DISTRIBUTION, BREEDING BIOLOGY AND NESTING HABITAT OF HARLEQUIN DUCKS (HISTRIONICUS HISTRIONICUS) IN NORTHERN IDAHO

by

R. L. Wallen and C. R. Groves

Natural Heritage Section
Nongame Wildlife/Endangered Species Program
Bureau of Wildlife

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Idaho Department of Fish and Game
600 S. Walnut St., Box 25
Boise, Idaho 83707
Jerry M. Conley, Director

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ABSTRACT

A survey of 37 streams between the Lochsa River and the Canadian border was conducted during 1987 and 1988 to determine the status and distribution of harlequin ducks in northern Idaho. Twenty-one sightings were recorded during the survey and 51 additional reports by other observers were noted. Harlequins began arriving in northern Idaho in late April. Females began incubating by the middle of May. Chicks hatched during the last two weeks of June. Broods were documented along eight streams within the study area. The mean size of six broods that we observed was 4.3 young/brood (range 2-7). Most breeding adult females and juveniles depart the study area by the end of August. Seven adult birds were marked with nylon nasal markers in 1988. Physical features of nesting and brood-rearing habitat were quantified along seven streams. Shrubs were the dominant stream bank vegetation. Stream width varied from 7 to 50 in. Log jams and overhanging vegetation were more abundant and of greater importance as security cover along the smaller streams. Stream gradient was less than one degree for six of the seven streams. Forty-seven percent of the birds observed were found in canyon-type channels. Harlequins appear to tolerate adjacent human activities in a few locations. However, the best habitat was found away from human disturbance. The upper Priest River drainage on the Kaniksu National Forest appears to contain the highest quality habitat, while the Clearwater National Forest contained the most extensive habitat for harlequin ducks in northern Idaho. The Coeur d' Alene National Forest was the only Forest where broods were not observed. A summary of harlequin duck status for each *national* forest in the study area is included in this report, as well as recommendations for future management of this Sensitive Species.

INTRODUCTION

In 1987, Wallen and Groves (1988) surveyed 30 streams on the Clearwater, St. Joe, Coeur d' Alene, and Kaniksu National Forests to determine the population status and distribution of the harlequin duck (Histrionicus histrionicus), a Forest Service Sensitive Species in northern Idaho. During that 1987 survey we located only two confirmed nesting areas and made only six sightings of harlequins in seven weeks of field inventories. From our 1987 efforts we learned that harlequins arrived in Idaho by early May, young hatched in June, and that by mid-August, adult females and juveniles had departed their nesting areas.

Historical information suggests that harlequin ducks were not common nesters in northern Idaho. These ducks winter along the Pacific coast and fly inland to nest along forested, mountain streams. Background information on the ecology and distribution of harlequins was provided in Wallen and Groves (1988). Because only four studies of nesting harlequins have been conducted prior to this one, information on nesting habitat and life history is limited (Bengtson 1972, Kuchel 1977, Dzinbal 1982, Wallen 1987). From our 1987 survey we obtained some preliminary information on distribution, population size, breeding chronology, productivity, and nesting habitat of harlequin ducks in northern Idaho. However, our sample sizes were very small, and the need for additional information was obvious.

In 1988 we continued our status survey on harlequin ducks. Our objectives in 1988 were to continue our searches for nesting harlequin ducks, attempt to quantify nesting habitat, and obtain additional data on productivity and breeding chronology. The purpose of this report is to summarize the results of our two years of field surveys in northern Idaho.

METHODS

During April of 1987 and 1988 we distributed an informational poster about harlequin ducks to Clearwater National Forest, Idaho Panhandle National Forest, and Idaho Department of Fish and Caine biologists (See Appendix B - Wallen and Groves 1988). We searched the majority of stream locations from which sightings were reported.

Our study area encompassed that portion of Idaho from the Lochsa River north to the Canadian border (Figure 1). Within that study area, we selected stream reaches for field surveys based on the following criteria:

1. Observations of harlequin ducks had been reported along a stream.
2. Stream width of 10 m or greater and stream gradient of less than a 3-5 % slope.
3. Limited human activities along the stream.
4. Stream reaches that were braided or meandering and/or a high quality riparian shrub component were present.
5. Water quality was sufficient to support healthy aquatic insect populations.

Criteria 2 - 5 were based upon our knowledge of harlequin nesting habitat from previous studies (Bengston 1966, Kuchel 1977, Dzinbal 1982, Wallen 1987)

During May - June 1987 and May 1988, streams were surveyed for breeding pairs by hiking or driving along stream banks and searching for ducks. During July - August 1987 and July 1988, we surveyed streams for female harlequins with broods. Lower water levels during the brood surveys allowed us to walk in the streambed while searching for harlequins. This improved our chances of observing birds because the riparian cover could prevent us from seeing harlequins from the banks. Appendix A provides a complete list, by national forest, of stream reaches surveyed during 1987 and 1988.

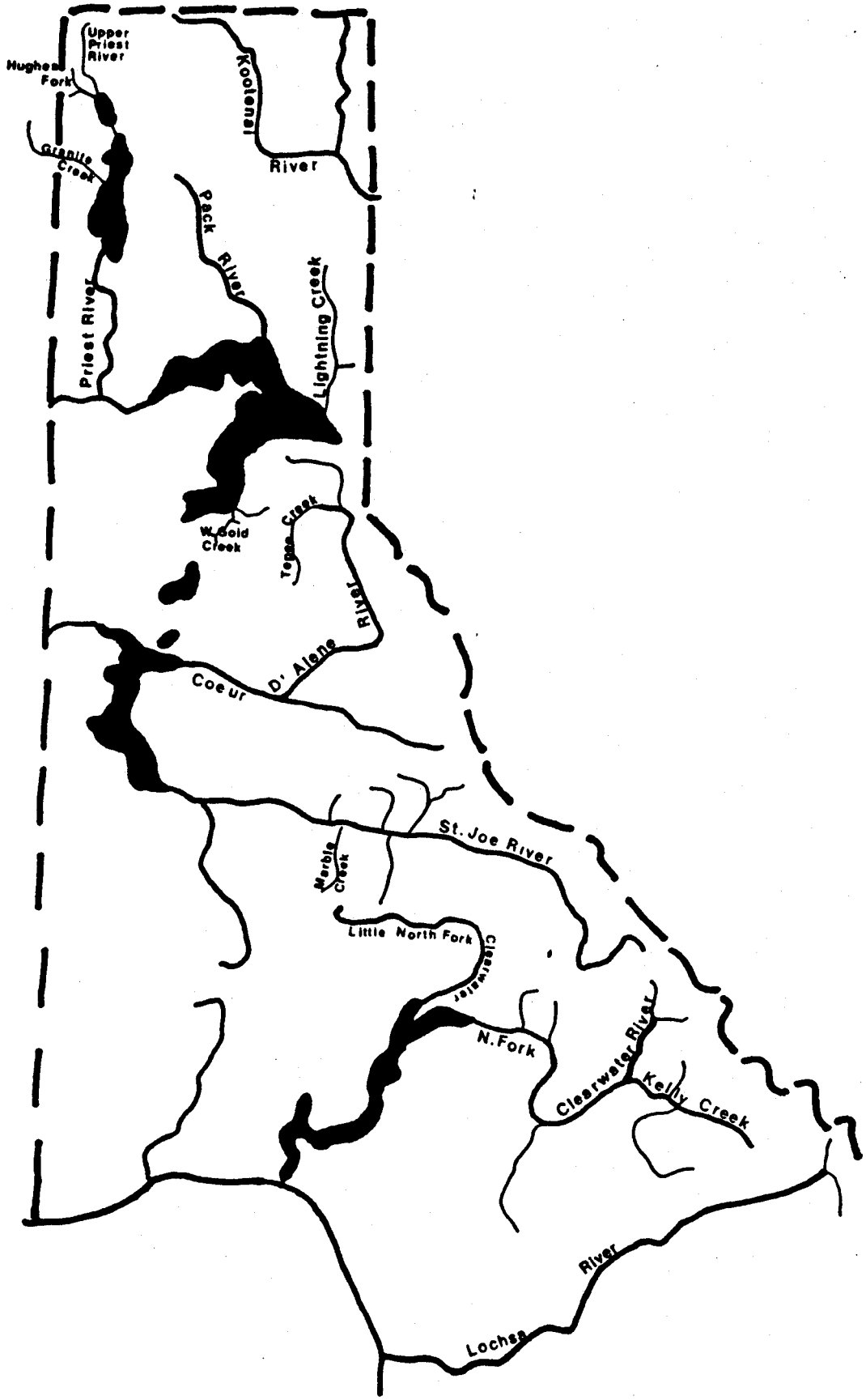

Figure 1. The major streams of the study area in northern Idaho.

When harlequins were observed in 1988, we collected the following habitat information (adapted from Kuchel 1977):

1. Dominant streambank vegetation:

   herbaceous
   shrub
   tree

2. Availability of mid-stream loafing sites:

   0 sites /10 m stream 1-3
   sites /10 m stream >3
   sites /10 m stream

3. Channel type:

   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.

   channelized - Stream channel is artificially straightened by human activities.

4. Proximity of birds to human activities:

   Adjacent - maintained trail or road within 10 m of stream
   Near - maintained trail or road within 50 m of stream
   Accessible - unmaintained trail or road used by humans for access to stream
   Inaccessible - stream not accessible by any trail or road

We attempted to capture, mark, and band harlequins in 1988. When water flows were low enough to allow it, we stretched 10-cm mesh mist nets across streams to capture ducks (see Wallen 1987 for a more detailed discussion of capture techniques). Captured birds were banded with a U. S. Fish and Wildlife Service aluminum leg band, weighed, and measured. The five

measurements made were total length (nm), length of culmen (mm), middle toe (mm), tarsus (mm), and wing (mm). Adult birds were marked with nylon nasal discs of two shapes and six colors (Lokenoen and Sharp 1985).

Additional habitat data, beyond that recorded at observation sites, were collected in 1988 along five stream reaches where nesting was confirmed and two streams where pairs had been observed and breeding was suspected. Stream width was measured and vegetative cover was estimated ocularly in 5 x 10 m plots at three points along the streambanks where harlequins were observed (Platts et al. 1987). The vegetation in each plot was grouped by percent cover into five categories: trees, shrubs, forbs, gramminoids and ferns. The total number of complete and partial log jams was noted. Dominant streambank vegetation (tree, shrub, herb), overhanging vegetation, and channel type were recorded at 200 m intervals. Overhanging vegetation was estimated as the distance between the farthest protrusion of the streambank over the water surface to the farthest point that vegetation covered the water column within 12 in.

When broods were observed, we estimated the age of the chicks from plumage development. Hatching dates were then estimated by backdating from the time of observation.

RESULTS AND DISCUSSION

Observations

From May 1987 to August 1988 we surveyed a total of 37 streams for harlequin ducks in northern Idaho and northeastern Washington (Appendix A). Twelve of these streams were located on the Clearwater National Forest (NF), nine on the St. Joe NF, four on the Coeur d'Alene NF, and 12 on the Kaniksu NF. During these surveys we made six separate observations of harlequin ducks in 1987 and 15 in 1988 (Table 1). Of these 21 sightings, nine were on the Clearwater NF (Nos. 1-9), three on the St. Joe NF (Nos. 10-12), and nine on the Kaniksu NF (Nos. 13-21).

Fifty-one reports of harlequins were received in response to the poster, which we distributed (Table 2). Twenty-one of these reports were from the Clearwater NF (Nos. 1-21), 16 from the St. Joe NF (Nos. 22-37), four from the Coeur d'Alene NF (Nos. 38-41), and the remaining 10 from the Kaniksu NF (Nos. 42-51). Thirty-six of these 51 reports were made by U.S. Forest Service or Idaho Department of Fish and Game personnel. Harlequin ducks were observed on 15 different streams throughout the study area (Tables 1 and 2; Figure 2).

Observations of harlequin ducks gathered during this project indicate that some adult birds arrive in Idaho by the first week of May (Tables 1 & 2). Because of the secretive nature of these ducks and the isolation of streams they inhabit, it's likely that harlequins begin to arrive in Idaho during late April. Kuchel (1977) first sighted harlequins in Glacier National Park in late April, and Wallen (unpublished data) has observed them in Yellowstone National Park (YNP) in late April. Wallen (1987) noted that most adult harlequins arrive in Grand Teton National Park between the second and third week of May.

Table 1. Sightings of harlequin ducks in northern Idaho and northeastern Washington by Wallen and Groves in 1987 and 1988.

	Date	Stream	Observation
1.	9 May 87	Crooked Fork	Saw two-four drakes. These birds were moving up and down the stream feeding. T37N,R14E,Secll,SE1/4 and T37N,R14E,Sec14,NW1/4
2.	13 May 88	Crooked Fork	Saw one drake loafing.
3.	10 Jun 87	Lochsa River	Saw one drake loafing on an island downstream of Wendover C.G.
4.	29 Jul 87	Lochsa River	Saw an adult hen and one young-of-the-year feeding about 40 m apart. T37N,R13E,Sec35,NW1/4
5.	13 May 88	Lochsa River	Saw a pair feeding. T37N,R13E,Sec35,SW1/4
6.	23 Jul 88	Lochsa River	Saw an adult hen and six young-of-the-year feeding. T37N,R13E,Sec35,N41/4
7.	5 May 87	Kelly Creek	Saw two pairs (possibly the same pair) T39N,R12E,Sec27,N41/4
8.	12 May 88	Kelly Creek	Saw a pair feeding. T39N,R12E,Sec27,N41/4
9.	1 Aug 87	N. Fork of Clearwater River	Saw two young-of-the-year birds adult. These birds were loafing on the downstream end of a gravel bar in an area where the stream was braided. T40N,R11E,Sec5,NE1/4
10.	9 May 88	St. Joe River	Saw a pair loafing on a rock. T44N,R8E,Sec25,SW1/4
11.	20 Jul 88	St. Joe River	Saw a single adult hen plus an adult hen with four young feeding. T44N,R8E,Sec25,SW1/4
12.	8 May 88	Marble Creek	Saw a drake loafing on a rock. T44N,R3E,Sec33, NE1/4
13.	15 Jul 88	W. Gold Creek	Saw an adult hen with four young loafing. T53N,R]W,S3,SE1/4
14.	15 Jul 88	W. Gold Creek	Saw two adult hens loafing. T53N,R1W,Sec3,NW1/4
15.	7 Jun 87	Granite Creek	Sawa single hen drifting and feeding in the current. T37N,R45E,Secl2,SW1/4 (Washington?

Table 1. Continued.

	Date	Stream	Observation
16.	3 May 88	Granite Creek	Saw one drake loafing (Washington) T37N,R45E,Sec11,N3
17.	11 Jul 88	Granite Creek	Saw two young-of-the-year birds feeding. T37N,R45E,Secll,NE1/4 (Washington)
18.	2 May 88	Hughes Fork	Saw a pair of adults and a bachelor drake feeding.T63N,R5W,Sec4,NWl/4
19.	3 May 88	Hughes Fork	Saw a pair of adults feeding. T63N,R5W,Sec9, NE1/4
20.	3 May 88	Hughes Fork-	Saw a bachelor drake loafing. T63N,R5W,Sec9,SEl/4
21.	3 May 88	Hughes Fork	Saw a pair of adults feeding. T63N,R5W,Secl3,SWl/4

Table 2. Sightings of harlequin ducks in northern Idaho and northeastern Washington reported during 1987 and 1988 in response to harlequin poster.

#	Date	Stream	Observation
1.	2 May 87	Crooked Fork	Dick Kramer reported one drake at T37N,R15E,Sec6,SW1/4
2.	2 May 87	Crooked Fork	Dick Kramer reported a second drake at T37N,R14E,Secl4,NW1/4
3.	28 May 88	Crooked Fork	One pair at MP152, three drakes at MP147, one pair at MP145 and one drake at MP 141 reported by Peter Grubb
4.	13 May 87	Squaw Creek	Dick Kramer reported a pair feeding in a pool. T37N,R13E,Sec3l,NE1/4
5.	14 May 87	Lochsa River	Dick Kramer reported a pair loafing on a gravel bar 4 miles downstream of Powell R.S. T37N,R13E,Sec35,N41/4
6.	Jun 87	Lochsa River	Dwight Kilgore reported a pair upstream of Wendover C.G. near milepost 159. T37N,R13E,Sec36
7.	May 88	Lochsa River	Commercial river rafter Peter Grubb reported two
8.	13-16 May 1988	Lochsa River	One drake reported by Peter Grubb atMP120.5 T35N,R9E,Sec33
9.	19 May 88	Lochsa River	Two drakes reported by Peter Grubb at Powell T37N,R14E,Sec34
10.	20 May 88	Lochsa River	Four pairs and two drakes reported by Peter Grubb between Powell and MP1328
11.	23 May 88	Lochsa River	One pair reported by Peter Grubb at MP121 T35N,R9E,Sec34 and one pair at MP119 T34N,R9E,Sec8
12.	28 May 88	Lochsa River	Keith Carlson observed harlequins twice between Weir Creek and Mocus Pt. Pack Bridge T36N,R11E,Sec13
13.	29 May 88	Lochsa River	One pair reported by Peter Grubb at MP119. T34N,R9E,Sec8
14.	4-6 Jun 1988	Lochsa River	Two pairs reported by Peter Grubb between MP136 and MP138 T36N,R11E,Sec28,29,30

Table 2 continued

#	Date	Stream	Observation
16.	29 Jun 88	White Sands	One hen reported by Peter Grubb T37N,R15E
17.	Summer 1981	N. Fork Clearwater River	Steve Babler photographed a drake near the confluence with Elizabeth Creek T40N,Rl0E,Sec20
18.	26 Jun 88	N. Fork Clearwater R.	John Patrick reported a hen with three young at confluence with Vanderbilt Creek. T41N,R11E,Sec7
19.	Aug 79	Kelly Creek	Steve Babler photographed a hen with four chicks near the confluence with Clayton Creek T39N,R11E,Sec2l
20.	Aug 80	Kelly Creek	Steve Gabler photographed hen with six chicks near Junction Pack Bridge T39N,R1OE,Sec17
21.	14 May 88	Orogrande Creek	Steve Gabler photographed a pair near the confluence with Tama Creek. T37N,R7E,Sec3
22.	Jul 84	Little North Fork Clear-water River	Harry Jageman reported a hen with brood just above Trapper Cabin. T42N,R6E,Sec12
23.	Jul 85		
24.	25 Jul 88	Little North Fork Clear-water River	Richard Crouse reported a hen with four young near the confluence with Larkin Creek T42N,R6E,Sec13
25.	7 May 87	St. Joe River	Craig Norris reported a pair downstream from Avery near the 2.5 mile mark on the road. T45N,R4E,Sec17,N41/4
26.	14 May 87	St. Joe River	Craig Norris reported a lone drake downstream from Avery near the 2.5 mile mark. T45N,R4E,Sec17,N41/4
27.	28 May 87	St. Joe River	Joel Okula reported a lone drake downstream from Avery near the 2.5 mile mark. T45N,R4E,Sec17,NW1/4
28.	Jul 87	St. Joe River	Dwain Lowry reported a pair near Beaver Creek T43N,R9E,Sec8
29.	Jul 87	St. Joe River	Dwain Lowry reported a pair near Red Ives T43N,R9E,Sec20
30.	28 May 88	St. Joe River	Ned Horner reported a lone drake near confluence with Simmons Creek. T44N,R8E,Sec24 or 25
31.	May 88	St. Joe River	Pat Flach reported seeing harlequins twice near Red Ives. T43N,R9E,Sec20

Table 2 continued

#	Date	Stream	Observation
32.	3 Jul 88	St. Joe River	William Carter reported a hen 1/8 mi above St. Joe Lodge. T42N,R9E,Sec18.
33.	Jul 87	Marble Creek	Mike Mahan reported a single drake in meadows of upper creek. T43N,R4E,Sec 7 or 18
34.	8 Aug 88	Marble Creek	Al Crousser reported a hen with seven young near the confluence of Stanfill Creek. T45N,R3E,Sec34
35.	Jul 87	Mica Creek	Mike Mahan reported a pair 2 mi upstream from confluence with St. Joe. T45N,R3E,Sec18
36.	30 May 88	St. Joe River	Cindy Thomson reported two drakes and one hen
37.	22 Jun 88	St. Joe River	near Fly Creek. T44N,R8E,Sec25
38.	23 May 87	Coeur d' Alene River	Ned Horner reported a pair northeast of Cathedral Peak. T53N,R3E,Sec17
39.	May 87	Coeur d' Alene River	Barry Kendall reported harlequins 1 mi below Jordan Creek confluence. T53N,R3E,Secl7
40.	4 May 88	Coeur d' Alene River	Dwain Lowry reported a pair just below Steamboat Creek. T50N,R2E,S24
41.	Jul 87	Tepee Creek	Dwain Lowry reported a pair near Magee Ranger Station. T52N,R2E,Sec 17 or 18
42.	May 85	Gold Creek	Ned Horner photographed harlequins here. T53N,R1W,Sec3
43.	8 Jun 87	Gold Creek	Mark Engler and Dave Thorson reported a lone drake on Pend Oreille Lake at the mouth of Gold Creek. T53N,R1W,Sec3
44.	22 Jul 87	Gold Creek	Barry Kendall reported 4 harlequin hens (one with a chick). T53N,R1W,Sec3

45. 16 May 87 Huff Lake John Murnane and Bart Schleyer reported a pair on Huff Lake adjacent to Granite Creek. T37N,R45E,Sec2 (Washington)

46. 22-26 May 1987 Hughes Fork John Murnane and Bart Schleyer reported a pair at Hughes Meadow. T64N,R5W,Sec33

47. 14 May 88 Granite Creek Barry Rosenburg reported a pair. T62N,R5W,Sec34

48. 27 May 88 Granite Creek C. Case reported a pair of drakes near mile marker 10. T37N,R45E,Secll (Washington)

49. 30 May 88 Granite Creek Dennis Riley reported a pair of drakes near mile marker 10. T37N,R45E,Secll (Washington)

50. 21 Jun 88 Granite Creek Harry Jageman reported a hen near mouth of Tillicum Creek. T37N,R45E,Sec2 (Washington)

51. 26 Aug 88 Upper Priest River Bill Baer reported an adult female with 2 young near mouth of Lime Creek. T64N,R5W,Sec15

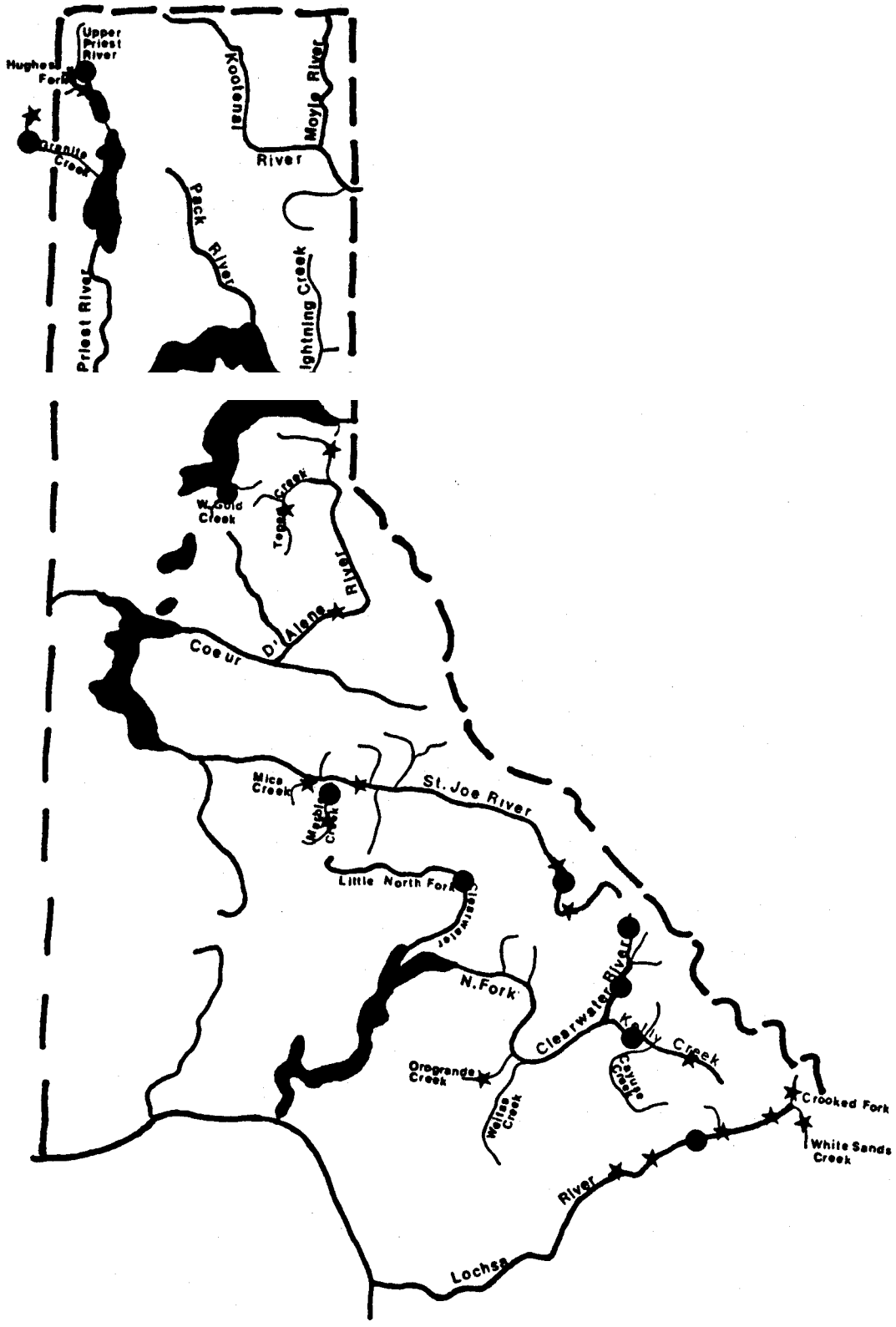

Figure 2. Location of harlequin duck sightings in northern Idaho compiled from Tables 1 & 2. A single star represents one or more observations at that particular site. A circle represents a brood location.

Late season reports (Table 2) indicate that most harlequins have departed Idaho by the end of August. Kuchel (1977) reported some harlequin broods remained in Glacier NP into September. Wallen (1987) observed harlequins in Grand Teton NP as late as mid-September, and believes their departure date is related to the time at which nesting is initiated. Initiation of nesting, in turn, appears to depend on the timing of spring snow melt.

All four studies of nesting harlequins (Alaska - Dzinbal 1982, Iceland - Bengtson 1972, Montana - Kuchel 1977, Wyoming - Wallen 1987) have demonstrated a high degree of site tenacity. Some breeding pairs have even been noted to select the same mate on successive years (Bengtson 1966, Kuchel 1977). In addition, harlequins in Grand Teton NP (Wallen 1987) and Glacier NP (Kuchel 1977) have exhibited natal philopatry with chicks returning as breeding adults to the site where they were born.

It is likely from the observations in Tables 1 and 2 that some harlequin ducks in northern Idaho and northeastern Washington return to the same nesting streams annually. For example, we know that harlequins nested at nearly the identical location along the Lochsa River (Clearwater NF) in 1987 and 1988. Additionally, many of the sightings by us and others are from the same reaches of the same streams in 1987 and 1988. Marking and banding efforts should eventually allow us to determine the extent to which harlequins in Idaho are tenacious to a site and exhibit natal philopatry.

Breeding Biology

In our two years of surveys in northern Idaho and northeastern Washington we have documented six broods of harlequins while U.S. Forest Service personnel and others observed four broods (Table 3, Figure 2). Although the

sample size is small, it appears that the breeding chronology is similar for birds on Granite Creek near the Canadian border and birds on the Lochsa River. Our estimates of hatching dates indicate that incubation is initiated around 15 May and that 30 days later the first chicks are hatched (15 June). Using six weeks as the age at which young birds fledge (Kuchel 1977, Wallen 1987), broods in northern Idaho should begin dispersing from their natal streams by early August.

Brood size ranged from 1 - 7 with a mean of 3.5 (n=10). Two broods located in 1987 were 5-6 weeks old and one brood did not have an adult hen in attendance. Thus, it is possible that other chicks had already dispersed from the natal site. The brood found along Granite Creek in July 1988, also did not have an adult hen in attendance. Some type of disturbance may have caused these chicks to become separated from the hen and/or the rest of the brood. Excluding these three broods, the average brood size is 4.3 (n=6). Mean brood size of harlequins at fledging ranges from 2.5 in Alaska (Dzinbal 1982) to 5.4 in Wyoming (Wallen 1987). Kuchel (1977) noted in Glacier NP that most mortality of harlequin chicks occurred during the first two weeks, and that after three weeks no additional young were lost. Thus, based on the number of chicks older than three weeks, a minimum of 29 harlequins probably fledged in 1988 within our study area.

Harlequins nested on eight different streams in 1988, two of which were known nesting areas from 1987 (Lochsa and North Fork Clearwater Rivers). We strongly suspect that harlequins are nesting in a few other places such as Kelly Creek (where broods have been photographed in the past) and Hughes Fork (where we observed three pair of birds in May). However, our hundreds of hours of field surveys as well as the sightings we received by others, suggest that harlequin ducks are at best uncommon nesters in northern Idaho.

Table 3. Location, age, and classification of harleguin duck broods observed in northern Idaho and northeastern Washington in 1987 and 1988.

Date	Location	Brood Size	Age - Classification (weeks)	Hatching Date (+ 3 days)
29 Jul 87	Lochsa River	1	6 - III	15 June
23 Jul 88	Lochsa River	6	5 - IIc	14 June
1 Aug 87	North Fork Clearwater River	2	5 - IIc	25 June
26 Jun 88	North Fork (*) Clearwater River	3	?	?
25 Jul 88	Little North Fork Clearwater River (**)	4	?	?
20 Jul 88	St. Joe River	4	3.5 - IIb	27 June
8 Aug 88	Marble Creek (*)	7	?	?
15 Jul 88	West Gold Creek	4	4 - IIc	15 June
11 Jul 88	Granite Creek	2	3-3.5 - IIb	15 June
26 Aug 88	Upper Priest (*) River	2	?	?

(*) Observations by U.S. Forest Service personnel.

(**) Observed by Richard Crouse, American Forestry Association

We have not located any stream in Idaho where more than one brood is produced, although we suspect there may be multiple broods on the Lochsa, St. Joe and Hughes Fork Rivers. The density of breeding pairs on Idaho streams is far below that observed elsewhere (Bengtson 1972, Ruchel 1977, Wallen 1987). Higher levels of human activities may account for this lower density of harlequin ducks. All studies of harlequins have noted the need for undisturbed, pristine habitat for nesting and brood-rearing areas.

Banding and Marking

We banded 10 harlequin ducks in northern Idaho during 1988 and seven adults were marked with nasal discs (Appendix B). Adult birds were banded and marked on Hughes Fork, West Gold Creek, and the upper St. Joe River. Three young-of-the-year birds were banded but not marked on the upper St. Joe. Standard measurements (see methods) were taken on all captured birds, and these measurements are provided in Appendix B. The primary reasons for banding and marking birds are to potentially learn more about their migration routes, identify the location of their winter range and to determine whether breeding harlequins in northern Idaho are returning to the same areas annually (i.e. exhibiting nest-site fidelity and natal philopatry).

Harlequin Habitat

Observations of harlequin ducks suggest that mid-stream loafing sites and shrubby streambank vegetation are important physical components of their habitat (Table 4). Mid-stream loafing sites were present at all observation sites. Shrubs were the dominant stream bank vegetation at 67% of the observation sites, while birds were noted in canyon channel types 47% of the time.

Table 4. Habitat parameters compiled at 21 observation sites identified in Table 1.

Dominant Streambank Vegetation:	
Trees	33%
Shrubs	67%
Herbaceous	0%
Availability of Mid-stream Loafing Sites:	
0 sites / 10 m	0%
1-3 sites / 10 m	60%
>3 sites / 10 m	40%
Channel Type:	
Meandering	27%
Braided	27%
Canyon	47%
Proximity of Birds to Developed Human Access:	
Adjacent	47%
Near	13%
Accessible	13%
Inaccessible	27%

Forty percent (40%) of our observations were in areas relatively removed from human disturbance (i.e., accessible and inaccessible), whereas the remainder of the sightings was made in areas with roads or trails in close proximity to the stream (Table 4). Because this project attempted to survey as much of northern Idaho as possible, our stream searches were somewhat biased towards those areas, which contained some sort of access to the stream (i.e., a road or trail). Therefore, it was not surprising that the majority of our sightings were in areas with better accessibility to humans.

Streams with nesting harlequins varied in width from 7-50 m (Table 5). Bengtson (1972) identified harlequins breeding along streams in Iceland, which ranged from 3 - 40 m in width. On the smaller streams in northern Idaho, log jams and overhanging vegetation appeared to be important habitat components for security cover. On the larger rivers, mid-stream loafing sites such as islands and boulders offered security from disturbance.

Streambank vegetation, stream gradient and a buffer from human disturbance are important features of nesting and brood-rearing habitat. In all areas shrubs were the dominant streamside vegetation type (Tables 5 and 6). With the exception of Gold Creek on Pend Oreille Lake, the stream gradient in nesting areas was less than 1 degree. Four of the 10 known broods were raised in areas of relatively high human use (Lochsa River (2), Granite Creek, St. Joe River), whereas the remainder was in areas of relatively low human use.

Table 5. Physical habitat features of harlequin duck actual and suspected nesting and brood-rearing locations.

Parameter	Hughes Fork	Granite Creek	W. Gold Creek,	St. Joe River	North Fork Clearwater River	Kelly Creek	Lochsa River
Width (m)	9.7	7.7	7.2	35.8	34.2	36.3	49.2
Log jams / km.	8.9	8.6	7.1	0	.1	0	.4
Overhanging Vegetation (m)	.9	.68	.7	.15	1.02	.08	0
Dominant Streambank Vegetation (% cover)							
Tree	18	0	29	0	0	0	57
Shrub	68	89	57	100	100	100	43
Herbaceous	14	11	14	0	0	0	0
Channel Type (by %)							
Meander	28	43	14	0	16	0	
Braided	5	0	14	0	16	29	
Canyon	48	57	71	100	67	71	
Channelized	19	0	0	0	0	0	
Gradient (degrees)	.5	.5	1.7	.3	.3	.4	.7

Table 6. Percent cover of vegetation categories at 5 x 10 m streambank plots (N= 22 plots).

Vegetation Type	Mean % Cover	Range	% of plots identified
Trees	10.6	0-100	6
Shrubs	69.9	Trace-116	22
Forbs	20.6	0-93	20
Gramminoids	14.7	0-73	15
Ferns	13.4	0-73	11

In Grand Teton NP harlequin nesting and brood-rearing habitat was characterized by having a gradient less than 3 degrees, greater than 50% streamside shrub cover, more than three loafing sites per 10 m of stream, and minimal human use (Wallen 1987). Kuchel (1977) also noted in Glacier NP that nesting harlequins showed a preference for areas inaccessible to humans. Harlequin ducks in northern Idaho and northeastern Washington also seem to prefer low gradient streams with shrubs dominating the streamside vegetation, but they appear to be more tolerant of human activity. On the Lochsa River, harlequin activities center around an island in the middle of the river with at least 20 m of river between them and the road for security . On the St. Joe River and Granite Creek, a dense riparian thicket between the stream and road provides security for these birds. In addition, when harlequins first occupy these sites in May, human activity along Granite Creek and the St. Joe River is low, and hens are likely to nest prior to any significant human disturbance.

SUMMARY OF HARLEQUIN DUCK STATUS ON NATIONAL FORESTS

Clearwater National Forest

Harlequins have been documented to nest on the large rivers of this forest, the North Fork of the Clearwater and Lochsa Rivers. On Kelly Creek broods were photographed in 1979 and 1980; we observed pairs at Hansen Meadow in May 1987 and 1988, but were unable to confirm nesting. Although we have identified one nesting area on the Lochsa, the number of sightings there suggest there may be others. Harlequins have also been photographed on Orogrande Creek, where there appears to be some limited nesting habitat below the confluence with Tama Creek. Intensive surveys need to be conducted on the Lochsa River, Kelly Creek, Cayuse Creek, Orogrande Creek, Weitas Creek, and White Sands Creek to determine if harlequins are nesting along these streams. They all appear to contain good nesting habitat. Although harlequins have been observed on Crooked Fork, this stream does not appear to contain good nesting habitat. If harlequins are to persist on the N. Fork Clearwater River, mitigative measures may need to be taken to protect the riparian corridor along the stream reach from Deception Gulch to Vanderbilt Creek. Potential disturbance to harlequins by anglers, in late June and July, on the North Fork Clearwater River and Kelly Creek may also be a management concern for harlequins.

National Forest

We documented harlequins nesting on the upper St. Joe River, upstream of Simmons Creek. A historical nest record (Hand 1941) and numerous sightings in recent years suggest that harlequins regularly nest along this portion of the river. When harlequins arrive on the St. Joe River in May, they may be observed almost anywhere along the river. However, nesting along the St. Joe River seems confined to the upper reaches. The width of the river, ample boulders for loafing, and well-developed riparian shrub component appear to provide them sufficient security.

At least three other stream locations support nesting harlequins. A brood was observed by Forest Service personnel on Marble Creek in 1988, and we observed a single drake there in May 1988. In July 1988, a hen and brood were observed on the Little North Fork Clearwater River OR. Crouse, pers. comm.). Broods have previously been observed there near Trappers Cabin in 1984 and 1985 (H. Jageman, pers. comm.). In 1988 a single hen was observed by Idaho Fish and Game personnel on the St. Joe River above the St. Joe Lodge. All three of these locations appear to contain adequate security and nesting habitat and need to be intensively surveyed to better determine breeding chronology, productivity and locations of nesting and brood rearing-areas. As with the N. Fork Clearwater River and Kelly Creek, disturbance to harlequins by anglers may be a management concern on the St. Joe River in late June and July.

Although harlequins have also been observed on Mica Creek, our surveys of this stream suggest that the only potential nesting habitat is in the vicinity of Mica Meadows, which is highly disturbed by cattle and humans. Thus, it seems unlikely that harlequins nest along Mica Creek.

Coeur d'Alene National Forest

Although observations of harlequins have been made on the upper Coeur d'Alene River and Tepee Creek in 1987 and previous years, we never observed a harlequin duck in the Coeur d'Alene drainage during our two field seasons of surveys. In 1988 we spent 3.5 days in this drainage during May and July. No observations of broods have been made here, but marginal nesting habitat seems to be present on Tepee Creek, Independence Creek, and the Coeur d'Alene River above its confluence with Tepee Creek. One habitat feature appears to be missing in the Coeur d'Alene drainage - boulders or log jams for mid-stream loafing sites. Both Kuchel (1977) and Wallen (1987) have noted the importance of this habitat component for harlequins. Since most of the observations of harlequins in this river system occur during May when harlequins first arrive on breeding streams, it maybe that these streams are simply stopovers or are occupied by nonbreeding pairs. Nonbreeding pairs are known to move from one stream to another, whereas breeding pairs generally remain along one stretch of stream (Wallen 1987). As many as 50 - 60 % of harlequin hens along a stream may be nonbreeders in any given year (Dzinbal 1982, Wallen 1987).

Icanikstt Rational Forest

The Kaniksu NF potentially has the greatest number of *nesting* birds of any national forest in northern Idaho. We documented breeding harlequins on Granite Creek (Priest Lake R.D.) and West Gold Creek (Sandpoint R.D.) in 1988. Forest Service personnel documented breeding on the Upper Priest River, and we strongly suspect (based on the sightings of three pairs in May 1988) that nesting also occurs on the Hughes Fork. Although

numerous sightings of harlequins have been reported for Lightning Creek (Sandpoint R.D.), we have never observed a harlequin there despite five surveys in 1987 and 1988. A flood event in this drainage during autumn 1986 probably decreased the suitability for nesting harlequins. The majority of streams on the Bonners Ferry R.D. are simply too steep (i.e. Selkirk streams). The only other streams, which appeared remotely suitable, were Boulder Creek in the Purcell Mountains and the Moyle River. However, what appeared to be the only potential nesting habitat along Boulder Creek, Boulder Meadows, was highly impacted by humans, cattle, and flash floods. Historical data (IDFG files, 1953) indicate the occurrence of harlequins on the Moyie River just above the dam. We cursorily surveyed this area in 1987; a more intensive survey is needed.

Two streams on Lake Pend Oreille, Granite Creek and Johnson Creek, need to be surveyed for harlequins. They appear to have similar habitat features as West Gold Creek, which supports nesting harlequins (B. Kendall and D. Thorson ,pers. comm.). Tine did not allow us to visit these streams.

The Upper Priest River drainage appears to be northern Idaho's best habitat for harlequins. Granite Creek, Hughes Fork, and the Upper Priest River all appear to provide excellent nesting habitat. The Hughes Fork below forest Road 1013 and all of the upper Priest River are secluded, relatively undisturbed, pristine streams with healthy riparian zones and numerous log jams for security. It is likely that several pairs of harlequins nest in the Upper Priest River watershed. The lack of road building and logging adjacent to streams combined with fishing closures in this area are probably the major reasons harlequins remain here.

CONCLUSIONS AND RECOMMENDATIONS

This survey suggests that harlequin, ducks in northern Idaho nest in habitat similar to nesting habitat found in Glacier and Grand Teton National Parks - relatively undisturbed, low-gradient, mountain streams with a healthy riparian component. Harlequin ducks can be observed annually from late April to late August along streams within all National Forests in northern Idaho. The Upper Priest River drainage on the Kaniksu National Forest probably offers the highest quality remaining habitat for breeding harlequins, whereas the most extensive habitat is on the Clearwater National Forest.

The physical features of harlequin duck habitat focus on their need for security cover. Stream width is variable but shrubs are always found along the stream banks. Log jams and overhanging vegetation are most important along the smaller streams whereas islands and mid-stream boulders are used for security cover on larger rivers. Stream gradient at nesting locations is less than one degree. Harlequins appear to tolerate adjacent human activities in some locations where the riparian shrub component is dense enough to shield them from disturbance.

Compared to many other species of ducks, harlequins exhibit relatively low productivity. In the northwest, climatic conditions may severely impact production. Both Ruchel (1977) and Wallen (1987) noted that high spring runoffs lowered productivity by washing out nests or creating stream conditions too harsh for young chicks to negotiate, thus increasing mortality of young-of-the-year birds. Ruchel (1977) hypothesized that several consecutive years of poor production could eliminate harlequins from a stream.

Although harlequins may have been abundant historically in northern Idaho and the Northwest, they no longer are common nesting birds. In Washington and Oregon, both breeding and wintering numbers have probably declined since the

mid-70's (K. Dzinbal, pers. comm.). Outside of Glacier, Yellowstone and Grand Teton National Parks and the Bob Marshall Wilderness, nesting in Montana and Wyoming is localized and uncommon OR. Wallen and D. Center, pers. comm.). Due to the small numbers of breeding harlequin ducks located in our surveys, their relatively low rate of productivity, and the scarcity of nesting habitat remaining in northern Idaho, we recommend that the harlequin duck remain as a Forest Service Sensitive Species.

We have three major suggestions to make concerning future work with harlequin ducks. First, if the Forest Service is going to effectively manage the harlequin duck as a Sensitive Species then it must get more personnel involved at the forest level in determining the location of nesting and brood-rearing habitat, the precise breeding season chronology and productivity of harlequins on a particular forest, and any threats to their habitat. There are simply too many streams for two people to effectively survey and monitor for harlequin duck occupancy and productivity (Table 7) over a large study area. Capture, banding and marking of birds should continue until the breeding biology of harlequins is sufficiently understood for management purposes. If necessary, the Nongame Program staff could provide some short training courses on surveying techniques for harlequins.

Secondly, nesting and brood-rearing habitat which we have identified in our surveys should be protected from any further disturbances. As we have indicated, harlequin nesting habitat is not a plentiful commodity in

northern Idaho. Additionally, because harlequins do show fidelity to nesting sites, it is **u**nlikely that harlequins will relocate to new nesting areas once they have been disturbed.

Finally, we suggest that there is much to be learned about this species if it is to be properly managed to prevent it from becoming a threatened or **e**ndangered species. We recommend that an intensive study in one locale would provide much of the information necessary for management. The Upper Priest River drainage is probably the best place to conduct such a study, although the Clearwater drainage would also suffice. Information gathered at either location would be applicable to species management on all northern Idaho Forests. Some questions to focus on would include:

1. Does the breeding season chronology outlined in this report hold true during years with abundant winter snowfall?

2. Do any harlequins stay in northern Idaho outside the breeding and brood-rearing seasons (May through August)?

3. To what extent does pre-fledging mortality affect recruitment into the population?

4. What percentage of hens and young-of-the-year birds return to the same stream to nest in following years?

5. What percentage of harlequins on a stream actually breed in a given year?

6. What is the *nesting* density of harlequins on a given stream? Is this related to habitat? (Quantification of birds in northern

Idaho is necessary if harlequins are to be monitored in the future.)

7. How does human disturbance influence *nesting* success? (This is a very important question from a management standpoint.)

8. Where is the winter range of harlequins which summer in northern Idaho? Are there any threats to their winter range?

9. Are there any suitable locations in northern Idaho for harlequins to extend their current breeding range? If so, could harlequins be translocated to these areas if necessary?

10. What are the primary limiting factor(s) to harlequin numbers in Idaho?

11. How does the sex ratio of adult birds differ between early May, early June and early July?

Table 7. Locations to monitor for harlequin ducks.

CLEARWATER RIVER DRAINAGE	
Lochsa River	Between Papoose Creek and Wendover Campground
Kelly Creek	Upstream of Cayuse Creek confluence Between the old and newer Ranger Stations
N. Fork Clearwater	Upstream of Deception Gulch River
Little North Fork Clearwater River	Between the confluence with Canyon Creek and the confluence with Foehl Creek
ST. JOE RIVER DRAINAGE	
St. Joe River	Upstream of Simmons Creek
Marble Creek	Upstream of Stanfill Creek

COEUR D' ALENE RIVER DRAINAGE

Coeur d' Alene River	Upstream of Jordan Creek confluence
Tepee Creek	Magee station to Independence Creek
Independence Creek	From Tepee Creek confluence upstream 5 km.

LAKE PEND OREILLE DRAINAGE

Lightning Creek	At the confluence of Spring Creek (near hatchery)
W. Gold Creek	From the lake to the power line

PRIEST RIVER DRAINAGE

Granite Creek	Downstream of Huff Lake
Hughes Fork	Hughes Meadow to confluence with Upper Priest River
Upper Priest River	Upstream of Upper Priest Lake

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APPENDIX A

LOCATION OF SITES SURVEYED DURING 1987 and 1988

Name of Stream	Date	Surveyed From	Surveyed To
	CLEARWATER NATIONAL FOREST		
Fish Creek	1 May 87	T35N,R9E,Sec32	T35N,R9E,Sec19
Lochsa River	20 Apr 87	T37N,R14E,Sec34	T32N,R7E,Sec4
	1 May 87		
	9 May 87		
	10 Jun 87		
	13 May 88		
	28-29 Jul 87	T37N,R14E,Sec34	T36N,R13E,SecS
	23 Jul 88		
Crooked Fork	20 Apr 87	T38N,R15E,Sec32	T37N,R14E,Sec34
	1 May 87		
	9 May 87		
	28 Jul 87		
	13 May 88		
	23 Jul 88		
Skull Creek	2 May 87	T40N,R8E,Sec8	T41N,R9E,Sec20
Weitas Creek	3 May 87	T38N,R8E,Sec15	T37N,R8E,SeclO
Quartz Creek	4 May 87	T40N,R8E,Sec16	T40N,R9E,Sec5
Orogrande Creek	22 Jul 88	T37N,R7E,Sec3	T37N,R7E,Sec3
Kelly Creek	5-8 May 87	T39N,R10E,Sec18	T39N,R11E,Sec16
	31 Jul-2 Aug 87		
	12 May 88		
Kelly Creek	5 May 87	T39N,R11E,Sec16	T39N,R12E,Sec26
	1 Aug 87		
	12 May 88		
	22 Jul 88	T39E,R11E,Sec16	T39N,R11E,Sec24
Cayuse Creek	7 May 87	T39N,R11E,Sec35	T38N,R11E,Sec18
	31 Jul 87		
	30 Jul 87	T38N,R13E,Sec28	T37N,R12E,Sec5
Independence Creek	8 May 87	T39N,R11E,Secl6	T40N,R11E,Sec32
	1 Aug 87		
N. Fork Clearwater River	3-4 May 87	T41N,R6E,Sec27	T39N,R10E,Sec18
	8 May 87	T39N,R10E,Sec18	T41N,R11E,Sec28
	1-2 Aug 87		
	11 May 88		
	21-22 Jul 88	T39N,R10E,Sec18	T41N,R11E,Sec7
Long Creek	2 Aug 87	T41N,R11E,Sec28	T41N,RI1E,Secl

Name of Stream	Surveyed From	Surveyed To
	ST. JOE NATIONAL FOREST	
N. Fork St. Joe River 10 Jun 87	T45N,R5E,Secll	T47N,R5E,Sec2l
Slate Creek	T47N,R4E,Sec28	T47N ,R4E ,Sec36
Loop Creek	T46N,R6E,Sec8	T46N ,R6E ,Sec12
Little N. Fork Clearwater River23 Jul 88	T42N,R6E,Sec23 T42N,R6E,Sec14	T43N,R5E,Sec6 T42N,R6E,Sec2
Big Creek	T45N,R3E,Sec5	T46N,R3E,Sec6
Mica Creek	T45N ,R3E , Sec6 T45N,R2E,Sec27	T45N ,R3E ,Sec18 T44N ,R2E ,Sec4
Marble Creek	T45N,R3E,Sec13 T44N,R3E,Sec33 T44N,R3E,Sec33	T44N,R3E,Sec2 T43N,R3E,Sec2 T43N,R4E,Sec7
Fishhook Creek	T45N,R5E,Sec17	T44N,R5E,Sec19
St. Joe River	T46N,R2W,Sec14 T46N,R2W,Sec14 T45N,R5E,Sec15	T43N ,R10E ,Sec2l T42N,R9E,Sec6 T43N,R9E,Sec29
	N A T I O N A L	
Coeur D' Alene River	T53N,R3E,Secl7 T53N,R3E,Sec20 T52N,R3E,Sec6	T53N,R2E,Sec4 T53N,R2E,Sec12 T53N,R3E,Sec30
N. Fork Coeur D' Alene	T49N,R3E,Sec4	T53N,R]W,Sec32
Teepee Creek	T52N,R2E,Sec2	T52N,R1E,Sec3
Independence Ck.17 Jul 88	T52N,R2E,Sec4	T53N,R1E,Sec26

Name of Stream	Date	Surveyed From	Surveyed To
	RANIKSU NATIONAL FOREST		
Lightning Creek	3-4 Jun 87 6 Aug 87 4 May 88 15 Jul 88	T55N,R2E,Sec3	T58N,R2E,Sec26
East Fork Lightning Creek	3 Jun 87 6 Aug 87	T57N,R3E,Sec32	T57N,R3E,Sec27
Pack River	4 Jun 87	T60N,R2W,Sec34	T60N,R2W,SecS
Moyie. River	5 Jun 87	T64N,R2E,Sec2	T63N,R2E,Sec13
Boulder Creek	15 Jul 88	T60N,R2E,Sec17	T60N,R2E,Sec28
W. Gold Creek	5 May 88 15 Jul 88	T53N,R1W,Sec3	T53N,R1W,Sec10
Granite Creek	6-7 Jun 87 5 Aug 87 11&14 Jul 88	T62N,R5W,Sec33(Id.)	T37N,R45E,Sec2 (Wa.)
	3 May 88	T61N,R9W,Sec2(Id.)	T38N,R45E,Sec28(Wa.)
Gold Creek	6 Jun 87	T63N,R5W,Sec1.7	T63N,RSW,Sec9
Hughes Fork	6-7 Jun 87 4-5 Aug 87 2-3 May 88 12-13 Jul 88	T64N,R5W,Sec29	T63N,R5W,Sec13
Priest River	7 Jun 87 5 Aug 87	T64N,R5W,Secl5 T63N,R5W,Sec2	T65N,R5W,Sec22 T63N,R5W,Sec12
Soldier Creek	8 Jun 87	T59N,R4W,Sec2	T60N,R3W,Sec3l
Middle Fork of East River	8 Jun 87	T58N,R4W,Secl4	T58N,R3W,SeclO

APPENDIX B

1988 Banding and Measurement Data from captured Harlequin Ducks

Band t	Sex	Age	Date	Location (Stream)	Markers (R=right side,L=Left side)	Total Length (mm)	Wing Cord (mm)	Weight (g)	Oilmen Om)	Middle The (m)	Tarsus (m)
805-90201	M	AHY	2 May 88	Hughes Fork	Pluses Yellow(R)-Green(L)	431	198	640	25.05	54.15	44.35
805-90202	F	AHY	2 May 88	Hughes Fork	Pluses,White(R)-Black(L)	389	192	660	24.20	53.10	44.15
805-90203	M	AHY	3 May 88	Hughes Fork	Pluses,White(R) Yellow(L)	427	200	660	27.05	55.75	46.60
805-90204	F	AHY	3 May 88	Hughes Fork	Pluses,Orange(R)-Yellow(L)	415	196	750	24.55	57.35	45.35
805-90205	F	AHY	15 Jul 88	W. Gold Ck.	Pluses,Blue(R)-Yellow(L)	422	200	602	25.35	56.10	45.85
805-90206	F	AHY	15 Jul 88	W. Gold Ck.	Pluses,Black (R) -White (L)	403	197	530	26.75	53.90	44.25
805-90207	F	AHY	19 Jul 88	St. Joe R.	Pluses,Black(R)-Orange(L)	397	194	600	25.80	51.65	46.05
805-90208	?	L	19 Jul 88	St. Joe R.		340	117	395	21.95	49.60	44.10
805-90209	?	L	19 Jul 88	St. Joe R.		333	105	350	21.65	47.45	43.20
805-90210	?	L	19 Jul 88	St. Joe R.		327	95	345	21.25	48.00	40.90

APPENDIX C

Shrubs identified in the 5 x 10 m streambank plots

Genus	Mean % coverage per plot	Range	% of plots present
Salix	59.6	3-93	7
Cornus	37.7	T-93	17
Alnus	24.9	3-80	7
Lonicera	16.3	T-38	4
Rubus parviflorous	15.2	T-53	5
Rosa	10.3	3-20	3
Symphoricarpus	9.7	3-33	6
Amelanchier	T	T-T	2
Acer	3.0		1
Pachystima	8.0		1
Spiraea	3.0		1
Ribes	8.0		1
Rubus idaeus	T		1
Vaccinium	30.0		1
Viburnum	20		1

T= Trace amount

Submitted by:

Craig Groves
Wildlife Staff Biologist

Craig Groves

Approved by:

IDAHO DEPARTMENT OF FISH AND GAME

Jerry M. Conley, Director

Tom Reinecker, Chief
Bureau of Wildlife

Wayne Melquist
State Nongame Manager