2010 Harlequin Duck Monitoring

Stassinu Stantec Limited Partnership
19-21 Burnwood Drive
Happy Valley-Goose Bay, NL A0P 1C0
Tel: (709) 896-5860
Fax: (709) 896-5863

Prepared for

Institute for Environmental
Monitoring and Research
114 Hamilton River Road,
North Star Building
P.O. Box 1859, Station B
Happy Valley-Goose Bay, NL
A0P 1E0

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1.0 INTRODUCTION

In 1990, the eastern North American population of the Harlequin Duck (*Histrionicus histrionicus)* was designated as *Endangered* by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) (Environment Canada 2007). This designation was based on concerns that the known wintering populations were declining at monitoring locations (Vickery 1988; Goudie 1991). After several years of subsequent research, inventory and monitoring, a reassessment was completed by COSEWIC who down-listed this population to *Species of Concern* in 2001. COSEWIC defines a species of Special Concern as "A wildlife species that may become a threatened or an endangered species because of a combination of biological characteristics and identified threats." One of the criterion that COSEWIC uses to assess whether a species should be upgraded to a *Threatened* status, is the observation of a 30 percent reduction in population size that is "observed, estimated inferred or suspected over 10 years or three generations, whichever is longer" (COSEWIC 2007).

Due to this former status and to reduce potential disturbance, Harlequin Duck breeding pair locations and suspected nest sites were historically excluded (starting in the early 1990s) from military aviation training activities from 5 Wing Goose Bay by a 1.5 nautical mile radius (Department of National Defence 1994). Exclusion zones around breeding pair locations remained in effect until 2005. At this time, the Institute for Environmental Monitoring and Research (IEMR) initiated an annual monitoring program to determine whether the potential effects of military activities on Harlequin Duck (i.e., distribution or density) were detectable over the long-term. The monitoring program was originally designed by Environment Canada (Thomas 2006). The exclusion zones were removed in 2005 to examine effectiveness of the mitigation as well as longer-term trend of the population exposed and not exposed to the military training.

Environment Canada completed the survey for the first two years (Thomas 2006), however in 2007, determined that it could no longer be involved. Unfortunately, a survey was not completed in 2007. In 2008, the IEMR awarded a two-year contract to LGL Limited to complete the annual program (Jones and Goudie 2008, 2009). In 2010, the fifth year of this program in the last six years, the IEMR awarded Stassinu Stantec Limited Partnership the contract to complete the annual monitoring survey.

The current monitoring program has evolved from the original design by Environment Canada (Thomas 2006) to comprise 43 rivers (or river sections) that are surveyed in three areas in the Province: 1) South-central Labrador and within the Low-Level Training Area (LLTA) (also referred to as CYA731); 2) elsewhere in Labrador outside the LLTA; and 3) the Northern Peninsula of Newfoundland, also outside the LLTA.

Within Labrador, the annual Harlequin Duck monitoring program involves rivers or river sections that were first identified by members of the Stassinu Stantec Study Team or others in association with the mitigation and monitoring program for 5 Wing Goose Bay (Jacques

Whitford 1992a, 1992b, 1994, 1995, 1996, 1997a, 1997b, 1998a, 1999a, 1999b, 2001); the Lower Churchill Hydroelectric Generation Project (Agra Earth & Environmental and Harlequin Enterprises 1998; LGL Limited 2008); the Voisey's Bay Mine/Mill assessment (Jacques Whitford 1996b, 1997c); the Trans-Labrador Highway (Jacques Whitford 1998b, 2003); or other initiatives (Goudie et al. 1994; Northland Associates (1995) Ltd. 1998a, 1998b). The river sections of interest for the monitoring program on the Northern Peninsula were identified by Environment Canada and others (Goudie 1998; Gilliland et al. 2002; Gilliland et al. 2008; Thomas 2008).

1.1 Objectives

The 2010 survey program for Harlequin Duck represents the 5th year of a long-term monitoring program examining the possible long-term effects of military flying activity. The objective will be to compare 2010 survey results from rivers located within the LLTA with those results from outside the LLTA in Labrador, and outside the LLTA in Newfoundland. Results will also be examined in terms of previous surveys over the last six years. An additional objective, proposed by Stassinu Stantec will be to examine previous survey results for these same rivers summarized in Trimper et al. (2008) and related sources (e.g., Jacques Whitford 1999b) in Labrador; and from surveys by the Canadian Wildlife Service (e.g., Gilliland et al. 2008). In particular, to explore the data for trends in consistent occupation of potentially attractive habitat for breeding pairs of Harlequin Duck.

2.0 STUDY TEAM

Stassinu Stantec assembled a Study Team of personnel experienced with Harlequin Duck and/or other related experience. Mr. Perry Trimper (Senior Associate with Stantec) was the Project Manager, served as navigator and observer on several of the surveys, and the preparation of the report. Ms. Tina Newbury (Stantec Scientist) served as an observer on several of the surveys and was involved in the preparation of the report. Dr. Marcel Gahbauer (Stantec Scientist) was a navigator on the second survey team and assisted with the preparation of the report. Additional observers in the field were Ms. Mary-Ann Aylward (Innu Consultant with Stassinu Stantec), Mr. Scott Finlay (Stantec Scientist), Mr. Sean Bennett (Stantec Scientist), Mr. Simon Kohlmeister (Nunatsiavut Beneficiary and Conservation Officer with the Nunatsiavut Government), Mr. Randy Thompson (Gros Morne Naturalist with Parks Canada) and Mr. Wayne Jenkins (Partner with Aivek Stantec Limited Partnership). The helicopter pilots were Mr. Lorne Pike, Mr. Geoff Goodyear, and Mr. Peter Jefford with Universal Helicopters Newfoundland Limited. Map and GIS support were provided by Stantec staff Mr. Zachary Bartlett and Ms. Carolyn Pelley. Planning related to health and safety was overseen by Ms. Caroline Hong (Stantec Scientist).

3.0 METHODOLOGY

3.1 Survey Preparation

Following contract award and prior to the start of the field program, Stassinu Stantec applied for and received permits to complete surveys within Gros Morne National Park (from Parks Canada), and within Nunatsiavut (from Nunatsiavut Government). Neither a Federal permit nor a permit from the Provincial Wildlife Division, were required for this scope of work.

A review of health and safety issues related to the project was completed in advance of the field surveys. A health and safety checklist and/or safety toolbox meetings were held each morning of field survey and documented. Through UHNL, the Military Co-ordination Centre at 5 Wing Goose Bay was advised of survey routes and timing within the LLTA each day prior to departure. On the morning of each survey day, the navigator and pilot confirmed the expected route, weather conditions, refueling options and other details related to safety.

Survey routes were plotted on 1:50,000 National Topographic Series map sheets in advance of the field program. Routes were then designed according to distance and fuel limitations of the helicopter. Refueling occurred in Goose Bay, Churchill Falls, Nain and Postville. Specially designed data sheets were prepared for data entry.

3.2 Survey Conduct

The survey protocol followed the original design by Thomas (2006) and was consistent with earlier surveys by the Study Team and others (Thomas 2006; Trimper et al*.* 2008; Gilliland et al 2008; Jones and Goudie 2008). The timing of the surveys was designed for the third week of May for the most southerly rivers (e.g., Northern Peninsula) to coincide with the highly visible, breeding pair period and prior to the onset of continuous incubation; approximately one week later in Labrador. Surveys were conducted from a Bell 206 Long Ranger helicopter equipped with rear 'bubble' windows for enhanced observation. Every effort was made to stay approximately 15 m above water level and at speeds not exceeding 70 km/hr. Surveys were conducted upstream when wind conditions or refueling logistics permitted. The aircraft followed the centre of each river and large islands were circumnavigated. Using a '12-hour' clock system of communication, the Study Team guided the pilot (or vice-versa) when necessary. All observations of Harlequin Duck and their social structure (i.e., lone male, lone female, pair, flocked males and number, flocked females and number, mixed flocks and actual number by sex) were recorded directly on the 1:50,000 NTS map sheets (by the navigator) and on data sheets with a GPS waypoint by one of the rear observers. Harlequin Duck observations were also described in terms of 'indicated pairs' (calculated as observed pairs plus calculated pairs which equals lone males plus males in all male groups of 4 or less) (Dzubin 1969) to distinguish individuals that will likely breed in a given area. Spacing between individuals, group size and behaviour will be used in making this determination. Ice conditions and incidental observations of other wildlife species were also recorded and geo-referenced.

Surveys were conducted with three observers in addition to an experienced pilot (Table 3-1). An observer-navigator was in the front seat next to the pilot with two observers in the rear, on either side of the aircraft.

Table 3-1 Role and Position of Study Team during 21 May to 3 June 2010

Date	Pilot	Navigator	Left Rear	Right Rear
19 May Newfoundland	Strong wind and precipitation – no survey			
20 May Newfoundland	Strong wind and precipitation – no survey			
21 May Newfoundland	L. Pike	P. Trimper	T. Newbury	R. Thompson
22 May Newfoundland	L. Pike	P. Trimper	T. Newbury	R. Thompson a.m. M. Aylward p.m.
31May Labrador	P. Jefford	M. Gahbauer	T. Newbury	S. Finlay a.m. S. Kolmeister p.m.
1 June Labrador	P. Jefford	M. Gahbauer	T. Newbury	S. Kolmeister a.m. W. Jenkins p.m.
2 June Labrador	P. Jefford	M. Gahbauer	T. Newbury	S. Finlay
2 June[R] Labrador	G. Goodyear	P. Trimper	S. Bennett	M. Aylward
3 June Labrador	G. Goodyear	M. Gahbauer	S. Finlay	M. Aylward

[R] Repeatability survey team

As per the monitoring protocol established by Environment Canada, three rivers/river sections (i.e., Crooked River, Fig River and Red Wine River) were re-surveyed by an independent team, who had not been involved in their initial survey, within 48 hours of initial survey for the purposes of a repeatability study. Rivers were surveyed at approximately the same time of day. Photographs from the field surveys were provided to the IEMR under separate cover.

3.3 Data Analyses

The original objective of the long-term monitoring program was to evaluate whether potential long-term effects of military training within the LLTA were occurring to Harlequin Duck. Ideally the design and selection of the rivers should reflect a typical effects monitoring design of exposure and control treatments. To that end, the Study Team has reorganized previous survey data according to one of three treatments: 1) Within the LLTA; 2) Outside the LLTA – Labrador; and 3) Outside the LLTA – Newfoundland. Stassinu Stantec also believes that it would have been preferable to have not included some rivers that occur at the periphery of the LLTA and/or are isolated regionally. In particular this applied to rivers located immediately north of the LLTA that had been grouped as part of the 'Central Labrador' region (including the LLTA) by Jones and Goudie (2009).

In a separate exercise to the 2010 survey, Stassinu Stantec reviewed the results of Harlequin Duck breeding pair surveys on the rivers of interest, prior to the initiation of the monitoring program in 2005 (e.g., Jacques Whitford 1994a, 1995a, 1996a, 1997a, 1997b, 1998, 1999a; and compiled in Jacques Whitford 1999b and Trimper et al. 2008). The historical data were mined to extract the presence of Harlequin Duck breeding pair sightings on the Labrador rivers

that are the focus of the current program. These data were reviewed to identify potential clusters of Harlequin Duck activity, or breeding 'cells', defined as a location where at least one breeding pair had been consistently observed within (±) one kilometer of a location in at least three of the previous survey attempts. To further explore the importance of locations on a given river, available data from previous surveys included results from the four years of the monitoring program to date. The information was presented graphically for each region (i.e., LLTA, Outside LLTA-Labrador and Outside LLTA-Newfoundland) and examined according to the following questions:

- Are the preferred cells occupied by a breeding pair (or pairs) in a given year? There were potentially many additional comparisons to be assessed instead of the single river annually as per the current design. Note that there may be occasions where more than one breeding pair could occur during the survey at a location (or cell) and more than one brood could be produced – as detected during work at Voisey's Bay by the Study Team (Jacques Whitford 1996a). Such situations were identified, but may be treated the same as other cells (i.e., not weighted).
- How many additional pairs were recorded? Due to the variability described above, this comparison is considered secondary to the design.

Following the field program, the analyses used a linear design to compare the indicated breeding pair data from the various rivers/cells within each of the 43 identified rivers, compared to data from 2008 and 2009. Note that data from 2005 and 2006 were presented as 'total males' with no identification as to 'indicated breeding pairs' and could not be compared.

4.0 RESULTS

Stable weather in Labrador allowed four consecutive days of survey for rivers within the LLTA and outside the LLTA during 31 May-3 June. Snow and ice were common particularly at higher elevations and for those rivers in the Voisey's Bay area.

Harlequin Duck were observed on 13 rivers/river sections of the 18 examined within the LLTA (Table 4-1). In 2010, 73 individuals and 45 indicated breeding pairs were observed, at least 50 percent lower than observed in 2009 (i.e., 272 and 143 respectively) and 2008 (i.e., 161 and 90 respectively) (Jones and Goudie 2008; Jones and Goudie 2009). Of note was the markedly lower numbers of Harlequin Duck at Fig River, Minipi River, Mistinippi North, Naskaupi River, Red Wine River and the outlet of Shapio Lake. Flocks of birds were not observed in these areas suggesting that the timing of the surveys here may have been earlier than in 2009 and 2008.

Table 4-1 LLTA Harlequin Duck observations, 31 May-3 June 2010

River	Survey Effort (minutes)	Males	Females	Pairs	Total	Indicated Breeding pairs
Beaver Brook	24	0	0	0	2010=0 2009=4 2008=0	2010=0 2009=2 2008=0

Table 4-1 LLTA Harlequin Duck observations, 31 May-3 June 2010 (continued)

River	Survey Effort (minutes)	Males	Females	Pairs	Total	Indicated Breeding pairs
Cache River	14	1	0	1	2010=3 2009=4 2008=8	2010=2 2009=2 2008=4
Elizabeth River	39	0	0	0	2010=0 2009=5 2008=2	2010=0 2009=3 2008=1
Fig River	33	2	0	5	2010=12 2009=23 2008=13	2010=7 2009=11 2008=6
Goose River	41	2	0	3	2010=8 2009=9 2008=8	2010=5 2009=5 2008=5
Metchin River	28	0	0	1	2010=2 2009=5 2008=1	2010=1 2009=2 2008=1
Minipi River	162	2	1	2	2010=7 2009=26 2008=20	2010=4 2009=15 2008=11
Mistinippi Lake Tributary	11	2	0	1	2010=4 2009=0 2008=0	2010=3 2009=0 2008=0
Mistinippi River North	2	0	0	1	2010=0 2009=22 2008=21	2010=1 2009=12 2008=12
Mistinippi River South	7	0	0	0	2010=0 2009=4 2008=8	2010=0 2009=2 2008=5
Naskaupi River	19	3	0	0	2010=3 2009=22 2008=13	2010=3 2009=11 2008=7
North Shipiskan River	32	1	1	1	2010=4 2009=36 2008=14	2010=2 2009=18 2009=9
Penas River	31	0	0	0	2010=0 2009=0 2008=2	2010=0 2009=0 2008=1
Red Wine River	50	2	1	4	2010=11 2009=33 2008=22	2010=6 2009=19 2008=12
Shapio Lake Outlet	3	2	0	2	2010=6 2009=53 2008=13	2010=4 2009=27 2008=7
Shapio Lake Tributary – 1 and 2	26	4	1	2	2010=9 2009=4 2008=3	2010=6 2009=3 2008=2
Thomas	24	0	0	0	2010=0 2009=22 2008=13	2010=0 2009=11 2008=7
Traverspine River	56	0	0	1	2010=2 2009=0 2008=0	2010=1 2009=0 2008=0
Total	**602**	**21**	**4**	**24**	**2010=73 2009=272 2008=161**	**2010=45 2009=143 2008=90**

Elsewhere in Labrador, outside the LLTA, Harlequin Duck were observed on 11 rivers/river sections of the 14 examined (Table 4-2). In 2010, 75 individuals and 46 indicated breeding pairs were observed, approximately 50 percent lower than observed in 2009 (i.e., 156 and 83 respectively) and 2008 (i.e., 131 and 70 respectively) (Jones and Goudie 2008; Jones and Goudie 2009). Note that English River, Unknown River and Little Reid Brook were surveyed in 2010 (and are added to the total) but were not surveyed in 2009 or 2008. Markedly lower numbers of Harlequin Duck were observed at Adlatok River, Anaktalak River, and Kogluktokoluk Brook.

Table 4-2 Outside LLTA – Labrador, Harlequin Duck observations, 31 May-3 June 2010

River	Survey Effort (minutes)	Males	Females	Pairs	Total	Indicated Breeding pairs
Adlatok River	60	2	0	6	2010=14 2009=30 2008=22	2010=8 2009=17 2008=12
Anaktalik	59	3	0	4	2010=11 2009=35 2008=45	2010=7 2009=17 2008=24
Crooked River	43	5	4	4	2010=17 2009=15 2008=9	2010=9 2009=8 2008=5
English River	31	1	1	3	2010=8 2009=n/a 2008=n/a	2010=4 2009=n/a 2008=n/a
Harp	3	0	0	0	2010=0 2009=4 2008=0	2010=0 2009=2 2008=0
Igluvigaluk	30	2	0	8	2010=18 2009=0 2008=7	2010=10 2009=0 2008=3
Ikadlivik	68	2	0	15	2010=32 2009=43 2008=32	2010=17 2009=23 2008=17
Kangeklualuk – Option 4	6	0	0	2	2010=4 2009=2 2008=0	2010=2 2009=1 2008=0
Kangeklukuluk – Option 5	3	0	0	0	2010=0 2009=0 2008=0	2010=0 2009=0 2008=0
Kogluktokoluk Brook	6	0	0	2	2010=4 2009=13 2008=7	2010=2 2009=7 2008=4
Little Reid Brook	11	0	0	1	2010=2 2009=n/a 2008=n/a	2010=1 2009=n/a 2008=n/a
Makhavinekh	4	0	0	2	2010=4 2009=0 2008=4	2010=2 2009=0 2008=2
Reid Brook	30	2	1	9	2010=21 2009=12 2008=5	2010=11 2009=7 2008=3
Unknown River #1 Voisey	11	3	1	0	2010=4 2009=n/a 2008=n/a	2010=3 2009=n/a 2008=n/a

Table 4-2 Outside LLTA – Labrador, Harlequin Duck observations, 31 May-3 June 2010 (continued)

River	Survey Effort (minutes)	Males	Females	Pairs	Total	Indicated Breeding pairs
Washkagama	7	0	0	0	2010=0 2009=2 2008=0	2010=0 2009=1 2008=0
Total	**372**	**20**	**7**	**56**	**2010=75 2009=156 2008=131**	**2010=46 2009=83 2008=70**

Based on the advance of spring like conditions in Newfoundland, the Study Team conferred with the IEMR and advanced the planned date of surveys there by one week (from 26 May). However, inclement weather resulted in delays over 19-20 May, and surveys did not start until 21 May. Approximately 5 hours of survey time was required to complete 11 rivers in this region. Five of the 11 rivers on the Northern Peninsula were surveyed downstream (as opposed to upstream) due to wind conditions and steep topography in consultation with the pilot. At higher elevations, snow was present on the ground and substantial ice cover occurred at headwater lakes although downstream sections were often completely open and further advanced phenologically. Harlequin Duck were found on 9 of 11 surveyed rivers on the Northern Peninsula in 2010 (Table 4-3; Appendix C). Note that Baker's Brook was also surveyed in this area as occurred in 2005 and 2006 (Thomas 2006), but was not surveyed in 2008 or 2009. No sightings of Harlequin Duck were noted and this river is not discussed further.

Table 4-3 Outside LLTA – Newfoundland, Harlequin Duck Observations 21-22 May 2010

River	Survey Effort (minutes)	Males	Females	Pairs	Total	Indicated Breeding pairs
Black Brook	23	0	0	0	2010=0 2009=7 2008=4	2010=0 2009=4 2008=2
Brian's Pond River[1]	35	0	1	0	2010=1 2009=3 2008=2	2010=0 2009=2 2008=1
Castor River West	12	0	0	1	2010=2 2009=8 2008=4	2010=1 2009=4 2008=3
Cloud River	47	0	1	6	2010=13 2009=5 2008=6	2010=6 2009=2 2008=3
Crow Gulch	20	0	2	3	2010=8 2009=11 2008=5	2010=3 2009=6 2008=4
Doctor's Brook	5	0	0	0	2010=0 2009=0 2008=0	2010=0 2009=0 2008=0
Humber River NW	17	0	0	1	2010=2 2009=9 2008=9	2010=1 2009=5 2008=5

Table 4-3 Outside LLTA – Newfoundland, Harlequin Duck Observations 21-22 May 2010 (continued)

River	Survey Effort (minutes)	Males	Females	Pairs	Total	Indicated Breeding pairs
Humber River SW	51	0	0	3	2010=6 2009=3 2008=10	2010=3 2009=2 2008=5
Parson's Pond	16	1	1	4	2010=10 2009=10 2008=6	2010=5 2009=6 2008=3
Torrent River	64	3	1	4	2010=12 2009=16 2008=21	2010=7 2009=10 2008-12
Western Brook	13	1	0	1	2010=3 2009=4 2008=4	2010=2 2009=2 2008=2
Total	**303**	**5**	**6**	**23**	**2010=57 2009=76 2008=71**	**2010=27 2009=43 2008=40**

Incomplete survey at two locations due to unsafe wind direction

The total number of individuals and indicated breeding pairs were markedly lower in 2010 than in the previous two years for the Northern Peninsula (Jones and Goudie 2008; Jones and Goudie 2009). In general, the abundance was similar or lower on most rivers in this region with the exception of Cloud River which was higher in 2010. Although pairs were present on Black Brook in previous years, no Harlequin Duck were observed on this river section in 2010. Note that due to high wind and poor lift, it was unsafe for the helicopter to survey two sections of Brian's Pond River that were adjacent to steep cliff terrain.

4.1 Repeatability Surveys

The first suite of the repeatability surveys of the Fig, Crooked and Red Wine Rivers (and those used in the calculations in Tables 4-1 and 4-2) were conducted on the 31 May and 2 June 2010. Marcel Gahbauer, Tina Newbury, Scott Finlay and pilot Peter Jefford surveyed these three rivers on the 31 May with a total effort of 2 hours and 6 minutes. The second survey of these rivers was carried out on 2 June by Perry Trimper, Mary Ann Aylward, Sean Bennett and pilot Geoff Goodyear with a total effort of 2 hours and 38 minutes. In general, observations tended to indicate fewer birds during the second survey of each river that was repeated (Table 4-4). In some cases, pairs were identified at the exact location of the first survey, other situations were variable.

Table 4-4 Repeatability Survey: Effort and Harlequin Duck observations from Fig, Crooked and Red Wine Rivers, Central Labrador on 31 May and 2 June, 2010

River	Date	Start Time	Effort (minutes)	Harlequin pairs	Individual Harlequins (male/female)	Indicated Breeding pairs
Fig River	31 May	1245 hrs	33	5	2/0	7
	2 June	1528 hrs	37	2	2/0	4
	Difference		***+4***	***-3***	***0/0***	***-3***
Crooked River	31 May	0925 hrs	43	4	5/1	9
	2 June	0936 hrs	60	3	5/0	8
	Difference		***+17***	***-1***	***0/-1***	***-1***
Red Wine River	31 May	1028 hrs	50	4	2/1	6
	2 June	1106 hrs	61	2	2/1	4
	Difference		***+11***	***-2***	***0/0***	***-2***

There were 30 other species of wildlife observed during the Harlequin Duck surveys: 5 mammal species and 25 bird species (plus unidentified duck and gull species). These wildlife observations are documented by region in Appendix D. Raptor nest locations as well as individuals from the Red Wine caribou herd were also noted. The locations of the Red Wine caribou were forwarded to the Wildlife Division Office in Happy Valley-Goose Bay.

5.0 DISCUSSION

The timing of the surveys in each of the three regions was ideal in that it appeared as if individuals had dispersed to the breeding areas (as evidenced by the abundance of pairs yet absence of flocks), but prior to the males departing for their moulting sites. This window of opportunity may vary from year to year but generally persists for approximately a two week period.

High winds on the Northern Peninsula were a factor, therefore short canyon sections of one river meant that we were unable to adequately complete two different sections of this river due the lack of lift and safety considerations. Both weather and timing conditions were ideal for all rivers and river segments surveyed in central Labrador and the Voisey's Bay area.

The fast-flowing rivers in the remote wilderness of Labrador provide excellent breeding territories for Harlequin Duck in this region of Eastern North America (Trimper et al. 2008). The southern and northern coastal areas of Labrador are recognized as important moulting and staging areas, respectively. Harlequin Duck that stage in Northern Labrador are known to continue with migration on to Greenland (Chubbs et al. 2008; Gilliland et al. 2008). This species is known to have a high degree of site fidelity (Bengtson 1972) and surveys over the seven year period from 1992 to1998 in Labrador found this species consistently occurring in the same locations each year (Trimper et al 2008).

Pairs arrive on rivers as soon as spring thaw conditions provide adequate open water habitat and thus these dates vary annually (Goudie 1998; Goudie and Gilliland 2008; Trimper et al.

2008). Harlequin Duck generally disperse to breeding grounds in northern Newfoundland approximately the third week of May (Robertson, G.J. pers. comm. *from* Thomas 2006) and in subsequent days and weeks, this dispersal from staging areas to the breeding grounds on rivers in Labrador is also complete. Harlequin Duck surveys from 1993 to 2002 reveal that pairs were present on the Torrent River on the Great Northern Peninsula of Newfoundland between early and late May (Goudie and Gilliland 2008). In surveys conducted in 1997, Harlequin duck pairs were found in the Lake Melville area as early as the 21 April and 8 May in the Voisey's Bay area (Jacques Whitford 1998b). Median clutch initiation dates on the Torrent River varied from 17 May to 3 June in 1998 and 1997, respectively (Goudie and Gilliland 2008). Males were presumed to have left the breeding grounds for the coast by mid-June, based on their absence on the river (Goudie and Gilliland 2008). During the breeding period, Harlequin Duck may move up to 8 km within a river system (Kuchel 1977; Cassirer and Groves 1992) although Kuchel (1977) noted that most movements were within 1-2 km. Once breeding is complete, Harlequin Duck migrate to coastal areas in the Province and elsewhere (Robertson and Goudie 1999; Chubbs et al. 2000, 2001; Gilliland et al. 2008; Robertson et al. 2008; Trimper et al. 2008). These aspects of their breeding ecology have been important considerations in terms of completing the previous monitoring and baseline research, but also in terms of airspace management and mitigating the potential effects of military training.

The Study Team has observed locations in Labrador where more than one breeding pair may occupy a location in spring and where more than one brood was detected during surveys in July (Jacques Whitford 1996a). As indicated in the Methods (Section 3.3) breeding 'cells', defined as a location where at least one breeding pair had been consistently observed within (±) one kilometer of a location (consistent with Kuchel (1977) in at least three of the previous survey attempts were identified (Appendices A, B and C). Breeding pair and brood survey data from the 1990s were also examined to determine areas of consistent use in Labrador (Jacques Whitford 1999b).

Twelve of the 18 rivers within the LLTA demonstrate areas that are used consistently by breeding pairs of Harlequin Duck annually (Table 5-1). For those rivers that were surveyed previously, it appears these cells have been identified over the last two decades. Only Beaver Brook appears to have had a decline in terms of previously located areas for breeding pairs, no longer occupied during the monitoring surveys.

Table 5-1 Rivers within the LLTA demonstrating breeding cells for Harlequin Duck

River	Breeding Cell	Correspondence with Jacques Whitford (1999b)	IBPs in 2010	IBPs Other Monitoring	Comments
Beaver Brook	No	N/A	N/A	N/A	One pair from 2009 overlaps area of concentration from 1990s
Cache River	Two Cells	Overlap	Yes	Yes	Several pairs observed within cells
Elizabeth River	No	N/A	N/A	N/A	Some overlap between years
Fig River	Two Cells	Overlap	Yes	Yes	Several pairs observed within cells

Table 5-1 Rivers within the LLTA demonstrating breeding cells for Harlequin Duck (continued)

River	Breeding Cell	Correspondence with Jacques Whitford (1999b)	IBPs in 2010	IBPs Other Monitoring	Comments
Goose River	Two Cells	Overlap	Yes	Yes	Pairs also 4-8 km downstream of cells
Metchin River	No	N/A	N/A	N/A	Some overlap between years
Minipi River	Three Cells	Overlap	Yes	Yes	Several pairs observed within cells
Mistinippi Lake Tributary	No	No Previous Survey in 1990s	N/A	N/A	Few Observations
Mistinippi River North	Cell	Overlap	Yes	Yes	Consistent use
Mistinippi River South	Two Cells	Overlap	Yes	Yes	Several pairs observed within cells
Naskaupi River	Two Cells	Overlap	Yes	Yes	Additional overlap at some locations
North Shipiskan River	Five Cells	No Previous Survey in 1990s	Yes	Yes	River flown in early 2000s, several sightings
Penas River	No	N/A	N/A	N/A	Some overlap between years
Red Wine River	Several Cells	Overlap	Yes	Yes	Several pairs observed within cells
Shapio Lake Outlet	Cell	Overlap	Yes	Yes	Several pairs consistently annually
Shapio Lake Tributary – 1 and 2	Several Cells	Overlap	Yes	Yes	Several pairs consistently annually
Thomas	Cell	Overlap	No	Yes	Pairs also 16 km downstream
Traverspine River	No	N/A	N/A	N/A	Few observations

All of the rivers with pre-2005 survey experience (Jacques Whitford 1999b) demonstrate consistent annual use at identified locations. Eleven of the 13 rivers within Labrador that are outside the LLTA, demonstrate areas that are used consistently by breeding pairs of Harlequin Duck annually (note that two of these rivers were not surveyed extensively prior to 2005) (Table 5-2). For those rivers that were surveyed previously, it appears these cells have been identified over the last two decades.

Table 5-2 Labrador Rivers outside the LLTA demonstrating breeding cells for Harlequin Duck

River	Breeding Cell	Correspondence with Jacques Whitford (1999b)	IBPs in 2010	IBPs Other Monitoring	Comments
Adlatok River	Several Cells	Overlap	Yes	Yes	Several pairs observed within cells, tributary has more use in monitoring program
Anaktalik River	Two Cells	Overlap	Yes	Yes	Several pairs observed within cells

Table 5-2 Labrador Rivers outside the LLTA demonstrating breeding cells for Harlequin Duck (continued)

River	Breeding Cell	Correspondence with Jacques Whitford (1999b)	IBPs in 2010	IBPs Other Monitoring	Comments
Crooked River	Three Cells	No Previous Survey in 1990s	Yes	Yes	Several pairs observed within cells
English River	Cell	No Previous Survey in 1990s	Yes	Yes	Pairs also upstream of cell
Igluvigaluk River	Two Cells	Overlap	Yes	Yes	Pairs also up and downstream of cells
Ikadlivik River	Several Cells	Overlap	Yes	Yes	Several pairs observed within cells
Kangeklualuk Brook	Cell	Overlap	Yes	Yes	Several pairs observed within cell
Kangeklukuluk Brook	Cell	Overlap	Yes	Yes	Several pairs observed within cell
Kogluktokoluk Brook	Cell	Overlap	Yes	Yes	Several pairs observed within cell
Little Reid Brook	Cell	Overlap	Yes	Yes	Difficult to survey
Makhavinekh Brook	Cell	Overlap	Yes	Yes	Several pairs observed within cell
Unknown River	No	N/A	N/A	N/A	Previous use in area
Washkagama River	No	N/A	N/A	N/A	Previous use in area

Only four of the 11 rivers in Newfoundland outside the LLTA demonstrate areas that are used consistently by breeding pairs of Harlequin Duck annually (Table 5-3). Previous surveys completed by CWS (e.g., Gilliland et al. 2008) have not been reviewed in detail to identify whether and where, consistent use of these areas occurs annually.

Table 5-3 Newfoundland Rivers outside the LLTA demonstrating breeding cells for Harlequin Duck

River	Breeding Cell	Consistent with CWS Surveys	IBPs in 2010	IBPs Other Monitoring	Comments
Black Brook	No	?	N/A	N/A	Pairs observed at upper section
Brian's Pond River	No	?	N/A	N/A	Pairs observed at upper section
Castor River West	No	?	N/A	N/A	Several pairs observed along river
Cloud River	Two Cells	?	Yes	Yes	Pairs also downstream upstream of cells
Crow Gulch	Cell	?	Yes	Yes	Pairs also downstream of cell
Doctor's Brook	No	?	N/A	N/A	No pairs observed
Humber River NW	No	?	N/A	N/A	Several pairs observed along river
Humber River SW	No	?	N/A	N/A	Several pairs observed along river
Parson's Pond	Cell	?	Yes	Yes	Pairs also upstream of cell
Torrent River	Cell	?	Yes	Yes	Several pairs upstream of cell
Western Brook	No	?	N/A	N/A	Several pairs observed along river

By reviewing the individual maps, particularly those with cells identified, there is clearly consistent use of most cells annually. Given the relatively low amount of broods found on these rivers later, extra pairs within or outside these cells may not be attempting to breed or are not successful. As a result of this exploratory approach to organizing the data from 2010 and prior, a power analysis was not completed to provide an indication of the probability of detecting a trend in the data when the trend is real, despite the variations in the count data (Smith 2003). If not reflecting the natural situation, variation in this case can be related to natural causes (e.g., births, deaths, weather effects) or possibly due to limitations of the sampling program (e.g., observer differences, different fractions of individuals being counted each time, survey length, number of surveys per year) (Smith 2003).

6.0 RECOMMENDATIONS FOR CONSIDERATION

The following section is intended for discussion and consideration for future design. Clearly there is regional and annual variability in terms of the way the program is being conducted to date; or at least in the manner in which the data are being analysed; or the previous results are a reflection of the natural variability that exists during the breeding pair season. The Study Team was questioned early in 2005 but was not involved in the design of the long-term monitoring program. Perhaps these suggestions were previously considered and discounted, however Stassinu Stantec asserts there could be validity in their further discussion.

Monitoring for Effects

Stassinu Stantec asserts that there has been and perhaps continue to be challenges with the design of this monitoring program and the issue that it is addressing, namely to evaluate the long-term effects of non-mitigated military training (i.e., without avoidance areas around traditional breeding areas) on Harlequin Duck within the LLTA. While military training has been relatively low to non-existent in recent years, it remains important to identify annual breeding pair activity by treatment. Given the large geographic areas under consideration, it is important to reduce the influence of other parameters whenever possible. The challenge to the original design was the relative absence of breeding activity to the east, south and west of the LLTA; hence the identification of selected rivers to the north of the LLTA and on the Northern Peninsula – an area approaching 1,000 km in total length and including individuals with probably demographically distinct populations (Robert et al. 2008) as first identified by Brodeur et al. (2002). The difference in climate, local and even regional limiting factors could be of sufficient consequence to cause confusion in the interpretation of the results. While the importance of the Northern Peninsula as a breeding area for this species in the northwest Atlantic, its role in an effects monitoring program is questioned.

Selection of Rivers

If the Northern Peninsula (Outside LLTA – Newfoundland) rivers are to remain part of the monitoring program it is recommended that Black Brook and Doctor's Brook be removed from the survey. Both of these survey sections are difficult to survey effectively due to the narrow width of the valley and obscuring vegetation particularly at higher water flow. While these rivers may have been selected because of their previous low density observations, the physical challenges of these locations probably introduce greater and different observer errors than encountered with most survey sections.

Stassinu Stantec is confused as to the rationale for including English River and Unknown River (vicinity of Voisey's Bay) in the 2010 survey as they had not been include in the 2008 or 2009 surveys by LGL (Jones and Goudie 2009). These rivers had been included in 2005 and 2006 (Thomas 2006).

Selection of Study Parameters

Future initiatives should consider: the magnitude of trend to be detected, over what time frame a trend is to be detected, and how often it is accepted to make incorrect conclusions regarding the population (Smith 2003). In her analysis of a previous aerial survey for Harlequin Duck in the Bow River region of Alberta, Smith (2003) indicates that two surveys per year would result in a 91 percent probability of detecting a 30 percent decline in the population in that area.

It is proposed that following discussion with the Scientific Review Committee of the IEMR, data collected prior to 2005 could also be added to the GIS files in Appendices A, B and C to identify possible 'cells' during this period and then used to evaluate occupation with each year of the monitoring program. These locations were added from the summary prepared by Jacques Whitford (1999b) for Labrador. A similar exercise could be completed by reviewing field observation data by the CWS (e.g., Gilliland et al. 2008). For 2008, 2009 and 2010, the analysis could include a series of multiple regressions applied to the data at three scales: individual cell, river, and treatment.

A final power analysis could be reapplied incorporating the 2010 data, including any new cells identified, to determine the probability or likelihood that the design was able to detect a trend. The null hypothesis was that there would be no difference in the trend of occupied cells from either of the treatment areas. This comparison could be completed at the individual cell, river and treatment.

Repeatability Surveys

The incorporation of the repeatability surveys was to better understand the errors around observers and detection. This component has been completed in each year of the monitoring program. While the abundance often varies within a survey year even though the surveys are less than 48 hrs apart, there are examples of birds (usually indicated breeding pairs) occurring at the same location. Groups of birds (believed to be non- or post-breeding individuals) tend to confuse the data given their often transient nature. Stassinu Stantec therefore advocates another examination of the repeatability data, with the focus on the ability of each survey crew to detect indicated breeding pairs and their location. Another consideration is the cost and time allocated to complete this work which is secondary to the objectives of the long-term monitoring.

Effects of Military Training

Military training at 5 Wing Goose Bay has been in decline since the withdrawal of permanent deployments of Allied Forces. Regardless, military aircraft continue to use the LLTA albeit at a greatly reduced level than when the program was envisaged. While it is difficult to quantify the noise and other stimuli to Harlequin Duck within the LLTA during the five years, it is recommended that the activity be described for future comparison with survey results.

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APPENDIX A

Within LLTA - Labrador, Harlequin Duck Breeding Pair Survey Results - 2010 and Previous

APPENDIX B

Outside LLTA - Newfoundland, Harlequin Duck Breeding Pair Survey Results - 2010 and Previous

APPENDIX C

Outside LLTA - Labrador, Harlequin Duck Breeding Pair Survey Results - 2010 and Previous

APPENDIX D

Incidental Wildlife Observations

Table D-1 Additional wildlife observations during Harlequin Duck surveys on the Northern Peninsula, Newfoundland on 21 and 22 May, 2010

Species
Mammals
Moose (two with calves)
Caribou
Birds
Canada Goose
American Black Duck
Green-winged Teal
Common Goldeneye
Common Merganser
Red-breasted Merganser
Ruffed Grouse
Bald Eagle
Spotted Sandpiper
Unknown Ducks
Unknown Gulls

Table D-2 Additional wildlife observations during Harlequin Duck surveys in the Voisey's Bay Area, Labrador on 31 May and 1 June, 2010

Species
Mammals
Moose
Caribou
Porcupine
Black bear
American Beaver
Birds
Canada Goose
American Black Duck
Green-winged Teal
Surf Scoter
Long-tailed Duck
Common Goldeneye
Common Merganser
Red-breasted Merganser
Spruce Grouse
Willow Ptarmigan
Rough-legged Hawk
Peregrine Falcon
Spotted Sandpiper
Short-eared Owl
Belted Kingfisher
Unknown Ducks
Old raptor nest

Table D-3 Additional wildlife observations during Harlequin Duck surveys in Central Labrador on 31 May, 2 and 3 June, 2010

Species
Mammals
Moose
Caribou (Red Wine)
Porcupine
Black bear
American Beaver
Birds
Canada Goose
American Black Duck
Green-winged Teal
Scaup spp.
Surf Scoter
Common Goldeneye
Common Merganser
Red-breasted Merganser
Spruce Grouse
Common Loon
Osprey (nest locations)
Bald Eagle
Spotted Sandpiper
Herring Gull
Common Raven
Rusty Blackbird
White-winged Crossbills