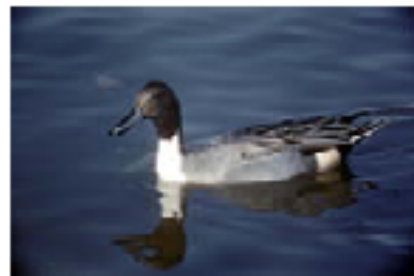


Assessment of virus movement across continents: using Northern Pintails as a test

Cooperative Assessment between
the USGS, FWS, University of
Tokyo, Yamashina Institute

Northern Pintail



Breeding
Jun-Aug

~750,000 birds Eurasia

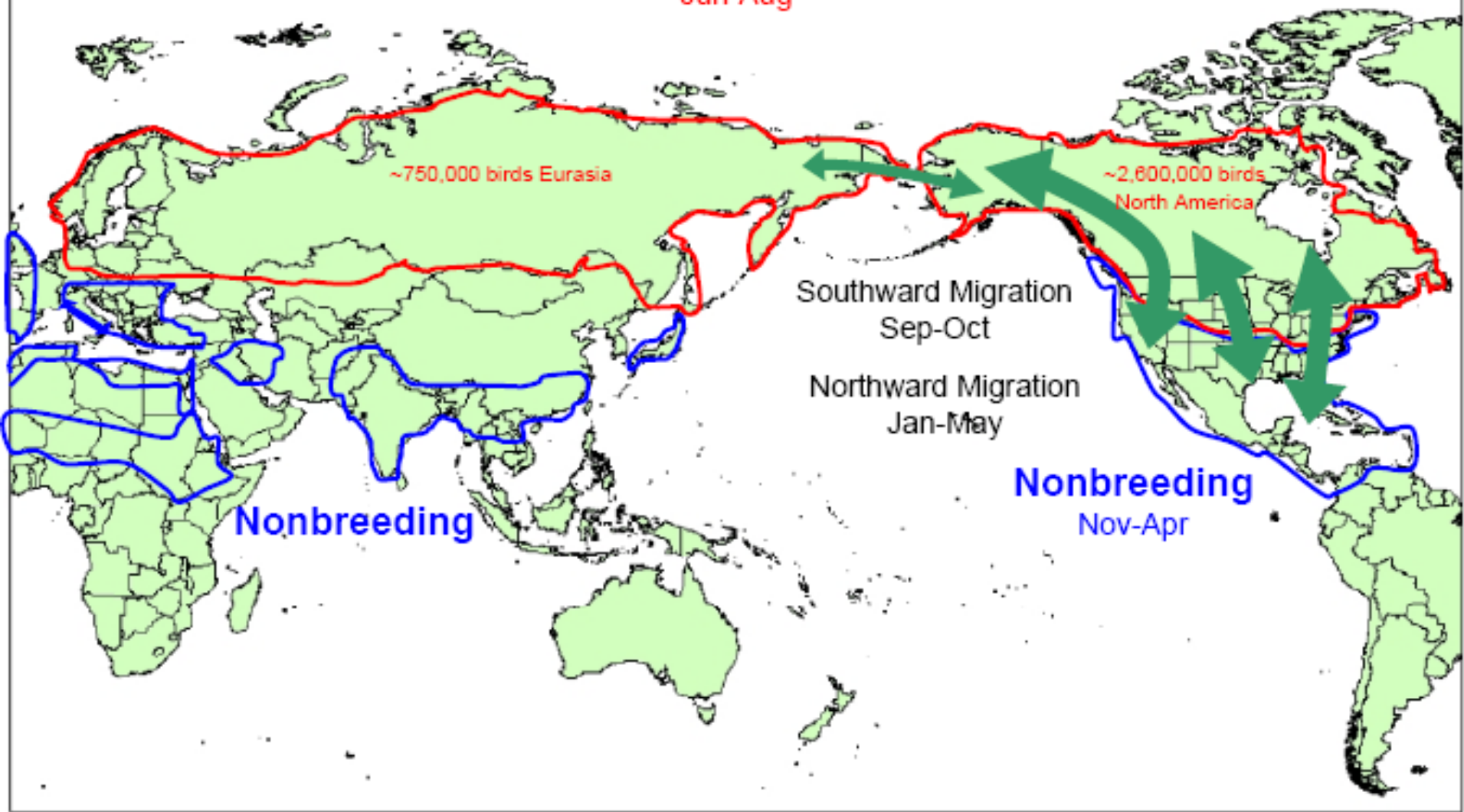
~2,800,000 birds
North America

Southward Migration
Sep-Oct

Northward Migration
Jan-May

Nonbreeding

Nonbreeding
Nov-Apr

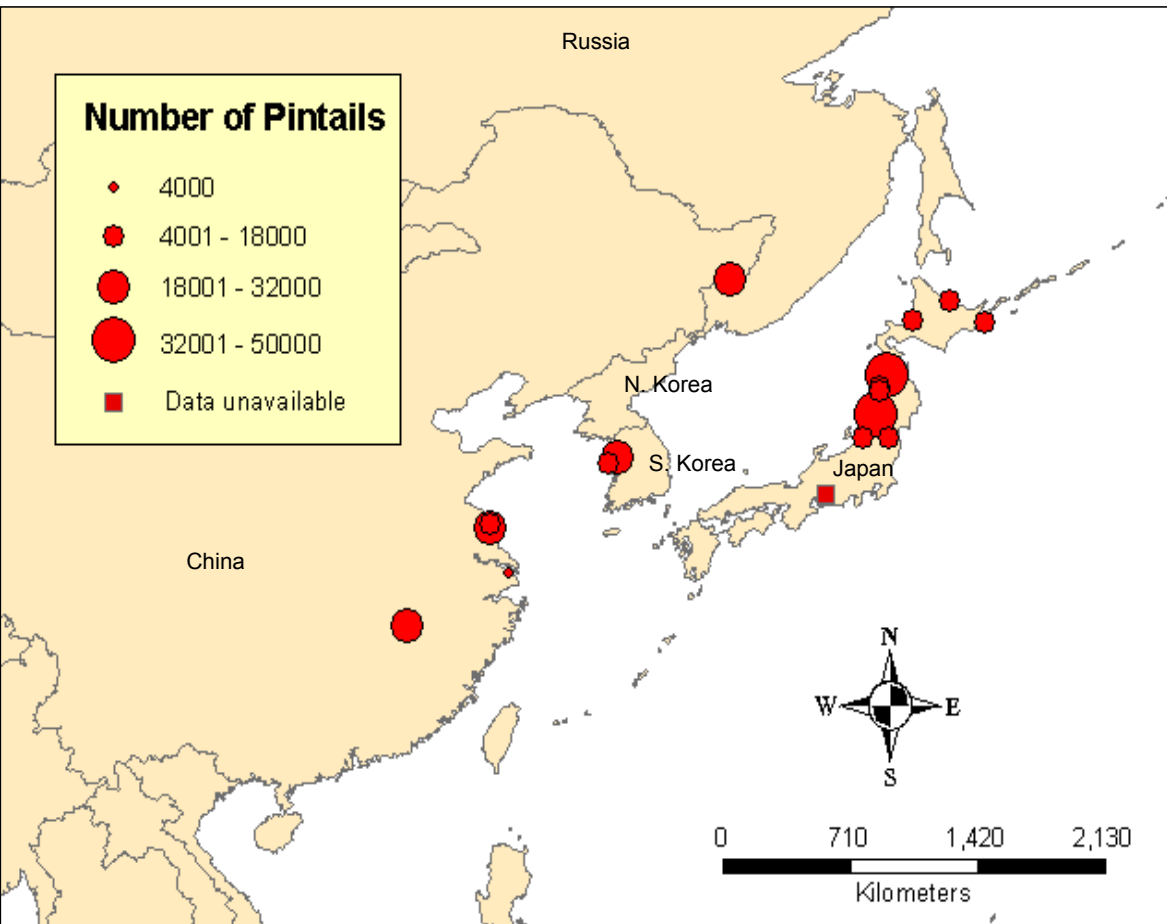


Specific Approaches

- 1. Band Recovery Analyses
- 2. Satellite Telemetry
- 3. Genetic Comparisons of Pintails
- 4. Genetic Comparisons of Viruses.

Why Japan?

1. Japan is the major wintering area for pintails in Eastern Asia
2. Japan has documented outbreaks of H5N1 that, in at least one case, are thought to have originated in wild birds



Band Recovery Analyses

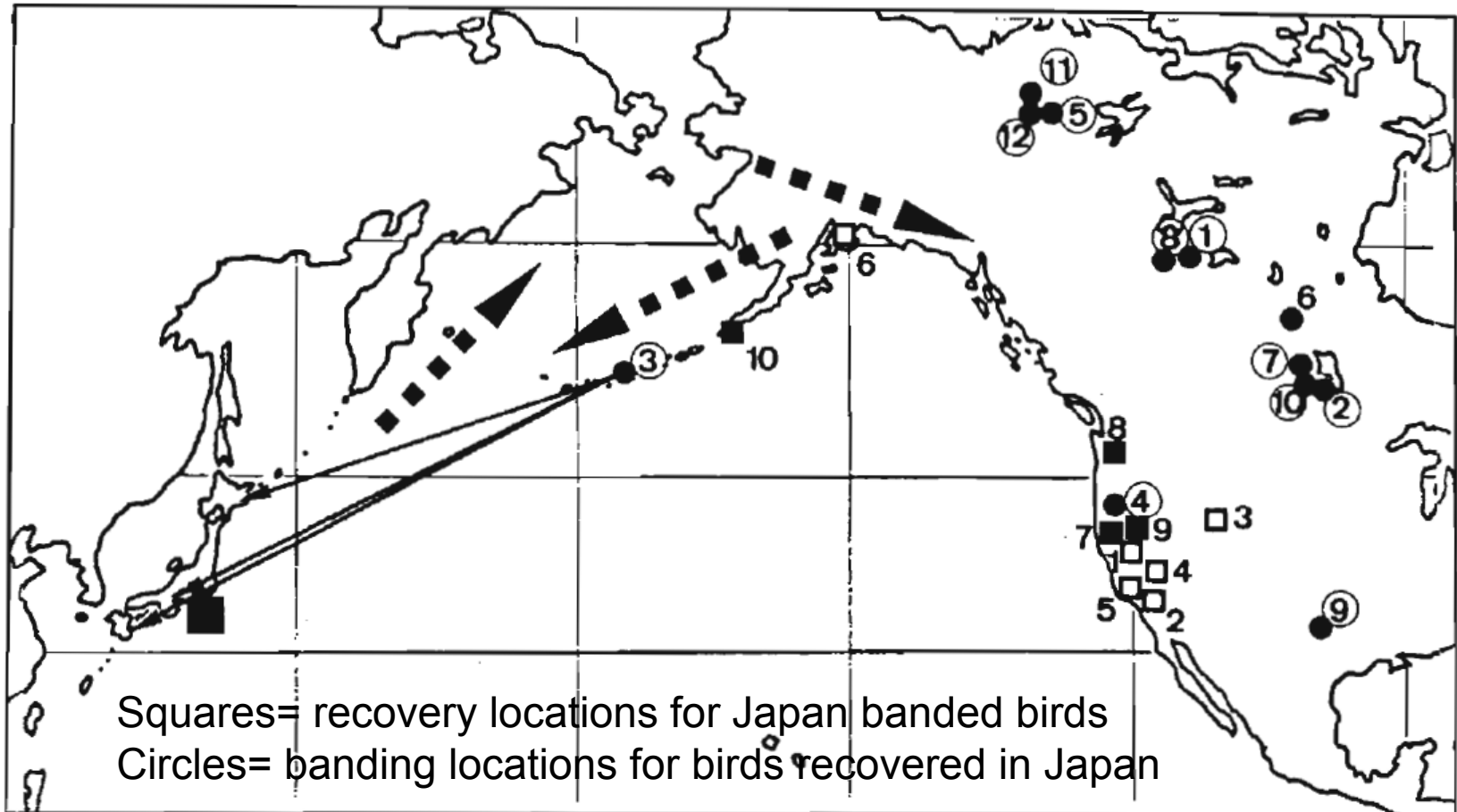
- Yamashina Institute of Ornithology is the functional equivalent of our Bird Banding Laboratory.
- They are not a government agency, basically a NGO
- There is no law governing bird banding within Japan. Anyone can do it, data are not required to be reported.

Intercontinental Band Recoveries

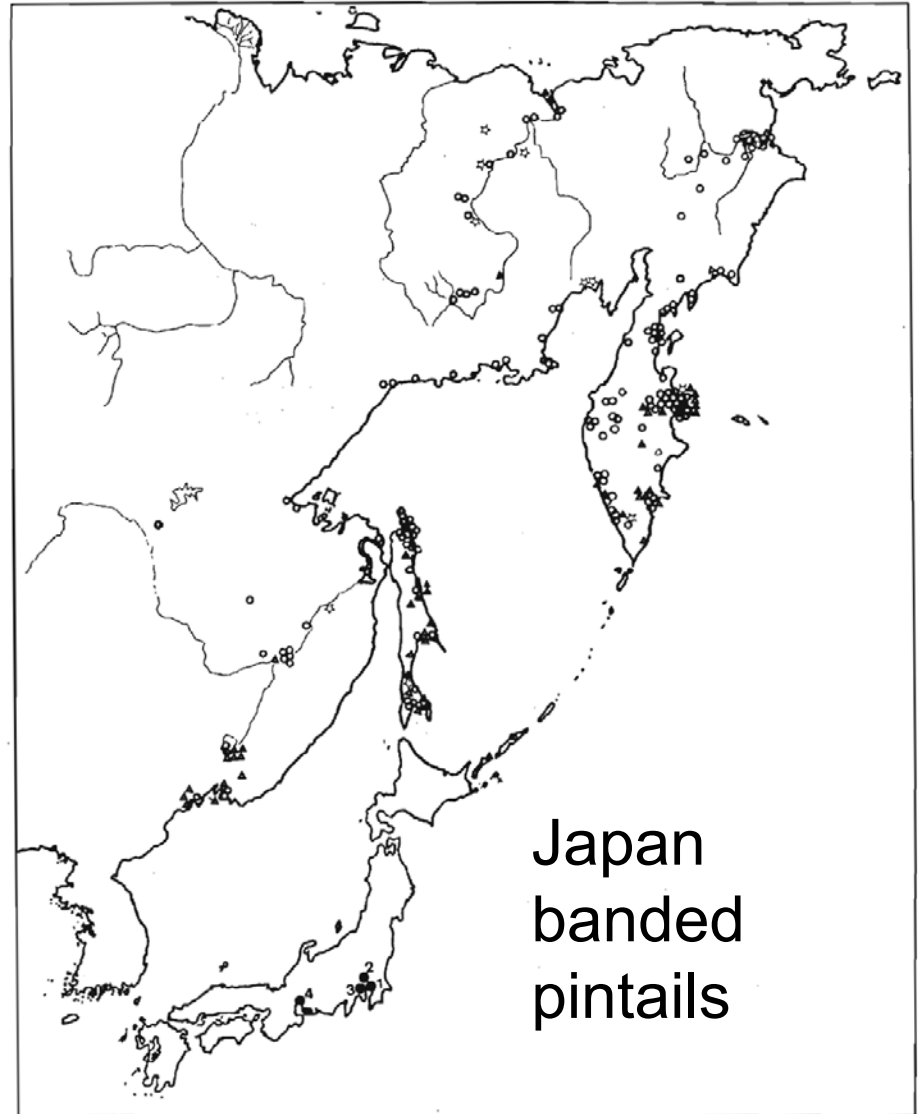
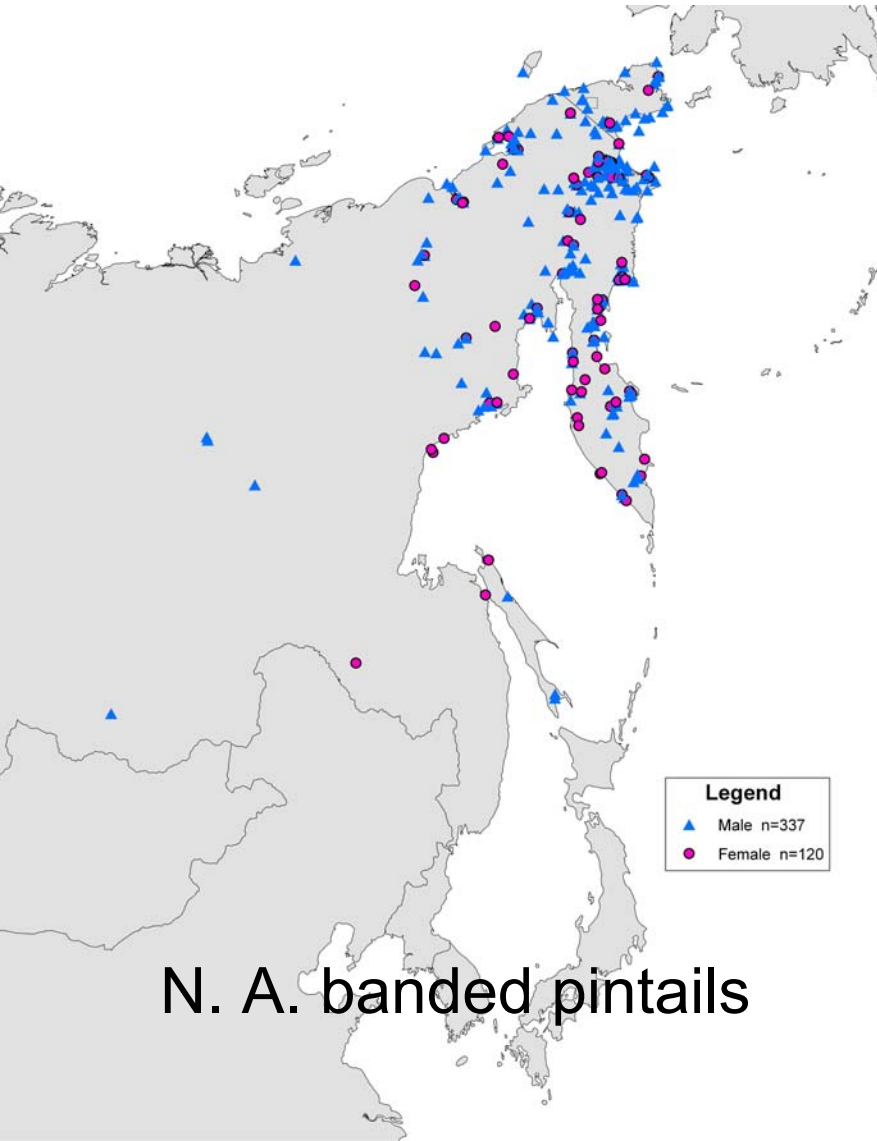
From 1961-2004

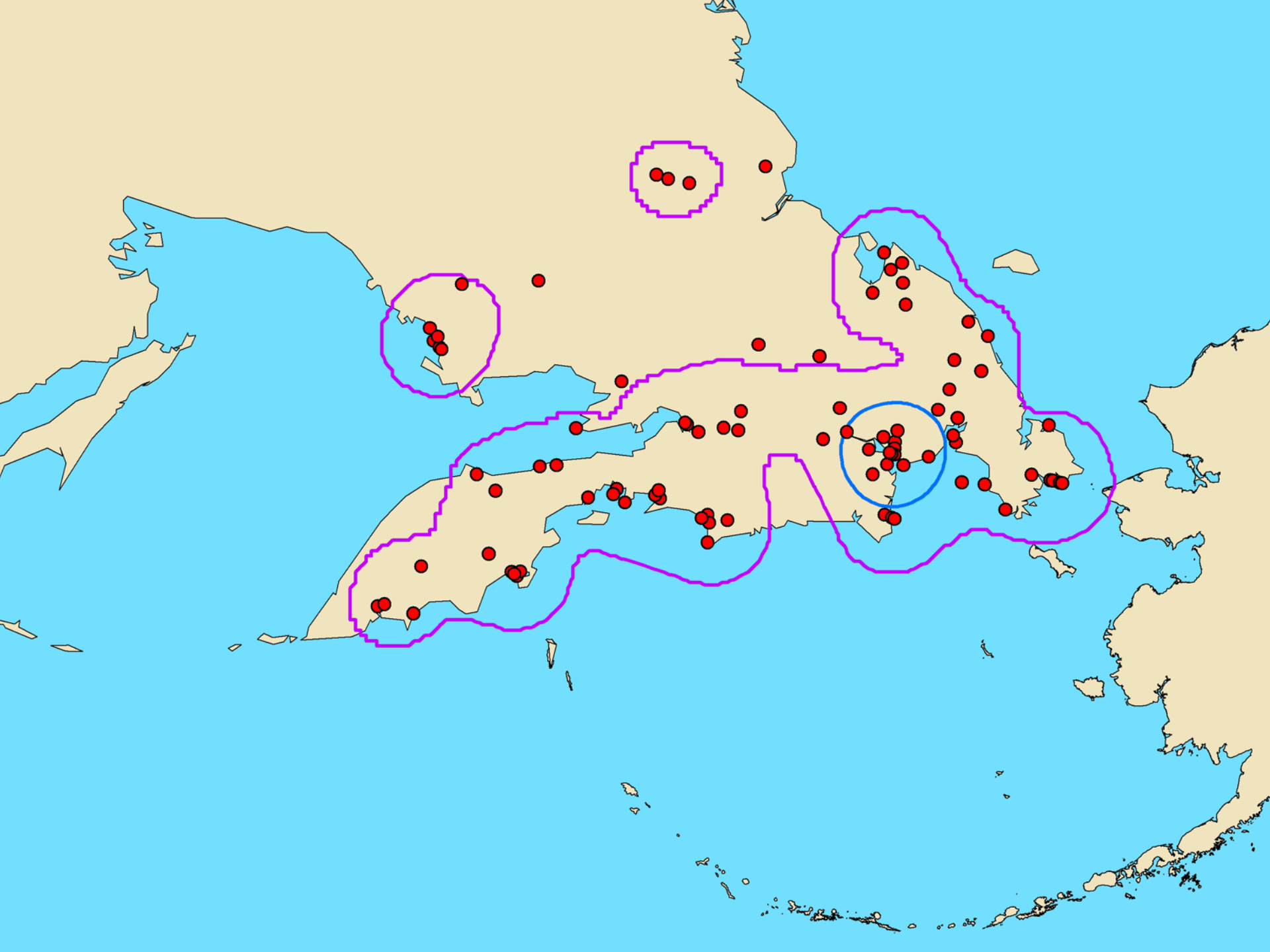
37 pintails banded in Japan recovered in North America

22 pintails banded in North America recovered in Japan



Overlap in recovery locations



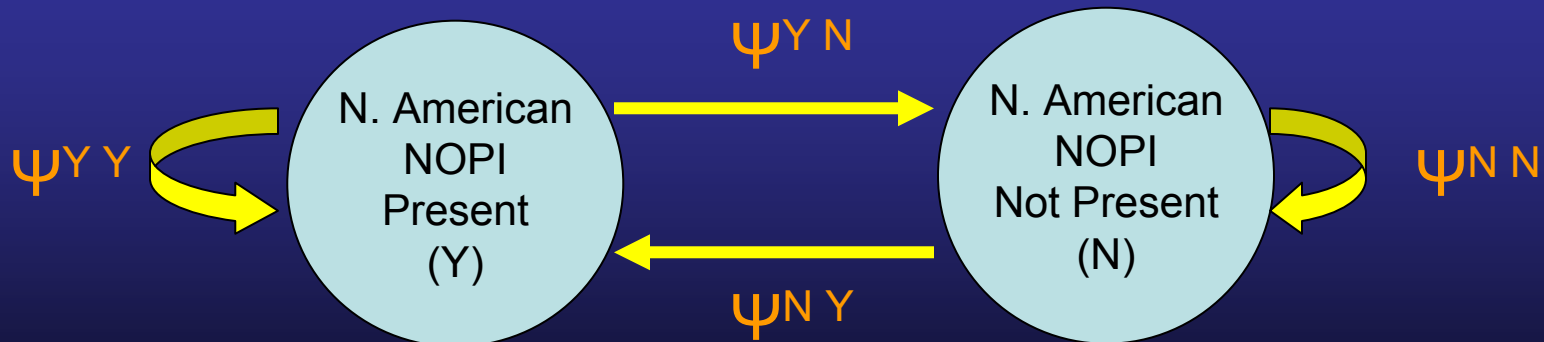


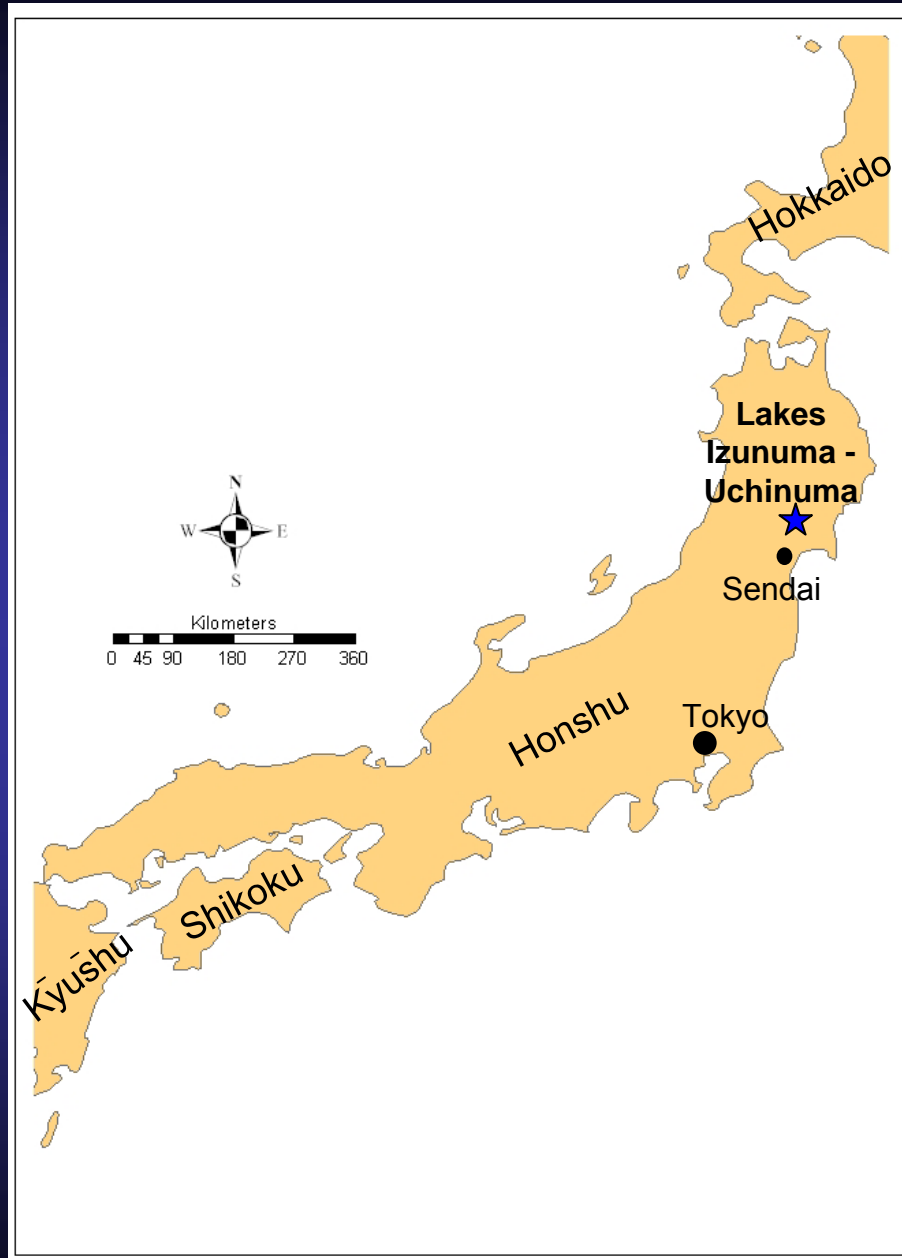
Satellite Telemetry Tracking of Northern Pintails in Asia



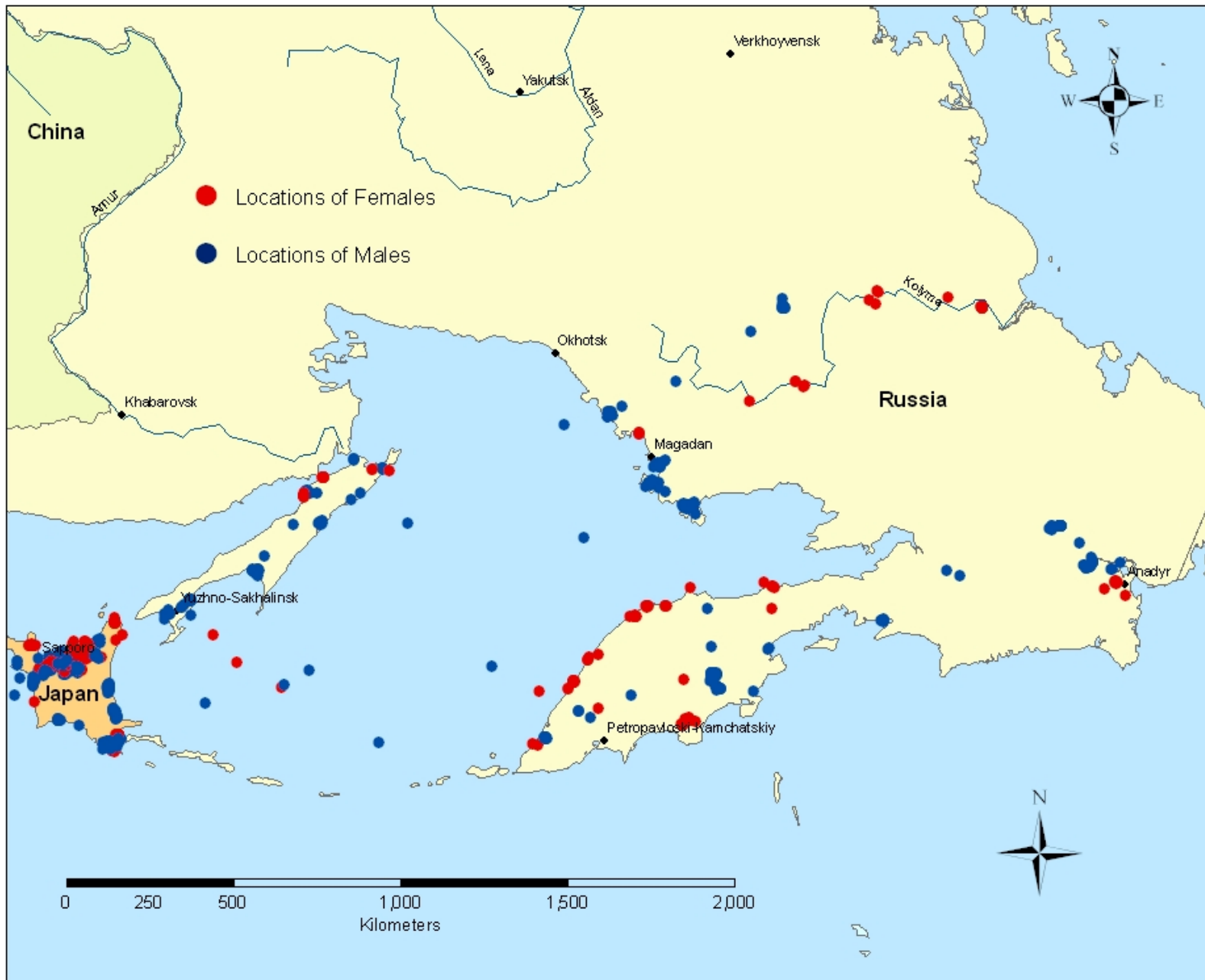
Objectives of Satellite Telemetry Study

1. Evaluate spatial and temporal distribution of Japanese pintails on molting and nesting areas in Russia via satellite telemetry.
2. Use multi-strata models to estimate movement of Japanese pintails to areas also likely to be used by North American pintails.









Conclusions

- Evidence that N.A. and East Asian pintails overlap in space and time
 - Occasional direct dispersal between wintering populations.
 - Small proportion of N.A. wintering population is sympatric with Asian population in summer.
 - Satellite telemetry will be used to further define the % time spent in zones of overlap

Evidence of Genetic Exchange

- Ok so now that we have shown that N.A. and Japan wintering pintails overlap in space and time during summer, do they actually have 'contact'?

MtDNA sequence data

- California (n = 60), Japan (n = 53)
- Observed similar levels of diversity in each wintering group
- No evidence for differentiation ($F_{ST} = 0.002$)
- This and other analyses suggest gene flow

Nuclear microsatellite loci

- 8 different loci
- California (n = 138), Japan (n = 60)
- Observed similar levels of genetic diversity in each wintering group
- No evidence for differentiation ($F_{ST} = 0.002$)
- suggests gene flow in agreement with mtDNA

Evidence of Virus Exchange

- To what extent do we find evidence of virus exchange and does it vary by distance?
- Collaborated with USGS Dixon Field Station and California Waterfowl Association to obtain winter virus samples from Pacific Flyway pintails
- Collaborated with USGS National Wildlife Health Center to subtype each virus and sequence all RNA segments

Viral genetic variation: subtyping

H1N2	1
H2N3	1
H3N1	1
H3N6	4
H3N8	29
H3N9	1
H4N5	1
H4N6	11
H5N2	5
H5N9	1
H6N1	3
H6N2	3
H6N4	1
H7N3	2
H8N4	1
H10N2	1
H10N7	3
H10N8	1
H11N2	2
H11N9	6
H12N2	1
H12N5	2
H12N8	1
H12N9	1

83 samples subtyped

24 subtypes observed

Green = Rundstadler (1997)

Red = Ito (1995)

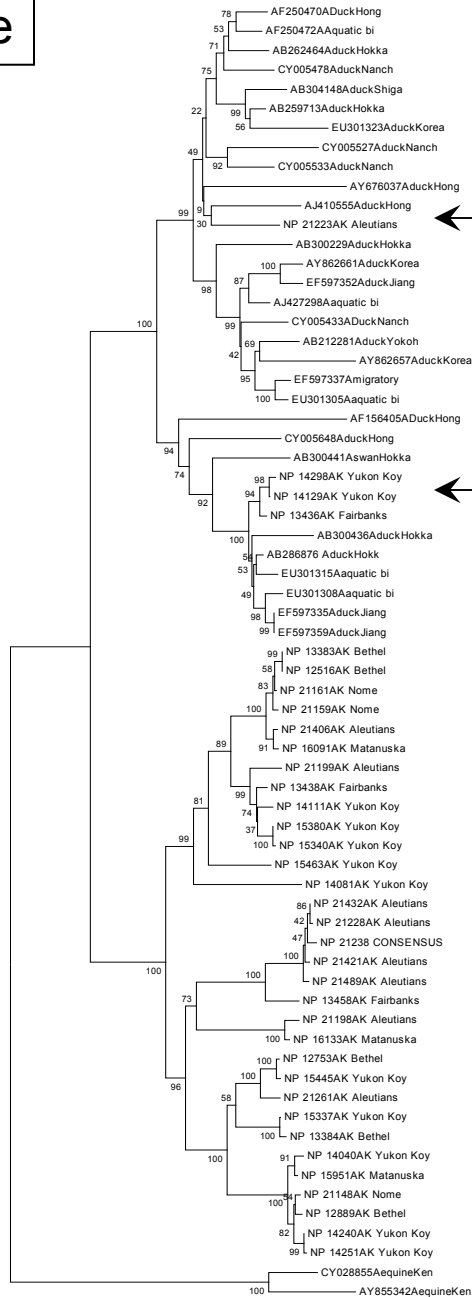
Ito found 1 H10N9

Viral genetic variation: sequence data from all 8 RNA segments

Area	N	# putative Eurasian origin*	# putative Eurasian segments (out of 8)
Alaska	38	19 (50%)	1-5 (mode = 1)
California	24	2 (8%)	1-2

*Based on similarity match to sequences available on GenBank

NP gene



Asian NP sequences from GenBank (“fowl”)

Alaska Northern Pintail
(n = 1; Eastern Aleutians)

Alaska Northern Pintail
(n = 3; Fairbanks, Yukon-Koyukuk)

Alaskan NP sequences from wild pintail

Outgroup

0.02

Conclusions

- Evidence that N.A. and East Asian pintails ‘exchange’ biological material
 - Clear evidence of gene flow amongst populations and viral transfer of some segments
 - Thus, avian species, such as pintails, are a viable mechanism for intercontinental transport of avian influenza viruses via movement and sympatric breeding areas