

Supplementary Table S1. Northern hemisphere surveillance summary of avian influenza subtype richness studies from published literature

Location (author, year)	Richness/ sample size (per 1000)	Analysis method	Sampling periods	Bird families (positive/total, % positive)
Asia (Marchenko et al. 2012)	6/2604 (0.64)	Cloacal swabs & intestinal samples + isolation + HI & NI test + RT-PCR + sequencing	1 (2003-2009)	Anseriformes (9/604, 1.5%) Charadriiformes (1/684, 0.14%) Passeriformes (2/674, 0.30%) Ciconiiformes (0/300, 0%) Gruiformes (0/118, 0%) Podicipediformes (1/45, 2.2%) Pelecaniformes (3/95, 3.2%) Falconiformes (1/42, 2.4%) Galliformes (0/16, 0%) Columbiformes (0/18, 0%) Coraciiformes (0/3, 0%) Cuculiformes (0/2, 0%) Piciformes (0/2, 0%) Strigiformes (0/1, 0%)
Canada (provided by Canadian Cooperative Center for Wildlife Health 4 January 2013)	26/4484 (5.8)	Cloacal swab + real time RT-PCR + (isolation + HI & NI test + RT-PCR) +/- sequence (live & dead birds)	1 (2005)	Dabbling ducks (1484/3874, 38%) Other ducks (107/454, 24%) Sea ducks (2/16, 13%) – dead Geese & swans (2/11, 18%) – dead Gulls (6/29, 21%) – dead Passerines (3/24, 13%) – dead Birds of prey (1/17, 6%) – dead Seabirds (0/7) – dead Other (5/50, 10%) – dead
Alberta, Canada (Hinshaw et al. 1985)	44/9195 (4.8)	Cloacal? + isolation + HI & NI test	8 (1976, 1977, 1978, 1979, 1980, 1981, 1982, 1983)	Anatidae majority (2275/9195, 24%)
*Alberta, Canada (Sharp et al. 1997)	58/12321 (4.7)	Cloacal swab + isolation + HI & NI test + RT-PCR + sequence	1 (1976–1990)	Anatidae (2839/12321, 23%)
*Alberta, Canada (Krauss et al. 2004)	63/13466 (4.7)	Cloacal swab + isolation + HI & NI test + RT-PCR + sequence	1 (1976–2001)	Anatidae (2989/13466, 22.2%)
*Alberta, Canada (Krauss et al. 2012)	12/1038 (12)	Respiratory swab + isolation + HI & NI test + RT-PCR + sequence	4 (2007, 2008, 2009, 2010)	Anatidae (141/1038, 14%)
Alberta, Canada (Krauss et al. 2012)	25/1240 (20)	Cloacal swab + isolation + HI & NI test + RT-PCR + sequence	4 (2007, 2008, 2009, 2010)	Anatidae (153/1240, 12%)

Newfoundland, Canada (Wille et al. 2011)	1/38 (26)	Cloacal swab + RT-PCR + isolation + sequence	1 (2008–2009)	Laridae (2/38, 5.3%)
China (Zeng 2008)	12/158 (76)	Cloacal/tracheal + HI test + RT-PCR	1(2005–2006)	Anatidae (20/144, 15%) Ardeidae (0/2, 0%) Accipitridae (0/4, 0%) Charadriidae (0/1, 0%) Corvidae (0/1, 0%) Falconidae (0/2, 0%) Gruidae (0/2, 0%) Rallidae (0/1, 0%) Phasianidae (0/1, 0%) Upupidae (0/1, 0%)
Egypt (Soliman et al. 2012)	17/6070 (2.8)	Cloacal swab + RT-PCR + isolation + haemagglutination test + sequencing	5 (2003, 2004, 2005, 2006, 2007)	Anatidae majority (9.4%)
Europe (Munster unpub.) used in Munster et al. 2007	29/24428 (1.2)	Cloacal swab + real-time RT-PCR + isolation + HI & NI test	8 (1998, 1999, 2000, 2001, 2002, 2003, 2004, 2005)	Total (612/24516, 2.5%) <i>Anas platyrhynchos</i> (325/4398, 7.4%)
France (Lebarbenchon et al. 2007)	1/1044 (0.96)	Cloacal swabs & fecal + RT-PCR + isolation + HI & NI test	1 (2006)	Charadriiformes (2/102, 1.9%) Accipitriformes (0/3, 0%) Caprimulgiformes (0/2, 0%) Ciconiiformes (0/175, 0%) Columbiformes (0/3, 0%) Coraciiformes (0/19, 0%) Passeriformes (0/621, 0%) Phoenicopteriformes (0/113, 0%) Piciformes (0/3, 0%) Strigiformes (0/3, 0%)
Germany (Hlinak et al. 2006)	2/630(3.2)	Tracheal & cloacal swab + isolation + HI & NI test	2 (2001, 2002)	Anatidae (4/50, 8%) Charadriiformes (0/494, 0%) Gruiformes (0/4, 0%) Passeriformes (0/82, 0%)
Germany (Süss et al. 1994) used in Sinnecker et al. 1983	28/19191 (1.5)	Tracheal or cloacal swab + isolation + HI & NI test	1(1977-1989)	Total wild/feral only (325/19191, 1.7%)
Guatemala (González-Reiche et al. 2012)	6/256 (23)	Tracheal & cloacal swabs + RT-PCR + isolation + sequencing	4 (2006–2007, 2007–2008, 2008–2009, 2009–2010)	Anatidae (28/234, 12%) Picidae (1/21, 4.8%) Tyrannidae (1/1, 100%)
Iran (Fereidouni et al. 2010)	13/1146 (11)	Oropharyngeal/cloacal + isolation + RT-PCR + HI & NI test +	3 (2003/2004, 2005, 2007)	Podicipedidae (0/19, 0%) Phalacrocoracidae (0/14, 0%)

		sequencing/microarray		Ardeidae (0/22, 0%) Phoenicopteridae (0/12, 0%) Anatidae (31/745, 4.2%) Rallidae (4/234, 1.8%) Recurvirostridae (0/6, 0%) Charadriidae (0/17, 0%) Scolopacidae (0/51, 0%) Laridae (0/25, 0%) Sternidae (0/1, 0%)
Italy (De Marco et al. 2005)	3/638 (4.7)	Cloacal swab + isolation + HI & NI test	6 (Jan-Mar 1998, Dec 1998-Jan 1999, Jun 1999, Dec 1999, Feb 2000, Jun 2000)	Anatidae (5/326, 1.5%) Gruiformes (0/162, 0%) Laridae (0/133, 0%)
Italy (Terregino et al. 2007) used in Cattoli et al. 2007	15/4083 (3.7)	Cloacal swab + RT-PCR + isolation + sequencing	1 (2004–2006)	Total (327/4083, 8.0%) Anatidae majority
Japan (Fujimoto et al. 2010)	12/4335 (2.8)	Fecal sample + isolation + HI & NI test + RT-PCR + sequencing	8 (2001, 2002, 2003, 2004, 2005, 2006, 2007, 2008)	Anatidae (41/4309, 0.95%) Laridae (0/26, 0%)
Mongolia (provided by M. Gilbert 10 February 2013) used in Gilbert et al. 2012	23/5831 (3.9)	Fecal sample + isolation + HI & NI test + RT-PCR + sequencing	15 (Jul 2009, Aug 2009, Sep 2009, May 2010, Jun 2010, Jul 2010, Sep 2010, May 2011, Jun 2011, Jul 2011, Aug 2011, Sep 2011, Oct 2011, Sep 2012, Oct 2012)	Anatidae (80/5731, 1.4%) Laridae (0/100, 0%)
Portugal (Henriques et al. 2011)	20/5691 (3.5)	Cloacal/oropharyngeal+ mRT-PCR + isolation + sequencing	5 (2005, 2006, 2007, 2008, 2009)	Total (93/5691, 1.63%)
Portugal (Tolf et al. 2012)	8/1632 (4.9)	Cloacal + RT-PCR + isolation + HI & NI test + sequencing	1 (2008-2009)	Total (72/1653, 4.4%) <i>Anas platyrhynchos</i> (69/1542, 4.5%) <i>Anas crecca</i> (2/56, 3.6%) <i>Anas clypeata</i> (0/30, 0%) <i>Anas penelope</i> (0/12, 0%) <i>Anas strepera</i> (1/8, 12.5%) <i>Aythya fuligula</i> (0/5, 0%)

Russia (Sivay et al. 2012)	8/5678 (1.4)	Cloacal and fecal (individual and pooled) + isolation + HI & NI test + PCR + sequencing	1 (2008)	Anatidae (30/2017, 1.5%) Araeidae (1/81, 1.2%) Laridae (10/1553, 0.64%) Rallidae (1/164, 0.61%) Podicipediformes (0/64, 0%) Scolopacidae (0/334, 0%) Alcidae (0/19, 0%) Charadriidae (0/190, 0%) Recurvirostridae (0/1, 0%) Stercorariidae (0/1, 0%) Columbiformes (0/25, 0%) Passeriformes (0/989, 0%) Galliformes (0/3, 0%) Strigiformes (0/5, 0%) Accipitriformes (0/8, 0%) Coraciiformes (0/26, 0%) Apodiformes (0/1, 0%) Piciformes (0/3, 0%) Guidae (0/1, 0%) Gaviiformes (0/1, 0%) Pelecaniformes (0/187, 0%) Procellariiformes (0/5, 0%)
South Korea (Kang et al. 2010)	38/28214 (1.3)	Fecal + isolation + HA assay + RT-PCR	1 (2003-2008)	Anseriformes (225/28214, 0.8%)
Spain , Castilla-La Mancha (Pérez-Ramírez et al. 2010)	4/1435 (2.8)	Cloacal/fecal sample + RT-PCR + isolation + sequence	1 (2005-2007)	Total (37/1435, 2.6%) Anseriformes (29/628, 4.6%) Charadriiformes (0/217, 0%) Gruiformes (3/180, 1.7%) Pelecaniformes (0/29, 0%) Columbiformes (0/31, 0%) Ciconiformes (3/308, 1%) Passeriformes (0/24, 0%) Phoenicopteriformes (2/7, 28.6%) Other (0/11, 0%)
Spain , Catalonia (Busquets et al. 2010)	13/1347 (9.5)	Tracheal/fecal sample + RT-PCR + isolation + sequencing for HA & NA subtypes	1 (2006-2009)	Alcedinidae (0/1, 0%) Anatidae (54/686, 7.9%) Ardeidae (0/12, 0%) Columbidae(0/9, 0%) Fringillidae (0/1, 0%)

				Laridae (2/256, 0.8%) Phalacrocoracidae (0/6, 0%) Phasianidae (0/1, 0%) Phoenicopteridae (4/154, 2.5%) Porphyridae (0/12, 0%) Procellariidae (0/9, 0%) Rallidae (1/80, 1.3%) Recurvirostridae (0/2, 0%) Scolopacidae (0/4, 0%) Stercorariidae (0/1, 0%) Sternidae (0/2, 0%)
Sweden (Ottenby Bird Observatory, Latorre-Margalef et al. 2014 used also in Latorre-Margalef et al. 2013)	74/18645 (4.0)	Cloacal swab + real time RT-PCR + isolation + HI test & NA sequencing	8 (2002-2009)	<i>Anas platyrhynchos</i> (2463/18645, 13.2%)
Switzerland (Baumer et al. 2010)	13/2106 (6.2)	Combined pharyngeal & cloacal sample + isolation + RT-PCR + sequencing for HA & NA subtypes	1 (2006-2009)	Anseriformes (83/1697, 4.8%) Gruiformes (1/179, 0.55%) Charadriiformes (0/37, 0%) Pelecaniformes (0/58, 0%) Podicipediformes (0/34, 0%) Hirundiniformes (0/67, 0%) Turdiformes (0/9, 0%) Sylviiformes (0/20, 0%) Ardeiformes (0/2, 0%) Phasianiformes (0/1, 0%) Corvidae (0/1, 0%) Scolopaciformes (0/2, 0%) Muscicapiformes (0/1, 0%)
Taiwan (provided by Meng Chu 12 November 2012) used in Cheng et al. 2010	46/44786 (1.0)	Fecal sample + isolation + HI & NI test + RT-PCR + sequencing	10 (1998, 1999, 2000, 2001, 2002, 2003, 2004, 2005, 2006, 2007, 2008, 2009, 2010, 2011)	Anatidae (229/20812, 1.1%) Shorebirds (3/6435, 0.05%) Laridae (2/617, 0.32%) Ardeidae (2/825, 0.24%) Other birds (1/598, 0.17%)
Ukraine (Kulak et al. 2010)	7/606 (12)	Cloacal swab + isolation + HI assay + RT-PCR	5 (Nov 2006, Mar 2007, Sep 2007, Mar 2008, Sep 2008)	Anatidae (20/514, 3.9%) Rallidae (0/18, 0%) Columbidae (0/45, 0%) Phasiandae (0/29, 0%)
Alaska, USA (Ito et al. 1995)	8/3120 (2.6)	Fecal + isolation + HI & NI test + RT-	4 (1991, 1992,	Anatidae (108/3120, 3.4%)

		PCR	1993, 1994)	
Alaska, USA – St. Laurence Island (Ramey, Pearce, Ely, et al. 2010)	13/1411 (9.2)	Cloacal swab + isolation + sequence	1 (2007–2008)	Alcidae (10/-) Laridae (6/-) Charadriidae (1/-) Anatidae (3/-) Total (20/1411, 1.4%)
Alaska, USA – Central and coastal AK (Ramey, Pearce, Flint, et al. 2010; Koehler et al. 2008)	18/3415 (5.3)	Cloacal swab + RT-PCR + isolation + sequence	1(2006-2008)	Anatidae (78/3415, 2.3%) <i>Anas acuta</i>
Alaska, USA – Aleutians (Ramey et al. 2011)	14/1226 (11)	Cloacal swab + RT-PCR + isolation + sequence	1(2006-2008)	Anatidae (78/1226, 2.5%) <i>Polysticta stelleri</i>
California, USA (Siembieda et al. 2010)	28/4421 (6.3)	Cloacal /oropharyngeal swab + real-time RT-PCR + isolation	3 (2005–2006, 2006–2007, 2007–2008)	Anseriformes (69/4618, 1.5%) Ciconiiformes (7/763, 0.9%) Passeriformes (5/1309, 0.4%) Galliformes (2/652, 0.3%)
Louisiana, USA (Stallknecht et al. 1990)	12/1389 (8.6)	Cloacal & tracheal swab + isolation + hemagglutination test + HI & NI test	2 (1986, 1987, Sep–Jan months)	Anatidae (28/1389, 2.0%)
Minnesota, USA (Wilcox et al. 2011)	22/4893 (4.5)	Cloacal swabs + HI & NI test	2 (2007, 2008)	Anatidae (660/4893, 13%)
Minnesota, USA (Lebarbenchon et al. 2010)	1/81 (12)	Cloacal swabs + isolation + HI & NI test + RT-PCR	1 (2007–2008)	Pelecaniformes (2/81, 2.4%)
New York, USA (Hinshaw et al. 1985)	23/1560 (15)	Cloacal? + isolation + HI & NI test	6 (1978, 1979, 1980, 1981, 1982, 1983)	Anatidae majority (155/1560, 9.9%)
New Jersey & Delaware, USA (Krauss et al. 2004)	71/4266 (17)	Mostly fecal (some cloacal) + pooled + + isolation + HI & NI test + RT-PCR + sequence	1 (1985-2000)	Charadriiformes (606/4266, 14.2%) <i>Larus atricilla</i> and <i>L. argentatus</i> majority
New Jersey & Delaware, USA + some Argentina/Chile/Bermuda & (Hanson et al. 2008)	40/9402 (4.3)	Cloacal swabs & fecal + isolation + HI & NI test	1 (1999-2005)	Haemotopodidae (0/84, 0%) Recurvirostridae (0/6, 0%) Charadriidae (0/45, 0%) Scolopacidae (291/8278, 0.35%) Laridae (1/989, 0.1%)
Ohio, USA (Slemons et al. 1991)	20/928 (22)	Cloacal swab + isolation + hemagglutination test + agar gel diffusion + as per Beard 1980	3 (1986, 1987, 1988, fall seasons)	Anatidae (55/928 ,5.9%)
Pennsylvania, USA (Alfonso, Cowen, and Van Campen	6/330 (18)	Cloacal swab + isolation + hemagglutination test + HI & NI test	2 (1990, 1991)	<i>Anas americana</i> (2/19, 11%) <i>Anas platyrhynchos</i> (25/240, 10%)

1995)				Others (0/71, 0%)
Texas, USA (Hanson et al. 2005)	7/258 (27)	Cloacal + isolation + HI & NI test	2 (2001, 2002)	Anatidae (22/258, 8.5%)

* Removed from global study to avoid duplication of result reporting

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