RESULTS OF HARLEQUIN DUCK (*Histrionicus histrionicus*) SURVEYS IN WILDERNESS AREAS OF THE FLATHEAD NATIONAL FOREST, MONTANA

by

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Kalispell, Montana

Cooperative Challenge Cost Share Program
Montana Natural Heritage Program
Flathead National Forest

October 1991

This document should be cited as follows:

Lee, D. N. B., and D. L. Genter. 1991. Results of harlequin duck (*Histrionicus histrionicus*) surveys in wilderness areas of the Flathead National Forest, Montana. Montana Natural Heritage Program. Helena, MT. 31 pp.

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ACKNOWLEDGEMENTS

Dave Lee and Rob Work conducted field surveys with assistance from Dave Genter and John Carlson. Forest Service staff at Spotted Bear Ranger District provided logistical support. Pat Troyer, Al Koss, Sue Johnson, Dave York, Gordon Ash, and Jerry Hess all contributed to the success of the study. Nancy Warren at the Flathead National Forest Supervisor's Office provided support and technical review of the project and report. Staff of the Hungry Horse Ranger District also assisted with field logistics. Staff of the Montana Natural Heritage Program provided technical advice, mapping, and logistical support throughout the study.

SUMMARY

Surveys of Harlequin Duck habitat were conducted during June through August 1991 in the wilderness portion of the Flathead National Forest. Over 220 miles (352 km) of stream were surveyed, yielding six sightings of Harlequin Ducks, totaling 13 individuals and two broods. In addition, eight other sightings in the study area were reported by Forest Service staff and private citizens. Most sightings occurred in the drainage of the South Fork of the Flathead River. Harlequin Ducks are localized and uncommon throughout the area. Descriptive data on stream characteristics such as loafing sites, streambed composition, stream-bank vegetation, and flow rates are presented. Record high spring runoff was recorded in the Flathead River and throughout western Montana during 1991. This reduced brood production to less than 15% of pairs attempting to nest statewide, thus contributing to the already limited productivity of the Harlequin Duck. Despite the low brood numbers, wilderness portions of the Flathead National Forest - particularly tributaries and main-stem waters of the South Fork and Middle Fork of the Flathead River - are identified as significant nesting and rearing areas for Harlequin Ducks in western Montana. Potential management challenges to maintaining this breeding population are discussed.

INTRODUCTION

In the Rocky Mountain region, Harlequin Ducks (*Histrionicus histrionicus*) are known to occur as rare and local breeders from northwestern Wyoming to British Columbia and Alberta. Western Montana is near the eastern limit of their breeding range, and according to Kuchel (1977), breeding populations are uncommon and localized in this region. The western populations of harlequins winter along the north Pacific coast on rocky seashores from the Aleutian Islands to central California (Kuchel 1977). A few individuals marked in northwest Wyoming and northern Idaho have been sighted near the San Juan Islands off Washington's northern coast (Cassirer and Wallen, unpubl. data).

Harlequins return in March and April to inland breeding sites, which are usually located on fast moving, low gradient mountain streams with high water quality and dense vegetation (Wallen and Groves 1989). Although some streams appear to be ideal harlequin habitat, human disturbance and precise ecological requirements severely restrict harlequins' breeding range (Kuchel 1977). After mating, males return to the Pacific coast (late May - early July) and are followed by females and their broods in

late August and early September (Kuchel 1977, Miller 1989).

In 1990, Carlson (1990) surveyed several streams for Harlequin Ducks on the North, South and Middle forks of the Flathead River, concentrating mainly on non-wilderness areas in the Flathead National Forest (FNF). This study compliments Carlson's efforts and attempts to determine the status of breeding Harlequin Ducks in the wilderness portion of the FNF.

While information on Harlequin Ducks remains sparse in the literature, several studies have provided insights on their management needs. Among the earliest and most thorough studies of harlequin biology are those conducted in Iceland by Bengston (1966, 1972) and Bengston and Ulfstrand (1971). Kuchel's (1977) classic study on harlequin breeding behavior and ecology in Glacier National Park provides the most complete account for the species to date in the western U.S. Other surveys of breeding harlequins include Miller's work on the lower Clark Fork River (Miler 1988, 1989), and Carlson's (1989) surveys on the FNF.

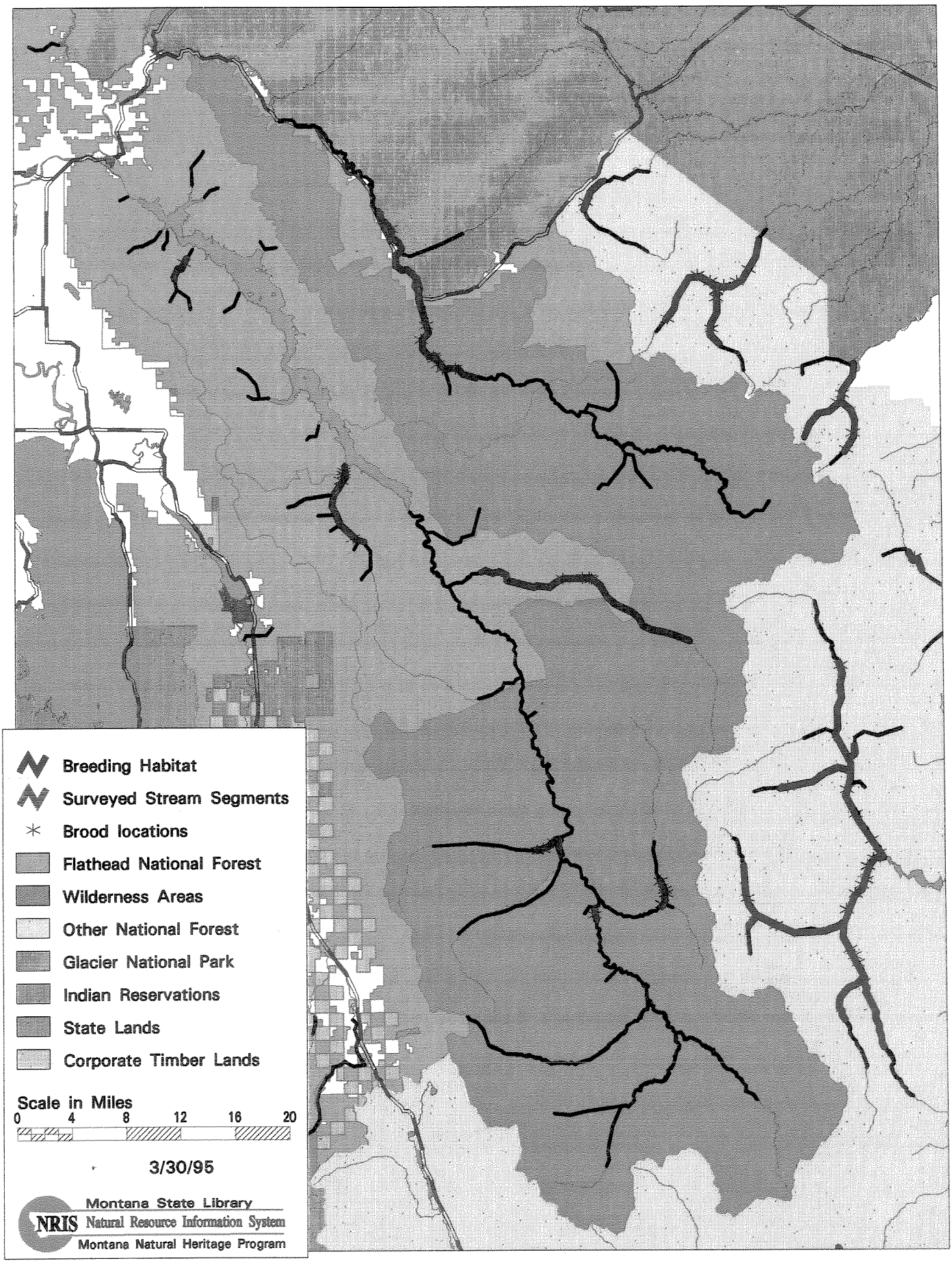
Other recent studies have been completed by Dzinbal (1982), who studied harlequin ecology in Prince William Sound, Alaska and Wallen (1987), who examined habitat utilization by harlequins in Teton National Park, Wyoming. Several workers have completed

research projects in Idaho, including Cassirer (1989), who studied harlequin distribution and status on the Nez Perce National Forest and Wallen and Groves (1988, 1989) efforts on harlequin distribution, breeding biology and nesting habitat in northern Idaho.

SURVEY AREA

All of the surveys completed were in the Flathead National Forest, northwest Montana and most were in the Bob Marshall, Great Bear and Scapegoat Wilderness Areas of the Forest (Fig. 1). A few streams were surveyed in the non-wilderness area of the Forest (see Table 1). The surveys were conducted along three main drainages; the South and Middle Forks of the Flathead River and the Spotted Bear River. Tributaries and side creeks of these drainages comprised the remainder of the survey mileage. Two days were spent on the southern end of the Forest surveying Monture Creek and the North Fork of the Blackfoot River, sections of which lie in the adjacent Lolo National Forest.

Harlequin Duck Occurrences
Hungry Horse and Spotted Bear Ranger Districts



METHODS

Harlequin Duck summer habitat has been defined by Wallen and Groves (1989) as low gradient mountain creeks and rivers that are greater than 10 meters wide, lined by dense vegetation along their streambanks and contain high quality water. Streams surveyed were selected using these criteria, recommendations by Montana Natural Heritage Program Staff, and reported sightings of Harlequin Ducks in the FNF. The study began on June 24 and ended on August 28, 1991.

Three types of surveys were utilized: dry land, floating, and wading. Early in the study, when streams were in their flood stage, wading and floating were not possible, and land surveys (i.e. walking and bushwacking along streambanks) were most practical. Later, as water levels dropped and currents quieted, wading and floating became possible. Both wading and floating were far more accurate than land surveys. During land surveys the observer's view of the stream was often obstructed by vegetation and other obstacles. Hens and young birds will occasionally hang close to the bank, thus avoiding detection from the land.

Survey accuracy was evaluated using the concept of sighting potential. The possibility of seeing a subject that was swimming or loafing in the stream was defined as the sighting potential, expressed as a percentage of the length of stream surveyed. The average sighting potential for land surveys was estimated at 64%, whereas the average sighting potential for wading and floating was about 95%.

Several stream characteristics were recorded during the surveys. The number of logjams, cliff loafing sights, mid-stream loafing sights, stream bed composition, bank vegetation type, percent ground cover, channel type and human proximity were summarized for each mile of stream (see Appendix A for definitions of the above variables).

Flow rate, stream depth and width were measured at the mouth of each creek. Flow rate was determined by timing a float attached to a 5-meter length of monofilament. Steam depth was measured using a calibrated rope weighted with a rock, and stream width was estimated using a pair of binoculars as a range finder. Volume of stream flow was then calculated using methods described by Robins and Crawford (1954).

When harlequins were sighted, time, exact location, stream habitat characteristics, and notes on behavior were recorded.

The number of individuals, and their sex and age, was also noted.

A summary was completed for each survey day. The summary included miles of stream surveyed, hours required to complete the survey, survey type, number of observers, sighting potential, other waterfowl, weather and site condition.

RESULTS AND DISCUSSION

The Stream Surveys

Over 220 miles of creeks and rivers were surveyed between June 24 and August 28, 1991. Some streams in the study area were not surveyed because they did not meet certain criteria for Harlequin Duck habitat, usually the size at the stream's mouth. For streams that were wide enough, we attempted to survey at least five miles upstream from the mouth. Table 1 summarizes the streams surveyed, as well as the length, start and stop point for each survey.

Harlequin Sightings

A total of 25 harlequins were recorded in the study area: 13

from our direct observations and 12 from qualified reports of others. Of those 25, eight were sighted alone and nine were sighted in adult groups. The remaining birds were in two broods, one of two ducklings and the other of four.

Harlequins were observed in five of the 31 surveys conducted (Table 1). This yields an average of about one sighting per 50 miles of stream surveyed. Data from these sightings and those reported by Forest Service employees and private individuals are presented in Table 2.

Fourteen sightings are summarized in Table 2. Almost half of those (6), were either on the South Fork of the Flathead or on one of its tributaries. Four of the sightings occurred on the Spotted Bear River, and three on the Middle Fork of the Flathead River. The remaining sighting was on the North Fork of the Blackfoot River.

Table 1. **Stream Survey Data**

River/ Creek	Date	Miles	Ducks Present	Start Point	Stop Point
South Fork*	6/24/91	4		T21N,R13W,S17	T21N,R13W,S32
South Fork*	6/26/91	5		T21N,R13W,S32	T20N,R13W,S8
South Fork*	6/27/91	3		T20N,R13W,S10	T20N,R13W,S23
Gordon Ck	6/27/91	3		T19N,T13W,S5	T20N,R13W,S23
South Fork*	6/28/91	5	+	T20N,R13W,S32	T20N,R12W,S31
South Fork*	7/2/91	3		T24N,R14W,S32	T24N,R14W,S20
Spotted Bear River	7/7/91-7/14/91	32	+	T24N,R12W,S4	T25N,R14W,S20
Gordon Ck	7/18/91	6		T24N,R12W,S4	T25N,R15W,S17
Young's Ck	7/20/91-7/21/91	14		T19N,R14W,S9 T20N,R12W,S31	T19N,R13W,S5 T18N,R13W,S17
Babcock Ck	7/22/91	6		T19N,R14W,S34	T19N,R13W,S33
Danaher Ck	7/24/91	9		T19N,R11W,S30	T20N,R12W,S31
South Fork*	7/29/91	8		T20N,R13W,S10	T21N,R13W,S17
Holbrook Ck	7/30/91	1		T21N,R13W,S17	T21N,R13W,S17
White River	7/31/91	5		T21N,R12W,S14	T21N,R13W,S8
South Fork*	8/1/91	6	+	T21N,R13W,S17	T22N,R14W,S35
Big Salmon	8/2/91	5		T21N,R15W,S23	T22N,R14W,S35
Little Salmon	8/3/91	7	+	T21N,R14W,S19	T22N,R14W,S23
South Fork*	8/4/91	22		T22N,R14W,S23	T24N,R14W,S32
South Fork*	8/5/91	7		T25N,R15W,S17	T26N,R16W,S23
Bunker Ck	8/6/91	5		T24N,R15W,S26	T24N,R14W,S20
Wheeler Ck	8/7/91	1		T27N,R17W,S22	T22N,R17W,S22
Dolly Varden Ck	8/18/91	4		T27N,R13W,S26	T26N,R12W,S7
Strawberry Ck	8/20/91	1		T26N,R11W,S17	T26N,R13W,S19
Schafer Ck	8/21/91	1		T27N,R13W,S35	T27N,R13W,S26
Middle Fork*	8/20/91-8/23/91	40		T26N,R11W,S18	T29N,R15W,S31
South Fork*	8/25/91	8			
Riverside Ck	8/26/91	1		T29N,R17W,S8	T29N,R17W,S6
Ryle Ck	8/26/91	1		T29N,R17W,S7	T29N,R17W,S8
Monture Ck	8/27/91	4		T16N,R12W,S29	T16N,R12W,S17
North Fork, Blackfoot River	8/28/91	6	+	T16N,R11W,S23	T17N,R10W,S29
Total Miles Surveyed:		223			

* - Flathead River

Table 2.

HARLEQUIN DUCK SIGHTINGS, JUNE-AUGUST, 1991
FLATHEAD NATIONAL FOREST

Date	Time	Location	T,R,S	Observations
6/16/91*	1600	Middle Fork, Flathead River	T28N R15W S34	1 adult male 1 adult female
6/16/91*		Mid Creek	T24N R14W S32	1 adult female flying upstream
6/22/91*		Granite Creek	T28N R14W S25	1 adult female
6/26/91*	1700	Spotted Bear River	T24N R12W S4	1 adult female swimming in river
6/28/91	1155	South Fork, Flathead River	T20N R13W S25	2 adult females loafing on freshly cut river bank.
7/9/91*	1530	Spotted Bear River	T25N R13W S36	3 adult females swimming in river
7/10/91	1444	Spotted Bear River	T25N R13W S36	1 adult female loafing on cliff bedrock
7/11/91	1005	Spotted Bear River S32	T25N R12W	1 adult female loafing on rock ledge
7/21/91*	1130	Bunker Creek	T24N R15W S26	1 adult female

*Reported Sighting

TABLE 2. (cont'd.)

7/25/91*	1300	Middle Fork, Flathead River	T29N R15W S25	1 adult female
8/1/91	1220	South Fork, Flathead River	T21N R13W S17	1 adult female 2 ducklings swimming in river
8/3/91	1735	Little Salmon Creek	T22N R14W S22	1 adult female swimming in creek
8/7/91*	1400	South Fork, Flathead River	T22N R14W S26	2 adult females
8/28/91	1440	North Fork, Blackfoot River	T17N R10W S31	1 adult female 4 ducklings loafing on rock

* Reported sighting

Habitat Characteristics

Data on the number of log jams, loafing sites, vegetation density, streambed composition and other habitat characteristics were recorded each mile of the surveys, averaged, and compiled into Table 3. These characteristics varied considerably along the stream continuum. Therefore data presented here should only be considered as a rough attempt to characterize a given stream.

The number of log jams varied from zero to almost 12 per mile, reflecting the difference in overall stream character. Cliff loafing sight availability also varied considerably and was related the channel type (i.e. canyon-type streams had more cliff loafing sites). Mid stream loafing sites similarly varied. It must be noted that water levels were dropping throughout the study period, and stream characters such as these obviously change with water level.

Shrubs comprise the majority of the stream bank vegetation, while trees and herbaceous plants appeared in roughly equal proportions. Cobbles composed the largest

Table 3.
Habitat Components of Streams Surveyed

	Gordon Creek	Young's Creek	Babcock Creek	Danaher Creek	Holbrook Creek
Logjams/mi:	9	1.6	4.4	5	10
Mid-stream Loafing Sites/mi:	1	7.2	8.6	4.9	11
Cliff Loafing Sites/mi:	0	1.4	2.2	1.1	0
Dominant Streambank Vegetation(%):					
Tree	20	30	34	19	30
Shrub	80	55	46	50	60
Grass/Forbs	0	15	20	31	10
Channel Type:	Mndr	Mndr(60%) Cany(40%)	Mndr(90%) Cany(10%)	Mndr(70%) Brad(30%)	Mndr
Bed Composition:					
Boulder	0	14	10	3	20
Cobble	80	62	62	64	80
Pebble	20	24	28	33	0
Human Prox.	Near	Near	Near	Near	Near

Table 3. (cont.)

	Bunker Creek	Wheeler Creek	D.Varden Creek	Strawbry. Creek	Schafer Creek
Logjams/mi:	1.8	3	8.7	0	0
Cliff Loafing Sites/mi:					
	0	16	0	0	1
Midstream Loafing Sites/mi:					
	10	25	8.7	7	1
Dominant Streambank Vegetation(%):					
Tree	73	45	30	40	60
Shrub	18	45	23	40	30
Grass/Forbs	9	10	47	20	10
Channel Type:	Mndr	Mndr(25%) Cany(75%)	Mndr(50%) Brad(50%)	Mndr	Mndr
Bed Composition:					
Boulder	4	30	3	20	0
Cobble	83	70	48	70	70
Pebble	13	0	59	10	30
Human Prox:	Near	Near	Near	Near	Near

Table 3. (cont.)

	Monture Creek	N. Fork Blackfoot	B.Salmon Creek	L.Salmon Creek
Logjams/mi:	9	0.3	2.3	11.8
Cliff Loafing Sites/mi:	0	>30	1.7	3.2
Midstream Loafing Sites/mi:	0.3	0	0.3	1.4
Dominant Streambank Vegetation(%):				
Tree	30	17	30	42
Shrub	57	17	40	45
Grass/Forbs	13	66	30	13
Channel Type:	Mndr	Cany	Mndr	Mndr(85%) Brad(15%)
Bed Composition:				
Boulder	0	7	3	7
Cobble	50	80	80	63
Pebble	50	13	17	30
Human Prox:	Near	Near	Near	Near

Channel Type Abbreviations

Brad = Braided

Mndr = Meander

Cany = Canyon

part of the streambed, usually accounting for 60 to 80% of the rock sizes. Pebbles were less common but still prevalent, making up about 30% of the streambeds, while boulders usually made up less than 10% of rock types. Since trails were used to access the streams, the human proximity category was always "near" (see definitions, Appendix A).

Stream Flow

Stream flow data such as flow rate, width, depth and temperature were recorded at each creek mouth. These data are presented in Table 4, along with the stream flow volume, calculated from the field data. Water temperature was also recorded, which was usually 15 degrees Celsius, plus or minus a few degrees. Again, it should be noted that water volume in the streams was decreasing, at times drastically, throughout the study.

Although the habitat data gathered in this study provide a rough outline of stream characteristics, a more concentrated and detailed effort would be necessary to provide data sufficient for the comparison of harlequin habitat from one stream to the next. Because of the low numbers of harlequins observed, no statistical tests were run to correlate habitat characteristics with use by the ducks. Because these were the first surveys for harlequins

Table 4.

Stream Flow Data

Date	Creek	Flow Rate(m/s)	Width (m)	Depth (cm)	Temp (C)	Stream Flow Volume (cms)
7/29/91	Gordon Ck	0.91	15	51	15	556.92
7/14/91	S.B. River	1.63	20	40	12	1043.20
7/19/91	Young's Ck	0.83	32	40	14	849.92
7/22/91	Babcock Ck	0.81	20	23	14	298.08
7/20/91	Danaher Ck	1.34	10	47	15	503.84
7/30/91	Holbrook Ck	0.93	6	35	14	156.24
7/31/91	White River	0.60	28	33	17	443.52
8/1/91	B. Sal. Ck	0.80	20	47	17	601.60
8/3/91	L. Sal. Ck	0.64	13	45	14	299.52
8/6/91	Bunker Ck	1.49	13	35	14	542.36
8/7/91	Wheeler Ck	0.45	7	43	15	108.36
8/18/91	Dol. V. Ck	2.61	11	29	15	666.07
8/20/91	Straw. Ck	1.32	8	23	11	191.36

conducted in the wilderness portions of FNF, it is not possible to estimate the relative abundance of harlequins in this area by comparing the number of sightings, broods and individuals over several breeding seasons.

CONCLUSIONS AND RECOMMENDATIONS

Results of this study suggest harlequins are localized and uncommon in the wilderness portions of Flathead National Forest. This is consistent with findings in similar studies conducted in northern Idaho and Montana (Wallen and Groves 1989, Carlson 1990). Harlequins have been consistently reported in low number in the Rocky Mountain breeding areas (Wallen and Groves 1989, Carlson 1990, Kuchel 1977). This inherent low density, combined with the extensive modification and loss of breeding habitat via human activities (such as dam building, stream-side development and water quality degradation) warrants a high level of protection for the Harlequin Duck and its remaining habitat.

A significant potential impact on the breeding population in the wilderness areas of FNF is recreational

floating and increased human activity in the riparian areas. This is especially critical during early summer while hens are tending nests and prone to abandon nest sites. Preliminary information from the Canadian Park Service indicates a strong negative correlation between Harlequin Duck numbers and increased recreational floating along some rivers (P. Clarkson, pers. comm.). Given the likelihood of increased water-borne recreation on the FNF and other primitive areas, this is an issue for which more information and attention is warranted.

Future studies of Harlequin Ducks in Northwest Montana should seek to standardize the methodology used by field workers. A field coordinator should be used to assist in this process as well as to conduct training for those researchers unfamiliar with the survey and habitat assessment techniques. Harlequin researchers should meet at least once during the field season to discuss common difficulties and their solutions, and once at the end of the season to review their results.

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APPENDIX A.

Field Definitions

Channel type (from Carlson 1990)

Meander Stream channel is located in a flat-bottomed valley with deep pools separated by shallow riffles. The channel appears to shift slightly during each peak flow period.

Braided Stream channel is located in a flat-bottomed valley with shallow channels and islands. The channel may shift slightly during each peak flow period.

Canyon Stream channel is structurally controlled by a "V" shaped valley. Rapids and runs characterize the stream flow. Virtually no movement of the channel occurs during peak flow periods.

Channel Stream channel is artificially straightened by human activities.

Human Proximity

Near: 50 meters or more from a maintained trail
Adjacent: Less than 50 meters from a maintained trail.

Logjam

Two or more trees 7 meters or longer protruding into the main flow of the stream but not 100% submerged.

Mid-Stream Loafing Site

An island of rock, wood, sand or gravel at least 30 square centimeters in area and isolated by a 3-meter buffer of water.

APPENDIX A (cont.)

Cliff Loafing Site

A shelf or series of rock ledges on the stream bank isolated both from above and on either side (i.e. inaccessible to predators) and not more than four meters above the stream surface.

Stream bank Vegetation

A zone of plant growth ten meters wide on both stream shores. Measurement begins at the high water line.

Rock Types (simplified Wentworth scale)

	Diameter Range
Pebble	2mm to 30mm
Cobble	31mm to 30cm
Boulder	larger than 30cm