

Final Report on 2012 and 2013 ISSSP Harlequin Duck Monitoring in the Oregon Cascades, Willamette and Mt. Hood National Forests and Salem and Eugene Bureau of Land Management Districts

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Abstract: *A small breeding population of harlequin ducks (*Histrionicus histrionicus*) occurs in the Oregon Cascades on the Mt Hood and Willamette National Forests (NFs) and on the Salem and Eugene Districts of the Bureau of Land Management (BLM). Due to concerns that the population had declined since comprehensive surveys in 1993, stream surveys were conducted in 2012 and 2013 using the same methods in many of the same streams and compared to the 1993 counts. Early season (26 April to 29 May) surveys on the Willamette NF found 59% fewer adult harlequin ducks in 2012 compared to 1993. A one-tailed Wilcoxon paired-sample test of counts on 5-km stream segments supported the a priori hypothesis that the duck population has declined overall on the Willamette NF ($P=0.022$, $n=22$). Surveys in 2012 and 2013 detected no harlequin ducks south of the McKenzie River and supported the a priori hypothesis that breeding harlequin ducks no longer occur in the southern part of the Willamette NF. This finding suggests a range contraction of about 40 kms in the past 20 years at the southern edge of a contiguous breeding area. Late season (21 June to 21 July) surveys on the Mt. Hood NF found lower densities of adults on all nine streams surveyed in 2013 compared to 1993 (0.26 vs. 0.14 adults/km stream overall, $P=0.0039$ using a two-tailed binomial sign test). On the northern portion of the Willamette NF and on the Salem BLM District there was no significant change in the harlequin duck breeding counts between 2012 and 1993. A minimum of 32 adults were found on the Willamette National Forest in 2012 based on 176 kms of stream surveyed and incidental observations. A minimum of 19 and 23 adults were found on Salem BLM District in 2012 and 2013, respectively, based on about 58 kms of early season stream surveys each year. On the Mt. Hood NF, 13 adult females and 40 young were counted on 93 kms of streams surveyed during the late season. Early and late season surveys in 2012 and 2013, totaling 106 kms of surveys on 68 kms of streams, detected only one female with 3 young on Eugene BLM in 2013. This detection on the main stem of the McKenzie River at about 44° 06.30' north latitude was the southernmost observation of harlequin ducks during the two years of this study. Reasons for the decline in the breeding population are unknown. The survey data gathered here together with surveys planned for 2014 will provide a baseline for future monitoring of this population.*

Introduction:

Harlequin duck (*Histrionicus histrionicus*) is a Region 6 Forest Service (FS) and Bureau of Land Management (BLM) sensitive species. In Oregon, the duck winters in rocky areas along the Pacific sea coast and breeds in the summer in limited inland areas along streams and rivers in the Cascade Mountains. Marshall et al. (2003) reported an isolated breeding area in the Umpqua River drainage and limited breeding locations in the upper headwaters of the Middle Fork of the Willamette River. A large breeding area along the west side of the Cascades extends north from the Middle Fork Ranger District across the Willamette National Forest to the Mount Hood National Forest and includes parts of Salem BLM. A smaller breeding area exists along the

White River on the east side of the Cascades by Mount Hood (op cit.). Historic surveys and observations have been very limited on Eugene BLM, but include documented occurrences on Bear, Mohawk, Marten, and Winberry Creeks and the McKenzie River (BLM GEOBOB database).

In the early 1990's, harlequin duck was a U. S. Fish and Wildlife Species of Concern for listing and there was much interest in the ecology and abundance of this species. This interest included a FS/BLM Harlequin Duck Working Group in the Pacific Northwest and focused efforts to survey the species on its Oregon breeding grounds and study aspects of its ecology (e.g., Latta 1992, Cassirer et al. 1993, Bruner 1997). In 1993, an extensive survey inventoried populations across the breeding grounds in the Cascades Mountains of Oregon (Thompson et al. 1993). A total of 680 kms of known or suspected breeding streams were surveyed by Thompson et al. who reported that 231 harlequin ducks were observed on 31 streams and rivers. (*Author's Note: A close look at their unpublished report reveals that multiple surveys were done on some reaches and some birds were counted more than once in their totals*).

Since the early 1990's, interest in the conservation of the bird waned, although the species remains a sensitive species for BLM and the Forest Service. On the Willamette National Forest (NF) and elsewhere, extensive surveys were largely discontinued after 1993. Observations of the species after that time consisted of opportunistic sightings and limited project surveys of select stream reaches.

The Willamette NF extends about 170 kilometers (kms) north to south along the westside of the Cascades. On the Middle Fork Ranger District at the southern end of the forest, sightings of harlequin ducks by agency biologists declined from relatively frequent in the early 1990's to zero with no records since 2001. A public request to local birding groups and experts in 2011 produced only two reports of harlequins on the Middle Fork District since 2000 that seemed reliable: two males seen in April 2004 on the Willamette River and two females on Salt Creek in June 2002. Some bird watchers reported an absence of the ducks at locations in Lane and Linn County where they were regularly detected in the 1990's. On the McKenzie River Ranger District (the second most southerly district), the opinion of local biologists was that there has been a great decline in harlequin sightings, although the species was still present. On the northern districts of the Willamette NF harlequin ducks were known to occur, but population trends were uncertain. From this information we developed two hypotheses that guided this study:

- a) Breeding populations of harlequin ducks no longer occur on the Middle Fork Ranger District, and
- b) The overall harlequin duck population has declined on the Willamette NF.

Salem BLM biologists also noted a decline in casual observations of harlequins since 1993, especially along the Lower North Santiam River. On the Mt Hood NF, the species was known to still occur, but trend status was uncertain. On Eugene BLM, there were no recent breeding records of the species.

Waterfowl counts by USFWS focused on winter shoreline counts are not sensitive to potential changes in the local Cascade breeding population. The informal evidence of a sharp decline coupled with lack of survey information in its breeding range creates a dilemma for managers

when trying to determine if viable populations are being maintained. Because climate change may lead to warmer stream temperatures and greater fluctuations in stream flow levels, harlequin ducks at the southern end of their range may be at risk.

In 2012 and 2013, this study was undertaken with FS/BLM Interagency Sensitive and Strategic Species Program (ISSSP) funding to resurvey historic breeding areas across the Cascades to test the management concern that breeding numbers of adults have greatly decline in the past 2 decades on the Willamette NF and perhaps elsewhere, provide evidence as to whether or not breeding harlequins persist on the Middle Fork Ranger District and Eugene BLM, and to establish a new baseline of harlequin ducks counts for future monitoring on the Willamette and Mt Hood NFs and the Salem and Eugene BLM Districts.

Methods:

In 2012 and 2013, we surveyed historic breeding sites on the four administrative areas. Because funding was limited, on the Willamette and Mount Hood NFs and on Salem BLM, we focused our surveys on areas of high-quality habitat, following the principle that population decreases are most efficiently monitored by sampling high-quality areas (Rhodes et al. 2006). High-quality habitat was assumed here as stream reaches where birds were documented during the breeding season in the 1993 surveys (Thompson et al. 1993). Also surveys were established in the South Santiam River drainage of the Sweet Home Ranger District of the Willamette NF because that area was known to have harlequin ducks and had not been surveyed by Thompson et al. in 1993 due to lack of time. On Eugene BLM, where habitat was more limited and past surveys were lacking, we surveyed stream reaches that either had observations of harlequin ducks in the 1990's or were thought to be likely breeding habitat. In addition, the main stem of the McKenzie River was surveyed in 2013 where it flows adjacent or near to Eugene BLM lands.

There are two time periods that are normal for conducting stream surveys for harlequin ducks in Oregon: an early season period prior to nesting when adults are actively courting (about 26 April–29 May) and a late season period after nesting when females rear their broods on the streams (about 21 June –21 July 2012). Surveys were conducted by one or more observer walking upstream either by wading in the stream or walking along the bank depending on water conditions. A harlequin duck observation form was filled out following the 1993 methodology with the addition of GPS coordinate information to more accurately document survey areas and observation sites for future monitoring. The number of harlequin ducks seen and their location was recorded, trying to avoid double-counting any ducks that may have been resighted after flushing ahead of the observers. In 2013, we also surveyed the main stem of the McKenzie River by floating downstream in the raft with 2 observers and an oarsman. The survey information, plus any observations received from other observers that were thought reliable, was entered into the NRIS (Forest Service) or GEOBOB (BLM) databases.

Because of funding restraints we could often only do a single survey each year on a given stream. On Salem BLM, surveys were done during the early season because that matched the season when most surveys were done by Thompson et al. in 1993 in that area. Conversely, on Mt Hood NF, surveys were done during the late season because that matched the season when most surveys were done there in 1993. On the Willamette NF, in 2012 surveys were done during the early season to be comparable to 1993. In 2013, we conducted both early and late season surveys, but restricted our effort to the southern portion of the Forest to provide additional data

to support the hypothesis that the species no longer occurred in that area. Stream reaches on Eugene BLM were surveyed in both early and late season, except a single late season survey was conducted in 2013 on the main stem of the McKenzie River.

For the Willamette NF, because the survey reaches in 1993 and 2012 matched, I divided stream reaches into approximately 5-km segments and compared early season counts in each 5-km reach using a one-tailed Wilcoxon paired-sample test (Zar 1999) to test the *a priori* hypothesis that the duck population had declined. For one stream that was surveyed twice in 1993 during the early season with different count results, I selected one survey result at random to use for 1993 in the comparisons.

For Mt Hood NF, where the starting and ending points of the surveys were somewhat different between 1993 and 2013 due to logistical and other considerations (e.g., roads had been removed that prevented stream access in 2013) and there was no *a priori* assumption of population changes, the counts between years were compared based on the density of birds on each stream reach using a two-tailed binomial sign test (Zar 1993).

Counts from Salem BLM were compared visually without statistical testing because the number of streams sampled was small and results between periods among streams were highly variable. Thus it was apparent that analysis would not reveal significant differences in population changes between 1993 and the present for that area, given the available data.

Results:

a. Willamette National Forest

In 2012 we conducted early season harlequin duck surveys on all stream segments across the Forest where ducks were detected in the intensive 1993 survey effort. Additional likely areas were also sampled on the South Santiam River which had not been included in 1993 surveys. Three incidental observations of harlequin ducks were made by the biologists on the Detroit Ranger District and one incident observation was made by a HJ Andrews researcher on the McKenzie River Ranger District. A total of 176 kms of streams were surveyed forest-wide in 2012 and a minimum of 32 adults were observed (Tables 1 and 2).

A one-tailed Wilcoxon paired-sample test between 5-km stream reaches found evidence of a decline in harlequin ducks from 1993 to 2012 ($P=0.022$). Overall numbers of ducks seen during the early season were 59% lower in 2012 compared to 1993. A closer look at the data (Table 1) shows no decline between those years in the northern Willamette National Forest, while no ducks were found during 2012 surveys of 9 streams in the southern part of the Forest. A single credible report in the southern half of the Willamette NF in 2012 was a pair of harlequin ducks seen by HJ Andrews Researchers on Lookout Creek near Blue River Reservoir on the McKenzie River Ranger District.

In 2011 and 2012, the Willamette NF made a big effort to update historic and recent sightings of harlequin ducks into the NRIS Wildlife database. Figures 1 and 2 show reported observations for the periods 1990-1999 and 2000-2011. Figure 3 shows the reported observations for 2012.

Table 1. Comparison of Single Early Season Harlequin Duck Surveys on Willamette National Forest, 1993 and 2012, by Stream Reach.

Stream Reach	Kms Surveyed	Harlequin Ducks Seen	
		1993	2012
Detroit Ranger District			
Breitenbush River	17.7	4	0
Blowout Creek/Cliff Creek	6.3	2	0
Marion Creek	3.9	0*	4
North Santiam	17.4	2	7
Sweet Home Ranger District			
Quartzville Creek	5.8	2	5
McKenzie River Ranger District			
Lookout Creek	4.2	1	0
Smith Creek	3.5	1	0
McKenzie River (upper trail)	8.4	0*	0
Horse Creek	11.6	3	0
South Fork McKenzie below Cougar Res.	6.6	2	0
South Fork McKenzie above Cougar Res.	25	10	0
Middle Fork Ranger District			
Salmon Creek	4.8	2	0
Little Fall Creek	6	2	0
Fall Creek	22	5	0
Portland Creek	6.1	3	0
TOTAL	149.3	39	16
*Although no ducks were detected in 1993 during that particular survey, harlequin ducks were seen at other times on the stream reach that year (Thompson et al. 1993).			

In 2013 surveys included concentrated effort in the southern half of the Forest, plus stream surveys on the Sweet Home District that were mostly done in conjunction with fish surveys (Table 3).

Fifty-seven kms of surveys (counting repeat surveys) were done on four streams reaches totaling 34 kms in length on the Middle Fork Ranger District in 2013 and no harlequin ducks were observed. No credible reports of the species on the Middle Fork District were received from other observers. The Forest Service has no reliable reports of the breeding harlequin ducks on the Middle Fork District since 2004.

Table 2. Additional Harlequin Duck Surveys and Incidental Observations on the Willamette National Forest in 2012 by Stream Reach.

District/Stream Reach	Kms Surveyed	Survey Type*	Harlequin Ducks Seen	Comments
Detroit Ranger District				
Devils Creek	0	IO	2	adult pair
French Creek	0	IO	2	adult pair
Breitenbush River	0	IO	6	female w/ 5 young
Sweet Home Ranger District				
South Santiam	11.3	Early Season	2	adult pair
	11.3	Late Season	6	female w/ 5 young
South Santiam-House Rock Falls	0.6	Early Season	0	
	0.6	Late Season	0	
Soda Fork	3.7	Pre-Season	2	adult pair
	3.7	Early Season	0	
	3.7	Early Season	2	2 males
	3.7	Nesting	0	
	3.7	Late Season	5	female w/ 4 young
Owl Creek	2.2	Pre-Season	0	
	2.2	Pre-Season	0	
	2.2	Early Season	0	
	2.2	Early Season	0	
Moose Creek	5.9	Pre-Season	0	
	5.9	Pre-Season	2	adult pair
	5.9	Early Season	0	
	5.9	Early Season	2	adult pair
	5.9	Nesting	0	
Canyon Creek	3.2	Pre-Season	0	
	3.2	Pre-Season	0	
	3.2	Early Season	0	
	3.2	Early Season	3	2 males, 1 female
McKenzie River Ranger District				
Lookout Creek	0	IO	2	adult pair
*IO=Incidental Observation; Pre-Season = 27 March-25 April; Nesting=30 May-20 June. Most of the repeat surveys in the Sweet Home District were done while conducting stream surveys for fish.				

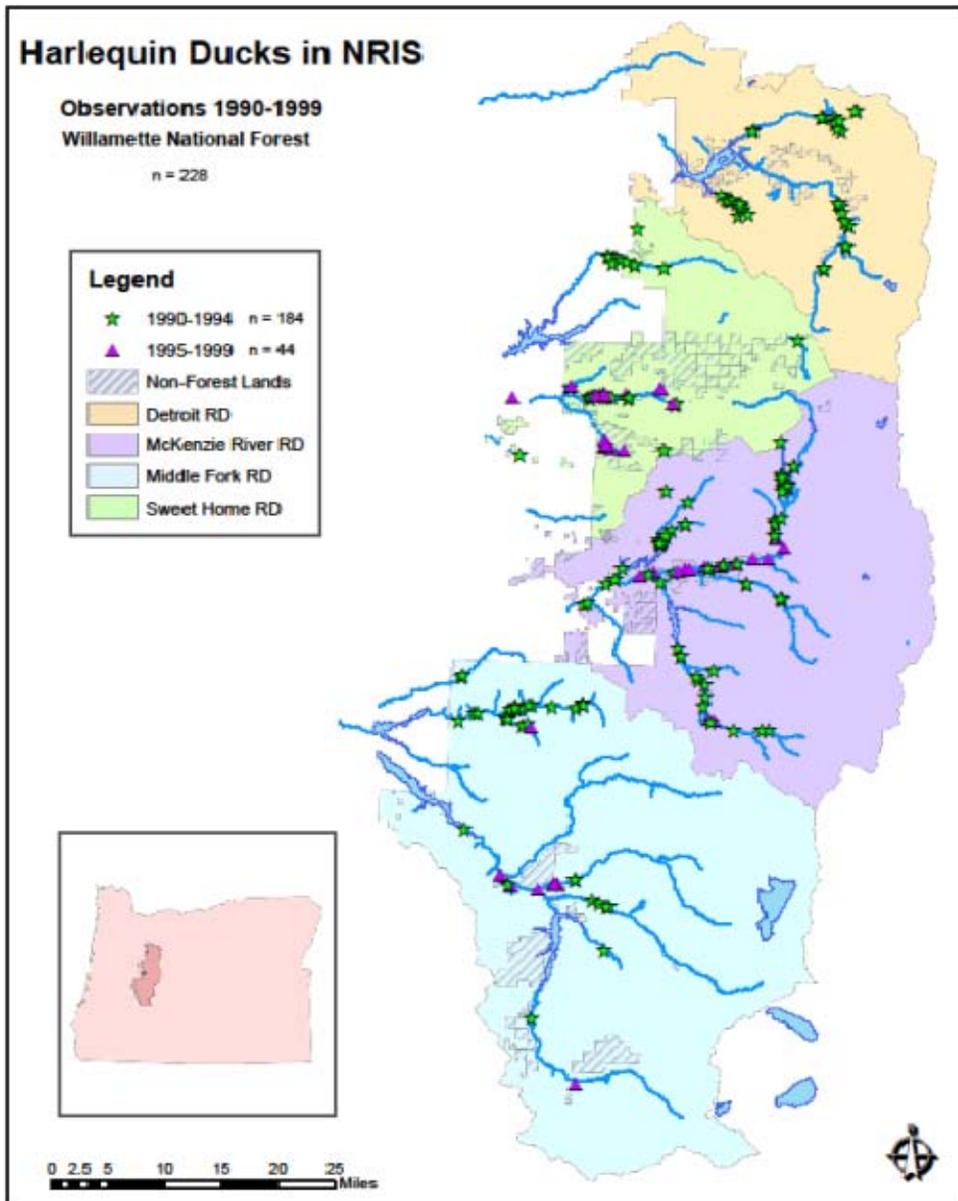


Figure 1. Harlequin Duck Observations on the Willamette National Forest, 1990-1999.

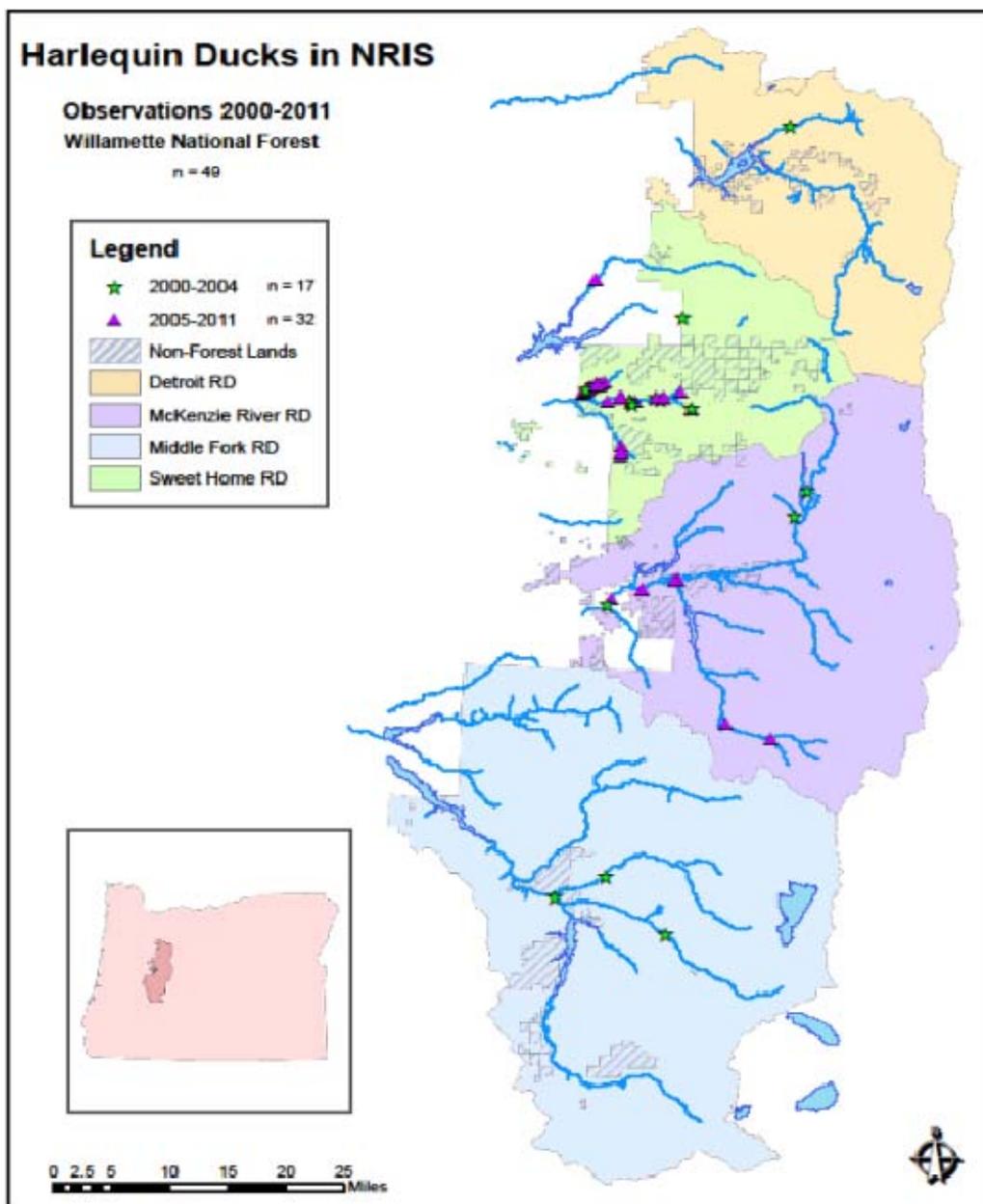


Figure 2. Harlequin Duck Observations on the Willamette National Forest, 2000-2011.

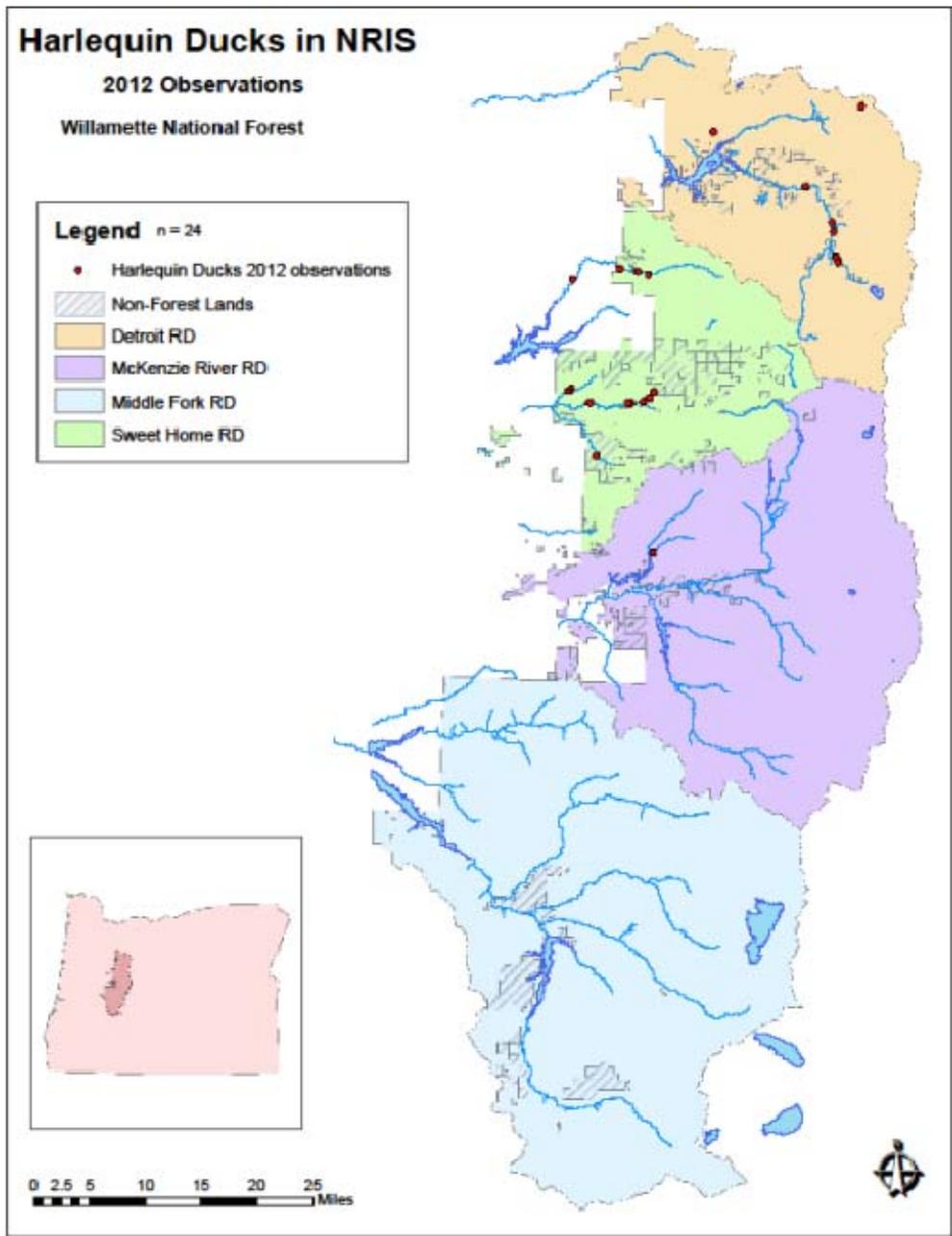


Figure 3. Harlequin Duck Observations on the Willamette National Forest, 2012.

Table 3. Harlequin Duck Surveys on the Willamette National Forest in 2013 by Stream Reach.

District/Stream Reach	Kms Surveyed	Survey Type	Harlequin Ducks Seen	Comments
Sweet Home Ranger District				
Quartzville Creek	6.4	Early Season	5	1 pair, 2 males, 1 single female
Owl Creek	2.2	Early Season	0	
	2.2	Early Season	0	
	2.2	Late Season	0	
Moose Creek	5.9	Pre-Season*	0	
	5.9	Early Season	0	
	5.9	Late Season	0	
Canyon Creek	3.2	Early Season	0	
	3.2	Early Season	0	
	3.2	Late Season	0	
McKenzie River Ranger District				
Lookout Creek	5.9	Early Season	2	2 males
Smith River	3.0	Early Season	0	
	3.0	Late Season	0	
McKenzie River (upper trail)	4.6	Early Season	0	
Horse Creek	14	Early Season	0	
	13	Late Season	0	
South Fork McKenzie below Cougar Res.	10	Early Season	0	
	10	Late Season	0	
South Fork McKenzie above Cougar Res.	26	Early Season	0	
	17.6	Late Season	0	
Main Stem McKenzie River (float trip)	32	Early Season	2	adult pair
	32	Early Season	0	
	32	Late Season	0	
Middle Fork Ranger District				
Salmon Creek	5.5	Late Season	0	
Little Fall Creek	5.6	Early Season	0	
Fall Creek	17.1	Early Season	0	
	17.1	Late Season	0	
Portland Creek	5.8	Early Season	0	
	5.8	Late Season	0	

* Pre-Season = 19 April. The repeat surveys in the Sweet Home District were done while conducting stream surveys for fish. The surveys on the main stem McKenzie River were done in conjunction with recreation Forest Plan monitoring.

In 2013, on the McKenzie River District, 203 kms of surveys (counting repeat surveys) were done on 7 stream reaches totaling 95.5 kms in length and 4 harlequin ducks were observed. The Lookout Creek Survey was extended 1.2 kms and 2 adult males were counted during the early season survey. Float trips down a 32-km segment of the main stem of the McKenzie River were added and one adult pair was observed during one survey in the early breeding season (Table 3). No harlequin ducks were detected during surveys of other historic reaches on that district in 2013.

Five harlequin ducks were detected on the Quartzville Creek segment of the Sweet Home District in 2013, same as in 2012. On three other streams on that District, no harlequins were observed even though three surveys were done on each stream and harlequins had been detected on two of the reaches in 2012.

b. Eugene Bureau of Land Management District

Four stream reaches on Eugene BLM totaling 20.4 kms in length were surveyed two to four times during 2012 and 2013 for a total of 58.3 kms of surveys (Table 4). No harlequin ducks were detected during these surveys. In 2013, forty eight kms of the main stem McKenzie River from Willamette NF downstream to Hendricks Bridge were floated during the late survey season. One adult female with three young was observed on a boulder in the river in the general vicinity of the mouth of Deer Creek. A substantial tract of BLM lands occurs along the south side of the river in this area with scattered parcels of private lands interspersed with BLM on the north side. Bruner (1997) found that nesting harlequin ducks in the Oregon Cascades only traveled an average of about 2 kms after nesting so it is very possible that this brood was reared on Eugene BLM lands. Nearby Deer Creek was considered the best potential rearing habitat for harlequin ducks of the streams surveyed on Eugene BLM (Chad Marks-Fife, personal communication). There is also a possibility that the brood came from farther upstream, including possibly the Willamette NF, since some broods are known to move downstream after the first few weeks post-hatching (Wallen 1987, Cassirer and Groves 1989). Occurring at about 44° 06.30' north latitude, the sighting was the southernmost observation of harlequin ducks during the two years of this study. Previous harlequin duck detections on the Eugene BLM are sparse and incidental. The BLM GeoBOB database shows adult detections on Bear Creek, Marten Creek, Mohawk River, McKenzie River and Winberry Creek at various years from 1989-2010, including a pair detected on Marten Creek during an early season survey in 1997. Surveys in the 1990's were too limited to test for population changes between then and the present (Table 5).

Table 4. Harlequin Duck Surveys on Eugene Bureau of Land Management in 1993, 1997, 2012 and 2013 by Stream Reach and Season.

Stream Reach	Survey Type*	Kms Surveyed			
		1993	1997	2012	2013
Bear Creek	Early Season	1.6	1.6	5.4	1.6
Gale Creek	Early Season	No survey	2.5**	4.6	2.4
	Late Season	No survey	No survey	2.4	2.4
Deer Creek	Early Season	No survey	No survey	3.5	3.5
	Late Season	No survey	No survey	3.5	3.5
Marten Creek	Early Season	4.5	4.5	6.9	6.9
	Late Season	No survey	No survey	4.8	6.9
Main Stem McKenzie River (float trip)	Late Season	No survey	No survey	No survey	48***

* Survey type not reported for 1993 and 1997 records but probably all were early season, including May 1997 pair detected on Marten Creek.
 ** Estimate based on incomplete records
 ***An adult female with 3 young were seen near the mouth of Deer Creek during the float trip. No other harlequin ducks were observed in the other stream surveys during the 2012 and 2013 surveys.

Table 5. Comparison of Early Season Surveys (and Incidental Detections) on Eugene BLM by Stream Reach.

Stream Reach	Harlequin Ducks Seen			
	1993	1997	2012	2013
Bear Creek	2 (pair)**	0	0	0
Deer Creek	NS	NS	0	0
Gale Creek	NS	0	0	0
Marten Creek	0	2 (pair)	0	0

**Incidental sighting March 27, 1993. No ducks seen in May 1993 survey of stream.

c. Salem Bureau of Land Management District

About 58 kms of streams were surveyed during the early season in both 2012 and 2013 (Table 6). Nineteen and 23 adults were counted during those respective years. By contrast, about 34 harlequin ducks were counted by Thompson et al. (1993) on those respective streams in 1993. (The 1993 count cited above was derived using Appendix 2 of the 1993 report to separate out any repeat counts of the same reach.)

The ISSSP surveys found 10 and 11 harlequin ducks on the BLM portion of Quartzville Creek compared to only 4 adults counted in 1993. In addition 4 and 2 adults were found in the Canal Creek tributary in 2012 and 2013, respectively. This tributary was not surveyed in 1993.

Other areas surveyed showed lower counts in recent years compared to 1993. The number of harlequins detected in the Table Rock Fork of the Molalla River was 4 in 2012, 6 in 2013, and 8 in 1993. No harlequins were seen in 2012 in the North Santiam River, 4 were counted in 2013, and 9 were found in 1993. Only one harlequin duck was found on the mainstem Molalla River in 2012 and 2013 combined, while 13 were seen in 1993. Figures 4–6 show locations of harlequin ducks on Salem BLM for the periods 1990-1999, 2000-2011, and 2012-2013, respectively.

Because of variability in the individual streams and questions with the reporting of the 1993 Salem BLM data in the Thompson et al. report, there is no clear evidence of a recent decline in harlequin ducks for that District. The low recent counts on the Molalla and North Santiam Rivers warrant further monitoring however (see Discussion Section below).

Cascade Resource Area	Kms Surveyed	Harlequin Ducks Seen		
		1993	2012	2013
Quartzville Creek	10.8	4	10	11
Canal Creek (trib of Quartzville Cr.)	1.8	NS	4	2
Table Rock Fork-Molalla River	13.8	8	4	6
Mainstream Molalla River (Not including Table Rock Fork)	18.3*	13	1	0
North Santiam River	13	9	0	4**
TOTAL	57.7	34	19	23

*In 1993, only 10.3 kms of the river were surveyed during the early season.
 **In 2013 only portions of the North Santiam River that could be seen from the road were surveyed.
 NS = No survey that year.
Note: There are also two detection records for the Salmon River during the period 2000-2011(Figure 5). This stream reach was not surveyed in this study.

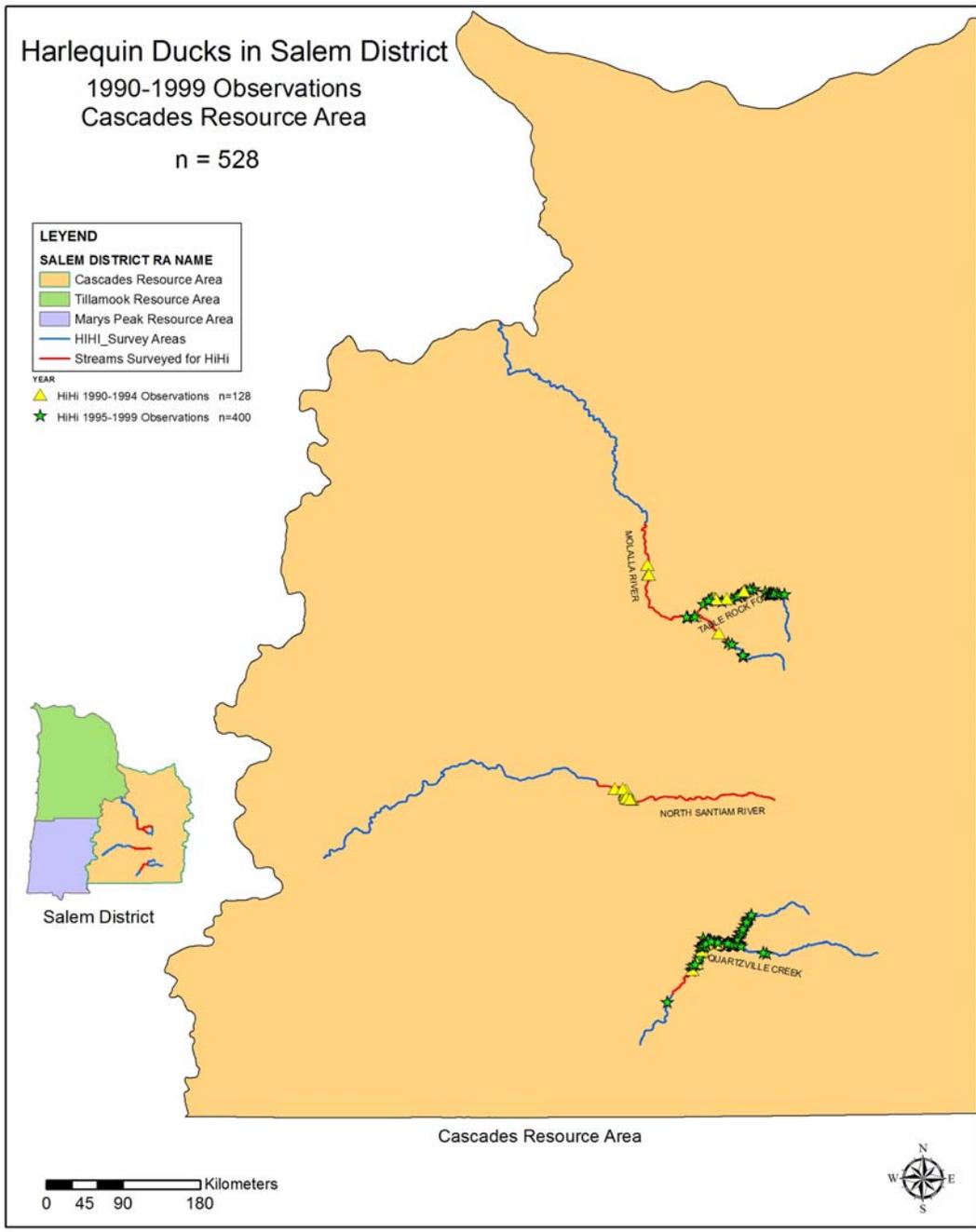


Figure 4. Harlequin Duck Observations on the Cascade Resource Area of Salem BLM, 1990-1999.

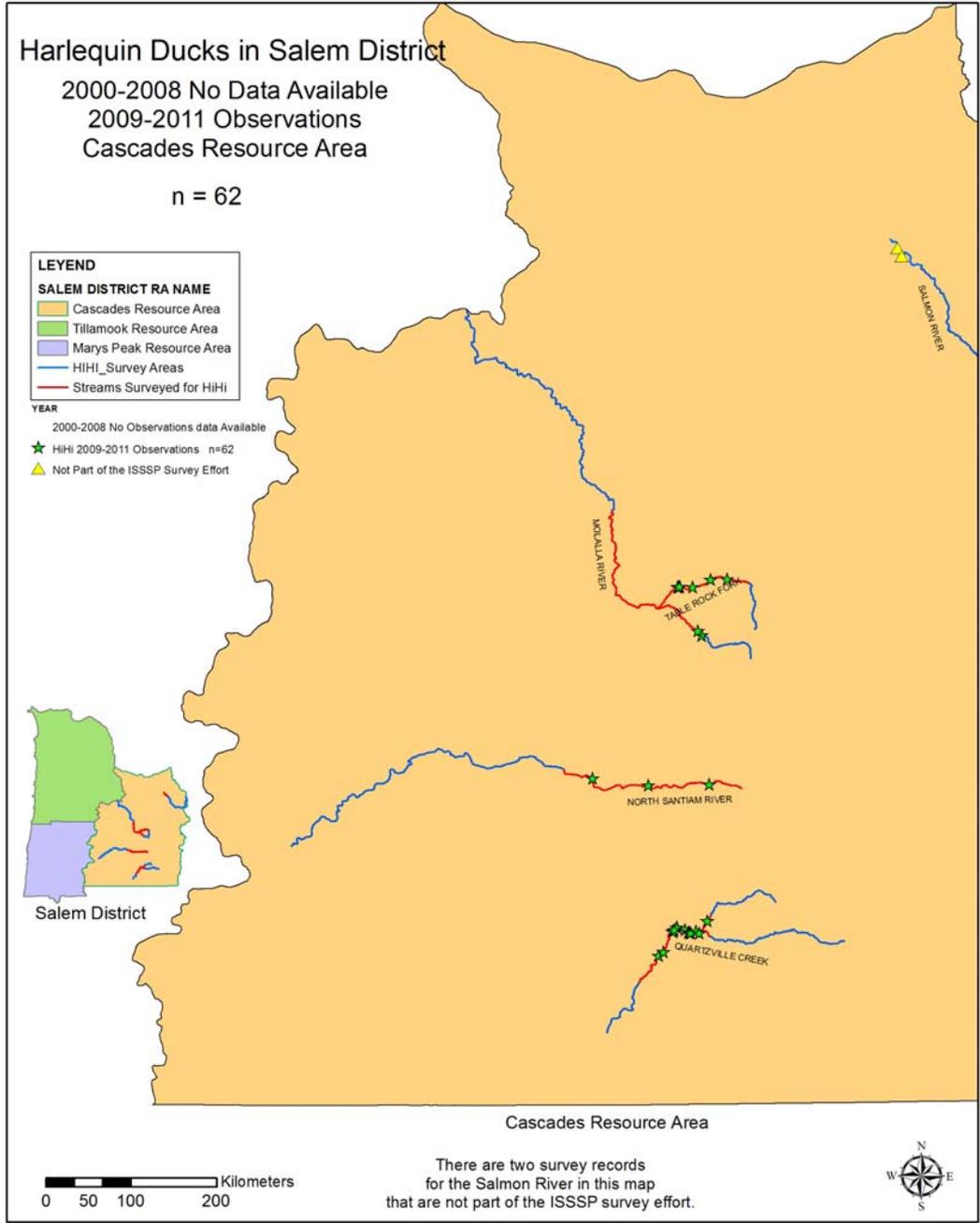


Figure 5. Harlequin Duck Observations on the Cascade Resource Area of Salem BLM, 2000-2011.

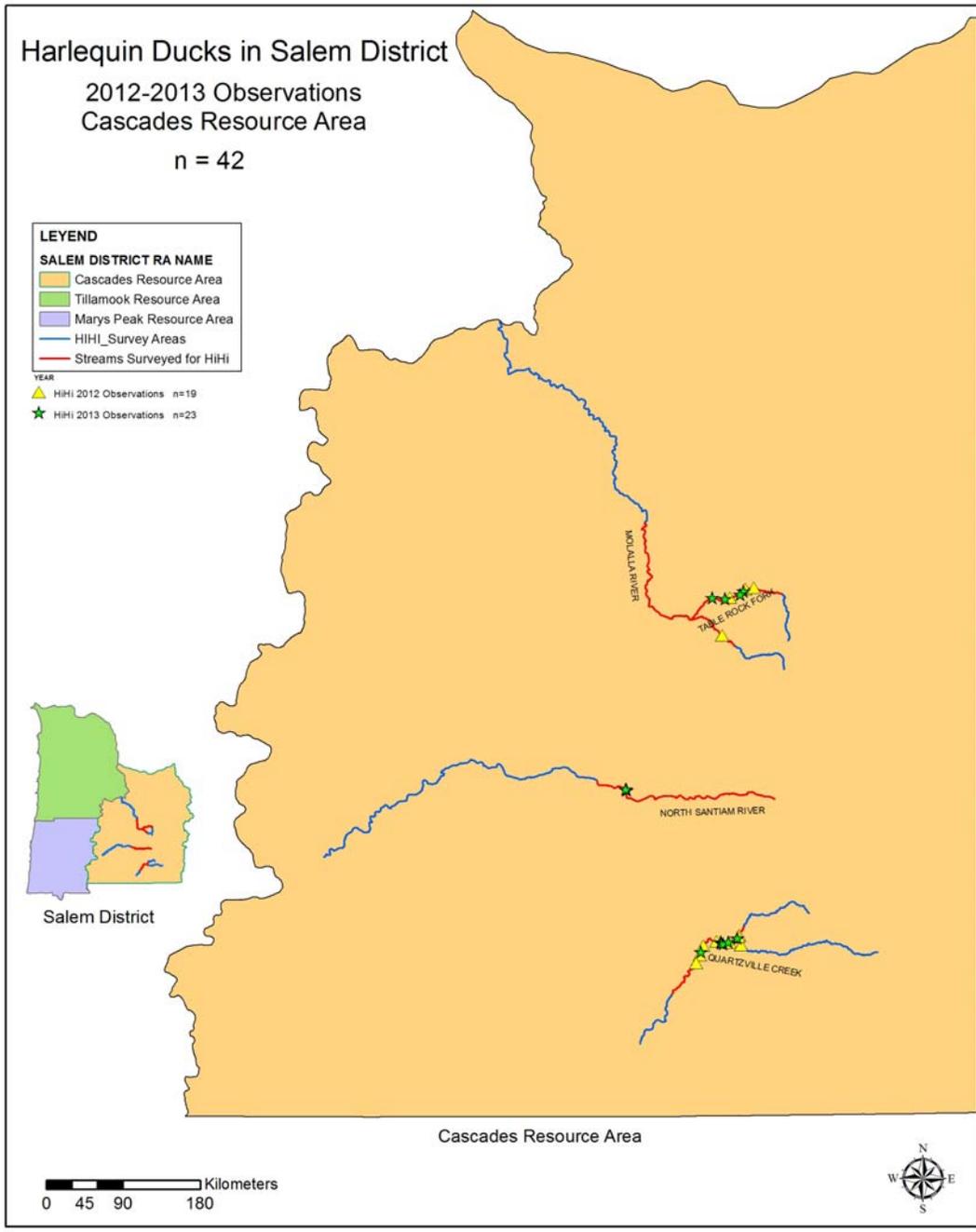


Figure 6. Harlequin Duck Observations on the Cascade Resource Area of Salem BLM, 2012-2013.

d. Mt. Hood National Forest

In 2012, short segments of streams totaling about 8 kms were surveyed and a number of “spot checks” (<0.3 km surveyed per site) were done during the late season at places where ducks had historically been found. A single adult female and a female with 3 young were observed on Sandy River and a female and subadult were observed on Still Creek in 2012.

In 2013, late season surveys were conducted on streams that were surveyed in 1993 (Table 7). Ninety three kms of streams were surveyed in 2013 compared to 121 kms in 1993 and total (juveniles and adults combined) overall densities of ducks found were comparable (0.57/km in 2013 vs. 0.62/km in 1993, respectively). Seven of the nine streams had higher densities in 1993, but this was not significant (P=0.18). However, the density of adults observed was almost twice as high in 1993 compared to 2013 (0.26/km vs. 0.14/km, respectively). All nine streams had higher densities of adults in 1993 and this difference is significant (P=0.0039).

Area/Stream Reach	1993			2013		
Mt Hood NF	Kms Surveyed	No. Seen*	Density	Kms Surveyed	No. Seen*	Density
Zigzag RD						
Sandy River	14.5	8 (2)	0.55	20.3	6 (1)	0.30
Zigzag River	8.4	3 (2)	0.36	9	7 (7)	0.78
Lost Creek	7.1	2 (1)	0.28	4.8	0	0.00
Hood River RD						
Lake Branch-Hood River	10.9	2	0.18	8	0	0.00
West Fork-Hood River	9.3	22 (16)	2.37	8.3	24 (20)	2.89
East Fork-Hood River	20.9	23 (16)	1.10	16.5	16 (12)	0.97
White River	22.5	9 (6)	0.40	9.8	0	0.00
Clackamas River RD						
Fish Creek-Clackamas River	10	2	0.20	2.4	0	0.00
Collowash River	17.4	4 (1)	0.23	14.1	0	0.00
TOTAL	121	75 (44)	0.62	93	53 (40)	0.57

* In parenthesis are the numbers of juvenile birds.

Discussion:

The findings of this study supported the *a priori* hypotheses that the harlequin duck breeding population has declined in the last two decades on the Willamette National Forest and that breeding populations no longer occur on the Middle Fork Ranger District. Surveys on Eugene BLM found low numbers in that area, although there is not past quantitative data to test for population changes. We were not able to document breeding harlequin ducks south of the

McKenzie River, which suggests a range contraction of about 40 kms in the past 20 years. Table 7 shows the last agency records for adults and broods on streams in the two southern districts of the Willamette National Forest and on the Eugene BLM District. While the data are incomplete since streams were not regularly surveyed, they are included here for potential historical purposes should the decline become permanent.

This study confirmed that breeding harlequin ducks still occur farther north in the Oregon Cascades. On the Sweet Home and Detroit Ranger Districts of the Willamette NF and in the Quartzville watershed of the Salem BLM District, numbers of ducks found in this study were comparable to 1993. Elsewhere there was evidence of a decline that warrants further monitoring. Lower numbers of harlequin ducks were found on the North Santiam and Molalla Rivers of Salem BLM in 2012 and 2013 compared to 1993. Late season densities of adult harlequin ducks on the Mt. Hood in 2013 were less than half that observed in 1993.

It is unfortunate that no regular monitoring of the Oregon Cascade breeding population occurred during the last 20 years. ISSSP has funded additional stream surveys on the Mt. Hood NF and on the Sweet Home and Detroit Ranger Districts of the Willamette NF in 2014. These surveys, together with surveys done in 2012 and 2013, will provide a baseline for this period. A monitoring proposal to track the Oregon Cascade population will be finalized at the end of 2014.

We have no explanation for the apparent decline in the population. It is tempting to speculate on climate warming since harlequins are a “north-latitude” species and the Willamette NF is the southernmost extent of a contiguous breeding area for this species in the Pacific States. (Breeding areas that occur farther south in Oregon and California are small and isolated and some may not be used consistently.) We are aware of no data showing stream temperature or invertebrate changes in the streams used by harlequin ducks during the past 20 years on the Willamette NF. The effective breeding population of harlequin ducks on each stream system is (or was) very small so it seems plausible that any number of factors could cause the species to temporarily “blink out” on any reach. Our finding of an apparent pattern with local extinction at the southernmost part of the range clearly warrants future monitoring to determine if it is temporary or permanent and if it is expanding northward.

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Table 8. Year of last observation for harlequin ducks and broods by stream reach for the Middle Fork and McKenzie River Ranger Districts, Willamette National Forest and on Eugene BLM District.

District/Stream	Ducks Observed	Broods Observed
McKenzie River Ranger District		
Lookout Creek*	2013	1992
Blue River above Reservoir	1994***	NR
McKenzie River below Ollalie Campground	2013	2013
Trail Bridge Reservoir area**	2004	1993
McKenzie River above Trail Bridge Reservoir area	1997	1993
Smith River	1993	NR
Deer Creek	2002***	NR
Horse Creek	1994	NR
South Fork below Cougar Reservoir	1993	NR
South Fork above Cougar Reservoir	2008	2008
French Creek	1993	NR
Middle Fork Ranger District		
Middle Fork Willamette River above Hills Creek Reservoir	1999	NR
Middle Fork Willamette River between Lookout and Hills Creek Reservoirs	2004	NR
Hills Creek	1992	NR
Salt Creek	2000	1992
Salmon Creek	2001	NR
Lower 3 km of North Fork of Willamette River	1985	1985
South Fork Winberry Creek	1980***	1980
Fall Creek	1994	1993
Portland Creek	1995	NR
Little Fall Creek	1993	NR
Eugene BLM District		
Bear Creek	1993***	NR
Marten Creek	1997***	NR
McKenzie River	2013	2013
Mohawk River	1994***	NR
Winberry Creek	1989***	NR
<p>USFS data source is NRIS Wildlife. BLM data source is GeoBOB. *Includes Blue River Reservoir at the mouth of Lookout Creek. ** Includes portions of McKenzie River that can be seen from road crossing and dam. ***Stream reaches with a single observation. NR = No brood observations.</p>		

Literature Cited:

- Bruner, H. J. 1997. Habitat use and productivity of harlequin ducks in the Central Cascade Range of Oregon. M. S. Thesis, Oregon State University, Corvallis.
- Cassier, E. F., and C. R. Groves. 1989. Breeding ecology of harlequin ducks (*Histrionicus histrionicus*) of the Kaniksu National Forest, Idaho. Idaho Dept. Fish and Game Report, Boise.
- Cassier, E. F, et al. 1993. Status of harlequin ducks (*Histrionicus histrionicus*) in North America. Unpublished multi-agency report to the Harlequin Duck Working Group. 83 pp. Copy available upon request at Willamette National Forest, Springfield, Oregon.
- Latta, S. 1992. Distribution and status of the harlequin duck (*Histrionicus histrionicus*) in Oregon. Unpublished report. Willamette National Forest, Springfield, Oregon. N.p.
- Marshall, D., B., M. G. Hunter, and A. L. Contreras. 2003. Birds of Oregon: A general reference. Oregon State University Press, Corvallis. 752 pp.
- Thompson, J., R. Goggans, and P. Greenlee. 1993. Abundance, distribution and habitat associations of the harlequin duck (*Histrionicus histrionicus*) in the Cascade Mountains, Oregon, 1993. Unpublished cooperative agreement report. Willamette National Forest, Springfield, Oregon. N.p.
- Wallen, R. L. 1987. Habitat utilization by harlequin duck's in Grand Teton National Park. M. S. Thesis, Montana State University, Bozeman.
- Zar, J. H. Biostatistical analysis (4th ed.). Prentice Hall. Upper Saddle River, NJ.