Age and Sex-ratios of Sea Ducks Wintering in the Strait of Georgia, British Columbia, Canada (2003, 2004, 2008, 2014, 2015): Implications for Monitoring

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ABSTRACT

Winter age and sex ratios provide valuable demographic data for sea ducks that are difficult to obtain by other means. Our objectives were to determine spatial, temporal, and density-related variability in age and sex ratios for five, and in proportions of adult males for 11, sea duck species that winter in the Strait of Georgia, British Columbia. Km-long shoreline sections (n = 49-62) were surveyed in early February 2003, 2004, 2014, and 2015. Bufflehead (*Bucephala albeola*), Common Goldeneye (*Bucephala clangula*), Surf Scoters (*Melanitta perspicillata*) and Harlequin Ducks (*Histrionicus histrionicus*) were the most ubiquitous species in our study, occurring in 74 to 96% of km-sections; Hooded Mergansers (*Lophodytes cucullatus*), Long-tailed Duck (*Clangula hyemalis*) and Common Mergansers (*Mergus merganser*) were least common. Numbers of individuals counted were highest for Surf Scoters, White-winged Scoters (*Melanitta fusca*), and Harlequin Ducks with over 1000 individuals counted each year for Surf Scoters and Harlequin Ducks, and in most years for White-winged Scoters. Densities differed among years for White-winged Scoter, Bufflehead, and Red-breasted Merganser (*Mergus serrator*). Annual estimates for male age ratio (first year:adult male) varied significantly for Black Scoter (*Melanitta americana*; 0.071 to 0.170), Surf Scoter (0.064 to 0.139), Harlequin Duck (0.068 to 0.147), and Common Goldeneye (0.096 to 0.201). Regional differences in male age ratio were found for Barrow's Goldeneye (*Bucephala islandica*; 0.029 to 0.144) and Common Goldeneye (0.060 to 0.178), and more complex interactions were found between regions by year for Surf Scoter. Sex ratios were less variable than age ratios and varied by year and region only for Common Goldeneye and Surf Scoter. Adult male proportions were correlated with but varied more than sex ratios and showed significant differences by year for Surf Scoter, Common Goldeneye, and Bufflehead and by region for Surf Scoter, Common Goldeneye, Bufflehead, Common Merganser, and Red-breasted Merganser. Based on previous research that calculated expected confidence limits from different numbers of occupied km-sections, the species-specific sampling intensity obtained in this study likely provided age ratio estimates with 95% confidence limits of ± 5% for Surf Scoter and ± 3% for Harlequin Ducks. Age ratios best serve as a relative index of recruitment because there is a demonstrated mismatch between known population trends and trends inferred from estimated age ratios and survival rates. Regional and density-related differences in age ratios, sex ratios, and adult male proportions indicated segregation and emphasize the need for broad-scale sampling to achieve representativeness. Inter-annual differences may indicate demographic changes but few comparative data exist, and several consecutive years of surveys are needed to provide baseline data.

RÉSUMÉ

Les rapports entre les classes d'âge et les rapports des sexes en hiver fournissent de précieuses données démographiques sur les canards de mer, lesquelles sont difficiles à obtenir par d'autres moyens. Les objectifs étaient de déterminer la variabilité spatiale et temporelle ainsi que celle liée à la densité dans les rapports entre les classes d'âge et les rapports des sexes pour cinq espèces de canards de mer et la variabilité dans les proportions de mâles adultes pour onze espèces qui hivernent dans le détroit de Georgia, en Colombie-Britannique. Des tronçons de rive d'un kilomètre (n = 49-62) ont été étudiés au début de février en 2003, en 2004, en 2014 et en 2015. Les espèces les plus omniprésentes étaient le Petit Garrot (*Bucephala albeola*), le Garrot à œil d'or (*Bucephala clangula*), le Macreuse à front blanc (*Melanitta perspicillata*) et l'Arlequin plongeur (*Histrionicus histrionicus*), et se rencontraient dans 74 à 96 % des tronçons d'un kilomètre. Les espèces les moins fréquentes étaient le Harle couronné (*Lophodytes cucullatus*), le Harelde kakawi (*Clangula hyemalis*) et le Grand Harle (*Mergus merganser*). Le nombre d'individus comptés pour la Macreuse à front blanc, la Macreuse brune (*Melanitta fusca*) et l'Arlequin plongeur étaient les plus élevés : plus de 1 000 individus ont été comptés chaque année pour la Macreuse à front blanc et l'Arlequin plongeur, et la plupart des années pour la Macreuse brune. Les densités variaient d'une année à l'autre pour la Macreuse brune, le Petit Garrot et le Harle huppé (*Mergus serrator*). Les estimations annuelles des rapports entre les classes d'âge des mâles (mâle de l'année : mâle adulte) variaient considérablement pour la Macreuse à bec jaune (*Melanitta americana*; de 0,071 à 0,170), la Macreuse à front blanc (de 0,064 à 0,139), l'Arlequin plongeur (de 0,068 à 0,147) et le Garrot à œil d'or (de 0,096 à 0,201). Des différences régionales dans les rapports entre les classes d'âge des mâles ont été notées pour le Garrot d'Islande (*Bucephala islandica*; de 0,029 à 0,144) et le Garrot à œil d'or (de 0,060 à 0,178). Des interactions complexes ont été constatées d'une région à l'autre selon l'année pour la Macreuse à front blanc. Les rapports des sexes variaient moins que les rapports entre les classes d'âge et variaient selon l'année et la région seulement pour le Garrot à œil d'or et la Macreuse à front blanc. Les proportions de mâles adultes étaient corrélées avec les rapports des sexes, mais variaient davantage que ces derniers et présentaient des différences considérables selon l'année pour la Macreuse à front blanc, le Garrot à œil d'or et le Petit Garrot et par région pour la Macreuse à front blanc, le Garrot à œil d'or, le Petit Garrot, le Grand Harle et le Harle huppé. D'après des recherches antérieures qui ont calculé les limites de confiance prévues à partir de différents nombres de tronçons d'un kilomètre occupés, l'intensité d'échantillonnage par espèce de la présente étude a probablement permis d'obtenir des estimations des rapports entre les classes d'âge dont les limites de l'intervalle de confiance à 95 % sont de ± 5 % pour la Macreuse à front blanc et de ± 3 % pour l'Arlequin plongeur. Les rapports entre les classes d'âge constituent le meilleur indice relatif du recrutement, car il y a un écart manifeste entre les tendances connues en matière de population et les tendances inférées à partir des rapports entre les classes d'âge et des taux de survie estimés. Les différences régionales et liées à la densité dans les rapports entre les classes d'âge, les rapports des sexes et les proportions de mâles adultes indiquent une ségrégation et font ressortir la

nécessité d’un échantillonnage à grande échelle en vue d’atteindre la représentativité. Les différences interannuelles peuvent indiquer des changements démographiques, mais il existe peu de données comparatives, et des relevés devraient être réalisés pendant plusieurs années consécutives avant que des données de base soient obtenues.

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1 INTRODUCTION

Life history traits of delayed sexual maturity, high annual survival, and low fecundity and recruitment rates, make sea duck (Tribe Mergini) populations resilient to short-term fluctuations in reproductive performance but slow to recover from population impacts (Goudie et al. 1994, Iverson and Esler 2010, Wilson et al. 2012). Distributions at sea often overlap areas of human activity and wintering populations are stressed by hunting, habitat loss, and oil-spill-related mortality (De La Cruz et al. 2013, Esler et al. 2000). Although population dynamics are most sensitive to changes in adult survival rates, those rates may be relatively invariant and population trends may be most affected by variation in reproductive parameters and recruitment rates (Wilson et al. 2012). Estimating and monitoring recruitment is therefore especially important for sea duck species (Flint 2015). Apparent declines in the 1990's of many Mergini led to heightened concern for Pacific populations (Goudie et al. 1994, Petersen and Hogan 1996) and to the formation of the Sea Duck Joint Venture (SDJV). More recently, British Columbia Coastal Waterbird Surveys (BCCWS) in the Strait of Georgia have indicated declines in five species since 1999 (Crewe et al. 2012). Population dynamics of sea ducks are generally poorly understood and demographic data are needed to assist in the management of all species (SDJV 2008).

Age and sex ratios have long been used as demographic tools in the management of a variety of taxa (Bellrose et al. 1961, Harris et al. 2008, Citta et al. 2014). Among waterfowl, obtaining demographic data using common methods is more difficult for sea ducks than for other species (Iverson et al. 2004). Most sea ducks are dispersed breeders, making studies that assess nesting success and post-fledging survival logistically problematic, and, because sea ducks occur infrequently in hunter bags, estimates of age and sex ratios from wing counts are unreliable. It is also difficult to conduct mark-recapture studies to determine recruitment and survival rates because, in addition to logistical difficulties in breeding areas, most species are difficult to capture and resight on wintering areas. As a consequence, the use of relatively easy to determine winter sex and age ratios to infer population demographics has particular value for this group of waterfowl, and models have been developed to estimate population trends from statistics developed from these measures (Robertson 2008). However, although population trends can be inferred from winter sex and age ratio data, spatial and temporal variation in these ratios may lead to differing conclusions, and most available data on age and sex ratios and survival rates yield a mismatch between inferred and observed population trends. It is therefore valuable to document potential variability in age and sex ratios in time and space, and, if possible, relate them to independent measures of population status.

The Strait of Georgia in coastal British Columbia (BC) is an important wintering area for 11 Mergini species, many of which occur there in globally or continentally significant proportions (Campbell et al. 1990, Crewe et al. 2012, Gaydos and Pearson 2011, Savard 1989, Vermeer 1982). Burgeoning human activity and its impact on wintering sea duck populations in this area present conservation challenges to wildlife managers. A variety of long-term survey programs are underway to monitor numbers of wintering marine birds in the Strait of Georgia and the larger Salish Sea area (Anderson et al. 2009, Bower

2009, Crewe et al. 2012, Sauer et al .1996) but information on the demographic composition of wintering populations is poor, and fragmentary at most (Iverson et al. 2004, Rodway et al. 2003a, Smith et al. 2001). The Strait of Georgia is ideal for documenting and evaluating spatial and temporal variability in sex and age ratios of sea ducks due to its importance as a wintering area and because of its extensive sheltered marine waters, shorelines, and estuaries that are well suited to shoreline surveys.

Although all Mergini exhibit delayed plumage maturation and can be aged in the hand (Weller 1976), of those that winter in the Strait of Georgia, first year males can be reliably distinguished from adult males via field observation only for Black Scoter (*Melanitta americana*), Surf Scoter (*Melanitta perspicillata*), Harlequin Duck (*Histrionicus histrionicus*), Barrow's Goldeneye (*Bucephala islandica*), and Common Goldeneye (*Bucephala clangula*), thereby allowing identification of three demographic classes (adult males, first year males, and adult females and first year females combined) and permitting estimation of age and sex ratios for these species. For White-winged Scoter (*Melanitta fusca*), Long-tailed Duck (*Clangula hyemalis*), Bufflehead (*Bucephala albeola*), Common Merganser (*Mergus merganser*), Red-breasted Merganser (*Mergus serrator*), and Hooded Merganser (*Lophodytes cucullatus*), immature males are difficult to distinguish from females, making it practical only to separate adult males from all other demographic classes combined (adult females and first year individuals of both sexes).

Objectives of this study were to: 1) establish a sample of geo-referenced survey sites that can be easily replicated to monitor changes in density, distribution, and demographic composition of wintering sea ducks in the Strait of Georgia; 2) estimate age and sex ratios for five, and proportions of adult males for 11, wintering sea duck species; 3) determine spatial and temporal variability in these demographic parameters for each species; 4) relate variation in demographic parameters to local bird densities; 5) collate available data on sea duck sex and age ratios from other studies; and 6) evaluate age ratios as an index of recruitment in light of reported population trends and survival rates.

2 METHODS

2.1 Study area

This study took place in the Strait of Georgia, BC, where the sheltered marine waters provide wintering habitat for regionally and globally significant populations of wintering waterbird species (Butler and Vermeer 1989, Campbell et al. 1990). Habitats available to sea ducks in the Strait of Georgia range from rich estuaries around Baynes Sound and the Fraser River Delta to rocky fjord-like shorelines along the Sunshine Coast. Some areas, such as Burrard Inlet have highly industrialized foreshores, while others, such as the Discovery Islands at the northern end of the Strait, remain largely undeveloped. Surveys were conducted in the Lower Mainland (Tsawwassen and White Rock to Burrard Inlet), on the Sunshine Coast (Gibsons to Sliammon townsite north of Powel River), and on the east coast of Vancouver Island (from Columbia Beach north of Nanaimo to Quadra Island).

Km-long survey sections were established with geo-referenced start and end points at 49 sites in 2003. Sites were chosen that were known to have relatively large numbers of wintering sea ducks. Survey locations were categorized logistically into three regions to allow regional comparisons: 1) Lower Mainland, including Boundary Bay, Fraser Delta, English Bay and Burrard Inlet; 2) Sunshine Coast, from Gibsons to Powell River; and 3) Vancouver Island, from French Creek to Campbell River, including Denman, Hornby, and Quadra islands. Within each region, sites were also grouped into areas (Table 1). In 2004 an additional 13 sites were established (Iverson et al. 2006). Target sample size was based on previous research in the study area indicating that about 60 km-sections surveyed from land could provide age-ratio estimates with 95% confidence limits of ± 2% for Harlequin Ducks (Rodway et al. 2003a) and ± 5% for Surf Scoters (Iverson et al. 2004). Data from 2003 and 2004 have been previously presented in Iverson et al. (2006).

2.2 Survey effort

Midwinter surveys were conducted in 2003, 2004, 2008, 2014 and 2015. All 11 wintering Mergini species were surveyed in 2003, 2004, 2014, and 2015 (hereafter referred to as the main survey years).

In 2008, 35 of the established km-sections were surveyed by Vanessa Richard (unpubl. data) for Barrow's Goldeneye, Harlequin Ducks, and Surf Scoters only (Table 1). Point counts were conducted at two additional locations, Deep Bay and Sea Edge, to sample additional Surf Scoter flocks, but these were not surveyed as km-sections and were not revisited in subsequent years. Data from 2008 were not included in statistical comparisons due to the reduced survey effort in this year, but are included here for completeness and are presented in data summary tables and Appendix 2.

In 2014, all established km-sections except nine in the Lower Mainland region were resurveyed and in 2015 all 62 km-sections were resurveyed (Table 1). Data from these years have not been previously presented and were added to the existing database.

Table 1. Summary of survey effort from 2003 to 2015.

Region	Area[1]	Number of km-sections	Km-sections surveyed				
			2003[2]	2004	2008[3]	2014	2015
Lower Mainland	BBFD	7	1-4	all	all	1-5	all
	BIEB	7	all	all	all	none	all
Sunshine Coast	LOSC	5	1-4	all	1,3	all	all
	UPSC	7	1-6	all	3,5,7	all	all
Vancouver Island	BSHI	12	1-8	all	1,2,12	all	all
	CRCX	12	1-10	all	1-5,7,10	all	all
	DBFC	6	all	all	all	all	all
	DIIS	6	1-4	all	none	all	all
Total		62	49	62	35	53	62

[1] BBFD – Boundary Bay / Fraser Delta; BIEB – Burrard Inlet / English Bay; LOSC – lower Sunshine Coast; UPSC – upper Sunshine Coast; BSHI – Baynes Sound / Hornby Island; CRCX – Campbell River / Comox; DBFC – Deep Bay / French Creek; DIIS – Discovery Island (Quadra Island).
[2] BUFF, COME, HOME, LTDU, RBME, and WWSC were not sexed in 2003.
[3] Only BAGO, HADU, and SUSC were surveyed in 2008.

2.3 Survey protocol

Surveys were conducted from the end of January to the end of February when age class determinations are most reliable (Iverson et al. 2003, Leukering 2012, Smith et al. 1998) and winter distributions are stable (Rodway et al. 2003b). Experienced observers walking the shoreline of each km-section identified and counted birds within an estimated 500 m of shore using binoculars and 20-60X spotting scopes. Surveys were conducted only during daylight hours (08:00-16:30) and were not conducted in fog, heavy rain or snow, or when Beaufort Sea Condition rated >3 (small scattered whitecaps, gentle breeze, wind speed 7-10 knots). Boundaries of the survey sections were determined from geo-referenced start and end points using hand-held GPS units and compass bearings associated with each end point (Appendix 1). Bearings at each end point were generally taken perpendicular to the shoreline, so that the area surveyed was approximately 500 m by 1000 m. This general rule was modified when shoreline contours were complex, such as when the survey section encompassed a bay and a perpendicular bearing at an end point would cut across the survey area. In such cases, bearings were taken to maintain as close to a 500 m by 1000 m survey area as possible.

For Black Scoter, Surf Scoter, Harlequin Duck, Barrow's Goldeneye, and Common Goldeneye, first winter (1Y) males were identified by their partial male plumage (Alderfer 2006, Iverson et al. 2004, Leukering 2012, Rodway et al. 2003a, Smith et al. 1998, 2001) (Figure 1) and age and sex ratios were determined for these species in all years in which they were surveyed. In most cases, numbers of each demographic class were simply counted but sub-sampling was occasionally required for large flocks and/or those that were diving. Male age ratio was calculated as the ratio of 1Y males to adult males, corresponding to the way recruitment is typically indexed in waterfowl (Cowardin and Blohm 1992) and the way age ratios have been used in population models (Robertson 2008), but differing from the way it has been reported by others (Caron and Paton 2007, Gardarsson 2008, Mittelhauser et al. 2002, Smith et al. 2001), who used the ratio of immature males to the total number of males (also see Iverson et al. 2004, Rodway et al. 2003a).

Sex ratio was defined as the ratio of all males to all females and indicates the degree of male bias in the population. Ratios of adult males to all other birds have often been reported as sex ratios in previous studies, but that measure better corresponds to adult male proportions reported here (see below).

Female age ratio is most relevant to population demographics because females are the limiting sex and produce the young, and recruitment among waterfowl is commonly indexed as the ratio of fledgling females to adult females (Cowardin and Blohm 1992). Female age ratio was calculated by assuming that the number of 1Y females is equivalent to the number of 1Y males, a reasonable assumption given that secondary sex ratios are generally equal and survival rates do not differ between the sexes for subadults in waterfowl (Bellrose et al. 1961, Blums and Mednis 1996, Johnson et al. 1992, Sun et al. 2011).

For White-winged Scoter, Long-tailed Duck, Bufflehead, Common Merganser, Red-breasted Merganser, and Hooded Merganser, adult males were distinguished from birds in female-like plumage, which included females and 1Y males, in 2004, 2014, and 2015. For these species in these three years, proportion of adult males was calculated as the number of adult males divided by the total number of birds. In 2003, only total counts were made for these six species and estimates of sex ratio were not possible and in 2008 these species were not included in surveys. Though likely correlated with sex ratios, adult male proportions were also determined for Black Scoter, Surf Scoter, Harlequin Duck, Barrow’s Goldeneye, and Common Goldeneye whenever these species had been surveyed to allow comparisons of these parameters among all species.

Figure 1. Flock of Surf Scoters showing one male, two females, and three juveniles at DIIS-3 on Quadra Island on February 16, 2015 (photo by Heidi Regehr).

2.4 Statistical analysis

Proportions of km-sections occupied by a particular species were compared across years (excluding 2008) using *G*-tests, and the density of birds within occupied km-sections were compared among years using Kruskal-Wallis *H* tests. Log-linear analyses were used to determine associations with year and region for age ratios, sex ratios, and adult male proportions. Numbers of adult males relative to numbers of other birds (females plus 1Y males) were tabulated to analyze adult male proportions. Using SYSTAT 13, best-fitting models were chosen from a saturated model by excluding interaction terms that did not contribute significantly to model fit, based on changes in likelihood-ratio chi-square (G; Sokal and Rohlf 1995). *G*-tests were used to test the relationship of age ratios, sex ratios, and adult male proportions to numbers of conspecifics per km-section in order to evaluate segregation in relation to abundance. The metric "numbers of conspecifics per km-section" rather than "flock size" was used in these analyses because it was difficult and arbitrary to define flock sizes where birds were relatively continuously distributed and flock sizes and compositions were changing during a survey.

3 RESULTS

3.1 Abundance and distribution

Bufflehead, Common Goldeneye, Surf Scoters and Harlequin Ducks occurred most frequently in our study, and were present in 74 to 96% of km-sections surveyed during the main survey years (Table 2). Hooded Mergansers, Long-tailed Duck and Common Mergansers were least common (Table 2).

Numbers of individuals counted in all survey stations combined was highest for Surf Scoters, White-winged Scoters, and Harlequin Ducks with over 1000 individuals counted in each of the main survey years for Surf Scoters and Harlequin Ducks and in most years for White-winged Scoters (Table 3). In 2008, the number of Harlequin Ducks was low relative to other survey years due to the reduced percent occurrence for this species in this year, likely due to the subset of km-sections surveyed.

Hooded Mergansers were most infrequently observed of all species, with a maximum of 18 observed in 2014 and none observed in 2003 (Table 3). This species was not observed in the Lower Mainland region in any year and in the other two regions in two of four years. It was the only species that showed a significant difference in percent occurrence among years (Table 2). Long-tailed Ducks were not observed in the Lower Mainland region in 2003 and 2014, and were recorded in the Sunshine Coast region only in 2015 (Table 3). Common Mergansers were infrequently recorded in the first three survey years (with a maximum total of 52 birds) and were also not recorded in the Lower Mainland region in those years (Table 3). However, in 2015 a total of 447 individuals were counted including 207 in the Lower Mainland region (Table 3). The low occurrence of Barrow's Goldeneye in 2014 likely relates to the fact that the Lower Mainland Burrard Inlet-English Bay area, which had 100% percent occurrence in all other years, was not surveyed in 2014. In 2015 two male Bufflehead / Common Goldeneye hybrids (Finley and Huot 2010) occurred in survey sections, one in the Lower Mainland region in BIEB-2 (Spanish Banks) on February 8 (Figure 2) and one in the Vancouver Island region in BSHI-12 (Gartley Point) on February 18.

In km-sections where birds occurred, Kruskal-Wallis tests indicated differences among years in the density of birds per occupied km-section for White-winged Scoter, which was lowest in 2014 and highest in 2004, Bufflehead, which was lowest in 2004 and highest in 2014, and Red-breasted Merganser, which was lowest in 2015 and highest in 2014 (Table 4).

Table 2. Percent occurrence of sea duck species in surveyed km-sections in the Strait of Georgia, British Columbia, 2003-2015 and results of G-tests.

Species[1]	Year (number of km-sections surveyed)					G	P
	2003 (49)	2004 (62)	2008[2] (35)	2014 (53)	2015 (62)		
BAGO	42.9	43.5	48.6	24.5	41.9	3.41	0.49
BLSC	59.2	48.4	-	39.6	30.6	3.93	0.27
BUFF	95.9	93.5	-	86.8	95.2	0.16	0.98
BUFF/COGO	0.0	0.0	-	0.0	3.2	-	-
COGO	91.8	74.2	-	84.9	93.5	0.90	0.83
COME	20.4	30.6	-	22.6	48.4	6.39	0.09
HADU	77.6	80.6	60.0	75.5	75.8	0.84	0.93
HOME	0.0	3.2	-	11.3	3.2	**8.40**	**0.04**
LTDU	18.4	17.7	-	35.8	30.6	4.23	0.24
RBME	65.3	74.2	-	66.0	62.9	0.39	0.94
SUSC	91.8	87.1	97.1	83.0	80.6	0.49	0.97
WWSC	63.3	56.5	-	52.8	33.9	3.92	0.27

[1] BAGO – Barrow's Goldeneye; BLSC – Black Scoter; BUFF – Bufflehead; BUFF/COGO - Bufflehead/Common Goldeneye hybrid; COGO – Common Goldeneye; COME – Common Merganser; HADU – Harlequin Duck; HOME – Hooded Merganser; LTDU – Long-tailed Duck; RBME – Red-breasted Merganser; SUSC – Surf Scoter; WWSC - White-winged Scoter.
[2] Only BAGO, HADU, and SUSC were surveyed in 2008. Data from 2008 were not included in analyses.

Table 3. Male age ratios, sex ratios, adult male proportions, and calculated female age ratios of sea ducks surveyed in the Lower mainland (LM), Sunshine Coast (SC), and Vancouver Island (VI) regions of the Strait of Georgia, British Columbia, 2003-2015.

Species	Year	Region	Total[1]	Female[2]	Male	Adult male	1Y male	Male age ratio	Sex ratio (male/ female)	Adult male prop.	Female age ratio
Black Scoter	2003	LM	108	17	34	32	2	0.063	2.000	0.627	0.133
		SC	102	24	79	70	9	0.129	3.292	0.680	0.600
		VI	563	156	409	344	65	0.189	2.622	0.609	0.714
		Total	773	197	522	446	76	0.170	2.650	0.620	0.628
	2004	LM	6	2	4	3	1	0.333	2.000	0.500	1.000
		SC	61	17	44	43	1	0.023	2.588	0.705	0.063
		VI	744	204	540	485	55	0.113	2.647	0.652	0.369
		Total	811	223	588	531	57	0.107	2.637	0.655	0.343
	2014	LM	4	2	2	2	0	0.000	1.000	0.500	0.000
		SC	26	7	19	18	1	0.056	2.714	0.692	0.167
		VI	533	158	325	303	22	0.073	2.057	0.627	0.162
		Total	563	167	346	323	23	0.071	2.072	0.630	0.160
	2015	LM	0	0	0	0	0				
		SC	41	9	32	29	3	0.103	3.556	0.707	0.500
		VI	347	111	236	207	29	0.140	2.126	0.597	0.354
		Total	388	120	268	236	32	0.136	2.233	0.608	0.364
White-winged Scoter	2003	LM	730								
		SC	98								
		VI	1020								
		Total	1848								
	2004	LM	542	245		297				0.548	
		SC	65	35		30				0.462	
		VI	1628	775		853				0.524	
		Total	2235	1055		1180				0.528	
	2014	LM	18	12		6				0.333	
		SC	17	9		8				0.471	
		VI	685	328		357				0.521	
		Total	720	349		371				0.515	
	2015	LM	35	20		15				0.429	
		SC	1	1		0				0.000	
		VI	1012	507		505				0.499	
		Total	1048	528		520				0.496	

Table 3 (continued).

Species	Year	Region	Total[1]	Female[2]	Male	Adult male	1Y male	Male age ratio	Sex ratio (male/ female)	Adult male prop.	Female age ratio
Surf Scoter	2003	LM	1039	280	473	438	35	0.080	1.689	0.582	0.143
		SC	225	71	154	152	2	0.013	2.169	0.676	0.029
		VI	1036	288	743	698	45	0.064	2.580	0.677	0.185
		Total	2300	639	1370	1288	82	0.064	2.144	0.641	0.147
	2004	LM	521	180	341	282	59	0.209	1.894	0.541	0.488
		SC	253	85	168	164	4	0.024	1.976	0.648	0.049
		VI	839	247	592	574	18	0.031	2.397	0.684	0.079
		Total	1613	512	1101	1020	81	0.079	2.150	0.632	0.188
	2008[3]	LM	1952	595	1357	1240	117	0.094	2.281	0.635	0.245
		SC	62	13	49	40	9	0.225	3.769	0.645	2.250
		VI	414	89	325	312	13	0.042	3.652	0.754	0.171
		Total	2428	697	1731	1592	139	0.087	2.484	0.656	0.249
	2014	LM	93	26	67	55	12	0.218	2.577	0.591	0.857
		SC	173	49	124	120	4	0.033	2.531	0.694	0.089
		VI	1643	679	821	744	77	0.103	1.209	0.496	0.128
		Total	1909	754	1012	919	93	0.101	1.342	0.520	0.141
	2015	LM	1016	373	643	567	76	0.134	1.724	0.558	0.256
		SC	218	60	158	151	7	0.046	2.633	0.693	0.132
		VI	1085	383	702	601	101	0.168	1.833	0.554	0.358
		Total	2319	816	1503	1319	184	0.139	1.842	0.569	0.291
Harlequin Duck	2003	LM	55	28	27	23	4	0.174	0.964	0.418	0.167
		SC	58	25	33	32	1	0.031	1.320	0.552	0.042
		VI	896	378	518	486	32	0.066	1.370	0.542	0.092
		Total	1009	431	578	541	37	0.068	1.341	0.536	0.094
	2004	LM	56	29	27	25	2	0.080	0.931	0.446	0.074
		SC	77	31	46	37	9	0.243	1.484	0.481	0.409
		VI	1154	490	664	610	54	0.089	1.355	0.529	0.124
		Total	1287	550	737	672	65	0.097	1.340	0.522	0.134
	2008[3]	LM	98	53	44	39	6	0.154	0.830	0.398	0.128
		SC	12	5	7	7	0	0.000	1.400	0.583	0.000
		VI	288	126	162	161	1	0.006	1.286	0.559	0.008
		Total	398	184	213	207	7	0.034	1.158	0.520	0.040
	2014	LM	52	25	27	24	3	0.125	1.080	0.462	0.136
		SC	62	26	36	33	3	0.091	1.385	0.532	0.130
		VI	967	402	565	495	70	0.141	1.405	0.512	0.211
		Total	1081	453	628	552	76	0.138	1.386	0.511	0.202
	2015	LM	55	24	31	25	6	0.240	1.292	0.455	0.333
		SC	82	36	46	43	3	0.070	1.278	0.524	0.091
		VI	932	407	525	457	68	0.149	1.290	0.490	0.201
		Total	1069	467	602	525	77	0.147	1.289	0.491	0.197

Table 3 (continued).

Species	Year	Region	Total[1]	Female[2]	Male	Adult male	1Y male	Male age ratio	Sex ratio (male/ female)	Adult male prop.	Female age ratio
Long-tailed Duck	2003	LM	0								
		SC	0								
		VI	55	10		0				0.000	
		Total	55	10		0				0.000	
	2004	LM	10	3		7				0.700	
		SC	0								
		VI	22	7		15				0.682	
		Total	32	10		22				0.688	
	2014	LM	0								
		SC	0								
		VI	77	27		50				0.649	
		Total	77	27		50				0.649	
	2015	LM	2	1		1				0.500	
		SC	2	2		0				0.000	
		VI	65	32		33				0.508	
		Total	69	35		34				0.493	
Barrow’s Goldeneye	2003	LM	191	83	108	101	7	0.069	1.301	0.529	0.092
		SC	180	83	98	93	5	0.054	1.181	0.514	0.064
		VI	41	13	28	26	2	0.077	2.154	0.634	0.182
		Total	412	179	234	220	14	0.064	1.307	0.533	0.085
	2004	LM	253	101	152	144	8	0.056	1.505	0.569	0.086
		SC	75	29	46	46	0	0.000	1.586	0.613	0.000
		VI	59	18	41	31	10	0.323	2.278	0.525	1.250
		Total	387	148	239	221	18	0.081	1.615	0.571	0.138
	2008[3]	LM	303	129	174	159	15	0.094	1.349	0.525	0.132
		SC	39	10	29	29	0	0.000	2.900	0.744	0.000
		VI	22	7	15	15	0	0.000	2.143	0.682	0.000
		Total	364	146	218	203	15	0.074	1.493	0.558	0.115
	2014	LM	2	0	2	1	1	1.000		0.500	
		SC	66	28	38	37	1	0.027	1.357	0.561	0.037
		VI	28	12	16	14	2	0.143	1.333	0.500	0.200
		Total	96	40	56	52	4	0.077	1.400	0.542	0.111
	2015	LM	389	170	219	207	12	0.058	1.288	0.532	0.076
		SC	182	74	108	105	3	0.029	1.459	0.577	0.042
		VI	36	17	19	18	1	0.056	1.118	0.500	0.063
		Total	607	261	346	330	16	0.048	1.326	0.544	0.065

Table 3 (continued).

Species	Year	Region	Total[1]	Female[2]	Male	Adult male	1Y male	Male age ratio	Sex ratio (male/ female)	Adult male prop.	Female age ratio
Common Goldeneye	2003	LM	100	27	73	69	4	0.058	2.704	0.690	0.174
		SC	57	23	34	33	1	0.030	1.478	0.579	0.045
		VI	461	197	258	231	27	0.117	1.310	0.508	0.159
		Total	618	247	365	333	32	0.096	1.478	0.544	0.149
	2004	LM	49	8	41	38	3	0.079	5.125	0.776	0.600
		SC	68	22	46	45	1	0.022	2.091	0.662	0.048
		VI	515	170	345	295	50	0.169	2.029	0.573	0.417
		Total	632	200	432	378	54	0.143	2.160	0.598	0.370
	2014	LM	59	24	35	32	3	0.094	1.458	0.542	0.143
		SC	111	34	77	74	3	0.041	2.265	0.667	0.097
		VI	489	201	288	239	49	0.205	1.433	0.489	0.322
		Total	659	259	400	345	55	0.159	1.544	0.524	0.270
	2015	LM	217	82	135	108	27	0.250	1.646	0.498	0.491
		SC	138	47	91	82	9	0.110	1.936	0.594	0.237
		VI	705	279	426	353	73	0.207	1.527	0.501	0.354
		Total	1060	408	652	543	109	0.201	1.598	0.512	0.365
Bufflehead	2003	LM	65								
		SC	60								
		VI	758								
		Total	883								
	2004	LM	117	60		57				0.487	
		SC	59	24		35				0.593	
		VI	719	360		359				0.499	
		Total	895	444		451				0.504	
	2014	LM	76	52		24				0.316	
		SC	107	52		55				0.514	
		VI	962	584		378				0.393	
		Total	1145	688		457				0.399	
	2015	LM	222	121		101				0.455	
		SC	110	40		70				0.636	
		VI	797	429		368				0.462	
		Total	1129	590		539				0.477	

Table 3 (continued).

Species	Year	Region	Total[1]	Female[2]	Male	Adult male	1Y male	Male age ratio	Sex ratio (male/ female)	Adult male prop.	Female age ratio
Common Merganser	2003	LM	0								
		SC	5								
		VI	47								
		Total	52								
	2004	LM	0								
		SC	3	0		3				1.000	
		VI	48	23		25				0.521	
		Total	51	23		28				0.549	
	2014	LM	0								
		SC	11	8		3				0.273	
		VI	32	20		12				0.375	
		Total	43	28		15				0.349	
	2015	LM	207	190		17				0.082	
		SC	86	54		32				0.372	
		VI	154	102		52				0.338	
		Total	447	346		101				0.226	
Red-breasted Merganser	2003	LM	41								
		SC	26								
		VI	174								
		Total	241								
	2004	LM	38	25		13				0.342	
		SC	22	10		12				0.545	
		VI	187	109		78				0.417	
		Total	247	144		103				0.417	
	2014	LM	28	25		3				0.107	
		SC	20	13		7				0.350	
		VI	237	143		94				0.397	
		Total	285	181		104				0.365	
	2015	LM	31	10		21				0.677	
		SC	21	14		7				0.333	
		VI	113	68		45				0.398	
		Total	165	92		73				0.442	

Table 3 (continued).

Species	Year	Region	Total[1]	Female[2]	Male	Adult male	1Y male	Male age ratio	Sex ratio (male/ female)	Adult male prop.	Female age ratio
Hooded Merganser	2003	LM	0								
		SC	0								
		VI	0								
		Total	0								
	2004	LM	0								
		SC	0								
		VI	4	2		2				0.500	
		Total	4	2		2				0.500	
	2014	LM	0								
		SC	7	6		1				0.143	
		VI	11	8		3				0.273	
		Total	18	14		4				0.222	
	2015	LM	0								
		SC	4	3		1				0.250	
		VI	0								
		Total	4	3		1				0.250	

[1]Totals do not always equal the sum of females and males because in some cases not all birds were sexed.
[2]Female includes 1Y male for species in which 1Y males were not distinguished.
[3]Data from 2008 were not included in statistical comparisons.

Figure 2. Male Bufflehead / Common Goldeneye hybrid, shown adjacent to female Bufflehead, in km-section BIEB-2 on February 8, 2015 (photo by Heidi Regehr).

Table 4. Mean density (± SE) of birds in occupied km-sections (N) surveyed for sea ducks in the Strait of Georgia, British Columbia, 2003-2015, and results of Kruskal-Wallis tests.

Species	Year (total km-sections surveyed)					H	P
	2003 (49)	2004 (62)	2008 (35)	2014 (53)	2015 (62)		
BLSC	26.7 ± 6.9 (29)	27.0 ± 7.3 (30)	-	26.8 ± 9.8 (21)	20.4 ± 5.5 (19)	0.96	0.81
WWSC	59.6 ± 20.2 (31)	63.9 ± 15.1 (35)	-	25.7 ± 11.5 (28)	49.9 ± 23.4 (21)	**12.96**	**0.005**
SUSC	51.1 ± 11.8 (45)	29.9 ± 6.3 (54)	81.6 ± 31.4 (34)	43.4 ± 14.3 (44)	46.4 ± 17.6 (50)	8.45	0.076
HADU	26.6 ± 3.7 (38)	25.7 ± 3.5 (50)	19.0 ± 3.9 (21)	27.0 ± 3.3 (40)	22.7 ± 3.4 (47)	3.22	0.52
LTDU	5.0 ± 1.4 (9)	2.9 ± 0.7 (11)	-	4.1 ± 0.8 (19)	3.6 ± 1.2 (19)	3.71	0.29
BAGO	19.6 ± 4.8 (21)	14.3 ± 3.6 (27)	21.4 ± 5.9 (17)	7.4 ± 2.1 (13)	23.3 ± 7.3 (26)	1.84	0.77
COGO	13.7 ± 2.5 (45)	13.7 ± 2.0 (46)	-	14.6 ± 2.6 (45)	18.3 ± 3.1 (58)	0.78	0.86
BUFF	18.8 ± 2.8 (47)	15.4 ± 2.1 (58)	-	24.9 ± 2.9 (46)	19.1 ± 2.7 (59)	**8.60**	**0.035**
COME	5.2 ± 2.4 (10)	2.7 ± 0.5 (19)	-	3.6 ± 0.9 (12)	14.9 ± 4.5 (30)	1.82	0.61
RBME	7.5 ± 1.2 (32)	5.4 ± 0.9 (46)	-	8.1 ± 1.4 (35)	4.2 ± 0.6 (39)	**11.75**	**0.008**
HOME	0.0	2.0 ± 0.0 (2)	-	2.8 ± 0.7 (6)	2.0 ± 0.0 (2)	0.28	0.87

3.2 Male age ratios

Male age ratios (1Y males to adult males) differed among species for all years combined (G_4 = 57.5, P < 0.001) and separately (2003: G_4 = 37.0, P < 0.001; 2004: G_4 = 10.7, P = 0.031; 2014: G_4 = 14.5, P = 0.006; 2015: G_4 = 35.0, P < 0.001). Male age ratio was generally highest for Black Scoter and Common Goldeneye, and lowest for Barrow's Goldeneye (Table 3).

Log-linear models indicated significant associations between male age ratios and year for Black Scoter, Surf Scoter, Harlequin Duck, and Common Goldeneye, and between age ratios and region for Surf Scoter, Barrow's Goldeneye, and Common Goldeneye (Table 5). In the main survey years, male age ratios were lowest in 2014 and highest in 2003 for Black Scoters, ranging from 0.071 to 0.170, were lowest in 2003 and highest in 2015 for Harlequin Ducks, ranging from 0.068 to 0.147, and were lowest in 2003 and highest in 2015 for Common Goldeneye, ranging from 0.096 to 0.201 (Table 3). Harlequin Duck age ratios were unusually low in 2008 likely due to the subset of km-sections surveyed in that year. For example, relatively high male age ratios have been found in all years (0.153) on Quadra Island, which was not surveyed in 2008.

Regional differences in male age ratios for Barrow's Goldeneye ranged from 0.029 on the Sunshine Coast to 0.144 on Vancouver Island in the main survey years, and for Common Goldeneye from 0.060 on the Sunshine Coast to 0.178 on Vancouver Island for all years combined (Table 3). Male age ratio was lowest on the Sunshine Coast in all years for both species and highest on Vancouver Island in two (Barrow's Goldeneye) or three (Common Goldeneye) years. In 2008, juvenile Barrow's Goldeneye were only found in the Lower Mainland region but survey effort was reduced in the other two regions in that year (Table 1).

For Surf Scoter, the 3-way interaction term of age class, year, and region contributed significantly to model fit, making the interpretation of year and region effects more complicated. The interaction of year*region was significant for all species except Harlequin Duck. This reflects expected variability in bird numbers in km-sections and indicates that for four of five species, yearly and regional variation in numbers of birds present in survey sections had a major influence on cell frequencies in log-linear models. Harlequin Duck numbers showed little variation relative to the other species.

Two-way analyses at each level of the third factor were used to investigate the significant 3-way interaction for Surf Scoter: differences by year were significant in the Lower Mainland (G_3 = 20.9, P < 0.001) and Vancouver Island (G_3 = 63.0, P < 0.001) regions, but not on the Sunshine Coast (G_3 = 3.1, P = 0.38), where the age ratio remained low in all of the main survey years (Table 3). Regional differences were significant in all four years: 2003 (G_2 = 10.3, P = 0.006), 2004 (G_2 = 65.4, P < 0.001), 2014 (G_2 = 11.8, P = 0.003), and 2015 (G_2 = 14.5, P < 0.001). The pattern of regional differences for Surf Scoter was similar in 2003 through 2014, tending to be highest on the Lower Mainland and lowest on the Sunshine Coast, but differed in 2015 when it was highest on Vancouver Island though still lowest on the Sunshine Coast. In 2008 a different pattern was observed in which age ratio was highest on the Sunshine Coast and lowest on Vancouver Island, but this year was not included in statistical comparisons due to the low number of km-sections surveyed.

Male age ratio varied in relation to the total number of conspecifics present in a km-section only for Surf Scoter (

Table 6). Surf Scoter age ratio tended to be highest when there were larger numbers of conspecifics within a km-section. The maximum age ratio of 0.137 was associated with counts of 51 to 100 individuals per km-section and the second highest (0.113) was associated with counts of over 200 individuals. One group of Surf Scoters with an extreme age ratio was observed for an intermediate group size. This flock, composed largely of juveniles, was recorded at CRCX-7 in the Vancouver Island region (Oyster Bay) in 2015 in a group. The group of 65 Surf Scoters contained 54 juveniles, two males, and nine females. A similar group with an unusually high proportion of juveniles was also observed at Deep Bay, Vancouver Island, in 2008 during a point count. This group was composed of 50 juveniles, 12 adult males, and 60 females (Appendix 2). The 2008 observation was not conducted within a km-section survey and was therefore not included in estimation of male age ratio for that year. Km-sections were chosen for age ratio surveys in order to avoid potential biases that may result from subjectively choosing specific flocks of birds.

Table 5. Log-linear model selection for sea duck age ratios (analyzing frequency of 1Y males to adult males) and sex ratios (analyzing frequency of males to females) in relation to year and region in the Strait of Georgia, British Columbia, in 2003, 2004, 2014 and 2015. Age and sex categories are included in the variable "Class". Only interaction terms are listed and those that were retained in the final model are indicated in bold. Significance of a term was judged by the change in likelihood ratio chi-square (G) due to removing that term from the model.

Model term	BLSC		SUSC		HADU		BAGO		COGO	
	Age ratio	Sex ratio	Age ratio	Sex ratio	Age ratio	Sex ratio	Age ratio	Sex ratio	Age ratio	Sex ratio
Class*year *G* change	**15.2**	5.6	**35.7**	**61.2**	**18.3**	0.7	0.8	2.4	**15.8**	**15.0**
df	**3**	3	**3**	**3**	**3**	3	3	3	**3**	**3**
P	**0.002**	0.13	**0.000**	**0.000**	**0.000**	0.88	0.084	0.49	**0.001**	**0.002**
Class*region *G* change	5.2	3.2	**53.4**	**14.4**	1.4	3.2	**14.8**	2.1	**21.3**	**10.3**
df	2	2	**2**	**2**	2	2	**2**	2	**2**	**2**
P	0.08	0.20	**0.000**	**0.001**	0.51	0.20	**0.001**	0.36	**0.000**	**0.006**
Year*region *G* change	**88.2**	**125.1**	**489.1**	**1023.5**	4.4	6.3	**123.9**	**221.9**	**67.0**	**95.4**
	6	**6**	**6**	**6**	6	6	**6**	**6**	**6**	**6**
	0.000	**0.000**	**0.000**	**0.000**	0.63	0.39	**0.000**	**0.000**	**0.000**	**0.000**
Class*year* region *G* change	4.05	1.4	**51.3**	**41.8**	11.0	1.3	12.5	5.9	7.8	11.5
df	6	6	**6**	**6**	6	6	6	6	6	6
P	0.67	0.96	**0.000**	**0.000**	0.09	0.97	0.053	0.44	0.25	0.08
Model fit *G*	9.2	10.2	0	0	16.8	11.5	13.3	10.4	7.8	11.5
df	8	11	0	0	14	17	9	11	6	6
P	0.32	0.51	1	1	0.27	0.83	0.15	0.50	0.25	0.08

Table 6. Variation in age ratio and sex ratio in relation to the total number of conspecifics present per km-section in the Strait of Georgia, British Columbia, in 2003, 2004, 2014 and 2015.

Species	Number of conspecifics per km-section	Female	Adult male	1Y male	Age ratio	Sex ratio	Age ratio *G*-test	Sex ratio *G*-test
BLSC	1-20	145	302	34	0.113	2.317	$G_3 = 0.35$ $P = 0.95$	$\mathbf{G_3 = 16.5}$ $\mathbf{P < 0.001}$
	21-50	156	317	41	0.129	2.295		
	51-100	199	346	42	0.121	1.950		
	101-200	207	571	71	0.124	3.101		
SUSC	1-20	302	564	46	0.082	2.020	$\mathbf{G_4 = 34.3}$ $\mathbf{P < 0.001}$	$\mathbf{G_4 = 45.5}$ $\mathbf{P < 0.001}$
	21-50	421	856	51	0.060	2.154		
	51-100	530	1031	141	0.137	2.211		
	101-200	680	959	74	0.077	1.519		
	201-1000	788	1136	128	0.113	1.604		
HADU	1-20	384	447	53	0.119	1.302	$G_3 = 0.95$ $P = 0.81$	$G_3 = 1.9$ $P = 0.60$
	21-50	827	966	110	0.114	1.301		
	51-100	544	700	76	0.109	1.426		
	101-200	146	177	16	0.090	1.322		
BAGO	1-20	157	198	14	0.071	1.350	$G_3 = 4.1$ $P = 0.26$	$G_3 = 6.8$ $P = 0.08$
	21-50	121	200	17	0.085	1.793		
	51-100	242	296	17	0.057	1.293		
	101-200	108	129	4	0.031	1.231		
COGO	1-20	424	637	101	0.159	1.741	$G_3 = 5.6$ $P = 0.13$	$G_3 = 5.9$ $P = 0.12$
	21-50	342	520	90	0.173	1.784		
	51-100	305	392	47	0.120	1.439		
	101-200	43	50	12	0.240	1.442		

3.3 Sex ratios

Sex ratios (all males to all females) differed among species for all years combined (G_4 = 202.4, $P < 0.001$) and separately (2003: $G_4 = 73.0$, $P < 0.001$; 2004: $G_4 = 65.9$, $P <$ 0.001; 2014: $G_4 = 18.6$, $P = 0.001$, 2015: $G_4 = 37.2$, $P < 0.001$). In the main survey years sex ratios (all males to all females) ranged from 1.3 for Harlequin Ducks in 2003, 2004, and 2015 and Barrow's Goldeneye in 2003 and 2015, to 2.6 for Black Scoters in 2003 and 2004 for all regions combined (Table 3). Sex ratio tended to be highest for the two scoter species, lowest for Harlequin Duck and Barrow's Goldeneye, and intermediate for Common Goldeneye. In 2008, estimates of Harlequin Duck and Surf Scoter sex ratios from the subset of km-sections surveyed were lower and higher than in all other years, respectively.

Log-linear models indicated significant associations between sex ratio and year and between sex ratio and region only for Common Goldeneye and Surf Scoter (Table 5). Male bias in the Common Goldeneye sex ratio was highest in 2004 and lowest in the Vancouver Island region in all years (Table 3). The 3-way interaction between sex class, year, and region contributed significantly to model fit for Surf Scoter. Two-way analyses for Surf Scoter revealed significant annual differences in the Vancouver Island region (G_3 = 100.8, $P < 0.001$) and not in the Lower Mainland (G_3 = 3.9, P = 0.28) or Sunshine Coast (G_3 = 2.6, P = 0.46) regions, and significant regional differences in 2003 (G_2 = 17.1, $P < 0.001$), 2014 (G_2 = 28.0, $P < 0.001$), and 2015 (G_2 = 6.9, P = 0.032), but not in 2004 (G_2 = 4.34, P = 0.11). In the Vancouver Island region, male bias in the Surf Scoter sex ratio was lower in 2014 and 2015 than in 2003 and 2004 (Table 3). Due to these annual differences in the Vancouver Island region, regional differences for Surf Scoters were not consistent across years: that region had the overall highest male bias in 2003 and the lowest in 2014. The interaction of year*region was again significant for all species except Harlequin Duck (Table 5).

Sex ratio varied in relation to the total number of conspecifics present in a km-section for Black Scoter and Surf Scoter (

Table 6). Trends were contrary for Black Scoter, which had the highest male biased sex ratio where the density of birds was highest, and for Surf Scoter, for which male bias was lowest where there were larger numbers of birds.

3.4 Adult male proportions

Adult male proportions (adult males to total birds) differed among species for all years combined (G_{10} = 604.2, P < 0.001) and separately (2003: G_4 = 47.2, P < 0.001; 2004: G_{10} = 119.4, P < 0.001; 2014: G_{10} = 135.9, P < 0.001; 2015: G_{10} = 2013.3, P < 0.001). Adult male proportions were generally highest for Black Scoters and Surf Scoters and lowest for Common Merganser, Red-breasted Mergansers, and Bufflehead (Table 3).

As expected, samples from each year and region showed a high correlation between adult male proportion and sex ratio (r_s = 0.79, P < 0.001, n = 58) for the five species for which sex ratios were estimated. However, results of analyses for adult male proportions differed somewhat from those for sex ratios for these species, especially for Common Goldeneye (Table 5, Table 7).

Log-linear models indicated a significant association between adult male proportions and year for Surf Scoter, Common Goldeneye, and Bufflehead, and between adult male proportions and region for Surf Scoter, Common Goldeneye, Bufflehead, Common Merganser, and Red-breasted Merganser (Table 7). The 3-way interaction between sex class, year, and region was significant for Surf Scoter, Common Goldeneye, and Red-breasted Merganser. The interaction of year*region was significant for all species except Harlequin Duck and Red-breasted Merganser (Table 7). Sample sizes were insufficient to test the full log-linear model for Long-tailed Duck. Two-way G-tests revealed no significant differences by year and region for Long-tailed Duck (G_3 = 5.1, P = 0.17 and G_2 = 3.9, P = 0.14, respectively). Sample size was too small for 2-way tests for Hooded Merganser.

For Bufflehead adult male proportions were highest in 2004 and lowest in 2014 and regionally they were highest on the Sunshine Coast in all years (Table 3). For Common Merganser adult male proportions were highest on the Sunshine Coast in two out of three years; however, the species was not detected on the Lower Mainland in 2004 and 2014.

Two-way analyses were used to interpret the significant 3-way interaction for Surf Scoter, Common Goldeneye, and Red-breasted Mergansers. As with sex ratios, there were significant yearly differences in adult male proportions for Surf Scoter in the Vancouver Island region (G_3 = 124.4, P < 0.001) and not in the Lower Mainland (G_3 = 2.5, P = 0.48) or Sunshine Coast (G_3 = 1.4, P = 0.70) regions. There were significant regional differences in all four years: 2003 (G_2 = 18.4, P < 0.001), 2004 (G_2 = 28.3, P < 0.001), 2014 (G_2 = 26.9, P < 0.001), and 2015 (G_2 = 15.6, P < 0.001). In the Vancouver Island region, adult male proportions were lower in 2014 and 2015 than in 2003 and 2004 (Table 3). Due to these annual differences in the Vancouver Island region, regional differences for Surf Scoters were not consistent across years: that region had the overall highest proportions in 2003 and 2004, and the lowest in 2014 and 2015.

For Common Goldeneye there were significant yearly differences in adult male proportions in the Vancouver Island (G_3 = 8.9, P = 0.030) and the Lower Mainland (G_3 = 19.7, P < 0.001) regions but not in the Sunshine Coast (G_3 = 2.3, P = 0.51) region. There were significant regional differences in three of four years: 2003 (G_2 = 11.6, P < 0.003), 2004 (G_2 = 9.5, P < 0.009), and 2014 (G_2 = 11.8, P < 0.003), but not in 2015 (G_2 = 4.3, P = 0.12). In both the Vancouver Island and the Lower Mainland regions, adult male proportions were highest in 2004 (Table 3). In the three years with regional differences, adult male proportion was highest on the Lower Mainland in 2003 and 2004, and highest on the Sunshine coast in 2014.

For Red-breasted Mergansers there were significant differences across three years in adult male proportions in the Lower Mainland (G_2 = 22.1, P < 0.001) but not in the Vancouver Island (G_2 = 0.3, P = 0.90) or Sunshine Coast (G_2 = 2.5, P = 0.29) regions. There were significant regional differences in 2014 and 2015 but not in 2004: 2004 (G_2 = 2.4, P = 0.31), 2014 (G_2 = 10.7, P < 0.005), and 2015 (G_2 = 8.9, P < 0.012). In the Lower Mainland region, adult male proportions were highest in 2015 and lowest in in 2014 (Table 3). In 2014 and 2015, when there were regional differences within years, the Vancouver Island region had highest adult male proportions in 2014 and the Lower Mainland region had highest proportions in 2015.

Adult male proportions varied in relation to the total number of conspecifics present in a km-section for Black Scoter, White-winged Scoter, Surf Scoter, Bufflehead, Common Merganser, and Red-breasted Merganser (Table 8). Black Scoters and White-winged scoters had the lowest adult male proportions at intermediate densities, while Surf Scoters had highest proportions at intermediate densities. For Bufflehead, Common Merganser, and Red-breasted Merganser, adult male proportions were highest at low densities.

Table 7. Log-linear model selection for adult male proportions (analyzing frequency of adult males to females and 1Y males) in relation to year and region in the Strait of Georgia, British Columbia, in 2003, 2004, 2014 and 2015. Sex categories are included in the variable "Class". Only interaction terms are listed and those that were retained in the final model are indicated in bold. Significance of a term was judged by the change in likelihood ratio chi-square (G) due to removing that term from the model.

Model term	BLSC	SUSC	WWSC	HADU	BAGO	COGO	BUFF	COME	RBME
Class*year *G* change	3.7	**73.3**	2.9	4.6	1.3	**16.3**	**24.5**	7.5	3.0
df	3	**3**	2	3	3	**3**	**2**	2	2
P	0.30	**0.000**	0.23	0.20	0.73	**0.001**	**0.000**	0.024	0.23
Class* region *G* change	4.2	**42.2**	1.7	4.5	0.6	**18.9**	**20.6**	**49.8**	**0.4**
df	2	**2**	2	2	2	**2**	**2**	**2**	**2**
P	0.12	**0.000**	0.43	0.10	0.72	**0.000**	**0.000**	**0.000**	**0.023**
Year* region *G* change	**125.1**	**1023.5**	**467.4**	6.3	**221.9**	**93.4**	**99.8**	**109.5**	3.4
	6	**6**	**4**	6	**6**	**6**	**4**	**4**	4
	0.000	**0.000**	**0.000**	0.39	**0.000**	**0.000**	**0.000**	**0.000**	0.50
Class*year *region *G* change	1.2	**46.9**	5.1	2.0	4.0	**14.7**	2.1	4.0	**21.6**
df	6	**6**	4	6	6	**6**	4	4	**4**
P	0.98	**0.000**	0.27	0.92	0.68	**0.023**	0.71	0.40	**0.000**
Model fit *G*	9.1	0	9.7	17.5	5.9	0	2.1	4.0	11.8
df	11	0	8	17	11	0	4	4	5
P	0.61	1	0.29	0.42	0.88	1	0.71	0.40	0.037

Table 8. Variation in adult male proportions (frequency of adult males to females and 1Y males) in relation to the total number of conspecifics present per km-section in the Strait of Georgia, British Columbia, in 2003, 2004, 2014 and 2015.

Species	Number of conspecifics per km-section	Adult male	Female plus 1Ymale	Adult male proportion	*G*-test
BLSC	1-20	302	179	0.628	**G_3 = 11.2** **P = 0.011**
	21-50	317	197	0.617	
	51-100	346	241	0.589	
	101-200	571	278	0.673	
WWSC	1-20	821	665	0.552	**G_4 = 19.1** **P < 0.001**
	21-50	204	194	0.513	
	51-100	203	255	0.443	
	101-200	258	269	0.490	
	201-1000	585	549	0.516	
SUSC	1-20	1136	916	0.554	**G_4 = 39.0** **P < 0.001**
	21-50	564	348	0.618	
	51-100	856	472	0.645	
	101-200	1031	671	0.606	
	201-1000	959	754	0.560	
HADU	1-20	447	437	0.506	G_3 = 2.03 P = 0.57
	21-50	966	937	0.508	
	51-100	700	620	0.530	
	101-200	177	162	0.522	
BAGO	1-20	198	171	0.537	G_3 = 3.46 P = 0.33
	21-50	200	138	0.592	
	51-100	296	259	0.533	
	101-200	129	112	0.535	
COGO	1-20	637	525	0.548	G_3 = 2.69 P = 0.44
	21-50	520	432	0.546	
	51-100	392	352	0.527	
	101-200	50	55	0.476	
BUFF	1-20	436	487	0.472	**G_3 = 10.2** **P = 0.017**
	21-50	571	633	0.474	
	51-100	402	531	0.431	
	101-200	38	71	0.349	
COME	1-20	59	104	0.362	**G_3 = 52.9** **P < 0.001**
	21-50	71	133	0.348	
	51-100	4	59	0.063	
	101-200	10	101	0.090	
RBME	1-20	236	314	0.429	**G_1 = 8.36** **P = 0.004**
	21-50	44	103	0.299	

3.5 Female age ratio

Calculated female age ratios (1Y females to adult females) are sensitive to differences in sex ratios and varied more than observed male age ratios (Table 3). Similar to male age ratio, female age ratio was generally highest for Black Scoter and Common Goldeneye and lowest for Barrow's Goldeneye, and showed considerable variability among years and regions. Unusually low female age ratios for Harlequin Ducks in 2008 were consistent with the low number of 1Y males observed in this year and is likely due to the subset of km-sections surveyed.

4 DISCUSSION

4.1 Abundance and distribution

Density estimates from this study were not representative of the entire Strait of Georgia wintering area because survey sections were chosen subjectively to contain high densities of birds. However, inter-annual trends likely reflect meaningful changes and results can serve to complement other monitoring schemes (e.g., Crewe et al. 2012). The BCCWS, for which power analysis revealed the ability to generally detect an annual change in numbers of 3% or less, reported declines in White-winged Scoter, Black Scoter, Harlequin Duck, Long-tailed Duck, and Barrow's Goldeneye in the Strait of Georgia between 1999 and 2011 (Crewe et al. 2012). We detected no evidence of a trend in density between 2003 and 2015 for species identified as declining by the BCCWS, with the possible exception of White-winged Scoters. Kruskal-Wallis tests indicated differences in density across years for White-winged Scoter, Bufflehead, and Red-breasted Merganser, and results provide some evidence for a negative trend in White-winged Scoter abundance, but no directional trend was apparent for the other species. Inconsistency in trends with other monitoring programs, such as the Christmas Bird Count (Sauer et al. 1996) and aerial wintering surveys (Anderson et al. 2009) is common (see also Bower 2009), and trend analyses are sensitive to time periods chosen and number of years surveyed. Trends are also known to differ by scale and among locations (Anderson et al. 2009, Crewe et al. 2012). For example, although the BCCWS found a decline in Harlequin Duck numbers of 2.6% per year from 1999 to 2011, numbers were stable between 1999 and 2004 (Badzinski et al. 2008), and other monitoring programs have shown a recent increasing trend (Crewe et al. 2012). The first five years of the BCCWS reported increases for Bufflehead (Badzinski et al. 2008), but no trend was apparent with 12 years of data (Crewe et al. 2012).

In contrast, management concerns based on rates of decline and consistency in results from multiple monitoring programs were identified by the BCCWS for Black Scoters (19.2% per year) and Long-tailed Ducks (7% per year). Declines of White-winged Scoters and Barrow's Goldeneye also were supported by multiple monitoring methods (summarized in Crewe et al. 2012). BCCWS results, as well as those from aerial surveys at breeding areas, report a declining trend in abundance of scoter species at a continental level (Alisauskas et al. 2004, Dickson and Gilchrist 2002). Our results add to the evidence for declining White-winged Scoter populations. Density results for Harlequin

Duck and Bufflehead in this study were also in general agreement with other monitoring programs which have reported stable populations or local contradictory trends (summarized in Crewe et al. 2012). Results and comparability to other programs would be improved if all 62 established km-sections are surveyed in future years.

4.2 Demographic ratios

Results of this study indicate spatial and/or temporal variability in age ratios for most sea duck species surveyed which has implications for temporal replication and spatial scale of a monitoring program. Male age ratios varied by year for Black Scoter, Surf Scoter, Harlequin Duck, and Common Goldeneye and by region for Surf Scoter, Barrow's Goldeneye, and Common Goldeneye. The magnitude of variation was substantial in some cases, such as the temporal range observed for Black Scoter (0.071 to 0.170 in 2014 and 2003, respectively) and the spatial variation found for all species where regional differences were documented (e.g., 0.029 to 0.144 for Barrow's Goldeneye in the Sunshine Coast and Vancouver Island regions, respectively). Few data exist that allow comparison of these results to other years and areas. Iverson et al. (2004) found significant yearly variation in Surf Scoter age ratios on the Pacific Coast, with overall averages somewhat higher than this study (0.110 male age ratio and 0.230 female age ratio), suggesting that high variability is common for this species and must be considered in monitoring design. Harlequin Ducks have been most studied in this regard with previously observed male age ratios on the Pacific coast ranging from 0.073 to 0.098 (Rodway et al. 2003a, Rosenberg and Petrula 1998, Rosenberg et al. 2005, Smith et al. 2001 (recalculated)). Estimates from our study in 2014 and 2015 are thus the highest yet reported on the Pacific coast. Age ratios from Iceland (0.099; recalculated from data in Gardarsson 2008) were also within the range observed for the Pacific coast. Somewhat higher and increasing age ratios were associated with historically increasing populations of Harlequin Ducks in Maine (0.128 overall age ratio from 1989-1999; recalculated from Table 1 in Mittelhauser et al. 2002) and Rhode Island (0.15; recalculated from Caron and Paton 2007). A high male age ratio (0.382), indicative of a local hot spot for immature birds, was reported from a small population of Harlequin Ducks on the Wolves Archipelago in the Bay of Fundy (Hicklin and Barrow 2008). Unusually high values, such as those reported on the Atlantic Coast therefore likely reflect unusual population parameters (e.g., population growth) or sampling scale, similar to the unusually high values reported for some regions in our study (e.g., 0.240 and 0.243 for the Lower Mainland in 2015 and the Sunshine Coast in 2004, respectively). Given that Harlequin Ducks were well represented in km-sections surveyed in all years, annual differences from this study likely reflect variation in productivity.

Sex ratios, in contrast to age ratios, were relatively constant in this study, and significant variability was observed only for Common Goldeneye and Surf Scoter. As expected, adult male proportions were correlated with sex ratios and the two measures showed similar variability in the five species for which sex ratios were estimated. This suggests that adult male proportions can serve as a surrogate measure for sex ratio when 1Y males cannot be reliably distinguished, although adult male proportions will be more sensitive than sex ratios to the proportion of immature birds in the population. For example, male bias in Black Scoter sex ratio was higher and adult male proportion was lower in 2003 than 2014 likely because age ratio was higher in 2003 than 2014 (see Table 3).

Few comparative data exist on sex ratios of wintering populations. Sex ratios estimated in this study are similar to previously reported estimates on the Pacific coast for Surf Scoter (1.9, Iverson et al. 2004) and Harlequin Duck (1.4-1.5, Rodway et al. 2003a, Rosenberg et al. 2005, Smith et al. 2001). Because immature males typically are not distinguished from females during winter surveys, most published sex ratio data refer to the ratio of adult males to female-like birds, and are appropriately compared to adult male proportions determined in this study. Mid-winter surveys conducted throughout the Strait of Georgia in 1951-52 by Mitchell (1952) and in the Lower Mainland region in 1980-83 by Savard (1989) provide some comparisons of adult male proportions (reported as sex ratios in original sources and recalculated to allow comparisons). Estimates from Mitchell (1952), Savard (1989), and this study, respectively, for Black Scoter (0.51, 0.65, 0.64), Surf Scoter (0.71, 0.68, 0.60), Harlequin Duck (0.68, 0.62, 0.52), and Barrow's Goldeneye (0.52, 0.60, 0.55), suggest possible declines in adult male proportions for Surf Scoter and Harlequin Duck. However, inter-annual variation in this study (e.g., for Surf Scoter) was similar to variation among studies and inference of long-term trends is unwarranted without additional evidence. Mitchell (1952) also documented higher adult male proportions for White-winged Scoter (0.60), Common Goldeneye (0.73), and Bufflehead (0.62) than this study. Adult male proportions of White-winged Scoters in this study were similar to those of Harlequin Ducks suggesting a sex ratio much lower than other scoters. Reduced male bias was observed in the sex ratios of depressed populations of Harlequin Ducks in eastern North America and has increased in association with population recovery (Caron and Paton 2007, Mittelhauser et al. 2002, Robertson and Goudie 1999). Thus the relatively low male bias in White-winged Scoter sex ratios found in this study may also reflect a declining population as indicated by survey trends (Crewe et al. 2012). Reduced male bias in sex ratios for eastern Harlequin Ducks may have been caused by a male trophy hunt (Mittelhauser et al. 2002). There has been a male bias (2.62) in hunter kills of White-winged Scoters in North America (Sorensen et al. 1974 in Brown and Fredrickson 1997), although there are not enough data to evaluate how that bias compares to population sex ratios.

The target sample size of 62 km-sections used in this study was based on previous studies of Harlequin Ducks and Surf Scoters that calculated expected confidence limits for estimating age ratios from different numbers of occupied km-sections (Iverson et al. 2004, Rodway et al. 2003a). Due to high percent occurrence in km-sections (83 to 92%), sampling intensity reached our desired target for Surf Scoters of over 1000 males in each year, predicted to produce age-ratio estimates with 95% confidence limits of ± 5% (Iverson et al. 2004). For Harlequin Ducks, due to lower spatial variability in age ratios relative to Surf Scoters, sampling of 1000 males in about 60 km-sections was estimated to generate age-ratio estimates with 95% confidence limits of ± 2% (Rodway et al. 2003a). However, percent occurrence of 75 to 81% for Harlequin Ducks resulted in sampling of only 600 to 700 males per year rather than the target 1000, and likely provided estimates with 95% confidence limits of ± 3% (Rodway et al. 2003a). A consequence of including multiple species in a single monitoring program is reduced percent occurrence of individual species owing to the need to include habitats occupied by each species, and the overall number of samples must therefore be increased to compensate. Alternatively, sampling greater lengths of shoreline would increase habitat and species representation within individual samples but would present greater accessibility problems and reduce feasible sample sizes given budget constraints. Km-long sections as used in this study are recommended as a good compromise, considering desired sample sizes, occurrence and abundance of different species, and accessibility and other logistical constraints.

Regional differences in age and sex ratios most likely reflect segregation, and emphasize the need for broad-scale sampling to provide representative estimates. Age ratios were lowest on the Sunshine Coast for all three species that showed regional differences and surveys conducted only in that region would have yielded biased age-ratio estimates. Sexual segregation is common in diving ducks (summarized in Rodway 2007), and local, mid-winter sex and/or age segregation in the Strait of Georgia has previously been reported for Surf Scoters (Iverson et al. 2004), Harlequin Ducks (Smith et al. 2001, Rodway et al. 2003a), Barrow's Goldeneye (Eadie et al. 2000), and Red-breasted Mergansers (Coupe and Cooke 1999, Kahlert et al. 1998). Because the choice and size of the survey area can have major implications for our understanding of age and sex ratios, sampling should consider the scale of segregation on a species-specific basis. The scale of this study was adequate to accommodate local age- and sex-related segregation such as reported for Harlequin Ducks (Rodway et al. 2003a , Smith et al. 2001), but more robust estimates for species that may exhibit broad-scale segregation would be obtained by widening the sampling area. Further data on age and sex segregation in sea duck species would help evaluate potential scale-related biases for monitoring.

Differences in ratio estimates in relation to bird densities provide evidence of population structuring at finer scales. Surf Scoter age ratios tended to be highest when there were larger numbers of conspecifics within a km-section with highest density found when numbers of individuals per km-section were greater than 50. Two groups of Surf Scoters with unusually high age ratios were observed, one in 2015 when a group of 65 individuals contained 54 juveniles, and one during a point count in 2008 when a group of 122 individuals that contained 50 juveniles. These specific observations and general results concur with the findings of Iverson et al. (2004) that 1Y male Surf Scoters are segregated and tend to cluster in larger flocks. Sex ratios varied in relation to abundance for Black Scoter and Surf Scoter, and adult male proportions varied in relation to abundance for Black Scoter, White-winged Scoter, Surf Scoter, Bufflehead, Common Merganser and Red-breasted Merganser. However, trends were species-specific and trends for sex ratio and adult male proportion were not always consistent. For Surf Scoters, sex ratio was lowest where there were larger numbers of birds and adult male proportions were highest at intermediate densities. Iverson et al. (2004) also found that female proportions were higher in larger flocks of Surf Scoters. Structuring in relation to bird density and the highly clumped distribution of large flocks, especially for scoter species, presents a sampling challenge. For example, at one km-section in the Lower Mainland region, a large flock of scoters was present in all years, but in 2014 and 2015 it occurred too far offshore to be included in the count. Thus, for scoter species especially, numbers of sections surveyed need to be large enough to accommodate such variability and provide representative samples from highly clumped distributions (Iverson et al. 2004).

4.3 Implications for monitoring

Age ratios in relation to survival rates can be used to estimate population growth rates for sea duck species (Robertson 2008). As modelled by Robertson (2008), survival rate and the ratio of juveniles to adults can be used to estimate population growth rate (the relative balance between recruitment and mortality), with demonstrated robustness to variation in age of first breeding and fertility, especially when survival rates are high. Although sea duck species generally possess life history characteristics of high annual survival and low productivity and recruitment, some differences in age ratios were expected among species. For example, the goldeneye species have lower female survival than other sea duck species (61% and 66% for Barrow's Goldeneye and Common Goldeneye, respectively, as compared to 76-77% for other species; summarized in Rodway 2007), which are therefore expected to correspond to higher productivity and age ratios. As expected, Common Goldeneye had the second highest female age ratio in this study (0.289 over all regions and years). However, assuming age of first breeding between two and four years (appropriate for all species considered), Robertson's (2008) model suggests that survival rates of 75% and 65% require female age ratios of approximately 0.35 and 0.60 for population stability, respectively. Thus in this study only Black Scoters had an estimated female age ratio (0.362 over all regions and years) that is approaching the magnitude required for population stability according to female survival rates (77%; summarized in Rodway 2007). For other species, either age-ratio and/or female survival estimates are biased or the populations are declining. Even Common Goldeneye exhibit a declining population according to the model, based on the 0.289 age ratio and 66% survival. Other studies have found higher survival rates for Common Goldeneye (80%, 83%; Barker and White 2001, Ludwichowski et al. 2002), but these studies were conducted where hunting was absent. Similar to Common Goldeneye, Barrow's Goldeneye also has low survival rates relative to other sea duck species (61%) and a relatively high age ratio would be expected. However, female age ratios of Barrow's Goldeneye were the lowest among species surveyed (0.090). The relatively low age ratio documented for Barrow's Goldeneye in this study could be related to the biased sample of the population surveyed because the main wintering areas are the mainland fjords of BC (Vermeer 1982). The high variation in Barrow's Goldeneye and Common Goldeneye age ratios by region (from 0.029 to 0.144 and from 0.060 to 0.178, respectively; see Table 3 and Table 5) indicates substantial regional segregation of immature birds.

Population parameters such as survival rates, age ratios, and population trends are estimates with many sources of error. Two potential sources of bias are particularly relevant when interpreting population dynamics from age ratios and survival rates. First, female survival rates are typically biased low because mortality is frequently confounded with emigration (Clobert and Lebreton 1991). Second, juvenile age ratios are typically underestimated due to factors such as juvenile misidentification (e.g., Rodway et al. 2003a), segregation (Iverson et al. 2004, Rodway et al. 2003a, this study), and greater mobility (e.g., Regehr 2011, Rodway et al. 2003a). For Harlequin Ducks, attempts have been made to correct biases in female survival rates and age ratios to better characterize the balance between recruitment and mortality. Rodway et al. (2003a) developed a correction factor to adjust age-ratios due to misidentification at greater distances offshore (resulting in a corrected female age ratio of 0.152) and compared this to a survival rate calculated from paired females only (76%) which are thought to be highly site-faithful (Cooke et al. 2000). However, in spite of attempted corrections, population stability was not indicated. Nevertheless, stable or increasing populations have been reported for Maine (Mittelhauser 2008) and Alaska (Rosenberg et al. 2005) in association with age ratios and survival estimates similar to those estimated elsewhere, indicating that stable Harlequin Duck populations will exhibit some discrepancy between recruitment estimated by age ratios and survival rates. Although accuracy of survival and recruitment estimates could likely be improved by more intensive study, such discrepancies may be inevitable at the practical scale of most studies, and winter age ratios may generally underestimate recruitment. However, they still can serve to monitor changes as long as adequate baseline data, collected in standardized fashion, exist. Baseline data such as those from this study provide some evidence of the magnitude of age ratio and survival estimate biases for this species and provide a baseline to which future estimates can be related, provided that potential for inter-annual variability is taken into consideration. Although variability in age ratios is expected for sea ducks, cause for concern may be indicated if estimates fall well outside of previously documented ranges or if a trend is observed over time, both of which may signify changes in population dynamics.

Effectiveness of this monitoring program differs by species according to species-specific habitat and distribution characteristics and according to the potential to distinguish demographic classes. Abundance estimates are more effectively evaluated for species that are distributed relatively continuously along shorelines and present in the majority of samples, and accordingly, the study best sampled Harlequin Duck, Bufflehead, Common Goldeneye, Common Mergansers and Red-breasted Merganser. Species least well sampled during this study were Long-tailed Duck and Hooded Merganser, due to offshore and estuarine habitat preferences, respectively (Campbell et al. 1990). The three scoter species are well represented in the sampling design, although their relatively clumped distribution increases inter-sample variability, thus decreasing the potential to detect trends, and makes them more difficult to count accurately, especially if they are diving in large flocks. The most valuable demographic data are obtained for species for which 1Y males can be identified because for these species male age ratio, sex ratio, and proportion of adult males can be determined, and female age ratio can be derived. However, for the other species, proportion of adult males is still a valuable demographic parameter.

Monitoring programs for marine birds are a critical component of conservation efforts, and collaboration among multiple monitoring approaches has the greatest potential of achieving an understanding of population dynamics for sea duck species for which breeding studies with marked individuals and large sample sizes are difficult to accomplish. Collaboration allows compensation for spatial and methodological limitations inherent in individual programs and evaluation of confidence in conclusions.

With the exception of Harlequin Ducks, for which age and sex ratios have been published from BC, Maine, and Alaska (Mittelhauser et al. 2002, Rodway et al. 2003a, Rosenberg et al. 2005, Smith et al. 2001), age and sex ratio data are not commonly collected or are sometimes presented in such a manner that comparison to other work is difficult. Based on demographic information from Harlequin Ducks, it is apparent that biases inherent in estimation of age ratios and survival rates can be difficult to overcome, and that age ratio estimates are valuable as indices of recruitment, rather than estimates of recruitment, that are associated with species-specific spatial and/or temporal variability. Changes in indices and abundance, especially when associated with trends and supported by observations from other monitoring programs, can function as warning signals. However, inconsistencies among monitoring program methodologies are also recognized to limit the value of collaboration, with issues that affect comparability including survey timing, survey locations at coarse and fine scale and habitat included within them, and quality of species detection and identification (Anderson et al. 2009, Bower 2009). This study documented temporal and spatial variability in age and sex ratios for five Mergini species in the Strait of Georgia, adult male proportions for an additional six species, and abundances for all 11 species, and therefore provides valuable baseline data. However, data were inadequate to determine whether differences in age ratios reflect annual variation in recruitment or indicate real temporal trends. Baseline data need to be collected over several consecutive years to provide robust estimates of age ratios given the same study area, observers, and methods.

Changes in winter age and sex ratios, especially when associated with trends and/or supported by observations from other monitoring programs, can function as warning signals. However, a number of challenges exist in monitoring sea duck demographics using ratio estimates. Firstly, interpretation of the causes of changes of any of these measures can be complex due to the difficulty in distinguishing between alternative explanations (Harris et al. 2008). For example, an increase in age ratio may indicate either increased recruitment or reduced male survival, and a change in the proportion of males may be caused by changes in male survival, female survival, or recruitment. Thus, although our ability to interpret observed changes is superior when comparison among ratios is possible (e.g., analysis of sex ratios may permit distinction of the roles of recruitment and adult survival in age ratios), additional information, such as that provided by other monitoring programs, improves interpretation of results regardless of whether two or three demographic classes can be distinguished. Secondly, differences in survey timing, survey locations and habitats sampled, and quality of species detection and identification among monitoring programs may limit their comparability (Anderson et al. 2009, Bower 2009). Finally, the effectiveness of monitoring studies may differ by species according to species-specific distribution characteristics, the potential to distinguish demographic classes, and tendencies for demographic segregation. It is recommended that numbers for all demographic classes that can be distinguished are reported (Robertson 2008, Smith et al. 2001), standardized definitions for age and sex ratios are adopted, limitations and biases in survey methods are evaluated, broad-scale sampling is conducted to account for spatial segregation, and several consecutive years of surveys are conducted to provide baseline data.

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7 APPENDICES

Appendix 1. Location of km-sections surveyed for sea ducks in the Strait of Georgia, 2003 to 2015. British Columbia Marine Ecosystem Classification (BCMEC) was used to define substrate type, wind and wave exposure, and depth profile (see Methods). Bearings given for either end of each km-section define the boundaries of the section, and are generally perpendicular to the shoreline at that location.

Section Code	Section Name	Access	BCMEC Classification	Northerly or Westerly End			Southerly or Easterly End		
			Substrate Exposure Depth Profile	Lat Long	Location Description	Bearing (true)	Lat Long	Location Description	Bearing (true)
BBFD-1	White Rock South	Highway 99 S to Peace Arch Prov. Park. Follow Beach Rd west, then north, park at Canadian Legion Hall. Walk rail road tracks.	Sand Low <20m	49.01299 -122.7786	N end of railway bridge	195	49.00817 -122.76657	Mile marker 120	195
BBFD-2	White Rock Jetty	Marine drive to White Rock waterfront. Public jetty is near midpoint of transect.	Sand Low <20m	49.02162 -122.80816	~20 m N of White Rock museum	195	49.01796 -122.79558	Small ramp leading to beach ~700 m S of jetty	195
BBFD-3	1001 Steps South	Take Crescent Rd. to 128 St. then 16, 16, and 126A. Park at corner of 15A and 126A and take steps down to rail road tracks.	Mud Low <20m	49.03227 -122.87553	Bridge where trail meets RR tracks, at mile post 125.6	250	49.02445 -122.86485	P-20/F-20 sign on RR tracks, just S of point	170

Section Code	Section Name	Access	BCMEC Classification Substrate Exposure Depth Profile	Northerly or Westerly End Lat Long	Northerly or Westerly End Location Description	Northerly or Westerly End Bearing (true)	Southerly or Easterly End Lat Long	Southerly or Easterly End Location Description	Southerly or Easterly End Bearing (true)
BBFD-4	1001 Steps North	Take Crescent Rd. to 128 St. then 16, 16, and 126A. Park at corner of 15A and 126A and take steps down to rail road tracks.	Mud Low <20m	49.04008 -122.8820	~40 m beyond RR light set	230	49.03226 -122.87553	Bridge where trail meets RR tracks, at mile post 125.6	250
BBFD-5	Tsawwassen Ferry	Pullout on north side of highway 17 turnpike, which leads to ferry terminal; approximately 0.5 km before entrance.	Sand Low <20m	49.0191 -123.1127	At lane selection sign which passes over highway	320	49.0119 -123.1229	1 km W of lane selection sign. Waypoint is beside road, not along shore	310
BBFD-6	Iona South	Turn off main road to airport on Templeton St, following sign to MacDonald Beach park, pass park and continue on Ferguson Rd past sewage treatment plant. Park near end of Iona jetty. Section is at far end of jetty – must walk 3 km to section start.	Sand Low <20m	49.2056 -123.2639	end of Iona jetty, looking South	200	49.2083 -123.2506	1 km from end of jetty at 3km painted marker	200
BBFD-7	Iona North	Turn off main road to airport on Templeton St, following sign to MacDonald Beach park, pass park and continue on Ferguson Rd past sewage treatment plant. Park near end of Iona jetty. Section is at far end of jetty – must walk 3 km to section start.	Sand Low <20m	49.2056 -123.2639	end of Iona Jetty, looking North	20	49.2083 -123.2506	1 km from end of jetty at 3km painted marker	20

Section Code	Section Name	Access	BCMEC Classification Substrate Exposure Depth Profile	Northerly or Westerly End Lat Long	Northerly or Westerly End Location Description	Northerly or Westerly End Bearing (true)	Southerly or Easterly End Lat Long	Southerly or Easterly End Location Description	Southerly or Easterly End Bearing (true)
BIEB-1	Spanish Banks	NW Marine Dr. to Spanish Banks Beach (west end of section is where road begins to climb hill toward UBC). "East parking lot" accesses middle of section and east end of section is just east of this parking lot; "west parking lot" accesses west end of section.	Mud Low <20m	49.27868 -123.22758	boulder outcrop, W end of beach where distance to bluffs narrows	10	49.27716 -123.21332	boulder outcrop W of Jericho pier	20
BIEB-2	Kitsilano Beach	4th Ave Vancouver, access is along seawall. Access section midpoint from Arbutus.	Mud Low <20m	49.27414 -123.16155	At west end of seawall path, in front of an interpretive sign, 50 m W of sailing club pier	330	49.2776 -123.15092	Just beyond point, bearing is across to 2 navigation buoys	10
BIEB-3	English Bay	Beach Ave, Vancouver. Access is along seawall.	Mud Low <20m	49.29393 -123.14993	South end of 2nd beach	270	49.28646 -123.14276	North end of public bathroom building, midway along beach	260
BIEB-4	Third Beach	Stanley Park, Vancouver. Access is along seawall.	Mud Low <20m	49.30452 -123.15614	N end of 3rd beach, at pull-out w/ 6 benches	290	49.29669 -123.15338	South end of 2nd beach	235

Section Code	Section Name	Access	BCMEC Classification	Northerly or Westerly End			Southerly or Easterly End		
			Substrate Exposure Depth Profile	Lat Long	Location Description	Bearing (true)	Lat Long	Location Description	Bearing (true)
BIEB-5	Siwash Rock	Stanley Park, Vancouver. Access is along seawall.	Mud Low <20m	49.31243 -123.15031	5.5 km marker, ~100 m E of point leading into the first narrows	310	49.30452 -123.15614	N end of 3rd beach, at pull-out w/ 6 benches	290
BIEB-6	Lions Gate	Stanley Park, Vancouver. Access is along seawall, beneath Lions Gate Bridge. Access section from parking along Park Drive; can park near east end and middle of section, but not at the west end.	Mud Low 20-50m	49.31401 -123.14138	Prospect Point light	355	49.30627 -123.13343	Pipeline crossing sign	30
BIEB-7	Ambleside	Ambleside Park. W of Lions Gate Bridge, N shore of Burrard Inlet. Drive down 13th St. Section midpoint accessed from parking area.	Mud Low <20m	49.32565 -123.15455	Wooden pier (waypoint at end of pier)	200	49.32154 -123.14159	W bank of Capilano River, looking across to Prospect Point	155
BSHI-1	Goose Spit	Drive through Comox on Comox Ave, left on Pritchard (sign for Goose Spit), right on Balmoral, straight at 4-way stop go straight (turns into Hawkins), over hill to Goose Spit.	Mud Low <20m	49.66548 -124.90166	First pullout inside of spit between 2 concrete picnic tables	300	49.66400 -124.91530	Inside spit, on point of land next to dock, next to white shed, look across to blue house on opposite shore	300

Section Code	Section Name	Access	BCMEC Classification Substrate Exposure Depth Profile	Northerly or Westerly End Lat Long	Location Description	Bearing (true)	Southerly or Easterly End Lat Long	Location Description	Bearing (true)
BSHI-2	Ships Point	South of Fanny Bay. Turn off Highway 19A on Ships Pt. Rd, right on Baynes Dr., right on Park Rd., drive into park to Pt.; section is alongside Ships Pt. Park. There is a beach access where Baynes Dr. meets Ships Pt. <u>Cannot survey at low tide.</u>	Sand Low 20-50m	49.49758 -124.79262	Middle of rocky point on sedimentary shelve, 700 m NE of of point	35	49.49272 -124.79400	~100 m from head of bay, NW of Ships Point	215
BSHI-3	Denman Point	Denman Island – NW end of island. Go N on Northwest Rd, left on Scott Rd after junction with Lake Rd. Access via Scot Road, park at L in road, walk down to beach on trail.	Mud Low 20-50m	49.56294 -124.84152	point with small wooden shed on N end of cove	260	49.55403 -124.84319	250 m S of Denman Point, 50 m N of large rock at high tide line	230
BSHI-4	Fillongley	Denman Island – E side of island. Follow signs to Fillongley Provincial Park. N on Swan Rd., right on Beadnel Rd.	Hard Mod <20m	49.54523 -124.75954	~250 m S of small point, before mouth of creek	50	49.53661 -124.75557	570 m South of car park @ large rootwad	105
BSHI-5	Whalebone Point	Denman Island – E side of island, along East Rd, north of Denman-Hornby Ferry Terminal Take McFarlae Rd across island. There is a pull-out along the shore at the section middle.	Sand Low <20m	49.51113 -124.73711	~20 N of buried cable sign	25	49.50395 -124.73318	small creek on N end of Whalebone cove	110

Section Code	Section Name	Access	BCMEC Classification	Northerly or Westerly End			Southerly or Easterly End		
			Substrate Exposure Depth Profile	Lat Long	Location Description	Bearing (true)	Lat Long	Location Description	Bearing (true)
BSHI-6	Dunlop Point	Hornby Island – E side of island. Beach access W of section at Sandpiper Community Park. Access is a trail to beach, W of the point. Dunlop Pt is the middle of the section. Drive down Central Rd (heading W), left on Sandpiper Drive, left on Porpoise Cresc., park is immediately on right.	Hard Mod 20-50m	49.51258 -124.63633	Along bluffs between Dunlap Point and Little Tribune Bay	5	49.50687 -124.63657	on point in middle of sandpiper bay	130
BSHI-7	Tralee Point	Hornby Island - N side of island. Access from end of Ostby Rd. Left on St. John's Pt. Rd. (off Central Rd.), left on Ostby, right on Fowler; trail to beach at end of Fowler Rd. <u>Cannot get to S end at high tide</u>.	Sand Mod 20-50m	49.54173 -124.64245	30 m W of Tralee point, in E end of Seabreeze Bay	320	49.53773 -124.63135	On broad point below small limestone bluffs	0
BSHI-8	Phipps Point	Hornby Island - SW end of island, Turn left on Central Rd. Access down side road where Shingle Spit Rd turns into Central Rd.	Sand Mod 20-50m	49.53895 -124.70921	At S end of broad tidal shelf, 500 m N of Phipps Pt, at fossil beds	290	49.53117 -124.70980	In bay S of Phipps Point, 500 m S of point	240
BSHI-9	Cape Gurney	Hornby Island - NE end of island. Access via Helliwell Rd. From main road to Cape Gurney (St. John's turns into Anderson), turn left on Texada Dr. (go past Helliwell turnoff); road ends at "T" junction at Texada, turn left on Texada.	Hard Mod 20-50m	49.52950 -124.60190	In front of Helliwell house 150 of NW of park boundary	330	49.52320 -124.59200	Near point at NW end of beach, access at Texada Rd	40

Section Code	Section Name	Access	BCMEC Classification	Northerly or Westerly End			Southerly or Easterly End		
			Substrate Exposure Depth Profile	Lat Long	Location Description	Bearing (true)	Lat Long	Location Description	Bearing (true)
BSHI-10	Grassy Point	Hornby Island - North end of island,-near Galleon beach access. Turn off main island road on Solans, where Solans turns into Harwood there is a beach access, this access is about 370 m from E end of section. Note: small bluffs at SE end therefore cannot survey at high tide.	Sand Mod 20-50m	49.55110 -124.66970	160 m W of Grassy Point (Shields Point)	330	49.54590 -124.65930	840 m E of Grassy Point (Shields Point), on Point E of Grassy Bay	30
BSHI-11	Hinton Road	Denman Island - SW end. Access via Lacon Rd to Hinton Rd. Drive down Denman Rd., turn right on Lacon Rd, right on Hinton Rd.	Sand Low 20-50m	49.48862 -124.75385	Just east of the 3rd small point to W of Hinton Rd beach access 430 m W of Hinton Rd beach access	210	49.48510 -124.74110	Between 2 houses, SE one larger with partial 2nd story and decks, NW one with loft and no decks	190
BSHI-12	Gartley Point	South of Royston. Turn off 19A on Gartley road, access from small dirt road that goes to beach where Gartley curves N. Note: beach access is at the end of Gartley Rd., where Gartley Rd. meets Gartley Pt. Rd; not at end of Gartley Point Rd (this would take you to N end of section).	Mud Low <20m	49.64332 -124.92367	N most point of land before Creek outlet	20	49.63443 -124.92216	In SW corner of bay NW of Kingfisher Resort and 380 m S of road access	70
CRCX-1	Point Holmes	Alongside Lazo Road where it hits the Ocean (follow directions for Goose Spit, except at 4-way stop, turn left on Croteau, then immediately right on Lazo Rd).	Hard Mod <20m	49.69400 -124.86488	Pt Holmes, right under house on hill, 300 m N of boat ramp, overlooking point	110	49.68825 -124.87555	just before houses start again ~50 m N of beaches	130

Section Code	Section Name	Access	BCMEC Classification	Northerly or Westerly End			Southerly or Easterly End		
			Substrate Exposure Depth Profile	Lat Long	Location Description	Bearing (true)	Lat Long	Location Description	Bearing (true)
CRCX-2	Kin Beach	Just N of military base. Access is just N of CFB Comox. From Pt. Holmes, drive N on Knight Rd, turn right on Military Row (going around air force base). Also can access from Ryan Rd: cross Ryan Rd, turn right on Kilmorley Rd (still going around base), turn off to the left on Astra. Kin Beach Park immediately on right. At high tide must get around houses, clamber along riprap, or drive around to public access (Astra to Kilmorley, left on Kilmorley) at S end of section. N end of section also ends in riprap but can easily scan the remaining 50 m.	Hard Mod <20m	49.73141 -124.90155	in small bay ~30 m N of point N of Kin, in front of yellow stucco house	25	49.72603 -124.89035	~100 m S of Kilmorley Rd access, in military campground	45
CRCX-3	Wilkinson Road	Just N of Little River ferry terminal, drive N along Wilkinson Rd to end. From Kin Beach follow Astra Rd north, turns into Booth Rd., take Little River to Wilkinson.	Sand Mod <20m	49.74747 -124.93745	20 m S of point ~600 m N of end of Wilkinson Road, Point S of Cloudcraft Point	20	49.74042 -124.92858	just N of ferry terminal	50
CRCX-4	Kitty Coleman	Turn off island Hwy 19A on Coleman Road, then N on Left Rd, then right on Whitaker to end. Or, from Wilkinson, go N on Anderton Rd, Anderton becomes Waveland, from Waveland, left on Bates Rd., turn left on Coleman Rd., then N on Left Rd., right on Whitaker to end.	Sand Mod <20m	49.79217 -125.00200	just before 3nd house past N end of park (note that first house is set back and hard to see), ~ 30 m S of middle house	10	49.78627 -124.99178	40-50 m S of southern park boundary	50

Section Code	Section Name	Access	BCMEC Classification Substrate Exposure Depth Profile	Northerly or Westerly End Lat Long	Northerly or Westerly End Location Description	Northerly or Westerly End Bearing (true)	Southerly or Easterly End Lat Long	Southerly or Easterly End Location Description	Southerly or Easterly End Bearing (true)
CRCX-5	Miracle Beach	Turn off island Hwy 19A down Miracle Beach Rd, following sign to Miracle Beach Prov. Park; park at beach access parking lot.	Sand Mod <20m	49.85363 -125.09853	50-100 m S of river, shoreline curving around to river mouth	30	49.84787 -125.08790	nondescript shoreline E of park, in front of large house set close to beach	30
CRCX-6	Salmon Point	Turn off island Hwy 19A on Salmon Pt Rd.	Sand Mod 20-50m	49.89022 -125.12603	E side of entrance to marina breakwater at salmon point	30	49.88342 -125.11694	forested section of park, N of Oyster River, 1 km S of Salmon Pt. Marina	50
CRCX-7	Oyster Bay	Parking area is adjacent to Hwy 19A. Cannot survey at low tide.	Sand Mod 20-50m	49.90008 -125.16247	nondescript stretch of highway	40	49.89578 -125.15017	Foot crossing on creek N of rest area	10
CRCX-8	Shelter Point	Right on Heard Rd, off Hwy 19A.	Sand Mod 20-50m	49.94425 -125.18815	N of shelter point, N of large offshore rectangular rock	15	49.93585 -125.18703	opposite Engles Rd	90
CRCX-9	Willow Point	Turn off Hwy 19A on Adams Rd to Adams Park.	Sand Mod 20-50m	49.97423 -125.21950	Midway between start of bay and point to the north	40	49.96857 -125.20927	In front of 2nd house, N of public access	50

Section Code	Section Name	Access	BCMEC Classification	Northerly or Westerly End			Southerly or Easterly End		
			Substrate Exposure Depth Profile	Lat Long	Location Description	Bearing (true)	Lat Long	Location Description	Bearing (true)
CRCX-10	Rotary Beach	Along old Island Hwy (19A). Rotary Beach Park is the S end of section.	Hard Low 20-50m	50.00358 -125.23138	At boat rental, just N of super 8 motel	70	49.99480 -125.22823	S end of rotary beach park, at rock wall where 1st house starts	80
CRCX-11	Alders	Turn off Hwy 19A on Williams Beach Rd. Follow signs to Alders Beach Resort. Public access is just on N side of the resort.	Sand Mod <20m	49.83920 -125.06350	Treed section 200 m N of large steep gabled house with cement block breakers 500 m N of public access	30	49.83170 -125.05610	In bay S of Alders Resort, 500 m S of public access	75
CRCX-12	Cloudcroft	Off Hwy19A, down Coleman Rd., right on Bates Rd., left on Cloudcroft. Or, if coming from Comox, from Waveland turn right onto June Rd., go straight across Seabank and down Cloudcroft to end (Anderton becomes Waveland, must veer to left otherwise will end up at the ferry). If coming out of Courtenay, come down Ryan Rd., turn left on Anderton. Trail down hill to beach.	Sand Mod <20m	49.75980 -124.95130	S of broad point on S end of Seal Bay, btw 2 homes	0	49.75250 -124.94290	On broad point below steep slope, ~30 m N of small creek. 500 m S of Cloudcroft access	70
DBFC-1	Mapleguard Spit	Turn of Hwy 19A on Gainsberg Rd., right on Burne, left on Deep Bay Drive. Park at first pull out on right where sea is visible.	Sand Mod <20m	49.46772 -124.72739	second point N of parking area, 210 m N of pull out	350	49.45996 -124.72055	looking across to Chrome Island	75

Section Code	Section Name	Access	BCMEC Classification Substrate Exposure Depth Profile	Northerly or Westerly End Lat Long	Location Description	Bearing (true)	Southerly or Easterly End Lat Long	Location Description	Bearing (true)
DBFC-2	Bowser	Turn off Hwy 19A on Bowser Rd. Access from end of Bowser Rd.	Sand Mod <20m	49.43717 -124.67081	small resort with 6 brown cabins, 500m N of Bowser Rd, in front of 3rd cabin from north	5	49.43092 -124.66151	just south of continuous stretch of houses, 500 m S of Bowser Rd	40
DBFC-3	Qualicum Bay	Access directly from Hwy 19A. Difficult at high tide.	Sand Mod <20m	49.40503 -124.63087	500 m N of Henry's Kitchen, by yard with many flags	15	49.40234 -124.61771	In front of Indian Lodge	350
DBFC-4	Van Isle	Beach access off Hwy 19A, just adjacent to the N of Van Isle Rd. Access is at section midpoint. Note: there are creeks at N and S ends of section. May be crossable at low tide; otherwise may need boots.	Sand Mod <20m	49.39132 -124.59708	100 m N of small creek, in front of wooden barn shaped house	20	49.38612 -124.58580	Along wooded section of shore, ~100 m SE of row of cement blocks in intertidal	55
DBFC-5	Qualicum Beach	Access directly from Hwy 19A in Qualicum Beach.	Sand Mod <20m	49.35408 -124.45435	500 m N of public restrooms, 100 m from end of public walk	345	49.35595 -124.44095	Beside visitor center	345
DBFC-6	Columbia Beach	From Hwy 19A turn onto Columbia Dr., left on Admiral Tyron, beach access immediately on right accesses midpoint of section.	Sand Mod 20-50m	49.35385 -124.37525	Resort w/ beige cabin and large lawn	0	49.35250 -124.36201	Just W of spit on W side of French Creek	30

Section Code	Section Name	Access	BCMEC Classification	Northerly or Westerly End			Southerly or Easterly End		
			Substrate Exposure Depth Profile	Lat Long	Location Description	Bearing (true)	Lat Long	Location Description	Bearing (true)
DIIS-1	Cape Mudge	Quadra Island – SW end. S on Cape Mudge Road, right on Joyce to lighthouse Road, follow signs to Tsa-Kwa-Luten Lodge, take little road around left and down to shore by waterfront cabins; if private function, alternate access is at lighthouse (W end of section is 50 m from lighthouse). Note: if coming from DIIS6, carry on S on Green Rd past Yaculta Village, stay left and go uphill to join Cape Mudge Rd.	Mud Mod >50m	49.99803 -125.19534	~50 m SE of lighthouse, ~500 m W of lodge, in front of white house w/ red roof	230	49.99508 -125.18230	At cape below sand cliffs, 500 m east of Tsa-Kwa-Luten Lodge	155
DIIS-2	Francisco Point	Quadra Island – SE end. Turn off of Cape Mudge Rd onto Petroglyph Way (to end) and walk down to shore.	Mud Mod >50m	50.01652 -125.15027	110 m N of Petroglyph road access, 20 m S of small cabin right on shore	10	50.00877 -125.14954	Around Fransisco Pt toward Cape Mudge	140
DIIS-3	Smiths Road	Quadra Island – E side, N of Francisco Pt. Turn off Heriot Bay Rd onto Smiths Rd, onto Wawakie (Smith Rd. becomes Wawakie) switch back downhill, left turn at bottom of hill just before houses start along shore (note: must go back out to Cape Mudge Rd, can't go N from Fransisco).	Mud Mod >50m	50.04847 -125.17032	500 m N of Smiths Rd. beach access, 40 m N of house on high bank up off beach	50	50.03983 -125.16644	Just S of large angular rock in intertidal zone, 500 m S of Smiths Rd	85

Section Code	Section Name	Access	BCMEC Classification Substrate Exposure Depth Profile	Northerly or Westerly End Lat Long	Northerly or Westerly End Location Description	Northerly or Westerly End Bearing (true)	Southerly or Easterly End Lat Long	Southerly or Easterly End Location Description	Southerly or Easterly End Bearing (true)
DIIS-4	Rebecca Spit West	Quadra Island – E side. Turn off Heriot Bay Rd onto Rebecca Spit Rd, drive into Provincial Park. Section runs along W side of spit, almost parallel to section DIIS-5.	Mud Mod >50m	50.10467 -125.19258	Just south of N end of spit	270	50.09720 -125.18500	At narrowest part spit at the base, facing W toward north-most pilling in water	270
DIIS-5	Rebecca Spit East	Quadra Island – E side. Turn off Heriot Bay Rd onto Rebecca Spit Rd, drive into Provincial Park. Section runs along E side of spit, almost parallel to section DIIS-4.	Mud Mod >50m	50.10560 -125.19260	narrow neck near N end of spit, just N o N end of DIS4 section, on east side of spit)	45	50.09830 -125.18440	~50m N of narrow neck on spit that road passes. Near S end of DIIS4, but on E side of spit	65
DIIS-6	Yaculta	Quadra Island, village site aka Cape Mudge. From ferry, turn immediately right on Green Rd (1st right). Stop where it first hits the water.	Mud Mod >50m	50.03220 -125.20920	500 m N of parking spot where road leaves water and goes uphill	230	50.02670 -125.19880	~300 m N of government dock, 500 m S of where road leaves water and heads uphill	230
LOSC-1	Chaster Park	Access from Gibsons via Pratt Rd to Gower Pt. Rd. Right on Gower Pt. Rd when Pratt Rd. ends, at N end of Gower Pt. Rd road turns left becoming 6th St, then right into Ocean Beach Esplanade to Chaster Park. Parking is available all along section. Creek at S end must be crossed at road, then backtrack along shore.	Mud Mod 20-50m	49.39715 -123.56081	In front of large tree	240	49.38932 -123.55398	~220 m E of Chaster Park, at E end of cleared lot	175

Section Code	Section Name	Access	BCMEC Classification	Northerly or Westerly End			Southerly or Easterly End		
			Substrate Exposure Depth Profile	Lat Long	Location Description	Bearing (true)	Lat Long	Location Description	Bearing (true)
LOSC-2	Beach Ave West	Near Roberts Creek Prov Park (just N of Roberts Creek picnic ground). Access via Flume Rd. then W on Beach Ave. Park in pullout at public beach access where Beach Ave turns into Henderson Rd. Access is about 250 m from S end of section. Alternate route: take Beach Ave from Roberts Creek.	Hard Mod 20-50m	49.43618 -123.68476	In front of windowless wooden building after scrambling past rock point	230	49.43107 -123.67527	Rock outcrop E of parking area	190
LOSC-3	Mission Point	Easy access from Hwy. Most of section (except S end) is accessible from the road. Easy parking at section middle.	Hard Mod >50m	49.44725 -123.72919	W end of walkway	260	49.43910 -123.72408	W bank of Chapman creek	215
LOSC-4	Wakefield Creek	Access middle of section from Mason Rd, next door to Wakefield Inn. For N end of section, cannot cross creek (which is about 250 m from section end) at high tide.	Hard Mod >50m	49.46769 -123.80737	~450 m W of Mason Rd, at rocks with No Trespass sign	190	49.46605 -123.79453	~550 m E of Mason Rd. at rocks forming point	165
LOSC-5	Roberts Creek	Municipal Park, just down road from Roberts Creek General Store, on Roberts Creek Road from Hwy. To get to section middle, go right on Beach Ave after general store, and left on Edmonds Rd. Alternate route from Gibsons: take Lower Road to junction with Roberts Creek Rd. at General Store; turn left on	Mud Mod 20-50m	49.42270 -123.65450	Point at first set of rocks on SE	210	49.41820 -123.64190	Public jetty	190

Section Code	Section Name	Access	BCMEC Classification	Northerly or Westerly End			Southerly or Easterly End		
			Substrate Exposure Depth Profile	Lat Long	Location Description	Bearing (true)	Lat Long	Location Description	Bearing (true)
		Roberts Creek Rd and immediately right on Beach Ave.							
UPSC-1	Saltery Bay	Saltery Bay Prov Park picnic ground and boat launch, just off Hwy. Follow sign for boat launch on Hwy. Trail at west end of parking lot takes you about 200 m along rocky shore on west side of section; after that walking is difficult, especially at high tide.	Mud Low <20m	49.78010 -124.22755	Just E of 2nd point heading W from boat launch	180	49.78072 -124.21433	At point E of boat launch	190
UPSC-2	Palm Beach	Palm Beach Regional Park. Access from Lang Bay Rd., then turn left on Palm Beach Rd to park; must walk past gate and through ball field to reach beach.	Mud Low >50m	49.77085 -124.34484	Rocky point to W of park	165	49.77296 -124.33131	Just past cove at end of beach, next to large standing stump	165
UPSC-3	Myrtle Rocks	Pull-off from highway. Break wall jetty is near midway point.	Mud Low >50m	49.79357 -124.47841	At pilings ~300 m W of break wall jetty	220	49.79195 -124.46596	~250 W of point which lies SE of the break wall jetty	220
UPSC-4	Powell River South	S end of Powell River, where road begins to leave Oceanside.	Mud Low >50m	49.82038 -124.52544	Between 2 buoys, no landmark, must use gps to find end	280	49.81104 -124.52685	~400 m S of elevated parking site, N of Grief Point	250

Section Code	Section Name	Access	BCMEC Classification Substrate Exposure Depth Profile	Northerly or Westerly End Lat Long	Location Description	Bearing (true)	Southerly or Easterly End Lat Long	Location Description	Bearing (true)
UPSC-5	Willingdon Beach	Willingdon Beach Park, N end of Powell River.	Mud Low >50m	49.85249 -124.53618	At large rootwad, use trail above beach access	240	49.84439 -124.53035	In elevated lot at yellow concrete barriers	210
UPSC-6	Sliammon Church	N of Powell River in Sliammon Townsite, park on ocean side of Sliammon River. Turn left on Sliammon Rd., just N of Sliammon Creek (first left N of Sliammon Creek).	Mud Mod >50m	49.89614 -124.62012	Small green house 6621 Waterfront, had permission from owner to cross yard	250	49.89540 -124.60744	N bank of Sliammon Creek	190
UPSC-7	Grief Point	Take Windsor Road to Victoria. Parking is at small park near point.	Mud Low >50m	49.80880 -124.52610	400 m NW of point, ~75 , before boulders begin on sandy beach	270	49.80210 -124.51890	Break wall for Marina, 550m E of Grief Point	200

Appendix 2. Survey data for sea ducks in the Strait of Georgia for 2003, 2004, 2008, 2014, and 2015, summarized by year, km-section, and species. Data for 2003 and 2004 are from Iverson et al. 2006, and data for 2008 are from V. Richard (unpubl. data). Note that in 2008, only Barrow's Goldeneye, Harlequin Ducks, and Surf Scoters were surveyed, and that two point counts were also conducted (Deep Bay and Sea Edge; see Methods). Not all km-sections were surveyed in all years (see Table 1).

Section	Year	Species	Total	Female	Male	Adult male	1Y male
BBFD-1	2003	BLSC	108	17	34	32	2
BBFD-1	2003	BUFF	4				
BBFD-1	2003	SUSC	490	68	190	178	12
BBFD-1	2003	WWSC	620				
BBFD-2	2003	BUFF	25				
BBFD-2	2003	COGO	3	1	2	2	0
BBFD-2	2003	SUSC	17	2	15	14	1
BBFD-2	2003	WWSC	54				
BBFD-3	2003	BUFF	11				
BBFD-3	2003	COGO	14	7	7	5	2
BBFD-3	2003	HADU	22	9	13	10	3
BBFD-3	2003	RBME	10				
BBFD-4	2003	BUFF	3				
BBFD-4	2003	COGO	6	2	4	3	1
BBFD-4	2003	HADU	19	10	9	8	1
BBFD-4	2003	RBME	5				
BIEB-1	2003	BAGO	1	0	1	1	0
BIEB-1	2003	BUFF	3				
BIEB-1	2003	COGO	2	0	2	2	0
BIEB-1	2003	RBME	21				
BIEB-1	2003	SUSC	182	49	79	75	4
BIEB-1	2003	WWSC	31				
BIEB-2	2003	BAGO	10	4	6	6	0
BIEB-2	2003	BUFF	1				
BIEB-2	2003	COGO	6	1	5	5	0
BIEB-2	2003	SUSC	35	16	19	17	2
BIEB-2	2003	WWSC	25				
BIEB-3	2003	BAGO	20	10	10	10	0
BIEB-3	2003	BUFF	2				
BIEB-3	2003	COGO	1	0	1	1	0
BIEB-3	2003	HADU	6	4	2	2	0
BIEB-3	2003	RBME	4				
BIEB-3	2003	SUSC	32	14	18	16	2
BIEB-4	2003	BAGO	65	29	36	33	3

Section	Year	Species	Total	Female	Male	Adult male	1Y male
BIEB-4	2003	BUFF	5				
BIEB-4	2003	COGO	6	1	5	5	0
BIEB-4	2003	HADU	5	3	2	2	0
BIEB-4	2003	SUSC	71	31	40	40	0
BIEB-5	2003	BAGO	21	9	12	12	0
BIEB-5	2003	COGO	2	1	1	1	0
BIEB-5	2003	HADU	3	2	1	1	0
BIEB-5	2003	SUSC	78	38	40	34	6
BIEB-6	2003	BAGO	67	29	38	36	2
BIEB-6	2003	BUFF	3				
BIEB-6	2003	COGO	6	3	3	3	0
BIEB-6	2003	RBME	1				
BIEB-6	2003	SUSC	4	2	2	1	1
BIEB-7	2003	BAGO	7	2	5	3	2
BIEB-7	2003	BUFF	8				
BIEB-7	2003	COGO	54	11	43	42	1
BIEB-7	2003	SUSC	130	60	70	63	7
BSHI-1	2003	BUFF	31				
BSHI-1	2003	COGO	29	10	19	18	1
BSHI-1	2003	COME	2				
BSHI-1	2003	LTDU	5				
BSHI-1	2003	RBME	6				
BSHI-1	2003	SUSC	78	25	53	42	11
BSHI-1	2003	WWSC	96				
BSHI-2	2003	BAGO	29	9	20	20	0
BSHI-2	2003	BLSC	44	14	30	22	8
BSHI-2	2003	BUFF	43				
BSHI-2	2003	COGO	36	13	23	20	3
BSHI-2	2003	COME	3				
BSHI-2	2003	HADU	36	15	21	20	1
BSHI-2	2003	LTDU	1				
BSHI-2	2003	RBME	30				
BSHI-2	2003	SUSC	151	55	96	94	2
BSHI-2	2003	WWSC	111				
BSHI-3	2003	BAGO	5	2	3	3	0
BSHI-3	2003	BUFF	32				
BSHI-3	2003	COGO	6	1	5	5	0
BSHI-3	2003	HADU	10	4	6	6	0
BSHI-3	2003	RBME	5				
BSHI-3	2003	SUSC	115	41	74	71	3
BSHI-3	2003	WWSC	72				
BSHI-4	2003	BLSC	15	5	10	9	1
BSHI-4	2003	BUFF	37				

Section	Year	Species	Total	Female	Male	Adult male	1Y male
BSHI-4	2003	COGO	38	12	26	25	1
BSHI-4	2003	HADU	75	29	46	43	3
BSHI-4	2003	SUSC	29	14	15	15	0
BSHI-4	2003	WWSC	104				
BSHI-5	2003	BAGO	1	0	1	0	1
BSHI-5	2003	BLSC	16	9	7	4	3
BSHI-5	2003	BUFF	11				
BSHI-5	2003	COGO	5	2	3	2	1
BSHI-5	2003	COME	6				
BSHI-5	2003	HADU	29	11	18	15	3
BSHI-5	2003	RBME	13				
BSHI-5	2003	SUSC	13	5	8	7	1
BSHI-5	2003	WWSC	24				
BSHI-6	2003	BLSC	84	25	59	54	5
BSHI-6	2003	BUFF	13				
BSHI-6	2003	COGO	3	0	3	3	0
BSHI-6	2003	HADU	58	22	36	31	5
BSHI-6	2003	RBME	5				
BSHI-6	2003	WWSC	5				
BSHI-7	2003	BLSC	6	1	5	4	1
BSHI-7	2003	BUFF	17				
BSHI-7	2003	COGO	5	2	3	3	0
BSHI-7	2003	HADU	31	13	18	17	1
BSHI-7	2003	LTDU	4				
BSHI-7	2003	SUSC	51	19	32	30	2
BSHI-7	2003	WWSC	14				
BSHI-8	2003	BUFF	73				
BSHI-8	2003	COGO	29	10	19	14	5
BSHI-8	2003	COME	1				
BSHI-8	2003	HADU	26	12	14	14	0
BSHI-8	2003	RBME	15				
BSHI-8	2003	SUSC	9	3	6	6	0
BSHI-8	2003	WWSC	2				
CRCX-1	2003	BLSC	1	1	0	0	0
CRCX-1	2003	BUFF	32				
CRCX-1	2003	COGO	19	4	15	14	1
CRCX-1	2003	HADU	29	12	17	16	1
CRCX-1	2003	LTDU	7				
CRCX-1	2003	RBME	3				
CRCX-1	2003	SUSC	58	19	39	37	2
CRCX-1	2003	WWSC	51				
CRCX-10	2003	BLSC	8	7	1	1	0
CRCX-10	2003	BUFF	6				

Section	Year	Species	Total	Female	Male	Adult male	1Y male
CRCX-10	2003	COGO	2	2	0	0	0
CRCX-10	2003	HADU	13	7	6	6	0
CRCX-10	2003	RBME	1				
CRCX-10	2003	SUSC	2	0	2	0	2
CRCX-10	2003	WWSC	15				
CRCX-2	2003	BUFF	68				
CRCX-2	2003	COGO	18	11	7	7	0
CRCX-2	2003	COME	3				
CRCX-2	2003	HADU	37	17	20	20	0
CRCX-2	2003	LTDU	15				
CRCX-2	2003	RBME	2				
CRCX-2	2003	SUSC	77	21	56	51	5
CRCX-3	2003	BLSC	1	0	1	1	0
CRCX-3	2003	BUFF	38				
CRCX-3	2003	COGO	5	3	2	0	2
CRCX-3	2003	COME	26				
CRCX-3	2003	HADU	53	22	31	31	0
CRCX-3	2003	RBME	1				
CRCX-3	2003	SUSC	15	2	13	13	0
CRCX-4	2003	BAGO	1	1	0	0	0
CRCX-4	2003	BLSC	7	3	4	4	0
CRCX-4	2003	BUFF	7				
CRCX-4	2003	COGO	1	0	1	0	1
CRCX-4	2003	RBME	3				
CRCX-4	2003	SUSC	14	3	11	11	0
CRCX-4	2003	WWSC	8				
CRCX-5	2003	BLSC	9	1	8	8	0
CRCX-5	2003	BUFF	36				
CRCX-5	2003	COGO	70	39	32	29	3
CRCX-5	2003	HADU	20	10	10	10	0
CRCX-5	2003	LTDU	5				
CRCX-5	2003	SUSC	78	25	53	46	7
CRCX-5	2003	WWSC	11				
CRCX-6	2003	BLSC	1	0	1	1	0
CRCX-6	2003	BUFF	10				
CRCX-6	2003	HADU	46	21	25	25	0
CRCX-6	2003	LTDU	2				
CRCX-6	2003	RBME	4				
CRCX-6	2003	SUSC	8	2	6	4	2
CRCX-7	2003	BLSC	5	1	4	4	0
CRCX-7	2003	BUFF	37				
CRCX-7	2003	COGO	15	5	10	10	0
CRCX-7	2003	HADU	2	1	1	1	0

Section	Year	Species	Total	Female	Male	Adult male	1Y male
CRCX-7	2003	SUSC	20	6	14	11	3
CRCX-8	2003	BLSC	64	20	44	34	10
CRCX-8	2003	BUFF	47				
CRCX-8	2003	COGO	24	4	20	19	1
CRCX-8	2003	HADU	90	35	55	49	6
CRCX-8	2003	RBME	17				
CRCX-8	2003	SUSC	15	2	13	12	1
CRCX-8	2003	WWSC	49				
CRCX-9	2003	BLSC	14	5	9	7	2
CRCX-9	2003	BUFF	46				
CRCX-9	2003	COGO	16	7	9	9	0
CRCX-9	2003	HADU	29	11	18	17	1
CRCX-9	2003	RBME	3				
CRCX-9	2003	SUSC	7	3	4	3	1
CRCX-9	2003	WWSC	27				
DBFC-1	2003	BLSC	161	30	133	109	24
DBFC-1	2003	BUFF	26				
DBFC-1	2003	COGO	20	1	19	15	4
DBFC-1	2003	HADU	20	9	11	11	0
DBFC-1	2003	RBME	14				
DBFC-1	2003	SUSC	33	2	31	29	2
DBFC-1	2003	WWSC	160				
DBFC-2	2003	BAGO	1	0	1	0	1
DBFC-2	2003	BUFF	2				
DBFC-2	2003	COGO	1	0	1	1	0
DBFC-2	2003	HADU	20	9	11	11	0
DBFC-2	2003	RBME	19				
DBFC-2	2003	SUSC	38	7	31	31	0
DBFC-3	2003	BLSC	60	14	46	42	4
DBFC-3	2003	BUFF	67				
DBFC-3	2003	COGO	69	51	18	17	1
DBFC-3	2003	HADU	35	19	16	15	1
DBFC-3	2003	LTDU	3				
DBFC-3	2003	SUSC	8	2	6	6	0
DBFC-3	2003	WWSC	3				
DBFC-4	2003	BLSC	3	2	1	1	0
DBFC-4	2003	BUFF	14				
DBFC-4	2003	COGO	2	1	1	0	1
DBFC-4	2003	COME	6				
DBFC-4	2003	HADU	25	12	13	13	0
DBFC-4	2003	RBME	9				
DBFC-4	2003	SUSC	29	2	27	27	0
DBFC-5	2003	BLSC	5	1	4	4	0

Section	Year	Species	Total	Female	Male	Adult male	1Y male
DBFC-5	2003	BUFF	12				
DBFC-5	2003	COGO	6	1	5	5	0
DBFC-5	2003	SUSC	97	9	83	83	0
DBFC-5	2003	WWSC	53				
DBFC-6	2003	BLSC	37	13	24	21	3
DBFC-6	2003	BUFF	19				
DBFC-6	2003	COGO	13	6	7	7	0
DBFC-6	2003	HADU	27	13	14	13	1
DBFC-6	2003	SUSC	48	7	41	41	0
DBFC-6	2003	WWSC	10				
DIIS-1	2003	BLSC	4	0	4	3	1
DIIS-1	2003	BUFF	6				
DIIS-1	2003	COGO	11	2	2	1	1
DIIS-1	2003	HADU	37	16	21	18	3
DIIS-1	2003	LTDU	3				
DIIS-1	2003	RBME	5				
DIIS-1	2003	SUSC	12	6	6	6	0
DIIS-2	2003	BLSC	16	4	12	9	3
DIIS-2	2003	BUFF	17				
DIIS-2	2003	COGO	13	8	5	4	1
DIIS-2	2003	HADU	89	38	51	47	4
DIIS-2	2003	RBME	7				
DIIS-2	2003	SUSC	6	3	3	3	0
DIIS-2	2003	WWSC	41				
DIIS-3	2003	BLSC	2	0	2	2	0
DIIS-3	2003	BUFF	3				
DIIS-3	2003	HADU	39	10	29	27	2
DIIS-3	2003	RBME	5				
DIIS-3	2003	WWSC	6				
DIIS-4	2003	BAGO	4	1	3	3	0
DIIS-4	2003	BUFF	8				
DIIS-4	2003	COGO	5	2	3	3	0
DIIS-4	2003	HADU	20	10	10	10	0
DIIS-4	2003	RBME	7				
DIIS-4	2003	SUSC	25	5	20	19	1
DIIS-4	2003	WWSC	158				
LOSC-1	2003	BAGO	57	23	34	34	0
LOSC-1	2003	BUFF	11				
LOSC-1	2003	COGO	8	5	3	3	0
LOSC-1	2003	HADU	3	1	2	2	0
LOSC-1	2003	RBME	4				
LOSC-1	2003	SUSC	6	2	4	4	0
LOSC-2	2003	BAGO	56	30	26	25	1

Section	Year	Species	Total	Female	Male	Adult male	1Y male
LOSC-2	2003	BLSC	7	2	5	5	0
LOSC-2	2003	BUFF	14				
LOSC-2	2003	COME	1				
LOSC-2	2003	HADU	8	4	4	4	0
LOSC-2	2003	SUSC	10	8	2	2	0
LOSC-3	2003	BAGO	10	3	7	7	0
LOSC-3	2003	BLSC	33	9	25	22	3
LOSC-3	2003	BUFF	2				
LOSC-3	2003	COGO	9	4	5	5	0
LOSC-3	2003	HADU	6	3	3	3	0
LOSC-3	2003	RBME	9				
LOSC-3	2003	SUSC	34	12	22	22	0
LOSC-3	2003	WWSC	5				
LOSC-4	2003	BAGO	18	9	9	9	0
LOSC-4	2003	BUFF	4				
LOSC-4	2003	COGO	3	0	3	2	1
LOSC-4	2003	HADU	4	2	2	2	0
LOSC-4	2003	SUSC	13	5	8	8	0
UPSC-1	2003	BAGO	5	5	1	1	0
UPSC-1	2003	COGO	5	4	1	1	0
UPSC-1	2003	RBME	3				
UPSC-1	2003	SUSC	10	3	7	7	0
UPSC-2	2003	BAGO	21	9	12	9	3
UPSC-2	2003	BLSC	7	1	6	5	1
UPSC-2	2003	BUFF	3				
UPSC-2	2003	COGO	11	4	7	7	0
UPSC-2	2003	COME	2				
UPSC-2	2003	HADU	17	6	11	10	1
UPSC-2	2003	RBME	2				
UPSC-2	2003	SUSC	97	27	70	68	2
UPSC-2	2003	WWSC	9				
UPSC-3	2003	BAGO	6	2	4	4	0
UPSC-3	2003	BLSC	28	7	21	19	2
UPSC-3	2003	BUFF	2				
UPSC-3	2003	COGO	7	2	5	5	0
UPSC-3	2003	HADU	13	6	7	7	0
UPSC-3	2003	RBME	2				
UPSC-3	2003	SUSC	38	12	26	26	0
UPSC-3	2003	WWSC	23				
UPSC-4	2003	BLSC	17	3	14	13	1
UPSC-4	2003	BUFF	7				
UPSC-4	2003	COGO	3	1	2	2	0
UPSC-4	2003	HADU	6	3	3	3	0

Section	Year	Species	Total	Female	Male	Adult male	1Y male
UPSC-4	2003	RBME	6				
UPSC-4	2003	SUSC	4	0	4	4	0
UPSC-4	2003	WWSC	46				
UPSC-5	2003	BUFF	5				
UPSC-5	2003	COGO	2	1	1	1	0
UPSC-5	2003	HADU	1	0	1	1	0
UPSC-5	2003	SUSC	3	0	3	3	0
UPSC-5	2003	WWSC	11				
UPSC-6	2003	BAGO	7	2	5	4	1
UPSC-6	2003	BLSC	10	2	8	6	2
UPSC-6	2003	BUFF	12				
UPSC-6	2003	COGO	9	2	7	7	0
UPSC-6	2003	COME	2				
UPSC-6	2003	SUSC	10	2	8	8	0
UPSC-6	2003	WWSC	4				
BBFD-1	2004	BLSC	2	1	1	1	0
BBFD-1	2004	BUFF	7	2		5	
BBFD-1	2004	SUSC	77	26	51	51	0
BBFD-1	2004	WWSC	260	101		159	
BBFD-2	2004	BLSC	4	1	3	2	1
BBFD-2	2004	BUFF	13	6		7	
BBFD-2	2004	COGO	2	0	2	1	1
BBFD-2	2004	LTDU	2	0		2	
BBFD-2	2004	RBME	1	1		0	
BBFD-2	2004	SUSC	70	14	56	51	5
BBFD-2	2004	WWSC	121	45		76	
BBFD-3	2004	BAGO	12	4	8	8	0
BBFD-3	2004	BUFF	3	2		1	
BBFD-3	2004	COGO	7	0	7	6	1
BBFD-3	2004	HADU	17	8	9	8	1
BBFD-3	2004	LTDU	1	1		0	
BBFD-3	2004	RBME	16	15		1	
BBFD-4	2004	BAGO	3	2	1	1	0
BBFD-4	2004	BUFF	21	7		14	
BBFD-4	2004	COGO	14	3	11	10	1
BBFD-4	2004	HADU	21	12	9	9	0
BBFD-4	2004	RBME	5	4		1	
BBFD-4	2004	SUSC	1	0	1	1	0
BBFD-4	2004	WWSC	138	89		49	
BBFD-5	2004	BUFF	57	34		23	
BBFD-5	2004	COGO	6	0	6	6	0
BBFD-5	2004	RBME	2	1		1	
BBFD-5	2004	SUSC	8	4	4	4	0

Section	Year	Species	Total	Female	Male	Adult male	1Y male
BBFD-5	2004	WWSC	20	9		11	
BBFD-6	2004	BAGO	10	3	7	6	1
BBFD-6	2004	BUFF	2	2		0	
BBFD-6	2004	COGO	13	4	9	9	0
BBFD-6	2004	LTDU	7	2		5	
BBFD-6	2004	SUSC	246	77	169	137	32
BBFD-6	2004	WWSC	3	1		2	
BBFD-7	2004	BAGO	5	2	3	3	0
BBFD-7	2004	SUSC	109	54	55	33	22
BIEB-1	2004	BAGO	2	1	1	1	0
BIEB-1	2004	BUFF	3	0		3	
BIEB-1	2004	COGO	1	0	1	1	0
BIEB-1	2004	RBME	5	3		2	
BIEB-1	2004	SUSC	1	0	1	1	0
BIEB-2	2004	BAGO	8	2	6	6	0
BIEB-2	2004	BUFF	1	0		1	
BIEB-3	2004	BAGO	27	13	14	14	0
BIEB-3	2004	BUFF	2	1		1	
BIEB-3	2004	HADU	6	4	2	2	0
BIEB-3	2004	RBME	2	0		2	
BIEB-4	2004	BAGO	88	34	54	51	3
BIEB-4	2004	BUFF	4	3		1	
BIEB-4	2004	HADU	2	1	1	0	1
BIEB-5	2004	BAGO	30	17	13	13	0
BIEB-5	2004	BUFF	2	1		1	
BIEB-5	2004	HADU	6	3	3	3	0
BIEB-5	2004	RBME	1	0		1	
BIEB-6	2004	BAGO	18	9	9	7	2
BIEB-6	2004	BUFF	2	2		0	
BIEB-6	2004	COGO	3	1	2	2	0
BIEB-6	2004	RBME	6	1		5	
BIEB-7	2004	BAGO	50	14	36	34	2
BIEB-7	2004	COGO	3	0	3	3	0
BIEB-7	2004	HADU	4	1	3	3	0
BIEB-7	2004	SUSC	9	5	4	4	0
BSHI-1	2004	BUFF	35	15		20	
BSHI-1	2004	COGO	45	11	34	34	0
BSHI-1	2004	COME	1	1		0	
BSHI-1	2004	HADU	23	9	14	13	1
BSHI-1	2004	RBME	12	2		10	
BSHI-1	2004	SUSC	181	63	118	113	5
BSHI-1	2004	WWSC	436	202		234	
BSHI-2	2004	BAGO	5	2	3	3	0

Section	Year	Species	Total	Female	Male	Adult male	1Y male
BSHI-2	2004	BLSC	6	2	4	4	0
BSHI-2	2004	BUFF	9	5		4	
BSHI-2	2004	COGO	11	2	9	5	4
BSHI-2	2004	HADU	9	3	6	6	0
BSHI-2	2004	SUSC	46	13	33	33	0
BSHI-2	2004	WWSC	41	20		21	
BSHI-3	2004	BAGO	2	1	1	1	0
BSHI-3	2004	BUFF	17	7		10	
BSHI-3	2004	COGO	18	6	12	10	2
BSHI-3	2004	COME	2	1		1	
BSHI-3	2004	HADU	8	3	5	3	2
BSHI-3	2004	RBME	4	1		3	
BSHI-3	2004	SUSC	62	20	42	41	1
BSHI-3	2004	WWSC	11	4		7	
BSHI-4	2004	BLSC	124	30	94	92	2
BSHI-4	2004	BUFF	58	26		32	
BSHI-4	2004	COGO	31	8	23	23	0
BSHI-4	2004	HADU	111	48	63	61	2
BSHI-4	2004	RBME	2	2		0	
BSHI-4	2004	SUSC	22	8	14	14	0
BSHI-4	2004	WWSC	171	69		102	
BSHI-5	2004	BLSC	4	2	2	2	0
BSHI-5	2004	BUFF	15	4		11	
BSHI-5	2004	COGO	13	7	6	5	1
BSHI-5	2004	COME	1	0		1	
BSHI-5	2004	HADU	23	8	15	11	4
BSHI-5	2004	RBME	2	0		2	
BSHI-5	2004	SUSC	10	2	8	8	0
BSHI-5	2004	WWSC	15	7		8	
BSHI-6	2004	BLSC	30	9	21	19	2
BSHI-6	2004	BUFF	8	3		5	
BSHI-6	2004	COGO	2	1	1	0	1
BSHI-6	2004	COME	5	1		4	
BSHI-6	2004	HADU	103	42	61	54	7
BSHI-6	2004	RBME	6	5		1	
BSHI-6	2004	SUSC	4	1	3	3	0
BSHI-6	2004	WWSC	8	4		4	
BSHI-7	2004	BLSC	18	7	11	11	0
BSHI-7	2004	BUFF	28	16		12	
BSHI-7	2004	COGO	8	3	5	5	0
BSHI-7	2004	HADU	60	26	34	32	2
BSHI-7	2004	RBME	3	2		1	
BSHI-7	2004	SUSC	30	12	18	18	0

Section	Year	Species	Total	Female	Male	Adult male	1Y male
BSHI-8	2004	BLSC	28	6	22	18	4
BSHI-8	2004	BUFF	43	20		23	
BSHI-8	2004	COGO	36	10	26	25	1
BSHI-8	2004	COME	6	1		5	
BSHI-8	2004	HADU	15	8	7	7	0
BSHI-8	2004	HOME	2	1		1	
BSHI-8	2004	RBME	34	23		11	
BSHI-8	2004	SUSC	29	13	16	16	0
BSHI-8	2004	WWSC	2	1		1	
BSHI-9	2004	BLSC	31	12	19	16	3
BSHI-9	2004	BUFF	4	3		1	
BSHI-9	2004	COGO	12	2	10	9	1
BSHI-9	2004	COME	3	2		1	
BSHI-9	2004	HADU	56	21	35	29	6
BSHI-9	2004	RBME	7	5		2	
BSHI-9	2004	SUSC	4	2	2	2	0
BSHI-9	2004	WWSC	34	15		19	
BSHI-10	2004	BLSC	3	0	3	3	0
BSHI-10	2004	BUFF	13	7		6	
BSHI-10	2004	HADU	49	19	30	26	4
BSHI-10	2004	RBME	3	2		1	
BSHI-10	2004	SUSC	21	2	19	17	2
BSHI-10	2004	WWSC	9	4		5	
BSHI-11	2004	BAGO	25	8	17	14	3
BSHI-11	2004	BUFF	28	10		18	
BSHI-11	2004	COGO	37	9	28	17	11
BSHI-11	2004	HADU	66	29	37	35	2
BSHI-11	2004	RBME	11	7		4	
BSHI-11	2004	SUSC	15	4	11	11	0
BSHI-11	2004	WWSC	35	20		15	
BSHI-12	2004	BAGO	22	6	16	10	6
BSHI-12	2004	BLSC	165	47	118	108	10
BSHI-12	2004	BUFF	24	10		14	
BSHI-12	2004	COGO	70	24	46	38	8
BSHI-12	2004	COME	1	1		0	
BSHI-12	2004	HADU	18	7	11	8	3
BSHI-12	2004	LTDU	4	1		3	
BSHI-12	2004	SUSC	2	1	1	1	0
BSHI-12	2004	WWSC	160	101		59	
CRCX-1	2004	BUFF	16	5		11	
CRCX-1	2004	COGO	3	0	3	3	0
CRCX-1	2004	HADU	33	15	18	18	0
CRCX-1	2004	LTDU	4	1		3	

Section	Year	Species	Total	Female	Male	Adult male	1Y male
CRCX-1	2004	RBME	4	2		2	
CRCX-1	2004	SUSC	7	1	6	6	0
CRCX-1	2004	WWSC	15	5		10	
CRCX-2	2004	BUFF	17	12		5	
CRCX-2	2004	COGO	1	0	1	1	0
CRCX-2	2004	COME	1	1		0	
CRCX-2	2004	HADU	5	1	4	4	0
CRCX-2	2004	RBME	1	1		0	
CRCX-2	2004	SUSC	27	3	24	24	0
CRCX-3	2004	BUFF	20	12		8	
CRCX-3	2004	COGO	14	11	3	2	1
CRCX-3	2004	COME	4	3		1	
CRCX-3	2004	HADU	30	13	17	15	2
CRCX-3	2004	LTDU	1	0		1	
CRCX-3	2004	RBME	2	2		0	
CRCX-3	2004	SUSC	25	5	20	20	0
CRCX-4	2004	BUFF	7	6		1	
CRCX-4	2004	COGO	2	1	1	0	1
CRCX-4	2004	COME	2	2		0	
CRCX-4	2004	HADU	8	2	6	5	1
CRCX-4	2004	SUSC	17	4	13	13	0
CRCX-5	2004	BAGO	2	1	1	1	0
CRCX-5	2004	BLSC	15	2	13	13	0
CRCX-5	2004	BUFF	38	13		25	
CRCX-5	2004	COGO	28	13	15	12	3
CRCX-5	2004	COME	8	2		6	
CRCX-5	2004	HADU	27	14	13	12	1
CRCX-5	2004	RBME	1	1		0	
CRCX-5	2004	SUSC	123	44	79	76	3
CRCX-5	2004	WWSC	142	73		69	
CRCX-6	2004	BUFF	16	8		8	
CRCX-6	2004	COME	1	0		1	
CRCX-6	2004	HADU	30	15	15	14	1
CRCX-6	2004	RBME	3	1		2	
CRCX-6	2004	SUSC	1	0	1	1	0
CRCX-7	2004	BUFF	34	21		13	
CRCX-7	2004	COGO	17	4	13	11	2
CRCX-7	2004	HADU	3	2	1	0	1
CRCX-7	2004	SUSC	37	8	29	25	4
CRCX-8	2004	BLSC	61	26	35	31	4
CRCX-8	2004	BUFF	67	39		28	
CRCX-8	2004	COGO	22	4	18	18	0
CRCX-8	2004	HADU	58	25	33	32	1

Section	Year	Species	Total	Female	Male	Adult male	1Y male
CRCX-8	2004	HOME	2	1		1	
CRCX-8	2004	LTDU	7	1		6	
CRCX-8	2004	RBME	16	8		8	
CRCX-8	2004	SUSC	7	2	5	5	0
CRCX-8	2004	WWSC	39	20		19	
CRCX-9	2004	BLSC	12	6	6	6	0
CRCX-9	2004	BUFF	54	26		28	
CRCX-9	2004	COGO	25	12	13	8	5
CRCX-9	2004	COME	1	1		0	
CRCX-9	2004	HADU	53	19	34	32	2
CRCX-9	2004	LTDU	1	1		0	
CRCX-9	2004	RBME	3	0		3	
CRCX-9	2004	SUSC	8	2	6	5	1
CRCX-9	2004	WWSC	24	11		13	
CRCX-10	2004	BUFF	5	5		0	
CRCX-10	2004	COGO	5	3	2	2	0
CRCX-10	2004	HADU	4	2	2	2	0
CRCX-10	2004	RBME	3	2		1	
CRCX-10	2004	WWSC	20	8		12	
CRCX-11	2004	BLSC	4	2	2	2	0
CRCX-11	2004	BUFF	28	16		12	
CRCX-11	2004	COGO	27	8	19	13	6
CRCX-11	2004	HADU	41	19	22	20	2
CRCX-11	2004	LTDU	1	0		1	
CRCX-11	2004	RBME	2	1		1	
CRCX-11	2004	SUSC	31	7	24	24	0
CRCX-11	2004	WWSC	3	2		1	
CRCX-12	2004	BAGO	1	0	1	1	0
CRCX-12	2004	BLSC	3	0	3	3	0
CRCX-12	2004	BUFF	11	9		2	
CRCX-12	2004	COGO	3	3	0	0	0
CRCX-12	2004	COME	3	1		2	
CRCX-12	2004	HADU	37	19	18	17	1
CRCX-12	2004	LTDU	1	1		0	
CRCX-12	2004	RBME	11	10		1	
CRCX-12	2004	SUSC	2	1	1	1	0
CRCX-12	2004	WWSC	3	3		0	
DBFC-1	2004	BAGO	1	0	1	1	0
DBFC-1	2004	BLSC	48	14	34	29	5
DBFC-1	2004	BUFF	21	11		10	
DBFC-1	2004	COGO	18	1	17	15	2
DBFC-1	2004	HADU	23	10	13	12	1
DBFC-1	2004	RBME	11	5		6	

Section	Year	Species	Total	Female	Male	Adult male	1Y male
DBFC-1	2004	SUSC	14	4	10	10	0
DBFC-1	2004	WWSC	92	47		45	
DBFC-2	2004	BUFF	11	3		8	
DBFC-2	2004	COGO	1	0	1	1	0
DBFC-2	2004	HADU	21	10	11	11	0
DBFC-2	2004	RBME	1	1		0	
DBFC-2	2004	SUSC	15	5	10	10	0
DBFC-3	2004	BLSC	69	21	48	44	4
DBFC-3	2004	BUFF	21	11		10	
DBFC-3	2004	COGO	22	12	10	10	0
DBFC-3	2004	HADU	63	27	36	35	1
DBFC-3	2004	LTDU	3	2		1	
DBFC-3	2004	SUSC	3	1	2	2	0
DBFC-3	2004	WWSC	91	32		59	
DBFC-4	2004	BUFF	8	3		5	
DBFC-4	2004	COGO	9	3	6	6	0
DBFC-4	2004	HADU	24	10	14	12	2
DBFC-4	2004	RBME	5	4		1	
DBFC-4	2004	SUSC	12	2	10	9	1
DBFC-5	2004	BLSC	11	2	9	7	2
DBFC-5	2004	BUFF	20	11		9	
DBFC-5	2004	COGO	2	2	0	0	0
DBFC-5	2004	COME	3	0		3	
DBFC-5	2004	SUSC	33	4	29	29	0
DBFC-5	2004	WWSC	93	47		46	
DBFC-6	2004	BAGO	1	0	1	0	1
DBFC-6	2004	BLSC	102	14	88	70	18
DBFC-6	2004	BUFF	9	4		5	
DBFC-6	2004	COGO	18	4	14	13	1
DBFC-6	2004	COME	1	1		0	
DBFC-6	2004	HADU	20	9	11	11	0
DBFC-6	2004	RBME	1	0		1	
DBFC-6	2004	SUSC	16	2	14	14	0
DBFC-6	2004	WWSC	59	29		30	
DIIS-1	2004	BLSC	4	1	3	2	1
DIIS-1	2004	BUFF	1	1		0	
DIIS-1	2004	COGO	1	0	1	1	0
DIIS-1	2004	HADU	26	9	17	16	1
DIIS-1	2004	RBME	10	4		6	
DIIS-1	2004	SUSC	2	0	2	2	0
DIIS-2	2004	BLSC	3	1	2	2	0
DIIS-2	2004	BUFF	17	12		5	
DIIS-2	2004	COGO	8	4	4	4	0

Section	Year	Species	Total	Female	Male	Adult male	1Y male
DIIS-2	2004	HADU	48	20	28	28	0
DIIS-2	2004	RBME	3	2		1	
DIIS-2	2004	SUSC	11	4	7	7	0
DIIS-2	2004	WWSC	8	1		7	
DIIS-3	2004	BLSC	3	0	3	3	0
DIIS-3	2004	BUFF	1	1		0	
DIIS-3	2004	HADU	13	6	7	6	1
DIIS-3	2004	RBME	10	7		3	
DIIS-3	2004	SUSC	3	0	3	3	0
DIIS-3	2004	WWSC	11	5		6	
DIIS-4	2004	BUFF	12	4		8	
DIIS-4	2004	COGO	6	2	4	4	0
DIIS-4	2004	HADU	9	4	5	5	0
DIIS-4	2004	RBME	6	3		3	
DIIS-4	2004	SUSC	7	4	3	3	0
DIIS-4	2004	WWSC	106	45		61	
DIIS-5	2004	BUFF	3	1		2	
DIIS-5	2004	HADU	29	13	16	14	2
DIIS-5	2004	RBME	9	5		4	
DIIS-5	2004	SUSC	11	3	8	7	1
DIIS-6	2004	COME	5	5		0	
DIIS-6	2004	HADU	8	3	5	4	1
DIIS-6	2004	RBME	1	1		0	
DIIS-6	2004	SUSC	1	0	1	1	0
LOSC-1	2004	BAGO	25	7	18	18	0
LOSC-1	2004	BUFF	2	1		1	
LOSC-1	2004	COGO	3	0	3	3	0
LOSC-1	2004	RBME	2	1		1	
LOSC-2	2004	BAGO	11	7	4	4	0
LOSC-2	2004	BLSC	6	1	5	5	0
LOSC-2	2004	BUFF	10	5		5	
LOSC-2	2004	HADU	5	2	3	3	0
LOSC-2	2004	SUSC	1	1	0	0	0
LOSC-3	2004	BLSC	11	3	8	8	0
LOSC-3	2004	HADU	8	4	4	2	2
LOSC-3	2004	RBME	4	3		1	
LOSC-3	2004	SUSC	19	5	14	14	0
LOSC-3	2004	WWSC	6	3		3	
LOSC-4	2004	BAGO	3	2	1	1	0
LOSC-4	2004	BUFF	1	0		1	
LOSC-4	2004	COGO	6	2	4	4	0
LOSC-4	2004	HADU	9	4	5	5	0
LOSC-4	2004	RBME	3	1		2	

Section	Year	Species	Total	Female	Male	Adult male	1Y male
LOSC-4	2004	SUSC	14	6	8	8	0
LOSC-5	2004	BAGO	14	3	11	11	0
LOSC-5	2004	BLSC	7	3	4	3	1
LOSC-5	2004	BUFF	13	6		7	
LOSC-5	2004	COGO	1	1	0	0	0
LOSC-5	2004	HADU	18	6	12	11	1
LOSC-5	2004	RBME	2	2		0	
LOSC-5	2004	SUSC	2	0	2	1	1
UPSC-1	2004	BUFF	1	0		1	
UPSC-1	2004	COME	1	0		1	
UPSC-1	2004	RBME	3	0		3	
UPSC-1	2004	SUSC	2	1	1	1	0
UPSC-2	2004	BAGO	9	4	5	5	0
UPSC-2	2004	BUFF	8	3		5	
UPSC-2	2004	COGO	22	8	14	13	1
UPSC-2	2004	COME	2	0		2	
UPSC-2	2004	HADU	19	9	10	8	2
UPSC-2	2004	RBME	1	0		1	
UPSC-2	2004	SUSC	96	35	61	58	3
UPSC-2	2004	WWSC	7	5		2	
UPSC-3	2004	BLSC	24	7	17	17	0
UPSC-3	2004	BUFF	3	1		2	
UPSC-3	2004	COGO	15	4	11	11	0
UPSC-3	2004	HADU	8	2	6	4	2
UPSC-3	2004	SUSC	37	15	22	22	0
UPSC-3	2004	WWSC	11	6		5	
UPSC-4	2004	BAGO	3	2	1	1	0
UPSC-4	2004	BLSC	4	0	4	4	0
UPSC-4	2004	BUFF	5	2		3	
UPSC-4	2004	COGO	14	7	7	7	0
UPSC-4	2004	HADU	3	1	2	0	2
UPSC-4	2004	RBME	2	0		2	
UPSC-4	2004	SUSC	10	4	6	6	0
UPSC-4	2004	WWSC	9	4		5	
UPSC-5	2004	BAGO	3	2	1	1	0
UPSC-5	2004	BUFF	10	4		6	
UPSC-5	2004	SUSC	13	3	10	10	0
UPSC-5	2004	WWSC	32	17		15	
UPSC-6	2004	BAGO	7	2	5	5	0
UPSC-6	2004	BLSC	8	3	5	5	0
UPSC-6	2004	BUFF	3	1		2	
UPSC-6	2004	COGO	7	0	7	7	0
UPSC-6	2004	HADU	2	1	1	1	0

Section	Year	Species	Total	Female	Male	Adult male	1Y male
UPSC-6	2004	SUSC	49	11	38	38	0
UPSC-7	2004	BLSC	1	0	1	1	0
UPSC-7	2004	BUFF	3	1		2	
UPSC-7	2004	HADU	5	2	3	3	0
UPSC-7	2004	RBME	5	3		2	
UPSC-7	2004	SUSC	10	4	6	6	0
DEEP BAY	2008	SUSC	122	60	62	12	50
SEA EDGE	2008	SUSC	225	33	192	190	2
BBFD-1	2008	SUSC	7	0	7	7	0
BBFD-2	2008	BAGO	1	0	1	1	0
BBFD-2	2008	HADU	2	1	0	1	0
BBFD-2	2008	SUSC	80	20	60	60	0
BBFD-3	2008	HADU	78	40	38	33	5
BBFD-4	2008	HADU	8	7	1	1	0
BBFD-5	2008	HADU	4	2	2	1	1
BBFD-5	2008	SUSC	4	1	3	3	0
BBFD-6	2008	BAGO	15	2	13	13	0
BBFD-6	2008	SUSC	1015	277	738	730	8
BBFD-7	2008	SUSC	390	100	290	250	40
BIEB-1	2008	BAGO	2	1	1	1	0
BIEB-1	2008	SUSC	160	58	102	92	10
BIEB-2	2008	BAGO	19	7	12	12	0
BIEB-2	2008	SUSC	3	1	2	2	0
BIEB-3	2008	BAGO	21	10	11	11	0
BIEB-3	2008	SUSC	15	3	12	12	0
BIEB-4	2008	BAGO	70	37	33	33	0
BIEB-4	2008	HADU	6	3	3	3	0
BIEB-4	2008	SUSC	53	13	40	35	5
BIEB-5	2008	BAGO	52	23	29	29	0
BIEB-5	2008	SUSC	9	3	6	3	3
BIEB-6	2008	BAGO	49	25	24	24	0
BIEB-6	2008	SUSC	48	28	20	4	16
BIEB-7	2008	BAGO	74	24	50	35	15
BIEB-7	2008	SUSC	168	91	77	42	35
BSHI-1	2008	SUSC	26	2	24	24	0
BSHI-12	2008	BAGO	5	1	4	4	0
BSHI-12	2008	HADU	34	14	20	20	0
BSHI-12	2008	SUSC	26	9	17	17	0
BSHI-2	2008	BAGO	13	4	9	9	0
BSHI-2	2008	HADU	22	7	15	15	0
BSHI-2	2008	SUSC	73	23	50	49	1

Section	Year	Species	Total	Female	Male	Adult male	1Y male
CRCX-1	2008	HADU	27	12	15	15	0
CRCX-1	2008	SUSC	11	2	9	9	0
CRCX-10	2008	HADU	13	6	7	7	0
CRCX-2	2008	HADU	11	6	5	5	0
CRCX-2	2008	SUSC	3	1	2	2	0
CRCX-3	2008	HADU	31	12	19	19	0
CRCX-3	2008	SUSC	18	0	18	8	10
CRCX-4	2008	BAGO	2	1	1	1	0
CRCX-4	2008	HADU	7	3	4	4	0
CRCX-4	2008	SUSC	4	2	2	2	0
CRCX-5	2008	BAGO	2	1	1	1	0
CRCX-5	2008	HADU	13	6	7	7	0
CRCX-5	2008	SUSC	41	11	30	30	0
CRCX-7	2008	HADU	4	1	3	3	0
CRCX-7	2008	SUSC	17	4	13	13	0
DBFC-1	2008	HADU	21	11	10	10	0
DBFC-1	2008	SUSC	67	11	56	56	0
DBFC-2	2008	HADU	13	8	5	5	0
DBFC-2	2008	SUSC	17	3	14	14	0
DBFC-3	2008	HADU	37	18	19	19	0
DBFC-3	2008	SUSC	7	0	7	7	0
DBFC-4	2008	HADU	16	7	9	9	0
DBFC-4	2008	SUSC	9	1	8	8	0
DBFC-5	2008	SUSC	85	19	66	64	2
DBFC-6	2008	HADU	39	15	24	23	1
DBFC-6	2008	SUSC	10	1	9	9	0
LOSC-1	2008	BAGO	16	4	12	12	0
LOSC-1	2008	SUSC	22	8	14	12	2
LOSC-3	2008	BAGO	20	6	14	14	0
LOSC-3	2008	SUSC	23	4	19	13	6
UPSC-3	2008	BAGO	1	0	1	1	0
UPSC-3	2008	HADU	5	2	3	3	0
UPSC-3	2008	SUSC	1	0	1	1	0
UPSC-5	2008	BAGO	2	0	2	2	0
UPSC-5	2008	HADU	7	3	4	4	0
UPSC-5	2008	SUSC	3	0	3	2	1
UPSC-7	2008	SUSC	13	1	12	12	0
BBFD-1	2014	COGO	5	5	0	0	0
BBFD-2	2014	BLSC	2	0	2	2	0
BBFD-2	2014	BUFF	17	8		9	
BBFD-2	2014	COGO	3	1	2	2	0
BBFD-2	2014	SUSC	80	16	64	54	10
BBFD-2	2014	WWSC	18	12		6	

Section	Year	Species	Total	Female	Male	Adult male	1Y male
BBFD-3	2014	BLSC	2	2	0	0	0
BBFD-3	2014	BUFF	8	6		2	
BBFD-3	2014	COGO	19	6	13	12	1
BBFD-3	2014	HADU	31	13	18	16	2
BBFD-3	2014	RBME	28	25		3	
BBFD-3	2014	SUSC	13	10	3	1	2
BBFD-4	2014	BUFF	37	28		9	
BBFD-4	2014	COGO	25	11	14	13	1
BBFD-4	2014	HADU	21	12	9	8	1
BBFD-5	2014	BAGO	2	0	2	1	1
BBFD-5	2014	BUFF	14	10		4	
BBFD-5	2014	COGO	7	1	6	5	1
BSHI-1	2014	BUFF	24	13		11	
BSHI-1	2014	COGO	9	2	7	6	1
BSHI-1	2014	LTDU	5	4		1	
BSHI-1	2014	RBME	4	1		3	
BSHI-1	2014	SUSC	47	15	32	30	2
BSHI-1	2014	WWSC	159	61		98	
BSHI-2	2014	BUFF	33	22		11	
BSHI-2	2014	COGO	16	6	10	8	2
BSHI-2	2014	COME	7	2		5	
BSHI-2	2014	HADU	3	2	1	1	0
BSHI-2	2014	SUSC	4	2	2	2	0
BSHI-2	2014	WWSC	11	6		5	
BSHI-3	2014	BAGO	7	3	4	2	2
BSHI-3	2014	BUFF	24	21		3	
BSHI-3	2014	COGO	19	10	9	7	2
BSHI-3	2014	LTDU	1	1		0	
BSHI-3	2014	RBME	3	1		2	
BSHI-3	2014	SUSC	106	51	55	50	5
BSHI-3	2014	WWSC	9	6		3	
BSHI-4	2014	BUFF	55	37		18	
BSHI-4	2014	COGO	6	1	5	5	0
BSHI-4	2014	HADU	7	3	4	4	0
BSHI-4	2014	LTDU	2	1		1	
BSHI-4	2014	RBME	3	2		1	
BSHI-4	2014	SUSC	2	0	2	2	0
BSHI-5	2014	COGO	5	4	1	0	1
BSHI-5	2014	HADU	18	9	9	9	0
BSHI-5	2014	RBME	3	3		0	
BSHI-5	2014	SUSC	29	13	16	16	0
BSHI-5	2014	WWSC	16	5		11	
BSHI-6	2014	BLSC	4	1	3	3	0

Section	Year	Species	Total	Female	Male	Adult male	1Y male
BSHI-6	2014	BUFF	3	1		2	
BSHI-6	2014	HADU	4	2	2	2	0
BSHI-6	2014	RBME	4	3		1	
BSHI-6	2014	SUSC	15	14	1	1	0
BSHI-7	2014	BLSC	1	1	0	0	0
BSHI-7	2014	BUFF	18	8		10	
BSHI-7	2014	COGO	2	0	2	2	0
BSHI-7	2014	HADU	43	19	24	23	1
BSHI-7	2014	RBME	10	7		3	
BSHI-7	2014	SUSC	36	15	21	16	5
BSHI-8	2014	BUFF	80	48		32	
BSHI-8	2014	COGO	12	3	9	6	3
BSHI-8	2014	COME	4	1		3	
BSHI-8	2014	HADU	12	4	8	5	3
BSHI-8	2014	HOME	5	5		0	
BSHI-8	2014	LTDU	3	1		2	
BSHI-8	2014	RBME	23	19		4	
BSHI-8	2014	SUSC	24	11	13	12	1
BSHI-9	2014	BLSC	150	33	67	62	5
BSHI-9	2014	BUFF	2	1		1	
BSHI-9	2014	COGO	20	8	12	10	2
BSHI-9	2014	COME	1	1		0	
BSHI-9	2014	HADU	45	22	23	21	2
BSHI-9	2014	RBME	8	5		3	
BSHI-9	2014	SUSC	600	237	220	193	27
BSHI-9	2014	WWSC	3	3		0	
BSHI-10	2014	BUFF	29	12		17	
BSHI-10	2014	COGO	1	0	1	1	0
BSHI-10	2014	COME	1	1		0	
BSHI-10	2014	HADU	38	15	23	22	1
BSHI-10	2014	LTDU	1	0		1	
BSHI-10	2014	RBME	4	3		1	
BSHI-10	2014	SUSC	58	18	40	32	8
BSHI-10	2014	WWSC	2	1		1	
BSHI-11	2014	BAGO	2	1	1	1	0
BSHI-11	2014	BUFF	70	44		26	
BSHI-11	2014	COGO	26	5	21	14	7
BSHI-11	2014	COME	1	1		0	
BSHI-11	2014	HADU	23	10	13	9	4
BSHI-11	2014	HOME	2	2		0	
BSHI-11	2014	RBME	31	13		18	
BSHI-11	2014	SUSC	110	49	61	54	7
BSHI-11	2014	WWSC	33	17		16	

Section	Year	Species	Total	Female	Male	Adult male	1Y male
BSHI-12	2014	BAGO	4	1	3	3	0
BSHI-12	2014	BLSC	22	7	15	15	0
BSHI-12	2014	BUFF	27	19		8	
BSHI-12	2014	COGO	92	33	59	50	9
BSHI-12	2014	HADU	64	29	35	33	2
BSHI-12	2014	LTDU	12	4		8	
BSHI-12	2014	SUSC	53	20	33	33	0
BSHI-12	2014	WWSC	61	37		24	
CRCX-1	2014	BUFF	14	7		7	
CRCX-1	2014	COGO	1	0	1	1	0
CRCX-1	2014	HADU	65	29	36	35	1
CRCX-1	2014	LTDU	3	1		2	
CRCX-1	2014	RBME	10	6		4	
CRCX-1	2014	SUSC	11	1	10	8	2
CRCX-1	2014	WWSC	14	6		8	
CRCX-2	2014	BUFF	18	10		8	
CRCX-2	2014	COGO	4	3	1	0	1
CRCX-2	2014	HADU	41	19	22	22	0
CRCX-2	2014	LTDU	1	0		1	
CRCX-3	2014	BLSC	16	6	10	10	0
CRCX-3	2014	BUFF	46	28		18	
CRCX-3	2014	COGO	20	16	4	4	0
CRCX-3	2014	COME	3	2		1	
CRCX-3	2014	HADU	5	2	3	3	0
CRCX-3	2014	LTDU	2	0		2	
CRCX-3	2014	RBME	4	2		2	
CRCX-3	2014	SUSC	7	2	5	5	0
CRCX-4	2014	BLSC	10	1	9	9	0
CRCX-4	2014	BUFF	19	14		5	
CRCX-4	2014	COGO	10	2	8	7	1
CRCX-4	2014	HADU	17	5	12	10	2
CRCX-4	2014	LTDU	10	4		6	
CRCX-4	2014	RBME	3	2		1	
CRCX-4	2014	SUSC	13	4	9	9	0
CRCX-4	2014	WWSC	8	1		7	
CRCX-5	2014	BAGO	8	4	4	4	0
CRCX-5	2014	BLSC	6	4	2	2	0
CRCX-5	2014	BUFF	69	44		25	
CRCX-5	2014	COGO	24	10	14	14	0
CRCX-5	2014	HADU	11	5	6	6	0
CRCX-5	2014	HOME	2	2		0	
CRCX-5	2014	LTDU	8	2		6	
CRCX-5	2014	SUSC	9	3	6	6	0

Section	Year	Species	Total	Female	Male	Adult male	1Y male
CRCX-5	2014	WWSC	7	4		3	
CRCX-6	2014	BUFF	39	22		17	
CRCX-6	2014	HADU	30	12	18	16	2
CRCX-6	2014	LTDU	2	1		1	
CRCX-6	2014	RBME	8	4		4	
CRCX-6	2014	SUSC	19	7	12	10	2
CRCX-7	2014	BUFF	52	28		24	
CRCX-7	2014	COGO	9	5	4	3	1
CRCX-8	2014	BLSC	18	7	11	11	0
CRCX-8	2014	BUFF	32	20		12	
CRCX-8	2014	COGO	7	3	4	3	1
CRCX-8	2014	COME	2	0		2	
CRCX-8	2014	HADU	40	20	20	19	1
CRCX-8	2014	HOME	1	1		0	
CRCX-8	2014	RBME	11	6		5	
CRCX-8	2014	SUSC	81	47	34	26	8
CRCX-8	2014	WWSC	17	8		9	
CRCX-9	2014	BLSC	91	39	52	46	6
CRCX-9	2014	BUFF	54	31		23	
CRCX-9	2014	COGO	15	5	10	10	0
CRCX-9	2014	HADU	34	12	22	20	2
CRCX-9	2014	LTDU	1	0		1	
CRCX-9	2014	RBME	16	8		8	
CRCX-9	2014	SUSC	25	15	10	8	2
CRCX-9	2014	WWSC	8	6		2	
CRCX-10	2014	BLSC	7	2	5	5	0
CRCX-10	2014	BUFF	9	5		4	
CRCX-10	2014	COGO	5	3	2	1	1
CRCX-10	2014	HADU	13	4	9	7	2
CRCX-10	2014	RBME	1	1		0	
CRCX-10	2014	SUSC	3	1	2	2	0
CRCX-10	2014	WWSC	4	1		3	
CRCX-11	2014	BLSC	6	2	4	4	0
CRCX-11	2014	BUFF	12	9		3	
CRCX-11	2014	COGO	7	5	2	2	0
CRCX-11	2014	HADU	65	25	40	33	7
CRCX-11	2014	LTDU	9	1		8	
CRCX-11	2014	RBME	3	2		1	
CRCX-11	2014	SUSC	7	3	4	4	0
CRCX-12	2014	BLSC	3	1	2	2	0
CRCX-12	2014	BUFF	25	17		8	
CRCX-12	2014	COGO	3	1	2	1	1
CRCX-12	2014	HADU	67	26	41	30	11

Section	Year	Species	Total	Female	Male	Adult male	1Y male
CRCX-12	2014	RBME	31	23		8	
CRCX-12	2014	SUSC	17	5	12	10	2
CRCX-12	2014	WWSC	4	1		3	
DBFC-1	2014	BLSC	144	36	108	98	10
DBFC-1	2014	BUFF	41	25		16	
DBFC-1	2014	COGO	29	0	29	26	3
DBFC-1	2014	HADU	70	27	43	37	6
DBFC-1	2014	LTDU	2	1		1	
DBFC-1	2014	RBME	11	4		7	
DBFC-1	2014	SUSC	231	97	134	134	0
DBFC-1	2014	WWSC	293	149		144	
DBFC-2	2014	BUFF	4	2		2	
DBFC-2	2014	HADU	4	2	2	2	0
DBFC-2	2014	RBME	3	0		3	
DBFC-2	2014	SUSC	39	16	23	21	2
DBFC-3	2014	BAGO	2	0	2	2	0
DBFC-3	2014	BLSC	3	1	2	2	0
DBFC-3	2014	BUFF	59	33		26	
DBFC-3	2014	COGO	71	42	29	25	4
DBFC-3	2014	COME	5	4		1	
DBFC-3	2014	HADU	57	26	31	26	5
DBFC-3	2014	LTDU	6	2		4	
DBFC-3	2014	SUSC	5	2	3	3	0
DBFC-4	2014	BLSC	4	1	3	3	0
DBFC-4	2014	BUFF	4	3		1	
DBFC-4	2014	COGO	1	0	1	0	1
DBFC-4	2014	COME	5	5		0	
DBFC-4	2014	HADU	29	13	16	16	0
DBFC-4	2014	LTDU	5	3		2	
DBFC-4	2014	RBME	10	7		3	
DBFC-4	2014	SUSC	17	6	11	11	0
DBFC-5	2014	BLSC	46	15	31	30	1
DBFC-5	2014	BUFF	30	15		15	
DBFC-5	2014	SUSC	37	10	27	26	1
DBFC-5	2014	WWSC	7	1		6	
DBFC-6	2014	BAGO	5	3	2	2	0
DBFC-6	2014	BUFF	21	12		9	
DBFC-6	2014	COGO	34	12	22	19	3
DBFC-6	2014	COME	2	2		0	
DBFC-6	2014	SUSC	10	1	9	8	1
DBFC-6	2014	WWSC	3	0		3	
DIIS-1	2014	BUFF	7	5		2	
DIIS-1	2014	COGO	1	0	1	1	0

Section	Year	Species	Total	Female	Male	Adult male	1Y male
DIIS-1	2014	HADU	25	8	17	11	6
DIIS-1	2014	LTDU	3	1		2	
DIIS-1	2014	RBME	10	7		3	
DIIS-1	2014	SUSC	7	4	3	1	2
DIIS-1	2014	WWSC	3	1		2	
DIIS-2	2014	BLSC	2	1	1	1	0
DIIS-2	2014	BUFF	24	14		10	
DIIS-2	2014	COGO	13	3	10	9	1
DIIS-2	2014	HADU	59	24	35	31	4
DIIS-2	2014	LTDU	1	0		1	
DIIS-2	2014	RBME	10	5		5	
DIIS-2	2014	SUSC	4	3	1	1	0
DIIS-2	2014	WWSC	16	10		6	
DIIS-3	2014	BUFF	10	8		2	
DIIS-3	2014	COGO	3	2	1	0	1
DIIS-3	2014	HADU	31	8	23	16	7
DIIS-3	2014	RBME	7	6		1	
DIIS-3	2014	WWSC	1	1		0	
DIIS-4	2014	BUFF	7	5		2	
DIIS-4	2014	COGO	24	17	7	4	3
DIIS-4	2014	HADU	24	9	15	15	0
DIIS-4	2014	RBME	1	0		1	
DIIS-4	2014	SUSC	13	6	7	7	0
DIIS-4	2014	WWSC	6	3		3	
DIIS-5	2014	BUFF	1	1		0	
DIIS-5	2014	HADU	20	10	10	9	1
DIIS-5	2014	RBME	5	3		2	
DIIS-5	2014	SUSC	2	0	2	2	0
DIIS-6	2014	COME	1	1		0	
DIIS-6	2014	HADU	3	1	2	2	0
DIIS-6	2014	SUSC	2	1	1	1	0
LOSC-1	2014	COGO	2	1	1	1	0
LOSC-1	2014	RBME	7	5		2	
LOSC-1	2014	SUSC	3	0	3	2	1
LOSC-2	2014	BAGO	3	2	1	1	0
LOSC-2	2014	COGO	1	1	0	0	0
LOSC-2	2014	HADU	5	1	4	4	0
LOSC-2	2014	SUSC	1	0	1	1	0
LOSC-3	2014	BAGO	2	0	2	2	0
LOSC-3	2014	BLSC	1	0	1	1	0
LOSC-3	2014	COGO	9	3	6	6	0
LOSC-3	2014	SUSC	2	1	1	1	0
LOSC-4	2014	BAGO	29	12	17	16	1

Section	Year	Species	Total	Female	Male	Adult male	1Y male
LOSC-4	2014	BUFF	10	1		9	
LOSC-4	2014	COGO	8	2	6	6	0
LOSC-4	2014	HOME	2	2		0	
LOSC-4	2014	RBME	2	2		0	
LOSC-4	2014	SUSC	51	20	31	31	0
LOSC-5	2014	BUFF	8	4		4	
LOSC-5	2014	COGO	7	2	5	5	0
LOSC-5	2014	HADU	7	4	3	2	1
LOSC-5	2014	HOME	5	4		1	
LOSC-5	2014	RBME	3	3		0	
LOSC-5	2014	WWSC	1	0		1	
UPSC-1	2014	BAGO	8	4	4	4	0
UPSC-1	2014	BUFF	14	9		5	
UPSC-1	2014	COGO	4	2	2	2	0
UPSC-1	2014	HADU	2	1	1	1	0
UPSC-1	2014	RBME	1	1		0	
UPSC-1	2014	SUSC	20	6	14	13	1
UPSC-2	2014	BAGO	12	4	8	8	0
UPSC-2	2014	BUFF	16	6		10	
UPSC-2	2014	COGO	19	7	12	11	1
UPSC-2	2014	HADU	13	5	8	8	0
UPSC-2	2014	SUSC	29	7	22	21	1
UPSC-2	2014	WWSC	1	1		0	
UPSC-3	2014	BUFF	15	10		5	
UPSC-3	2014	COGO	23	7	16	15	1
UPSC-3	2014	HADU	17	7	10	10	0
UPSC-3	2014	RBME	3	1		2	
UPSC-3	2014	SUSC	12	3	9	9	0
UPSC-3	2014	WWSC	11	6		5	
UPSC-4	2014	BLSC	25	7	18	17	1
UPSC-4	2014	BUFF	30	13		17	
UPSC-4	2014	COGO	19	1	18	18	0
UPSC-4	2014	HADU	14	6	8	6	2
UPSC-4	2014	RBME	2	1		1	
UPSC-4	2014	SUSC	36	9	27	27	0
UPSC-4	2014	WWSC	1	0		1	
UPSC-6	2014	BAGO	12	6	6	6	0
UPSC-6	2014	BUFF	13	8		5	
UPSC-6	2014	COGO	19	8	11	10	1
UPSC-6	2014	COME	11	8		3	
UPSC-6	2014	RBME	2	0		2	
UPSC-6	2014	SUSC	19	3	16	15	1
UPSC-6	2014	WWSC	3	2		1	

Section	Year	Species	Total	Female	Male	Adult male	1Y male
UPSC-7	2014	BUFF	1	1		0	
UPSC-7	2014	HADU	4	2	2	2	0
BBFD-1	2015	BUFF	2	1		1	
BBFD-1	2015	COGO	16	6	10	9	1
BBFD-1	2015	SUSC	7	0	7	6	1
BBFD-1	2015	BAGO	2	1	1	1	0
BBFD-2	2015	BUFF	31	14		17	
BBFD-2	2015	COGO	9	5	4	2	2
BBFD-2	2015	RBME	2	1		1	
BBFD-2	2015	SUSC	100	29	71	59	12
BBFD-2	2015	WWSC	5	3		2	
BBFD-3	2015	BUFF	23	11		12	
BBFD-3	2015	COGO	12	2	10	9	1
BBFD-3	2015	HADU	28	13	15	12	3
BBFD-3	2015	LTDU	2	1		1	
BBFD-3	2015	RBME	9	6		3	
BBFD-3	2015	SUSC	5	2	3	3	
BBFD-4	2015	BUFF	18	15		3	
BBFD-4	2015	COGO	17	3	14	12	2
BBFD-4	2015	HADU	21	11	10	9	1
BBFD-4	2015	RBME	1	1		0	
BBFD-5	2015	BUFF	58	36		22	
BBFD-5	2015	COGO	19	7	12	9	3
BBFD-5	2015	RBME	2	2		0	
BBFD-6	2015	COGO	5	1	4	4	
BBFD-6	2015	SUSC	9	7	2	0	2
BBFD-7	2015	BAGO	5	4	1	1	0
BBFD-7	2015	BUFF	12	5		7	
BBFD-7	2015	COGO	3	0	3	2	1
BBFD-7	2015	SUSC	26	21	5	3	2
BIEB-1	2015	BAGO	92	36	56	49	7
BIEB-1	2015	BUFF	35	15		20	
BIEB-1	2015	COGO	105	43	62	50	12
BIEB-1	2015	COME	29	28		1	
BIEB-1	2015	SUSC	860	309	551	494	57
BIEB-1	2015	WWSC	30	17		13	
BIEB-2	2015	BAGO	5	2	3	3	0
BIEB-2	2015	BUFF	3	1		2	
BIEB-2	2015	COGO	4	3	1	1	0
BIEB-2	2015	BUFF COGO hybrid	1	0		1	
BIEB-3	2015	BAGO	4	2	2	2	0
BIEB-3	2015	BUFF	1	1		0	

Section	Year	Species	Total	Female	Male	Adult male	1Y male
BIEB-3	2015	COGO	3	1	2	2	0
BIEB-3	2015	COME	63	59		4	
BIEB-3	2015	HADU	3	0	3	2	1
BIEB-3	2015	RBME	9	0		9	
BIEB-3	2015	SUSC	2	0	2	2	0
BIEB-4	2015	BAGO	59	21	38	37	1
BIEB-4	2015	BUFF	10	4		6	
BIEB-4	2015	COGO	13	6	7	5	2
BIEB-4	2015	COME	111	101		10	
BIEB-4	2015	HADU	3	0	3	2	1
BIEB-4	2015	RBME	5	0		5	
BIEB-5	2015	BAGO	139	59	80	76	4
BIEB-5	2015	BUFF	3	3		0	
BIEB-5	2015	COGO	5	2	3	1	2
BIEB-5	2015	RBME	2	0		2	
BIEB-6	2015	BAGO	71	40	31	31	0
BIEB-6	2015	BUFF	19	13		6	
BIEB-6	2015	COME	4	2		2	
BIEB-6	2015	SUSC	7	5	2	0	2
BIEB-7	2015	BAGO	12	5	7	7	0
BIEB-7	2015	BUFF	7	2		5	
BIEB-7	2015	COGO	6	3	3	2	1
BIEB-7	2015	RBME	1	0		1	
BSHI-1	2015	BUFF	19	8		11	
BSHI-1	2015	COGO	13	3	10	10	0
BSHI-1	2015	LTDU	22	11		11	
BSHI-1	2015	RBME	4	1		3	
BSHI-1	2015	SUSC	150	44	106	97	9
BSHI-1	2015	WWSC	497	213		284	
BSHI-2	2015	BAGO	3	2	1	1	0
BSHI-2	2015	BLSC	1	1	0	0	
BSHI-2	2015	BUFF	25	12		13	
BSHI-2	2015	COGO	28	15	13	12	1
BSHI-2	2015	COME	2	1		1	
BSHI-2	2015	HADU	28	14	14	13	1
BSHI-2	2015	LTDU	1	0		1	
BSHI-2	2015	RBME	2	0		2	
BSHI-2	2015	SUSC	32	12	20	20	0
BSHI-2	2015	WWSC	23	14		9	
BSHI-3	2015	BUFF	35	22		13	
BSHI-3	2015	COGO	33	16	17	14	3
BSHI-3	2015	COME	2	1		1	
BSHI-3	2015	HADU	2	1	1	1	0

Section	Year	Species	Total	Female	Male	Adult male	1Y male
BSHI-3	2015	LTDU	2	0		2	
BSHI-3	2015	SUSC	95	28	67	65	2
BSHI-3	2015	WWSC	8	7		1	
BSHI-4	2015	BAGO	5	2	3	3	0
BSHI-4	2015	BLSC	12	3	9	8	1
BSHI-4	2015	BUFF	109	71		38	
BSHI-4	2015	COGO	96	32	64	52	12
BSHI-4	2015	COME	48	22		26	
BSHI-4	2015	HADU	37	18	19	16	3
BSHI-4	2015	RBME	13	8		5	
BSHI-4	2015	SUSC	19	9	10	10	0
BSHI-4	2015	WWSC	30	18		12	
BSHI-5	2015	BAGO	4	1	3	3	0
BSHI-5	2015	COGO	4	3	1	1	0
BSHI-5	2015	COME	18	13		5	
BSHI-5	2015	HADU	10	4	6	5	1
BSHI-5	2015	LTDU	2	1		1	
BSHI-5	2015	SUSC	3	2	1	0	1
BSHI-6	2015	BAGO	2	1	1	1	0
BSHI-6	2015	BLSC	81	22	59	50	9
BSHI-6	2015	BUFF	3	3		0	
BSHI-6	2015	COGO	2	1	1	1	0
BSHI-6	2015	HADU	41	14	27	20	7
BSHI-6	2015	RBME	8	4		4	
BSHI-7	2015	BUFF	9	1		8	
BSHI-7	2015	COGO	4	0	4	3	1
BSHI-7	2015	COME	1	1		0	
BSHI-7	2015	HADU	26	12	14	14	0
BSHI-7	2015	LTDU	3	2		1	
BSHI-7	2015	RBME	4	3		1	
BSHI-7	2015	SUSC	31	10	21	19	2
BSHI-8	2015	BUFF	44	20		24	
BSHI-8	2015	COGO	31	10	21	18	3
BSHI-8	2015	COME	1	1		0	
BSHI-8	2015	HADU	31	16	15	13	2
BSHI-8	2015	LTDU	4	1		3	
BSHI-8	2015	RBME	13	8		5	
BSHI-8	2015	SUSC	19	10	9	8	1
BSHI-9	2015	BLSC	4	1	3	1	2
BSHI-9	2015	BUFF	3	3		0	
BSHI-9	2015	COGO	19	5	14	12	2
BSHI-9	2015	HADU	53	25	28	26	2
BSHI-9	2015	LTDU	2	0		2	

Section	Year	Species	Total	Female	Male	Adult male	1Y male
BSHI-9	2015	RBME	1	0		1	
BSHI-9	2015	SUSC	8	1	7	7	0
BSHI-9	2015	WWSC	9	6		3	
BSHI-10	2015	BUFF	10	5		5	
BSHI-10	2015	COGO	2	1	1	1	0
BSHI-10	2015	HADU	25	11	14	12	2
BSHI-10	2015	LTDU	2			2	
BSHI-10	2015	SUSC	21	5	16	16	0
BSHI-10	2015	WWSC	1	0		1	
BSHI-11	2015	BAGO	7	4	3	2	1
BSHI-11	2015	BUFF	63	29		34	
BSHI-11	2015	COGO	45	11	34	34	0
BSHI-11	2015	HADU	37	16	21	21	0
BSHI-11	2015	RBME	18	13		5	
BSHI-11	2015	SUSC	126	50	76	72	4
BSHI-11	2015	WWSC	31	20		11	
BSHI-12	2015	BAGO	9	3	6	6	0
BSHI-12	2015	BLSC	8	1	7	7	0
BSHI-12	2015	BUFF	9	5		4	
BSHI-12	2015	BUFF COGO hybrid	1	0		1	
BSHI-12	2015	COGO	82	35	47	47	0
BSHI-12	2015	COME	1	1		0	
BSHI-12	2015	HADU	36	16	20	19	1
BSHI-12	2015	RBME	2	2		0	
BSHI-12	2015	SUSC	21	9	12	12	0
BSHI-12	2015	WWSC	67	43		24	
CRCX-1	2015	BLSC	11	4	7	7	0
CRCX-1	2015	BUFF	8	4		4	
CRCX-1	2015	COGO	7	1	6	4	2
CRCX-1	2015	COME	2	1		1	
CRCX-1	2015	HADU	38	17	21	19	2
CRCX-1	2015	LTDU	2	1		1	
CRCX-1	2015	RBME	1	1			
CRCX-1	2015	SUSC	150	79	71	70	1
CRCX-1	2015	WWSC	64	34		30	
CRCX-2	2015	BUFF	17	14		3	
CRCX-2	2015	COGO	4	0	4	3	1
CRCX-2	2015	HADU	10	5	5	4	1
CRCX-2	2015	LTDU	11	7		4	
CRCX-2	2015	RBME	1	1		0	
CRCX-2	2015	SUSC	18	5	13	12	1
CRCX-3	2015	BLSC	4	1	3	2	1

Section	Year	Species	Total	Female	Male	Adult male	1Y male
CRCX-3	2015	BUFF	25	13		12	
CRCX-3	2015	COGO	11	9	2	1	1
CRCX-3	2015	COME	27	24		3	
CRCX-3	2015	HADU	27	11	16	12	4
CRCX-3	2015	RBME	2	2		0	
CRCX-3	2015	SUSC	3	2	1	1	0
CRCX-4	2015	BUFF	5	3		2	
CRCX-4	2015	COGO	8	1	7	3	4
CRCX-4	2015	COME	14	13		1	
CRCX-4	2015	HADU	5	2	3	2	1
CRCX-4	2015	LTDU	3	2		1	
CRCX-5	2015	BAGO	3	2	1	1	0
CRCX-5	2015	BUFF	17	11		6	
CRCX-5	2015	COGO	26	12	14	10	4
CRCX-5	2015	COME	24	12		12	
CRCX-5	2015	HADU	16	8	8	8	0
CRCX-5	2015	RBME	2	1		1	
CRCX-5	2015	SUSC	65	23	42	39	3
CRCX-5	2015	WWSC	20	10		10	
CRCX-6	2015	BUFF	22	10		12	
CRCX-6	2015	COGO	1	0	1	0	1
CRCX-6	2015	COME	1	1		0	
CRCX-6	2015	HADU	20	8	12	11	1
CRCX-6	2015	SUSC	2	0	2	1	1
CRCX-7	2015	BUFF	22	15		7	
CRCX-7	2015	COGO	2	1	1	0	1
CRCX-7	2015	SUSC	65	9	56	2	54
CRCX-8	2015	BLSC	77	32	45	45	0
CRCX-8	2015	BUFF	71	42		29	
CRCX-8	2015	COGO	28	15	13	11	2
CRCX-8	2015	HADU	99	40	59	53	6
CRCX-8	2015	LTDU	3	2		1	
CRCX-8	2015	RBME	2	2		0	
CRCX-8	2015	SUSC	43	26	17	12	5
CRCX-8	2015	WWSC	36	25		11	
CRCX-9	2015	BLSC	19	6	13	8	5
CRCX-9	2015	BUFF	33	20		13	
CRCX-9	2015	COGO	28	12	16	8	8
CRCX-9	2015	HADU	16	8	8	8	
CRCX-9	2015	LTDU	1	1		0	
CRCX-9	2015	RBME	8	4		4	
CRCX-9	2015	SUSC	15	10	5	4	1
CRCX-9	2015	WWSC	1	1		0	

Section	Year	Species	Total	Female	Male	Adult male	1Y male
CRCX-10	2015	BUFF	4	3		1	
CRCX-10	2015	COGO	1	1	0	0	0
CRCX-10	2015	COME	2	1		1	
CRCX-10	2015	HADU	19	6	13	11	2
CRCX-10	2015	RBME	3	1		2	
CRCX-10	2015	SUSC	5	3	2	1	1
CRCX-11	2015	BLSC	44	13	31	28	3
CRCX-11	2015	BUFF	16	9		7	
CRCX-11	2015	COGO	27	19	8	5	3
CRCX-11	2015	COME	5	4		1	
CRCX-11	2015	HADU	45	20	25	21	4
CRCX-11	2015	LTDU	1	1		0	
CRCX-11	2015	RBME	1	1		0	
CRCX-11	2015	SUSC	6	2	4	2	2
CRCX-12	2015	BLSC	36	13	23	20	3
CRCX-12	2015	BUFF	11	5		6	
CRCX-12	2015	COGO	14	7	7	3	4
CRCX-12	2015	COME	3	3		0	
CRCX-12	2015	HADU	29	15	14	13	1
CRCX-12	2015	SUSC	1	0	1	0	1
DBFC-1	2015	BLSC	37	10	27	24	3
DBFC-1	2015	BUFF	66	34		32	
DBFC-1	2015	COGO	71	15	56	53	3
DBFC-1	2015	HADU	16	8	8	7	1
DBFC-1	2015	LTDU	5	2		3	
DBFC-1	2015	RBME	1	1		0	
DBFC-1	2015	SUSC	69	11	58	58	0
DBFC-1	2015	WWSC	137	66		71	
DBFC-2	2015	BUFF	3	3		0	
DBFC-2	2015	HADU	13	6	7	7	0
DBFC-2	2015	RBME	2	1		1	
DBFC-2	2015	SUSC	19	7	12	12	0
DBFC-3	2015	BAGO	2	1	1	1	0
DBFC-3	2015	BUFF	37	18		19	
DBFC-3	2015	COGO	25	14	11	10	1
DBFC-3	2015	COME	1	1		0	
DBFC-3	2015	HADU	23	10	13	13	0
DBFC-4	2015	BUFF	4	4		0	
DBFC-4	2015	COGO	5	5	0	0	
DBFC-4	2015	COME	1	1		0	
DBFC-4	2015	HADU	14	5	9	6	3
DBFC-4	2015	RBME	8	3		5	
DBFC-4	2015	SUSC	5	0	5	5	0

Section	Year	Species	Total	Female	Male	Adult male	1Y male
DBFC-5	2015	BUFF	27	12		15	
DBFC-5	2015	COGO	8	3	5	5	0
DBFC-5	2015	SUSC	7	1	6	5	1
DBFC-6	2015	BUFF	13	7		6	
DBFC-6	2015	COGO	17	8	9	6	3
DBFC-6	2015	HADU	2	1	1	1	0
DBFC-6	2015	LTDU	1	1		0	
DBFC-6	2015	RBME	2	2		0	
DBFC-6	2015	SUSC	7	1	6	6	0
DBFC-6	2015	WWSC	3	0		3	
DIIS-1	2015	BLSC	3	2	1	1	0
DIIS-1	2015	BUFF	38	10		28	
DIIS-1	2015	COGO	8	4	4	0	4
DIIS-1	2015	HADU	43	15	28	17	11
DIIS-2	2015	BLSC	9	2	7	5	2
DIIS-2	2015	BUFF	18	7		11	
DIIS-2	2015	COGO	45	12	33	24	9
DIIS-2	2015	HADU	125	56	69	62	7
DIIS-2	2015	RBME	4	2		2	
DIIS-2	2015	SUSC	40	14	26	21	5
DIIS-2	2015	WWSC	47	24		23	
DIIS-3	2015	BLSC	1	0	1	1	0
DIIS-3	2015	COGO	1	1	0	0	0
DIIS-3	2015	HADU	20	10	10	8	2
DIIS-3	2015	RBME	3	2		1	
DIIS-3	2015	SUSC	35	9	26	21	5
DIIS-3	2015	WWSC	4	3		1	
DIIS-4	2015	BAGO	1	1	0	0	0
DIIS-4	2015	BUFF	6	1		5	
DIIS-4	2015	COGO	9	7	2	2	0
DIIS-4	2015	HADU	4	1	3	2	1
DIIS-4	2015	SUSC	2	1	1	1	0
DIIS-4	2015	WWSC	11	6		5	
DIIS-5	2015	BUFF	4	4		0	
DIIS-5	2015	HADU	20	8	12	11	1
DIIS-5	2015	RBME	8	5		3	
DIIS-5	2015	SUSC	1	0	1	0	1
DIIS-6	2015	BUFF	1	1		0	
DIIS-6	2015	COME	1	1		0	
DIIS-6	2015	HADU	2	0	2	1	1
DIIS-6	2015	SUSC	2	0	2	2	0
DIIS-6	2015	WWSC	23	17		6	
LOSC-1	2015	BAGO	5	2	3	3	0

Section	Year	Species	Total	Female	Male	Adult male	1Y male
LOSC-1	2015	BUFF	5	3		2	
LOSC-1	2015	COGO	9	5	4	4	0
LOSC-1	2015	HADU	3	1	2	1	1
LOSC-1	2015	SUSC	1	0	1	1	0
LOSC-2	2015	BAGO	102	49	53	53	0
LOSC-2	2015	BLSC	14	5	9	9	0
LOSC-2	2015	BUFF	19	5		14	
LOSC-2	2015	COGO	1	1	0	0	0
LOSC-2	2015	COME	1	0		1	
LOSC-2	2015	HADU	18	10	8	8	0
LOSC-2	2015	RBME	2	2		0	
LOSC-2	2015	SUSC	2	1	1	1	0
LOSC-3	2015	BLSC	6	0	6	6	0
LOSC-3	2015	BUFF	1	0		1	
LOSC-3	2015	COGO	13	5	8	8	0
LOSC-3	2015	COME	3	2		1	
LOSC-3	2015	HADU	4	1	3	2	1
LOSC-3	2015	SUSC	4	0	4	4	0
LOSC-4	2015	BAGO	3	0	3	3	0
LOSC-4	2015	BUFF	5	2		3	
LOSC-4	2015	COGO	1	0	1	1	0
LOSC-4	2015	COME	1	1		0	
LOSC-4	2015	HADU	3	2	1	1	0
LOSC-4	2015	RBME	1	0		1	
LOSC-4	2015	SUSC	7	1	6	6	0
LOSC-5	2015	BUFF	13	6		7	
LOSC-5	2015	COGO	9	2	7	7	0
LOSC-5	2015	COME	1	1		0	
LOSC-5	2015	HADU	4	2	2	2	0
LOSC-5	2015	HOME	2	1		1	
LOSC-5	2015	LTDU	1	1		0	
UPSC-1	2015	BAGO	2	1	1	1	0
UPSC-1	2015	BUFF	5	1		4	
UPSC-1	2015	COGO	4	2	2	2	0
UPSC-1	2015	COME	2	1		1	
UPSC-1	2015	SUSC	12	3	9	9	0
UPSC-2	2015	BAGO	34	14	20	18	2
UPSC-2	2015	BUFF	16	3		13	
UPSC-2	2015	COGO	68	23	45	39	6
UPSC-2	2015	COME	47	27		20	
UPSC-2	2015	HADU	17	6	11	11	0
UPSC-2	2015	HOME	2	2		0	
UPSC-2	2015	SUSC	134	41	93	91	2

Section	Year	Species	Total	Female	Male	Adult male	1Y male
UPSC-2	2015	WWSC	1	1		0	
UPSC-3	2015	BLSC	4	0	4	3	1
UPSC-3	2015	BUFF	6	1		5	
UPSC-3	2015	COGO	11	3	8	7	1
UPSC-3	2015	COME	29	20		9	
UPSC-3	2015	HADU	15	7	8	7	1
UPSC-3	2015	RBME	2	2		0	
UPSC-3	2015	SUSC	7	1	6	6	0
UPSC-4	2015	BAGO	2	1	1	1	0
UPSC-4	2015	BLSC	17	4	13	11	2
UPSC-4	2015	BUFF	24	10		14	
UPSC-4	2015	COGO	7	1	6	6	0
UPSC-4	2015	HADU	12	5	7	7	0
UPSC-4	2015	RBME	2	0		2	
UPSC-4	2015	SUSC	21	2	19	19	0
UPSC-5	2015	BAGO	9	4	5	4	1
UPSC-5	2015	BUFF	6	4		2	
UPSC-5	2015	COGO	3	1	2	1	1
UPSC-5	2015	HADU	4	1	3	3	0
UPSC-5	2015	LTDU	1	1		0	
UPSC-5	2015	RBME	5	4		1	0
UPSC-5	2015	SUSC	2	1	1	1	0
UPSC-6	2015	BAGO	25	3	22	22	0
UPSC-6	2015	BUFF	9	5		4	
UPSC-6	2015	COGO	11	3	8	7	1
UPSC-6	2015	COME	2	2		0	
UPSC-6	2015	RBME	8	6		2	
UPSC-6	2015	SUSC	28	10	18	13	5
UPSC-7	2015	BUFF	1	0		1	
UPSC-7	2015	COGO	1	1	0	0	0
UPSC-7	2015	HADU	2	1	1	1	0
UPSC-7	2015	RBME	1	0		1	