Assessment of virus movement across continents: using Northern Pintails (*Anas acuta*) and Whooper Swans (*Cygnus cygnus*) as test species

Trip Report
Capture and Marking of Northern Pintails and Whooper Swans in Japan
17-22 January and 6-13 February 2009

Jerry Hupp, Paul Flint, John Pearce, and Andy Ramey. Alaska Science Center, U.S. Geological Survey, 4210 University Drive, Anchorage, AK 99508

Since 2007 The USGS Alaska Science Center (ASC) has been involved in a cooperative study[1] with Japanese scientists to assess the likelihood that migratory birds could transmit highly pathogenic H5N1 avian influenza virus from Asia to North America. Study collaborators include the University of Tokyo, USGS National Wildlife Health Center, USGS Western Ecological Research Center, U.S. Fish and Wildlife Service (USFWS), and Yamashina Institute of Ornithology. Our primary collaborator in Japan is Dr. Hiroyoshi Higuchi, Director of the Laboratory of Biodiversity Science, University of Tokyo. We are focusing on Northern Pintails as a model species for intercontinental virus transmission because they frequently migrate between Asia and North America, and because a relatively high proportion of pintails carry low pathogenic avian influenza strains of the virus. Japan is the main wintering area for Northern Pintails in east Asia, and has had repeated outbreaks of the highly pathogenic H5N1 virus. We are marking Northern Pintails at wintering areas in Japan with satellite transmitters in order to estimate the likelihood that they use nesting and molting areas in Russia that are also used by pintails that migrate from North America. Distribution of North American pintails in Russia is based on recoveries of birds marked with tarsus bands on North American wintering areas. In 2007 and 2008 we marked 79 Northern Pintails with satellite transmitters at two wintering areas in Japan and found that 58% of 466 locations in mainland Russia were in the region also used by North American pintails (Fig. 1). We also observed migration of one Northern Pintail from Japan to St. Lawrence Island, Alaska. These preliminary findings indicate substantial spatial overlap between Japanese and North American pintails on shared nesting and molting areas in Russia. That overlap likely contributes to the transmission of low pathogenic viruses from Asia to Northern Pintails in Alaska (*Koehler et al. 2008. Molecular Ecology 17:4754-4762*).

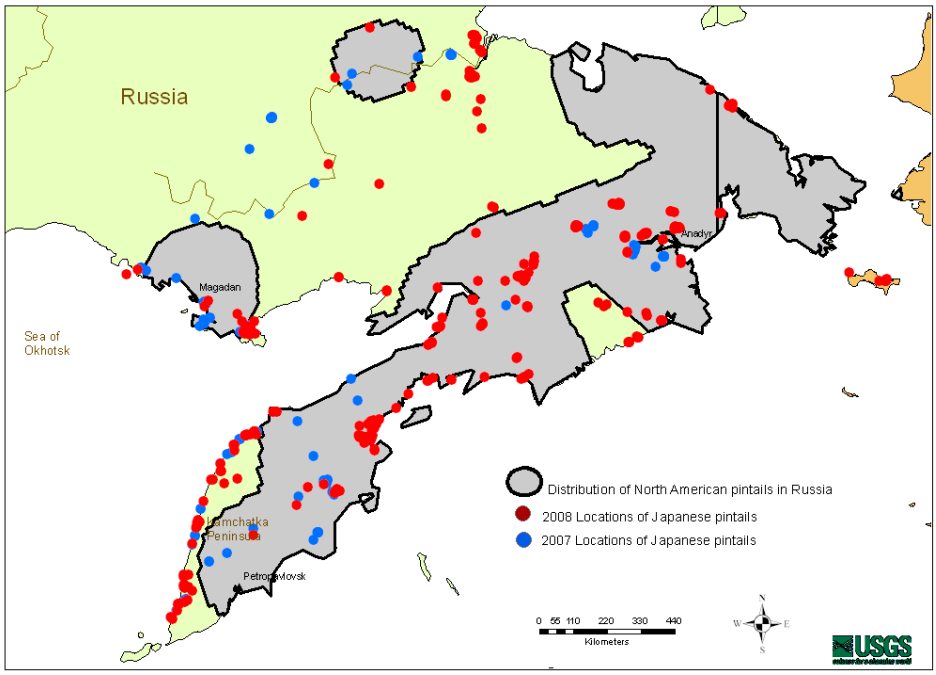

Figure 1. Locations of Northern Pintails marked with satellite transmitters in Japan in 2007-2008 overlapped substantially with the recovery distribution in Russia of Northern Pintails marked with tarsus bands on wintering areas in North America. Based on satellite telemetry locations and band recoveries from 1 May to 30 August on the Russian mainland. One satellite telemetry location per week for each marked pintail was used in the analysis. Recovery distribution of Northern Pintails marked in North America is indicated as a 95% utilization distribution computed using a kernel home range analysis.

[1] The study proposal is available at: http://alaska.usgs.gov/science/biology/avian_influenza/projects.html.

In 2009 we marked Northern Pintails in Japan with satellite transmitters for the third and final proposed year of the study. In addition, we initiated a project to mark Whooper Swans with satellite transmitters on Japanese winter areas. We expanded the project to include Whooper Swans because in 2008 the H5N1 virus was detected in Whooper Swans at three sites in Japan. Whooper Swans and Northern Pintails often share winter and migration habitats and can occur together in high concentrations. In 2008, 12% of Northern Pintails that carried satellite transmitters migrated through Japanese sites where the H5N1 virus had been detected in swans. We believe that by understanding migratory connectivity of Whooper Swans and Northern Pintails we can better assess virus exchange between those species, and evaluate pathways that could result in transfer of highly pathogenic viruses to North America.

Pearce and Ramey traveled to Hokkaido (Fig. 2) from 17-22 January to assist Japanese colleagues from the University of Tokyo in the capture of Whooper Swans, and to mark Northern Pintails with satellite transmitters. They were joined by Dr. Kazuaki Takehara and his colleagues from the School of Veterinary Medicine, Kitasato University. Dr. Takehara and his team collected fecal samples from Whooper Swans and Northern Pintails to assess shared low pathogenic viruses, and to screen birds for highly pathogenic viruses. Japanese colleagues marked 17 Whooper Swans at Lake Kussharo with satellite transmitters provided by the University of Tokyo. Pintails were marked at the Notsuke Peninsula, which was a site where the H5N1 virus was detected in Whooper Swans in 2008. Capture of Northern Pintails proved difficult due to smaller than expected numbers at the site, possibly because public feeding of ducks at that location had been discontinued due to concerns about spread of the H5N1 virus. Consequently, we were only able to deploy three satellite transmitters to Northern Pintails in Hokkaido.

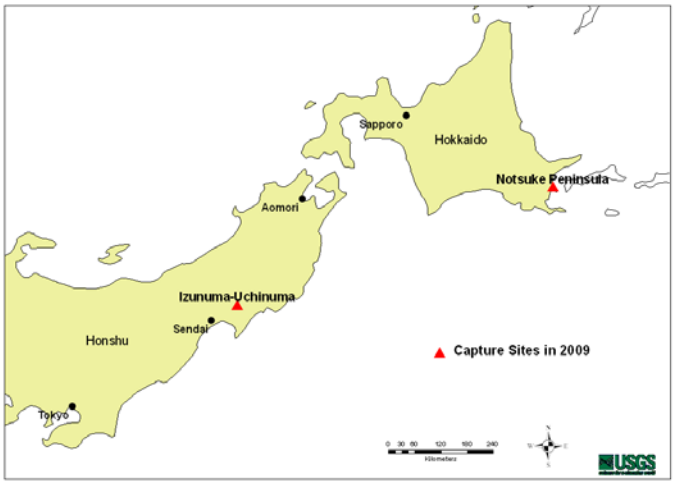

Figure 2. Locations of sites where Northern Pintails and Whooper Swans were captured and marked with satellite transmitters in Japan in 2009.

Following their visit to Hokkaido, Pearce and Ramey travelled to Kitasato University in Aomori to visit the laboratory of Dr. Takehara and to further discuss collaboration in whole genome sequencing of low pathogenic viruses isolated from Northern Pintails in Japan. This is an important collaboration as it will provide data on genetic characteristics of low pathogenic viruses of Northern Pintails in Asia for comparison to viruses found in pintails in North America. This will enable us to more directly measure intraspecific virus transfer by Northern Pintails between Asia and North America. To date, assessments of virus exchange between migratory birds in different continents have largely been interspecific comparisons based on data from GenBank.

Before departing Japan, Pearce and Ramey met with Toby Wolf and Mikako Sano, the Science, Technology and Helath Affairs Officer and Scientific Affairs Analyst respectively, at the U.S. Embassy in Tokyo. They discussed USGS research in Japan and its implications for understanding virus spread in Asia and to North America.

Hupp, Flint, and Ramey travelled to Japan from 6-13 February. They joined Japanese colleagues from the University of Tokyo in capture of Northern Pintails at Lakes Izunuma-Uchinuma in northern Honshu (Fig. 2). They successfully captured Northern Pintails and marked 47 individuals with satellite transmitters provided by USGS and the USFWS. In addition, the Japanese team marked 10 Northern Pintails with PTTs provided by the University of Tokyo. The USGS team then worked with Japanese colleagues for several days to capture and mark Whooper Swans with satellite transmitters. Three swans were captured by hand at public feeding sites. However, most swans were captured via a “clap-trap” at a flooded rice paddy that Japanese colleagues had baited with grain for several weeks to attract swans (Fig. 3). We marked a total of 17 Whooper Swans with satellite transmitters provided by USGS and USFWS, and 11 swans with transmitters provided by the University of Tokyo. Satellite transmitters were mounted on plastic neck collars that were attached to swans (Fig. 4).

Figure 3. Capture of Whooper Swans in Japan via a Japanese "clap-trap".

Figure 4. Dr. Noriyuki Yamaguchi, University of Tokyo, prepares to release a Whooper Swan marked with a neck-collar mounted satellite transmitter.

This project has provided direct evidence of movements of a migratory species from Asian wintering areas to regions where contact with North American migrants is likely[2]. We are also gathering important information on the exchange of low pathogenic viruses between Asia and North America. By combining data on migration movements and virus exchange, we will be able to more directly assess the likelihood that migratory species can transmit a highly pathogenic virus between Asia and North America. Collaboration with colleagues in Japan, a country in which there have been repeated outbreaks of the H5N1 virus, and in which there are known migratory links with North America, has been critical to our effort.

[2] Movements of Northern Pintails with satellite transmitters in Japan can be viewed on the Alaska Science Center web site: http://alaska.usgs.gov/science/biology/avian_influenza/pintail_movements.html. A new site will shortly be established to track swan movements.