How many GEESE?

(b) Are all the birds you killed today here? YES=1 NO=2 ☐

(c) If 4(b) is NO, how many birds did you leave elsewhere? DUCKS GESE

(d) If 4(a) is YES, about how many birds did you shoot and not retrieve while hunting elsewhere today?

DUCKS GEESSE

111 Bag check

[illegible]

IV Hunter Identification

M.G.B. Permit number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
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O.H. Hunting Permit number

NAME _____

ADDRESS

TELEPHONE NUMBER

V Comments :

APPENDIX C : SPY BLIND AND INTERVIEW SAMPLING DIFFERENCES

As reported in Table 4.1, the percentage of hunts during which a violation was detected by spy blind observation was 21% while for hunter interviews it was only 6%. This "detection rate" difference could cause spurious results when the spy blind and hunter interview data were combined if the sampling of a hunting component was very different between spy blinds and interviews. Fortunately, a sampling difference appears to exist only for the "use of decoys" component in this study. Twelve percent of all hunting parties spied upon were using decoys as compared to 55% of the hunting parties interviewed. The following example will demonstrate how such a large difference could result in incorrect conclusions when the spy blind and interview data are pooled.

The observed numbers of total hunts and total any-violation hunts in this study were as follows:

ACTUAL DISTRIBUTIONS

	Total Hunts	Violation Detection Rate	Total Any Violation	Decoys Used?	
				Yes	No
Spy Blind	1000	21%	210	120(12%)	880(88%)
Interviews	4200	6%	250	2310(55%)	1890(45%)

Let us **ASSUME** : Rate of violation among USERS of decoys =
Rate of violation among NON-USERS of decoys.

Then, given the actual distribution of total hunts and violation hunts and using the above assumption the following frequency counts would be derived :

Spy Blind Data

Decoys Used	Violation		
	Yes	No	(Total)
Yes	25	95	(120)
No	185	695	(880)

Hunter Interview Data

Decoys Used	Violation		
	Yes	No	(Total)
Yes	140	2170	(2310)
No	110	1780	(1890)

Now, when these data are pooled the following is obtained:

Pooled Data

Decoys Used	Violation		Total
	Yes	No	
Yes	165 (6%)	2265 (94%)	2430 (100%)
No	295 (11%)	2475 (89%)	2770 (100%)

and it is concluded that non-users of decoys violated at a higher rate than hunters who used decoys. This is contrary to the assumption of **no difference** which was used in constructing the individual frequency tables. This incorrect conclusion, from pooling the data, is a result of the unequal sampling between spy blinds and interviews. This can be seen in the following example using the same data, except that the sampling intensities of the "use of decoys" among hunters spied upon and interviewed is now quite similar. Let us assume that 65% of hunts spied upon used decoys (650 hunts) and that 60% of hunting parties interviewed used decoys (2520 hunts). Then we have the following:

Spy Blind Data

Decoys Used	Violation		
	Yes	No	(Total)
Yes	136	514	(650)
No	74	276	(350)

Hunter Interview Data

Decoys Used	Violation		
	Yes	No	(Total)
Yes	151	2369	(2520)
No	99	1581	(1680)

Now, when these data are pooled the following result is obtained:

Decoys Used	Pooled Data Violation		Total
	Yes	No	
Yes	287 (9%)	2883 (91%)	3170 (100%)
No	173 (9%)	1857 (91%)	2030 (100%)

That is, the violation rate among users and non-users of decoys is equal, which agrees with the assumption we used in constructing the individual frequency tables.