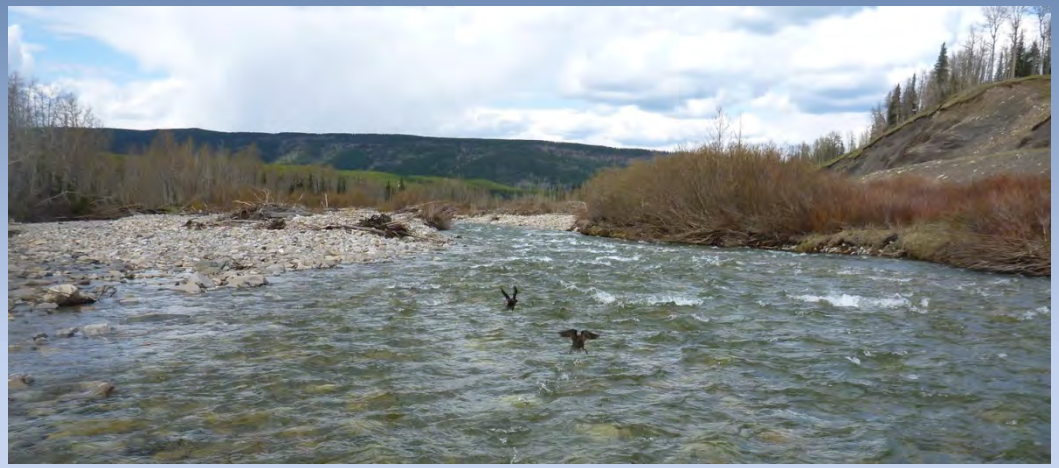
Cheviot Harlequin Duck Program

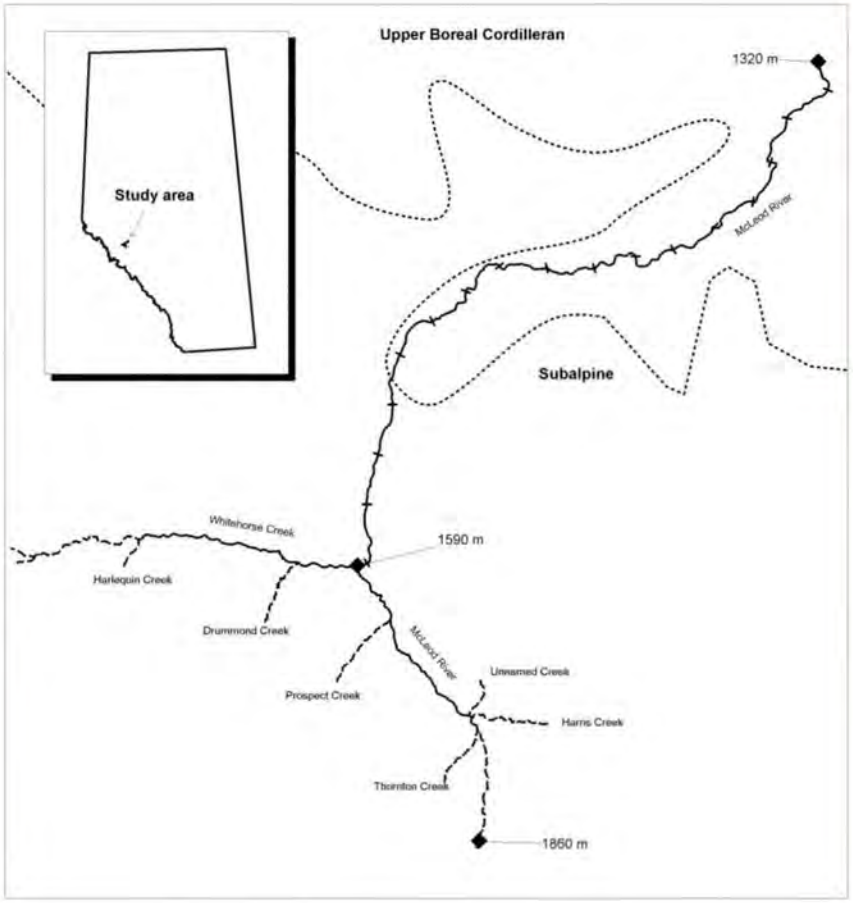


fRI Harlequin Duck Workshop

June 25, 2014

Beth MacCallum

Tour Map of the Rocky Mountains Branch of the Canadian Institute of Mining. 1998


Upper Boreal Cordilleran
Study area
1320 m
McLeod River
Subalpine
Whitehorse Creek
1590 m
Harlequin Creek
Drummond Creek
McLeod River
Unnamed Creek
Prospect Creek
Harris Creek
Thornton Creek
1860 m

1. Conduct Detailed Study 1996-1999 – multiple instream surveys

1. Conduct Detailed Study 1996-1999 - Population estimate CMR
   - Brood surveys
   - Annual Survival

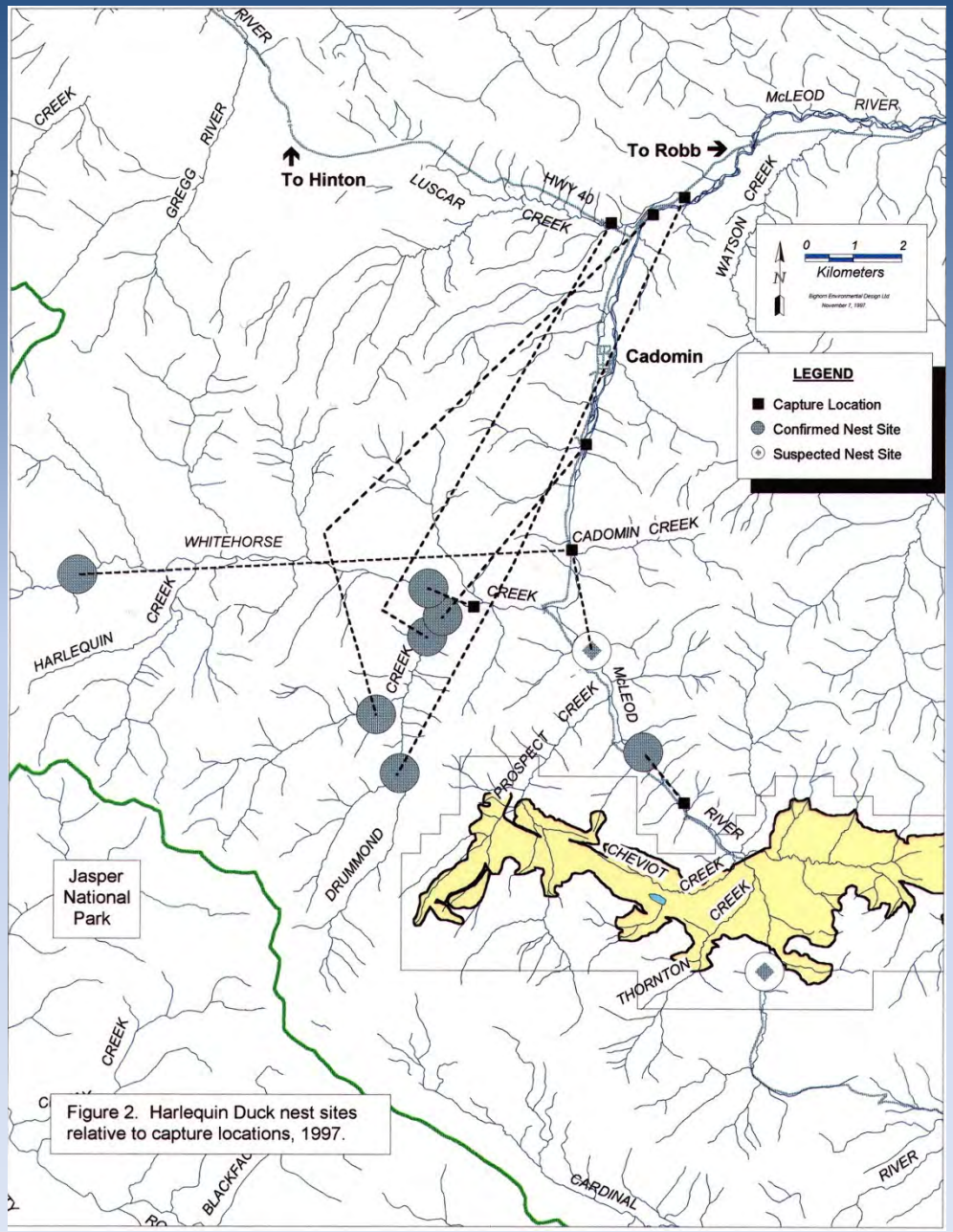


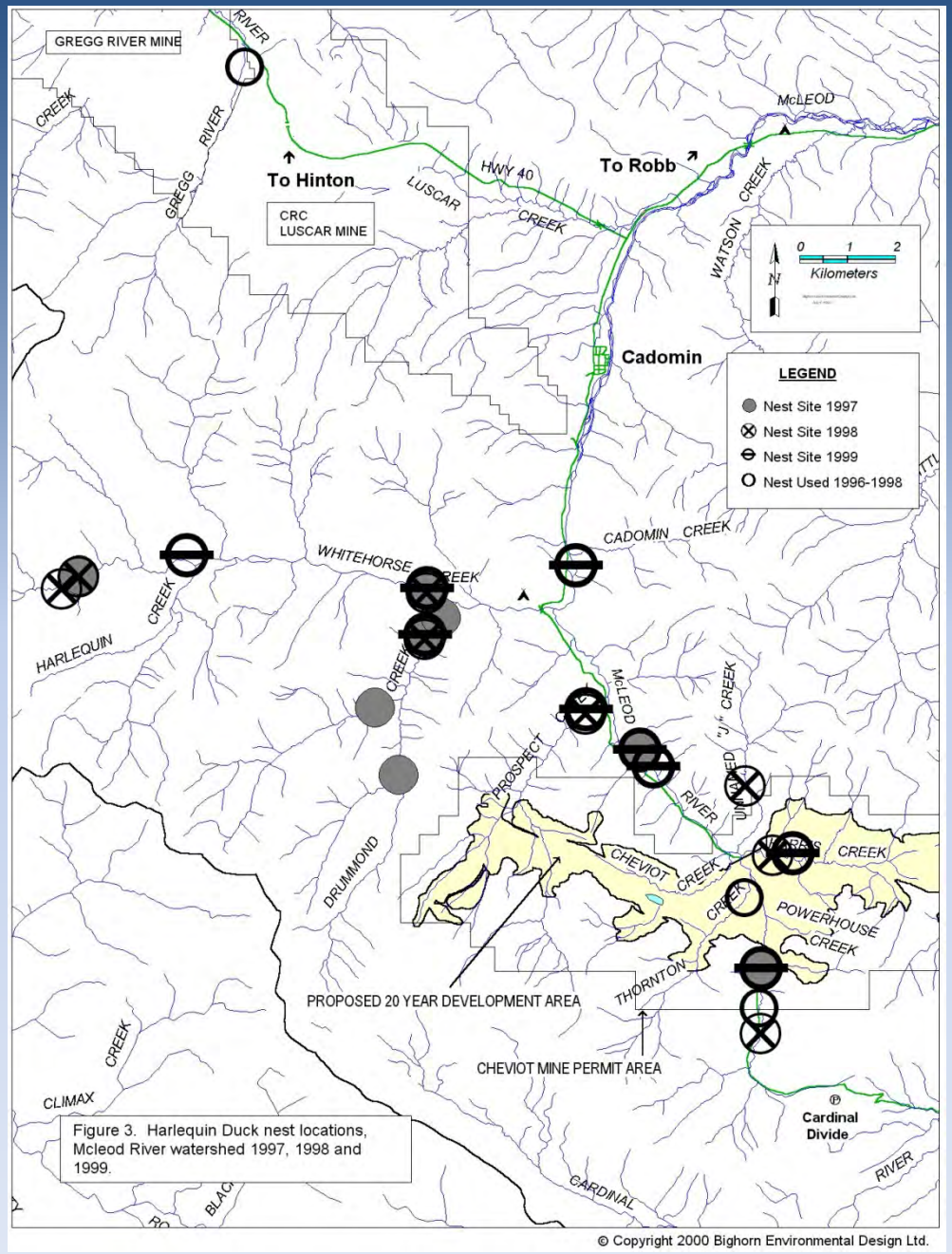
Figure 2. Harlequin Duck nest sites relative to capture locations, 1997.

Radio-tagged females

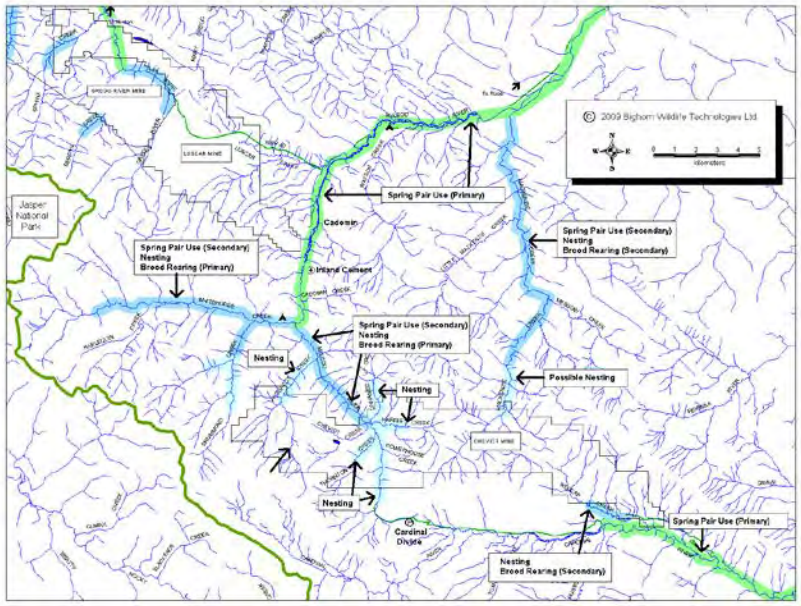
13 in 1997

13 in 1998

15 in 1999



Nest locations 1997-1999



- Chronology of harlequin activity
- Annual life cycle in McLeod River system
- Seasonal concentration areas
- Distribution of harlequins during the breeding season in the McLeod River system

2) Reduce Impacts During Construction Phase

No channel diversions (690 m) in McLeod River reduced construction impact

No rail bridge over McLeod at canyon reduced construction and habitat impact

Direct observation of harlequin response to Whitehorse Creek construction indicated no obstruction of movement up/down Whitehorse Creek and similar patterns of use as observed during surveys from 1996-2003

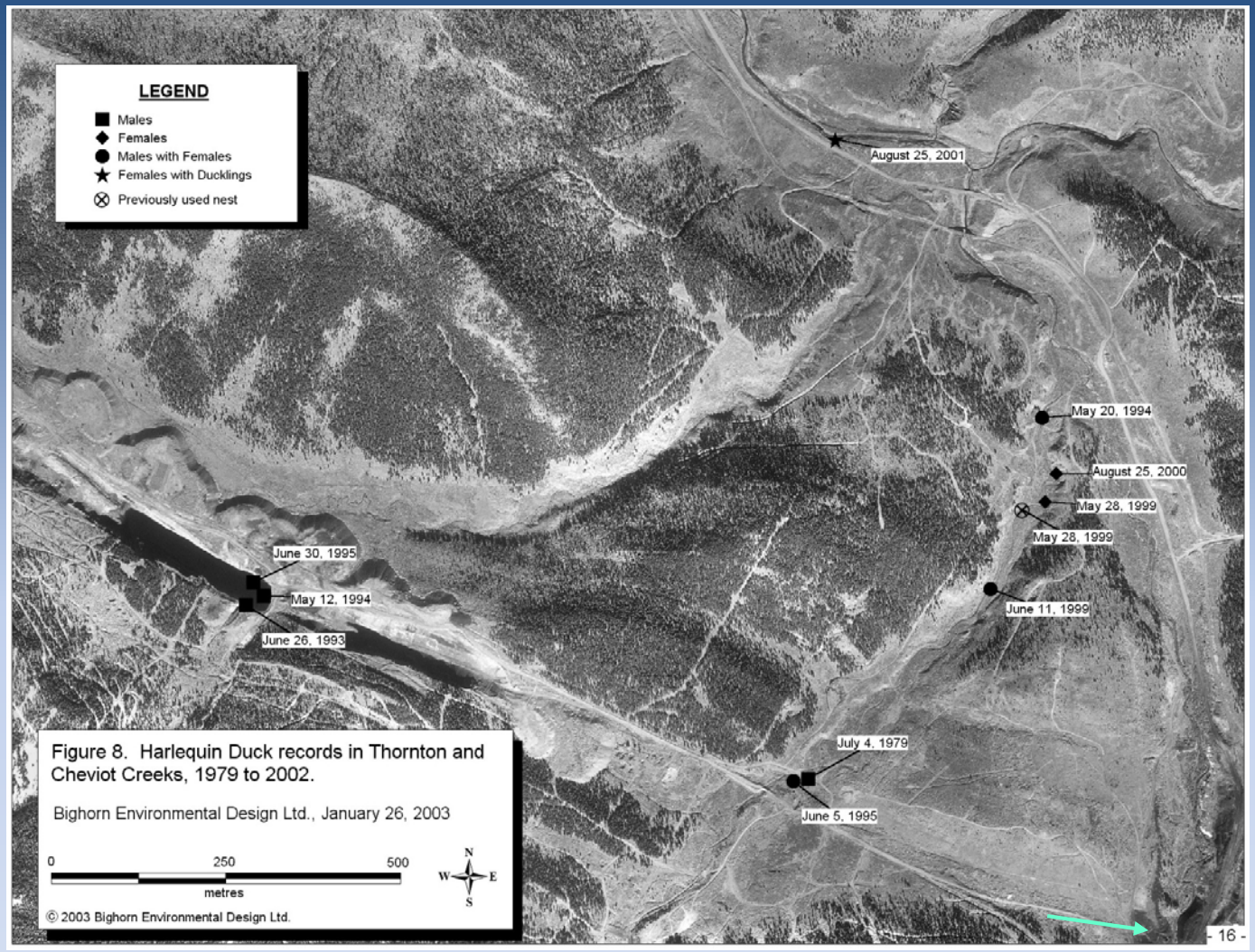
3) Reduce impacts during mining including reduction of disturbance levels in riparian

- 1,592 m less riprap on McLeod River banks increases amount of nesting and brood-rearing habitat

- Bank to bank arch structure at Whitehorse, Prospect and McLeod maintains natural stream bed

- Absence of CN rail restoration reduces linear disturbance of riparian habitat adjacent McLeod River

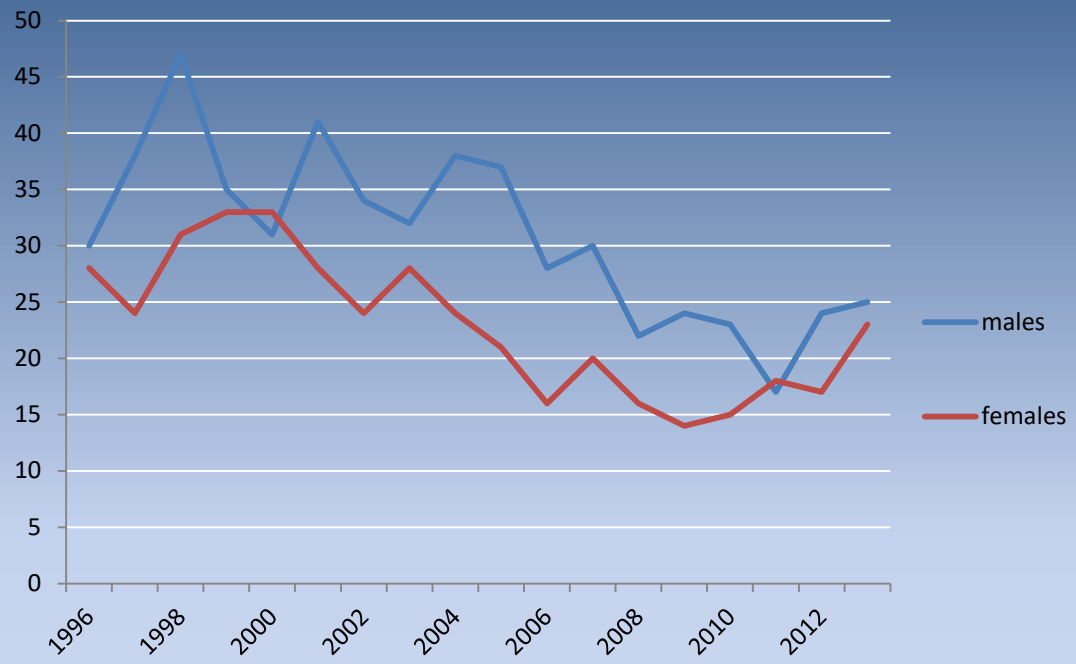
- Location of fish ponds outside of nesting / brood-rearing habitat avoids additional riparian disturbance



3) Reduce impacts during mining including reduction of disturbance levels in riparian

4) Implement stream restoration activities

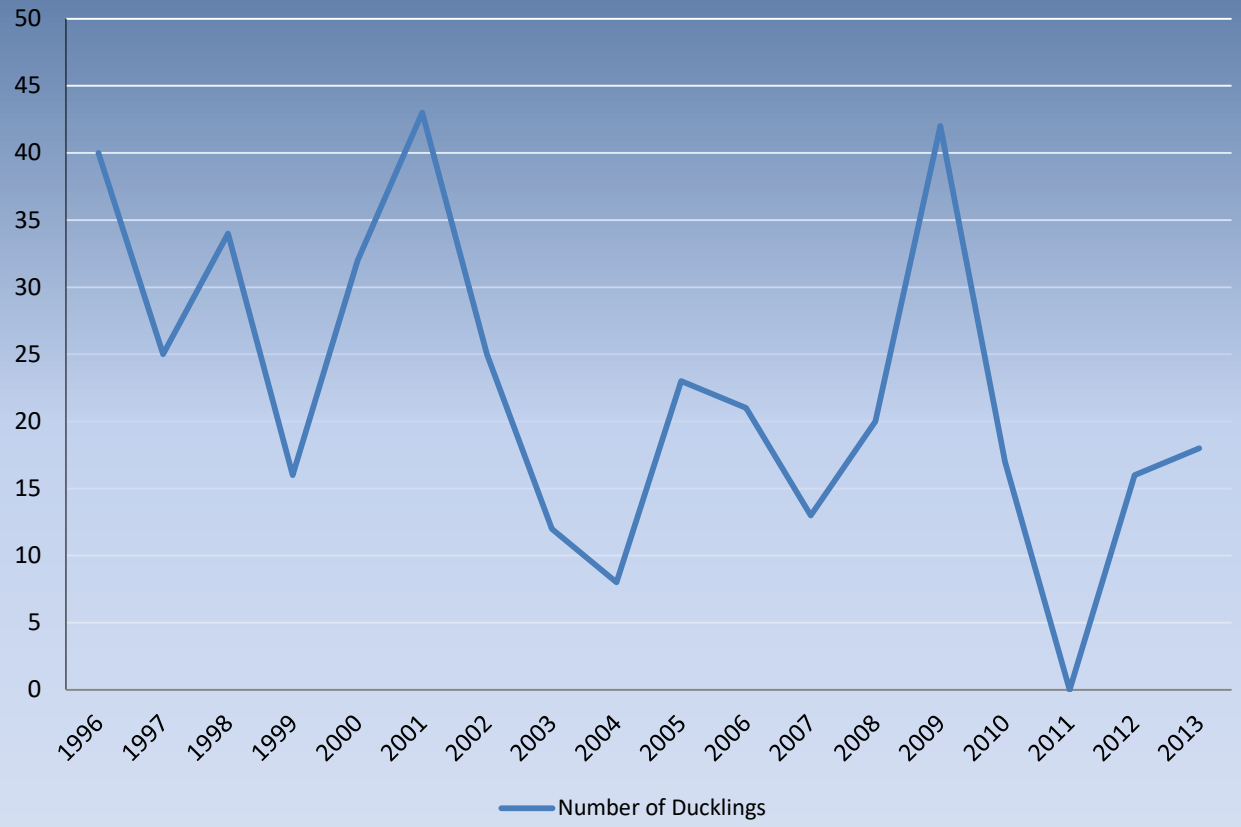
Harlequin Duck Population Trend 1996 - 2013



- Female Survival 2013 0.685 ± 0.025 S.E. (0.634 - 0.731 C.I.)
- Female Encounter 2013 0.827 ± 0.030 S.E. (0.760 - 0.878 C.I.)

- Male Survival 2013 0.651 ± 0.027 S.E. (0.595-0.702 C.I.)
- Male Encounter 2013 0.656 ± 0.041 S.E. (0.571-0.732 C.I.)

Figure 3. Number of harlequin ducklings produced in the McLeod River headwaters, 1996 to 2013



Modeling Harlequin Duck Brood-rearing Habitat in an Alberta Rocky Mountain East Slope Stream

July 31 – Aug 24

Modeling Harlequin Duck brood-rearing habitat in an Alberta Rocky Mountain east slope stream (one model)

- Assessed effects of environmental parameters on harlequin brood use (n = 38) and non-use sites (n = 38). Used Akaike's Information Criterion corrected for small samples (AICc) to select the best model over a set of models built a priori.

- Best model includes 4 variables: elevation; % of vegetation overhanging the channel, % of shrub cover in the 1st m adjacent bank full edge; and the interaction between elevation and the % of vegetation overhanging the channel.

- Odds of occupancy increased between 1600 and 1730 m, on sites where the percentage of vegetation overhanging the channel is none or low (<10%) and where the 1st meter from bank full edge is clear or has a low proportion of shrubs.

- Results suggest that hens with broods prefer streams with a variable structure, indicating importance of different scales (landscape and local) in the assessment of habitat.

- Females with broods may chose environmental characteristics associated with intermediate elevations as the best compromise between habitat features, food availability and predator avoidance.

Table 2. Three model sets examining the relationship between environmental brood rearing habitat selection by Harlequin Ducks

Candidate models	K	AIC_c	ΔAIC_c	ω_i	$\Sigma \omega_i$	Log-*L*
(a) Foraging Condition						
~ Depth + Biomass	3	103.73	0.00	0.20	0.20	-48.70
~ Biomass	*2*	*103.74*	*0.01*	*0.20*	*0.41*	*-49.79*
~ Gradient + Biomass	3	104.44	0.71	0.14	0.55	-49.05
~ Cobbles + Biomass	3	105.10	1.37	0.10	0.65	-49.38
~ Depth + Gradient + Biomass	4	105.41	1.68	0.09	0.74	-48.42
~ Depth + Cobbles + Biomass	4	105.82	2.08	0.07	0.81	-48.63
(b) Predator Avoidance						
~ Overhang + Shrub1 + Relief + Disturbance + Bank	6	70.93	0.00	0.37	0.37	-28.86
~ Overhang + Shrub1 + Relief + Bank	*5*	*71.58*	*0.64*	*0.27*	*0.63*	*-30.36*
~ Overhang + Shrub1 + Shrub2+ Relief + Disturbance + Bank	7	72.56	1.63	0.16	0.79	-28.46
~ Overhang + Shrub1 + Shrub2+ Relief + Bank	6	73.15	2.22	0.12	0.92	-29.97
(c) Combined						
~ Overhang + Shrub1 + Relief + Bank + Biomass	6	70.56	0.00	0.57	0.57	-28.67
~ Overhang + Shrub1 + Relief + Bank	*5*	*71.58*	*1.02*	*0.34*	*0.92*	*-30.36*
~ Overhang + Shrub1 + Bank + Biomass	5	75.51	4.95	0.05	0.97	-32.33

Models relating to foraging conditions
- probability of a site being used for brood-rearing > with total invertebrate biomass.

Models relating to predator avoidance
- probability of brood use high when % of channel overhang is close to 0,
but declines with increasing overhang, shrub coverage in the 1st meter, bank relief and more exposed bank.

Models testing whether selection of brood-rearing habitat optimizes foraging conditions and predator avoidance
- indicated that models with variables relating to predator avoidance had more support than models based on foraging conditions or models combining foraging conditions and predator avoidance

Invertebrate biomass was important but not as significant as the presence of a variety of predator avoidance features in distinguishing brood use from brood non-use areas.

Spring foraging habitat vs brood rearing habitat

Bank relief and exposed bank had negative associations with brood rearing habitat vs. spring foraging habitat, while invertebrate biomass was positively associated with brood rearing habitat.

McLeod River downstream Lehigh

Nesting habitat vs
Spring foraging habitat

Harlequin Duck Nest Habitat McLeod River and Thornton Creek

The probability of brood use vs nesting use declined with increasing channel overhang and increasing shrub cover in the first meter.

Brood rearing habitat

- Intermediate characteristics

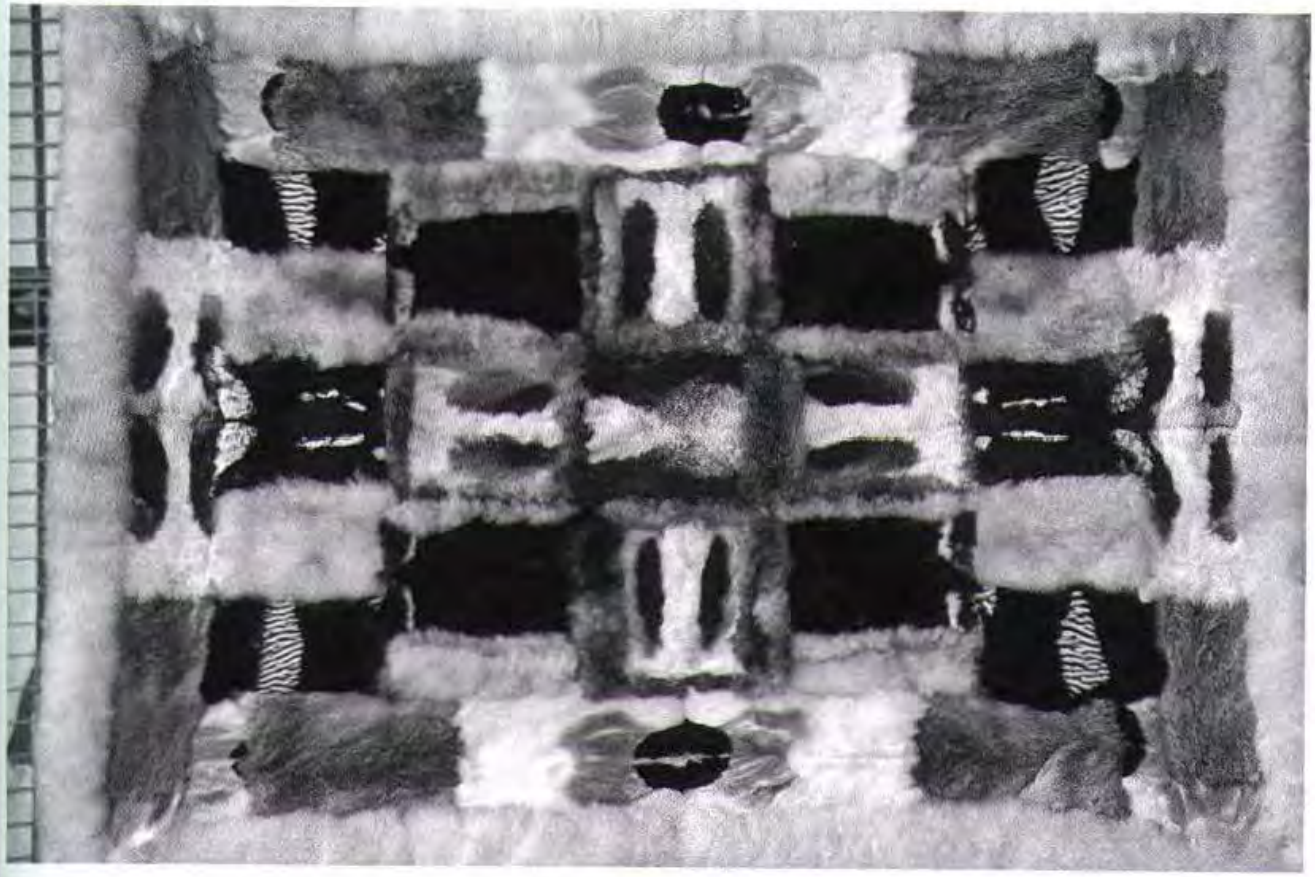


FIGURE 2. Bird skin rug from Qassimiut in Qaqortoq District. The border is made from Common Eider skins, where feathers are removed and down layer is intact. The pattern is made up from head and/or neck skins of Common Eider (both male and female), Common Loon, Mallard (male), Long-tailed Duck (male) and Harlequin Duck (male).