EARTHSPAN
2024 PEREGRINE FALCON MIGRATION STUDIES AT SOUTH PADRE ISLAND, TEXAS

In partnership with:

The Peregrine Fund

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CONDUCTED UNDER

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Additionally, we appreciate permitting assistance from the LANWR, the USGS Bird Banding Lab, and Texas Parks and Wildlife Department. We thank Jeff Johnson, Matthew Carling, and Elizabeth Wommack of the University of Wyoming's Museum of Vertebrates in the Robert and Carol Berry Biodiversity Conservation Center for support of our sample archive and shared insights. We appreciate the logistical assistance of Doyle Wells and the staff of the Island Adventure Park, and Steve Mercer of Coastal Transplants. We are grateful for the insights and assistance of Cristin Howard, Lynn and Gary Tate, the South Padre Island Birding and Nature Center, Thomas DeMar, and Wendy Knight of Sea Turtle Inc. As always, our warm thanks go out to Vicki and Pete Moore, Willard Heck, James Weaver, Steve Shepard, Richard Moore, Kelly McDowell, Ed Moody, Kathy Cunningham, Christina Jasso, Matt Reidy, Raul Andrade, Kathy Maechtle, and the Glady Porter Zoo. In addition, we thank the members of NAFA and the Texas Hawking Association, including Bruce and Evelyn Haak, Jimmy Walker, Kyle and Luke Massa, Bob Smith, Patrick Johnson, Russell Davidson, and Bill Hones for all their help. As always, we are grateful for the tireless interest, efforts and insights of Earthspan Founder Mark Fuller, Survey founder F.P. Ward and Earthspan Treasurer Jim Dayton, William Satterfield, plus all of those involved with our collaborative studies. These currently include Joe Barnes, Chris DeSorbo, Arnaud Van Wettere and Ericka Griggs. We appreciate the hoods and supplies provided by David Frank at Western Sporting. Finally, thanks are due to many South Texas residents and others not mentioned, who help in so many ways. Altogether this group represents a wealth of expertise, collaboration and dedication, without which the Survey could not continue.

We send our sincere thanks and appreciation to our Survey visitors who made the time to join us in the field this year. These include Kathy Cunningham, Christina Jasso, Richard Moore, Dr. Tania Homayoun, Dr. Rick and Lupita Bassett and Lori McDonnel. Field visits are encouraging and informative to our long-standing collaborative research and monitoring efforts at Padre Island. We look forward to future visits that align with accessible wind-tidal flats and pulses in the migration.

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EXECUTIVE SUMMARY

As part of a continuing research program of Peregrine Falcon (*Falco peregrinus*) migration studies in partnership with The Peregrine Fund (TPF); we conducted spring and fall Padre Island Peregrine Falcon Surveys (PIPFS) on South Padre Island (SPI), Texas. We monitor the health and dynamics of Peregrine Falcons that migrate along the Texas Gulf Coast and concentrate on South Padre Island. This report is focused on our productive 48th annual, 2024 field efforts.

During the spring migration period we surveyed the South Padre Island Unit of Laguna Atascosa National Wildlife Refuge from 11 April through 03 May, conducting 262 Survey hours in the field over 23 Survey days. Surveys recorded 204 Peregrine Falcon observations and 21 captures, including 3 seasonal recaptures. Among new captures, 13 (72 %) peregrines were first banded this spring and 5 (28 %) were previously banded. Four were Padre Returns marked during the 2022-2023 Surveys, and one second-year falcon was banded as a 2023 nestling in Ashland, Wisconsin. Adults comprised 33% of new captures. The minimum average area staging duration among seasonal recaptures was 10.3 days, ranging from 1 to 17 days. Our seasonal sighting rate of 7.79 peregrine observations per 10 Survey hours is well below the spring 45-year mean of 16.02 (± 6.29 SD).

During fall we surveyed South Padre Island from 24 September through 26 October, conducting 394 Survey hours in the field over 33 days. Surveys recorded 459 Peregrine Falcon observations and 117 captures, including 69 color-marked resights and 16 seasonal recaptures. Among new captures, 99 (98%) peregrines were first banded and 2 (2%) were previously banded Padre Returns marked during the 2021-2023 Surveys. Adults comprised 8.91% of new captures and 18.42 % of aged sightings. The minimum average area staging duration among seasonal recaptures was 4 days, ranging from 1 to 13 days. Our seasonal sighting rate of 9.62 peregrine observations per 10 Survey hours is well below the 46-year mean of 15.64 (± 5.42 SD).

Blood and feather samples were collected from 119 individual peregrines, including those from 7 previously banded falcons. Survey sampling supports: 1) collaborative mercury monitoring efforts with Joe Barnes (FWS) and Chris DeSorbo (Biodiversity Research Institute, or BRI); 2) Highly Pathogenic Avian Influenza (HPAI) serology studies with Arnaud Van Wettere of the Utah Veterinary Diagnostic Laboratory (UTVDL); 3) Avian Malaria/ haemosporidian parasite prevalence studies by Ericka Griggs from the Wildlife Pathogens Lab at the University of Vermont in collaboration with BRI; and 4) a pilot assessment of per- and polyfluoroalkyl substances (PFAS) with Chris DeSorbo at BRI. We conducted six outreach field tours this year with the help of Geoff Pampush, Paul Juergens, Brian Mutch, and Pete and Vicki Moore. We also continue efforts towards incorporating Survey data into the Global Raptor Data Bank to enhance the utility and security of our long-standing Survey datasets at Padre and Assateague Islands.

Our field Surveys, outreach and associated collaborative studies have been productive in 2024. A continued decreasing trend among counts and captures at Padre since 2016 (with potential age structure variation) is, however, of growing concern. This is especially the case since similar patterns are currently evident in other studies (Gallagher 2024, Rozell 2024, Johnson et al 2023). Concerted inquiries to assess these patterns with the insights in our broad-scale data and collaborative breeding area studies will be an asset to interpreting the developing patterns. That will lead to a better understanding of the factors currently influencing migratory peregrine populations and developing associated conservation strategies if needed.

Our long-term research at Padre Island addresses issues of concern to people, peregrines and Neotropical migrants in a changing world. Understanding the migratory peregrines' population health and dynamics provides broad-scale insights into the habitat conditions of avian populations throughout this predator's range. Survey data provide evidence of the tundra peregrine's recovery and the corresponding decline in organochlorine contaminant loads. The U.S. Fish and Wildlife Service used our data in removing F.p. *tundrius* and F.p. *anatum* from the List of Endangered Species, and also in developing management strategies for the harvest of juvenile migrant peregrines for falconry. Our research, while focused on peregrines, serves to benefit society and avian conservation.

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Cover painting – Larry Haines- www.spiartist.com

INTRODUCTION

In 1890, Griscom and Crosby (1925) identified the South Texas Gulf Coast as an autumnal focal point for the later-categorized high latitude, North American migratory Peregrine Falcons (*Falco peregrinus tundrius*). During the era of DDT-induced peregrine population declines, diverse efforts were undertaken to study, monitor and augment the species. James H. Enderson (1969) advocated coastal surveys to develop population indices to monitor remote migratory peregrine populations. For decades, Padre Island, one of the largest fall migratory stopover/staging sites and only known spring staging area for Tundra Peregrine Falcons, has been a center for population monitoring activity and related migration research by falconers and scientists alike. Our studies of peregrine migration ecology at Padre Island and contaminant/pathogen monitoring efforts here are well documented. We have demonstrated the importance of the South Texas Gulf Coast as migratory and winter habitats to peregrines and associated species, resulting in the conservation of associated habitats. Yet much remains to be learned.

Colonel R.L. Meredith initiated autumnal beachfront migration surveys on Padre Island from the 1940s through 1965. Surveys were further developed, in addition to studies of peregrine migration ecology by J.H. Enderson, W.G. Hunt, C.M. White, R.R. Rogers, and D.J. Slowe in the 1960s (Enderson 1963, Hunt 1966, Enderson 1969, Hunt *et al*. 1975). Padre Island was identified as a spring migration concentration point and staging area for northward migrants, the only known location of this type in the Western Hemisphere (Ward *et al*. 1978, Hunt *et al*. 1980). Drs. F.P. Ward and K.E. Riddle expanded surveys to incorporate both the spring and autumn migration periods (Riddle *et al*.1977-1985). Thus, the Padre Island Peregrine Falcon Survey was established as a counterpart in the Central Flyway to the standardized study Ward had begun within the Atlantic Flyway at Assateague Island, MD/VA in 1970 (Ward and Berry 1972, Ward et al. 1988). Earthspan principals W.S. Seegar, T.L. Maechtle, and M.A. Yates, with the addition of G.E. Doney in 2006, steer current migration Surveys, biomonitoring efforts and related migratory peregrine research through Earthspan, and in collaboration with The Peregrine Fund (Seegar *et al*. 2003).

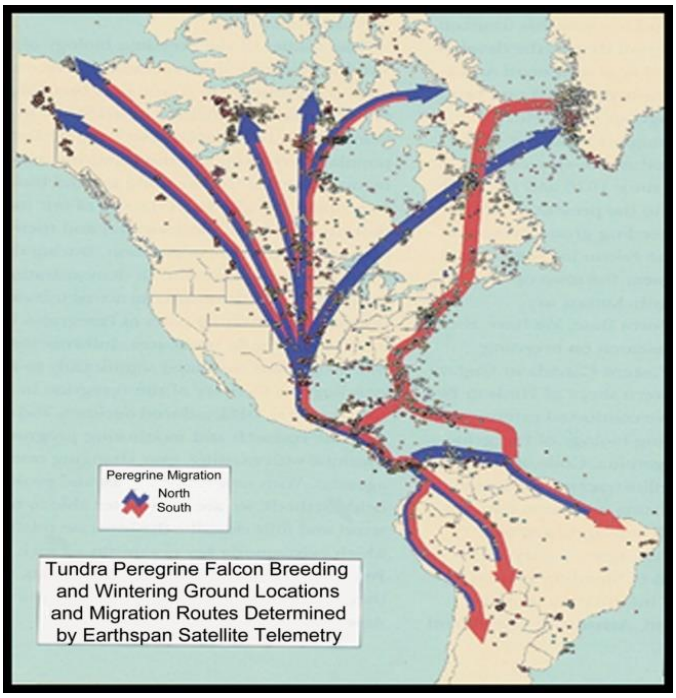

Figure 1. Migratory Range of Tundra Peregrine Falcons

Through the decades, associated studies of Padre migrants have addressed aspects of migratory peregrine natural history. These include migratory and foraging behavior (Hunt 1966, Hunt *et al*. 1975), spring migratory behavior (Hunt *et al*. 1980), and habitat selection of spring migrants (Hunt and Ward 1988). Recent investigations have also documented the importance of Padre Island as Peregrine Falcon winter habitat (Enderson *et al*. 1995, Juergens 2003). Building on the Yates *et al*. (1988) band return analyses,

our role in the development and application of satellite telemetry has greatly advanced the study of migratory peregrines (Fuller *et al*. 1998, McGrady et al. 2002, Seegar *et al.* 2003, Fuller *et al.* 2006).

Almost five decades of banding, telemetry and recapture efforts at Padre Island, along with breeding area studies, have defined the annual range of migratory, high latitude peregrines. These include the highlighted migratory routes in Figure 1, to and from breeding/winter ranges and the Mid-Atlantic States/Gulf Coast of the USA, and south throughout Latin America. Migratory peregrines are proven sentinels of environmental conditions due to their high trophic standing, extensive migrations, and catholic avian diet. The Padre Survey permits broad-scale, range wide sampling of this remote nesting sentinel species to monitor environmental contaminants and the spread of infectious diseases that pose human health and conservation concern in the Western Hemisphere. Biomonitoring of Padre migrants by Henny *et. al.* (1982, 1988, 1996, and 2009) illustrated broad scale declines of organochlorine (OC) contaminant burdens during the corresponding recovery period of Arctic peregrine populations. Dusek *et al*. (2005) documented increases in West Nile virus (WNV) seroprevalence from 2001-2004, following its introduction and spread across North America. Monitoring circulating polycyclic aromatic hydrocarbons (PAHs) from 2009-2011 addressed the potential scope of impacts of the 2010 Deepwater Horizon oil spill on migratory peregrines (Seegar *et al.* 2015). Present biomonitoring includes mercury (Hg) exposure (Barnes *et al*. 2019), Avian Influenza serology (Redig & Goyal 2012), Avian Malaria and haemosporidian parasite studies, and pilot analyses of per- and polyfluoroalkyl substances (PFAS). In addition, Surveys archive biannual sample allotments for retrospective analyses of new or emergent concerns.

As Jim Enderson envisioned in 1969, the ability to quantitatively link migration monitoring with wintering and breeding season population dynamics is still developing. A critical step is the partitioning of Padre migrants into their regional breeding populations (Longmire *et al*. 1991, Longmire 1988, Morizot 1988, Parrish *et al.*1983, N. Clum unpub.) and winter origins. Known origin (breeding/winter) of migrants will permit investigations of the dynamics of migratory population structure change over time, regional migration strategies, and the influence of continental weather patterns on migration. Dr. J. Johnson and colleagues (2010) addressed temporal changes and similarities in the genetic population structure of Padre migrants and American regional populations. Developments in genetic and stable isotope techniques hold the most promise for advances in these areas. All are relevant topics of interest to migration monitoring and refining our biomonitoring capabilities.

While peregrines are one of the most studied birds in the world (White *et al*. 2002, 2020), much remains to be learned about their migration and winter ecology, population dynamics, role as an infectious disease host and environmental contaminant sentinel, and how a changing climate may affect populations. Long-term studies provide a foundation to assess change and its causes. The health and dynamics of the tundra peregrine population is fundamental to the very nature and stability of the biologically diverse avian communities that constitute their prey base on a hemispheric scale. Therefore, understanding tundra peregrine population dynamics allows for critical insights into avian populations throughout this predator's range. For all these topics of interest, Padre Island and our Survey are important for the wealth of knowledge we have been able to amass on high latitude peregrines that frequent our study area during migration.

OBJECTIVES

To monitor the health and further understanding of the dynamics and migration ecology of tundra and high latitude peregrines, the Padre Island Peregrine Falcon Survey addresses both short and long-term objectives. Short-term objectives include: 1) monitoring contaminant loads to assess population health and the general habitat conditions of the broad areas they annually utilize; and 2) monitoring the spread of infectious diseases (such as Avian Influenza and WNV) that pose avian, human health and conservation concern. Long-term objectives include: 1) monitoring population trends and migration phenology through band returns and sightings; 2) maintaining a banded population and temporal tissue archive for future applications; 3) sampling blood from captured individuals for DNA level genetic analyses to identify the regional make-up of the Padre migrants; and 4) identifying migratory pathways, breeding areas, and critical wintering areas for Padre migrants through band returns and locations of radio marked falcons tracked by satellite and cellular technologies.

STUDY AREA AND METHODS

Our study area includes the northern 40 km of undeveloped land on South Padre Island, from the north end of Highway 100 to the Mansfield Channel (Fig. 2). Much of this property is currently a part of Laguna Atascosa National Wildlife Refuge. Hunt and Ward (1988) describe the study area. Survey efforts concentrate on the island's wind tidal flats, west of the dune barrier. Due to inundation, the landmass or amount of exposed and accessible wind tidal flats available to survey and as peregrine habitat can vary daily with tides, wind direction and rainfall. During autumn, we also monitor the beach front and hurricane washes due to seasonal habitat use of these areas.

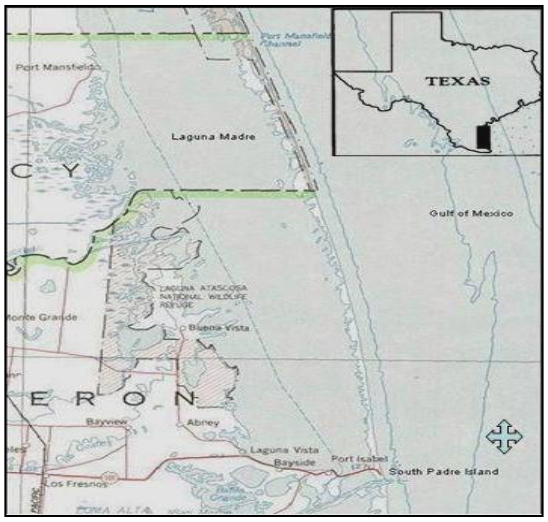

Figure 2. South Padre Island Study Area

The Padre Survey is conducted during the peak of spring and autumn migration periods. A team of 2-3 researchers surveys the study area using all-terrain vehicles (ATVs) from dawn to dusk, as weather conditions permit. Peregrine sightings are noted according to time, species, age, sex, location and activity.

A capture attempt is made when peregrines are found in areas conducive to trapping and are not identified by color marking as duplicates. Ward and Berry (1972) describe capture methods. Captured peregrines are processed and released at the capture site, usually within 15 minutes. Processing includes: 1) marking of unbanded individuals with U.S. Geological Survey (USGS) bands or recording band information for previously banded falcons; 2) individual sex and age determination by USGS Bird Banding Laboratory (BBL) guidelines; 3) collection of a 2ml blood sample (1.5 for males) from the brachiocephalic vein for contaminant, infectious disease, and genetic analyses; 4) collection of feather samples for contaminant and natal origin studies; 6) collection of morphologic measurements; and 7) color marking falcons'

feathers (red temporary dye) in the fall to subsequently identify previously captured falcons and accrue information on staging time and turnover on the Island. When the study plan and funding so dictate, we also outfit a few individuals with satellite or cellular-received transmitters. The backpack attachment of Teflon ribbon or neoprene is individually fitted on each falcon, and the package weight conforms to BBL guidelines.

Samples collected are processed for storage daily at the field station. Sighting and banding data are entered in a database for analyses, reporting and access to recapture information. Therein, we have adopted the BBL methods of describing age and sex among sighted and captured peregrines, as well as subsequent encounters with those individuals. All banding information is reported to the BBL after each season. Band recovery data are accrued throughout the year from the BBL and collaborators and compiled in our database.

The spring Survey was conducted by Bill Seegar, Mike Yates and Gregg Doney; and the fall Survey by Robert McGuire, Chris Pfister, Nick Todd, Samuel Voss, and Gregg Doney. Outreach field tours were organized and assisted with the help of Geoff Pampush, Paul Juergens, Brian Mutch, Pete and Vicki Moore, and Richard Moore.

RESULTS AND DISCUSSION

Spring Survey 2024-

During the spring migration period we surveyed the South Padre Island Unit of Laguna Atascosa National Wildlife Refuge from 11 April through 03 May, conducting 262 Survey hours in the field over 23 Survey days. Surveys recorded 204 Peregrine Falcon observations and 21 captures, including 3 seasonal recaptures. Among new captures, 13 (72 %) peregrines were first banded this spring and 5 (28 %) were previously banded. Four were Padre Returns marked during the 2022-2023 Surveys, and one second-year falcon was banded as a 2023 nestling in Ashland, Wisconsin. Adults comprised 33% of new captures. The minimum average area staging duration among seasonal recaptures was 10.3 days, ranging from 1 to 17 days. Our seasonal sighting rate of 7.79 peregrine observations per 10 Survey hours is well below the spring 45-year mean of 16.02 (± 6.29 SD). Daily sighting rates and the age demographic of captures are illustrated in Figures 3 and 4.

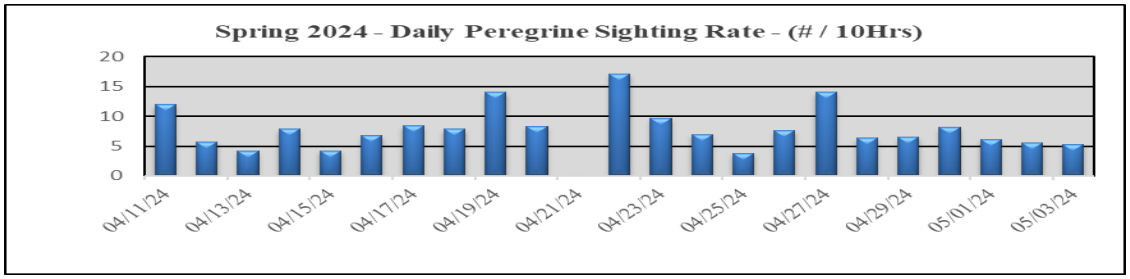

Figure 3. Spring daily sighting rate (peregrines observed per 10 Survey hours).

The ongoing South Texas drought was evident during setup and Survey start, as a dry northern system passed. The wind-tidal flats were relatively dry with portions of the black mat and light sand to the west primarily open to Survey access throughout the season. Two previously banded second year falcons were

captured on opening day and an additional adult and second year on 13-14 April. Southeast winds developed as a trickle of mixed age peregrines were found on the Island the following week. Their responsiveness varied daily as sightings began to mount. The migration peak was centered on a northern front that curtailed Surveys on 21 April and the following morning with strong northern wind and rain. This generated an impressive passerine fall-out in town, though relatively few (but primarily adult) peregrines were found on the Island ahead of or following this front. The wind-tidal flats then grew immensely during this period, up to 5.5 miles wide in places on the northern flats. A second smaller pulse of second year peregrine migrants followed on 27 April as the southeastern to east winds generally waned. Some migrants were responsive daily through the end of April, mixed with local winter residents. We were honored by and thoroughly enjoyed our field visits with Kathy Cunningham, Christina Jasso and Richard Moore on 29 and 30 April. Their good humor and endless interest in the Island were priceless, especially considering logistical breakdowns.

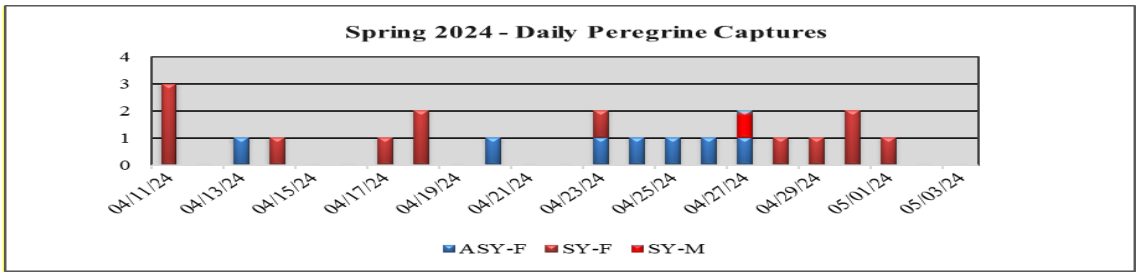

Figure 4. Spring age/sex specific daily captures.

Cooperative efforts and reports from The Peregrine Fund agree in many respects with our limited Survey results this spring. During the April Aplomado Falcon nesting surveys, Brian Mutch, Paul Juergens and Jeff Grayum reported no Peregrine Falcon observations on Matagorda and San Jose Islands. Sightings are typically quite common along the mid-Texas Gulf Coast. Also, following the Survey period Jeff conducted Survey observations on SPI (10 May), which were timed during northern winds that typically favor stopover behaviors in migrants. No peregrines were observed on SPI. This is consistent with typical peregrine migration timing and that the SPI winter residents had initiated northward migrations.

Fall Survey 2024 –

During fall we surveyed South Padre Island from 24 September through 26 October, conducting 394 Survey hours in the field over 33 days. Surveys recorded 459 Peregrine Falcon observations and 117 captures, including 69 color-marked resights and 16 seasonal recaptures. Among new captures, 99 (98%) peregrines were first banded and 2 (2%) were previously banded Padre Returns marked during the 2021-2023 Surveys. Blood and feather samples were collected from individuals supporting collaborative studies. Adults comprised 8.91% of new captures and 18.42% of aged sightings (n=342). The minimum average area staging duration among seasonal recaptures was 4 days, ranging from 1 to 13 days. Our seasonal sighting rate of 9.62 peregrine observations per 10 Survey hours is well below the 46-year mean of 15.64 (± 5.42 SD). Daily sighting rates and the age demographic of captures are illustrated in Figures 5 and 6.

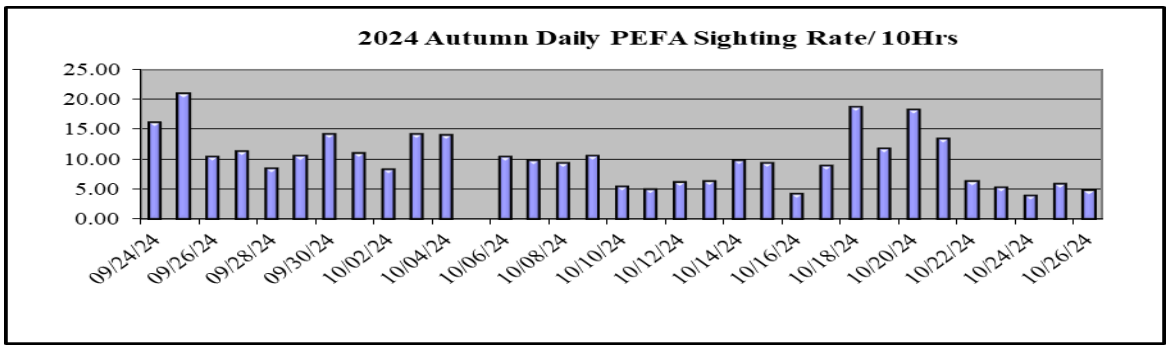

Figure 5. Fall daily sighting rate (new peregrines seen per 10 Survey hours).

On arrival the coastal plain of South Texas was lush, green, and the wetlands brimming. Richard Moore describes this in his September Outdoor Report (https://www.youtube.com/watch?v=8qtOMTfODTo). Thunderstorms continued during setup. Scouting Surveys on 24-25 September found a few mixed age class peregrines were already on the Island. The Survey was fully underway on the 26th and found a slow but steady (yet building) turnover of new peregrines on the Island as a northeast flow continued through the first 11 days of the Survey. Periods of calm winds (< 2-5 mph) were a new occurrence, resembling summer weather patterns. With the team's determination, Surveys yielded a productive suite of mixed age and sex peregrine captures, including one previously banded falcon from 2021. Clouds and developing thunderstorms on 4 October assisted the mixed flight peak during the afternoon, then heavy rain flooded the flats to the dunes on the 5th. Thunderstorms and lightning turned back a scouting run, precluding Surveys that morning.

The northern flow continued as this system broke, later forming Hurricane Milton in the Bay of Campeche. A slow influx of new birds mixed with color-marked falcons led to intermittently productive days with very limited flats access through 12 October. A southeast wind developed, coinciding with a brief opening of the northern flats and an influx of juvenile females ahead of an approaching northern system. These made for a productive day on 14 October. Access to the northern flats closed again on the 16th when that front reached the Island with showers during this general lull of the migration.

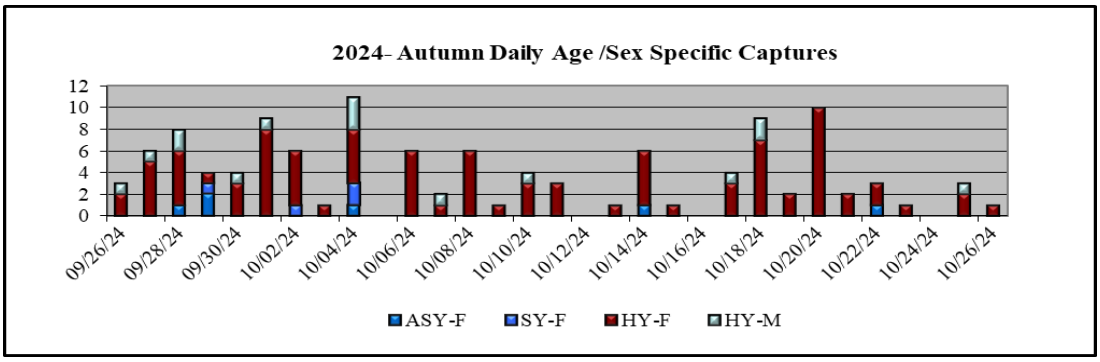

Figure 6. Fall age/sex specific daily captures.

A productive late season influx from 18-21 October resembled our peak flight in consisting of primarily juvenile females. This pulse of migrants aligned with complete cloud cover, occasional showers and steady Trade Winds spanning the entire Gulf of Mexico. High water in the Laguna Madre and Gulf complicated wind-tidal flats access, which varied markedly on a daily basis. Extreme tides also limited afternoon beach access. Nonetheless, this was a productive period of the fall Survey, when

afternoon/evening influxes of peregrines hunting and roosting on the Island followed a daily migration flight.

The migration quickly waned as unseasonably calm winds resumed, with occasionally building afternoon onshore breezes. A few new late season, mixed age-and-sex migrants trickled in daily from 22-26 October. These conditions coincided with accessible eastern flats on the 25th. Snow geese and American white pelicans were yet to be seen in the area as we began closing the Survey, nor were they evident during closing travels through 29 October.

We greatly appreciate the insights, interest and enthusiasm of Survey visitors this year. These visits from exceptional individuals provide the opportunity to share and learn. Sharing the Survey's knowledge, wonders, and the unique importance of the affinity of migratory peregrines to South Padre Island habitats with broad associated interests is critical. Of equal importance is our opportunity to gather insights and perspectives from visitors about this program. We thoroughly enjoyed our 16-17 October time in the field with Dr. Tania Homayoun, Statewide Ornithologist of the Nongame and Rare Species Program, Texas Parks and Wildlife Department. We were pleased to share a Padre Return on the beach during Dr. Rick and Lupita Bassett's 22 October Survey visit. Richard Moore joined us in the field on 23 October, and we always look forward to time in the field with this talented naturalist and long-time friend. We are honored by these visitors and send warm thanks for their interest. and encouragement.

2024 Seasonal Patterns-

Environmental conditions were an apparent influence of the migration seasons this year. During the spring Survey generally assisting east to southeast winds, strong at times, prevailed for 17 of 23 Survey days, resulting in vast wind-tidal flats. The record-setting 2024 Atlantic Basin Hurricane Season flooded (limiting access to and in some respects the attraction of migrants) the wind-tidal flats earlier in the fall season as compared to recent years. Local flooding and high water, however, have been notable during 4 of the last 6 years. The northern wind flow for 24 of 33 fall Survey days and the associated Trade Winds are viewed as favorable for migrants to travel in the western Gulf of Mexico. Very calm periods (< 5mph winds) were seemingly new this fall and noted at times during 13 Survey days. This contributed to flooding of the flats. Also, when sunny and calm, ground temperatures on the flats were hot and peregrines appeared to seek the cooler Gulf of Mexico onshore breezes in the dunes.

Survey results continue to document parallel declining patterns in sighting and capture rates of peregrines utilizing Padre Island during migration since a peak in 2016. Spring and fall sighting rates declined from a peak to a low point in 2018, then rebounded slightly in 2019 before declining again 2021-2024 with similar rates (Fig. 7).

A broad scale turning point of the northern peregrine management population in 2018 was identified by the USFWS integrated population model (USFWS 2023). Six-year averages (2018-2024) of fall Padre sighting and capture rates have declined 27% and 32% from 46-year averages. Corresponding spring rates have declined about 15% and 40%, respectively. Comparisons among recent three-year averages (2022-2024) of spring and fall sighting rates have declined more uniformly, at roughly 35% from 46-year means. Corresponding capture rates show similar patterns, being down 33% in fall and 60% in spring.

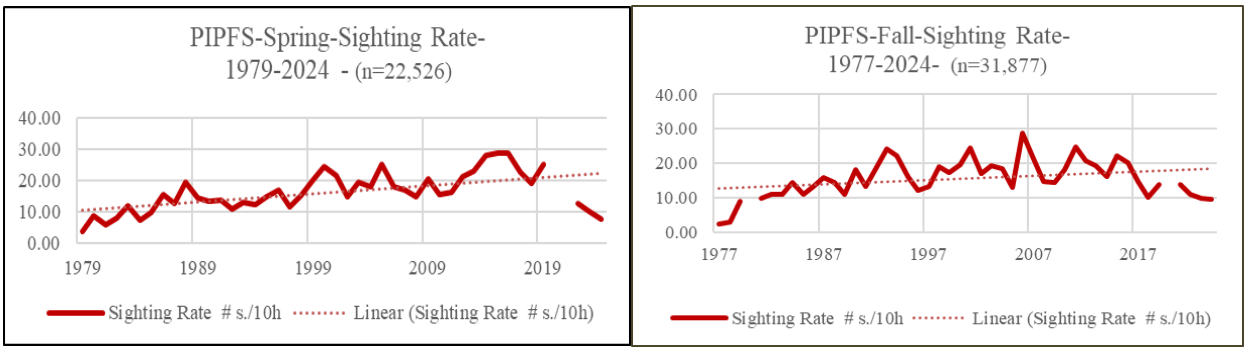

Figure 7 –Padre Survey sighting rate trends over time. – (SPR 2021 omitted due to only late season Surveys)

Current developing information from researchers and citizen science programs compiled and circulated through the Peregrine Occupancy Group by Bud Anderson and Mark Prostor mirror recent declining trends from some northern/continental breeding area studies. This trend holds true among some migration monitoring sites (Hawkcount). The degree varies by timing and specific locations. Yates *et al* 2024 detail these findings in Earthspan's 2024 Assateague Survey report. Declines are higher in coastal areas, suggesting HPAI mortality, and are not uniform across landscapes. The food habits of migrant adult peregrines suggest higher AI exposure potential when compared to juveniles (Ward and Laybourne, 1985). The Group's overarching goals of assessing trends in areas with previous background data will be an asset in understanding the geography and scale/scope of this decline and towards developing potential conservation strategies. Grainger Hunt advocates a keen focus on ageing breeders or wintering birds, since identifying subadults on territory can be a valuable bellwether of population status (Hunt and Law 2023).

Within the > 5 decades of research and monitoring at Padre and Assateague Islands our NA Migratory Peregrine Program holds a wealth of information and insights to assist understanding of the Tundra Peregrine Falcon recovery and current population trajectories for conservation. A review and restructuring of our datasets at Padre Island will enhance this program-associated input. Environmental and ecological factors strongly influence migrant behaviors at our migration sites and throughout the annual cycle. Teasing these influences apart from a population stressor could also be invaluable to accurate assessment of current populations.

Banding and Sampling Information

Bird banding is a primary tool utilized by our Surveys and administered by the USGS Bird Banding Lab to identify individuals and learn of annual distributions, demographics and life history traits. Seven previously banded peregrines were encountered this year, either as Padre Returns (n=6) captured this year and banded on Padre Island during previous Surveys, or as a foreign band recovery (n=1). Each provides pertinent population information on age structure, the fidelity of migratory routes, habitat use, and migration phenology for these long-distance migrants. Each clearly illustrates the hemispheric importance of Padre Island habitats to migratory peregrines.

During the spring season, we captured 4 previously banded Padre Returns and 1 foreign-banded falcon. These include a second-year peregrine captured on the first day in the field by Bill Seegar, originally banded as a juvenile during the fall of 2023 by Robert McGuire. Mike Yates captured a foreign second year falcon banded as a 2023 nestling in Ashland, Wisconsin. On 13 and 14 April, Mike Yates captured an adult falcon banded by Nick Todd as a second year during the fall of 2023 and a second-year falcon banded by Hana Weaver. On 25 April Mike Yates captured an adult falcon that marked its 4th encounter, one during each migration cycle since being banded in the fall of 2022. During the fall season 2 Padre Returns were captured. Robert McGuire recorded the 3rd encounter with a falcon that Sam Voss banded during the fall of 2021. In addition, Gregg Doney captured the spring adult Yates had captured on 13 April, marking its 3rd Survey encounter (each season since being marked). This falcon wintered on Russell Davidson's property in 2023 and was nearby on the beach this fall. APPENDIX III details these encounters.

Blood and feather samples were collected from 119 individual peregrines this year, which support our collaborative mercury monitoring efforts with Joe Barnes (US Fish and Wildlife Service) and Chris DeSorbo (BRI), HPAI serology studies with Arnaud Van Wettere of UTVDL, Avian Malaria / haemosporidian parasite studies by Ericka Griggs from the Wildlife Pathogens Lab at UVM, and a pilot assessment of per- and polyfluoroalkyl substances (PFAS) with Chris DeSorbo at BRI.

During our 48-year Survey efforts on Padre Island (1977–2024) we have conducted over 37,000 hours of field Surveys, recorded more than 54,000 Peregrine Falcon observations, and captured, marked, and sampled well over 10,000 peregrines. Including the Assateague Island Peregrine Falcon Survey, our NA Migratory Peregrine Program has captured and accrued almost 17,000 Tundra Peregrine Falcon banding records over > 5 decades. Our collective efforts provide migration metrics and support associated studies on the health, dynamics and movements of high latitude North American peregrines migrating along the Texas Gulf and Mid-Atlantic coastlines. Through sampling and gracious archive support, these data also provide snapshots of the habitat conditions that peregrines utilize throughout their annual range. We express sincere gratitude to all involved in the peregrine Survey efforts and to our past and present supporters (directly and indirectly) during the past > 5 decades.

COLLABORATIVE STUDIES AND RECENT PUBLICATIONS

Avian Disease Monitoring

We initiated a collaboration in December 2022 with Arnaud Van Wettere (DVM, MS, PhD, DACVP) At the School of Veterinary Medicine, Utah State University. Entitled Prevalence of Avian Influenza A Virus Antibodies in Migrating North American Peregrine Falcons, it is summarized thus:
An outbreak of highly pathogenic avian influenza (HPAI) virus H5N1 started in the fall of 2021. The scale of this outbreak is unprecedented; it is the largest and most prolonged to date in the USA. Raptors are known to be particularly susceptible to HPAI, with most succumbing within a few days post infection. Given that peregrines often prey on bird species known to carry the virus asymptomatically (e.g., waterfowl, gulls, shorebirds), they are at a higher risk of exposure to the virus than most raptor species. While a small number of wild peregrines and falconry birds that succumbed to HPAI virus infection have been found during this outbreak, data on how many falcons survive infection is lacking. Studies during

past outbreaks have shown that very few falcons (<0.1%) have antibodies to avian influenza virus. However, past HPAI outbreaks occurred in the fall and/or winter and disappeared in early summer with the return of warm temperatures. Therefore, exposure to the virus of peregrines that migrate to Central and South America for the winter was likely limited. As this H5N1 outbreak started in the fall of 2021 but persisted during the summer and fall 2022, peregrines are more likely to have been exposed to HPAI virus than in past outbreaks. The goal of this study is to detect evidence of exposure to avian influenza virus. The presence of antibodies to avian influenza virus will be evaluated in the plasma of peregrines captured during the fall and spring of 2021-2024 to determine how many peregrines have developed an immune response against the virus. Determining the prevalence of antibodies against avian influenza virus will provide documentation of exposure to the virus in migrant peregrines and indicate whether some falcons survive infection.

The UTVDL has tested 571 peregrine samples, with 6 birds positive for influenza A antibodies. For spring and fall 2021 (the period before the HPAI outbreak began) the combined number of positives is one out of 236 birds (0.42%, similar to past studies). For the outbreak period of Spring 2022 (0/26), Fall 2022 (4/107, 0/45), Spring 2023 (1/25), Fall 2023 (0/96, 0/36) the combined number of positive birds is 4/335 (1.19%). A single individual sampled during different migrations accounted for two of the positives, so was removed from the 2022-23 results. This is of keen interest in relation to immunity persistence among peregrines. The number of birds with antibodies remains very low, but perhaps higher than reported in past Surveys. The percentage of peregrines with antibodies in past studies in the US was 1/472 (0.2%) in 2006 to 2010, and 2/299 (0.67%) in 2001 to 2004, and 2 of 109 falcons (1.83%) during the large outbreak of 2014 to 2015. The encouraging news is that AI exposure is not invariably fatal to peregrines, although most succumb rapidly. We also infer that serology metrics in peregrines do relate to the scale of outbreaks, which has grown considerably. We look forward to the 2024 serology information gathered and screening results.

In a 2015 Survey collaboration with Dr. Tom Gidlewski and Meredith Grady from the USDA APHIS National Wildlife Research Center, we contributed blood and cloacal swab samples from our Assateague and Padre Island Surveys for analyses in their Highly Pathogenic Avian Influenza (HPAI) in Raptors of the US project. This effort contributes to the conservation of raptors, knowledge of the epidemiology of HPAI, heightened national surveillance efforts, and understanding of potential impacts on populations. The recent spread of HPAI viruses into North America and their tendency to reassort generates concerns and questions on the risks to agriculture, zoologic collections, wildlife and, potentially, human populations. As researchers have pointed out, robust, targeted surveillance programs among wild birds and poultry, modeling of the movements of HPAI-infected wild birds, and experimental research studies will provide the knowledge required for intelligent policy and management decisions (Hall *et al.* 2015). The USDA completed its first round of testing with 274 serum samples collected in 2015 from all species of raptors (including 109 peregrine samples we collected at Assateague and Padre Islands). Samples were analyzed using the IDEXX Multi-S ELISA to detect influenza A antibodies. Two peregrines (and two other raptors) tested positive for influenza A antibodies of the overall 459 raptor samples analyzed, including one positive peregrine from each of the Assateague Island and Padre Island Surveys. Among migratory peregrines 1.83% were seropositive. Please see Appendix II for details.

In collaboration with Dr. Pat Redig of the Raptor Center at the University of Minnesota, peregrine plasma and cloacal swabs we collected from 2006-2009 were analyzed to detect exposure to Highly Pathogenic

Avian Influenza H5N1. Consistent with wild bird monitoring throughout North America, the test results for the presence of Avian Influenza (H5N1) in all those samples were negative. Dr. Redig related in February 2009 that they have "... tested all cloacal swabs with a matrix pcr (m-PCR) and all of the blood samples with a competitive ELISA for influenza - neither test has yielded evidence of virus parts (m-pcr) or antibodies (ELISA) in these samples." To date H5N1 has not been detected in North America, but in late 2014 H5N2 was documented among wild ducks and H5N8 among domestic fowl in the Pacific Northwest. Captive Gyrfalcons and peregrines that had been fed falconry-captured ducks died of H5N8.

A research note (Redig and Goyal, 2012) was published indicating that among raptors, Bald Eagles do show exposure to influenza A viruses, and there is limited serologic prevalence of influenza A virus antibodies in migratory peregrines and other raptors. Please see the abstract for details in Appendix II.

Vector-borne Diseases of Arctic Breeding Raptors: We provided (2023-2024) whole blood smear slides, spots and feathers for this study by Wildlife Pathogens Lab, University of Vermont (UVM) PhD candidate Ericka Griggs in collaboration with Chris DeSorbo (BioDiversity Research Institute). The effort focuses on blood hematozoa, particularly haemosporidian parasites belonging to the Phylum Apicomplexa and Order Haemosporidia. It investigates the effects of climate change on the distribution and diversity of these parasites, including malaria-causing Plasmodium spp. These parasites have shown an alarming increase in both diversity and prevalence in recent years due to shifts in host, vector, and pathogen distributions brought about by climate change. The project centers around the prevalence of hemosporidians in migrating first-year raptors. The primary objective is to use light microscopy, multiplex PCR analysis, and stable isotope analysis to determine evidence of pathogens and the geographical origins of these birds. This will shed light on their migratory patterns and interactions with these blood parasites. The goal of this research is to document the prevalence and diversity of these pathogens within the Arctic and eventually Palearctic regions.

Contaminants Monitoring

In an ongoing collaboration with Joe Barnes of the U.S. Fish and Wildlife Service, we have continued to sample feathers for mercury contaminant analyses at Assateague and Padre Islands. This work draws from research by Barnes and Gerstenberger (2015) looking at mercury in feathers of a non-migratory population of peregrines in southern Nevada, and in their avian prey. Peregrine mercury levels are correlated with that of their prey in order to use peregrines as an indicator species of broader environmental contamination. AMAP (2011) has highlighted concerns about increasing mercury levels in the Arctic, primarily from anthropogenic sources and augmented by melting of permafrost. Ambrose et al. (2000) identified mercury as a contaminant of concern specifically for peregrines breeding in Alaska due to trends in egg burdens and the general increasing trends in Arctic biota. Climate warming may remobilize and increase methylization of mercury, thus increasing ecosystem and human exposure. Our initial publication of mercury exposure in peregrine migrants was published (Barnes et al. 2019) in the Journal of Raptor Research. The abstract can be found in Appendix II. Our current effort incorporates molt patterns (Hunt et al. 1975, White et al. 2013) into a new feather sampling regime and with the collaboration of Chris DeSorbo (BRI) including blood and feather analyses. We seek insights on the geography of annual mercury exposure and that of individual adult peregrines over time and annual juvenile assessments to understand exposure trends.

During the 2024 Surveys, we collected peregrine blood and feathers at the Assateague and Padre Island Surveys, focusing on adult migrant sampling due to their limited sampling availability at other sites. We also maintain sampling a seasonal juvenile cohort to assess trends and annual variability of mercury exposure in the Arctic.

In collaboration with The Peregrine Fund and the Center for Environmental Sciences and Engineering at the University of Connecticut, blood analyses of migrant peregrines collected during the Assateague and Padre Island Surveys quantified temporal and spatial trends of polycyclic aromatic hydrocarbon (toxic components of crude oil) exposure in migrant peregrines from 2009 through 2011 (Seegar *et al.* 2015). Please see the abstract in Appendix II. A method development poster of this study (Perkins et al. 2011) was presented at the SETAC North America 32nd Annual Meeting in Boston, MA. In addition, Tom Maechtle gave a presentation of this work at the 2014 Raptor Research Foundation Conference in Corpus Christi, Texas. The samples we collected at Assateague and Padre Islands (along with those previously archived) comprised an invaluable resource in demonstrating the utility of non-lethal blood sampling to assess effects of contaminants. Results showed a marked increase in both the levels of PAHs present and their composition (a transition to crude oil-based compounds) in the year following the 2010 Deepwater Horizon oil spill, followed by a return to near baseline components.

Henny *et al*. (1999) reported that organochlorine (OC) residues in plasma of Peregrine Falcons decreased significantly in spring migrants at Padre Island between collections obtained during 1978-80 and those collected in 1994. Henny noted that decreases in OC pesticide residues coincided with increased peregrine populations throughout the Arctic and other regions of North America. The update of this study conducted with 2004 samples (Henny *et al.* 2009) reported further dramatic declines (96-97%) in tundra peregrine OC contaminant loads at Padre Island during the later sampling period. This is a significant conservation milestone of the past century, though Henny suggests vigilance since the indoor use of DDT has been reauthorized in Africa. While the decreased use of persistent OCs has been an important factor in restoring peregrine populations, it heralds a change in agricultural processes that may now employ less persistent but more toxic chemicals. Henny (2009) also elucidates the large-scale utility of Padre Survey biomonitoring for emergent persistent organic pollutants (POPs) in the Americas. Polybrominated diphenyl ether (PBDE) flame retardants have dramatically increased in wildlife and humans and are of developing concern worldwide. By utilizing our sample archive and future sampling, a broad scale inquiry of PBDE contaminant burdens in Padre migrants is warranted.

Migration Phenology

In collaboration with Dr. Brad Fedy and Julie Galloway at the University of Waterloo, during her undergraduate thesis Galloway investigated whether the peak fall migration timing (in 1985-1989 and 2006-2013) of peregrines at SPI has changed. Migration timing was analyzed in conjunction with a suite of climate-related covariates, including local temperature, the North Atlantic Oscillation index (NAO), and the El Niño–Southern Oscillation index. Lastly, the study investigated migration timing in relation to several other variables that could influence Peregrine Falcon migration, including the predator-prey relationship between peregrines and shorebirds, and age and sex effects on migratory patterns and behavior. Prior to analyses, a database was created to store digitized data from scanned hard-copy Padre Island Peregrine Falcon Survey datasheets.

In this preliminary study, there was some evidence to suggest that migratory timing was correlated with the local-scale temperature and larger-level climate of South Padre Island. For instance, the study suggests that peak migration dates were later in years where the maximum temperature was high for the five-day period preceding peak arrival. However, additional data and a longer time frame are necessary to confirm this trend. The North Atlantic Oscillation index and mean Peregrine Falcon migration were correlated and suggested that migration timing was advanced in years where conditions were cold and wet along the migration route and delayed in years where conditions were hot and dry.

Genetic Analyses

In collaboration with Drs. Sandra Talbot (USGS) and Jeff Johnson (The Peregrine Fund) we provide red blood cell samples for continued genetic analyses. Dr. Talbot is completing DNA level analyses of peregrine samples acquired at Assateague and Padre Islands. Talbot is utilizing samples collected from past Surveys and investigating methods that will help us: 1) describe the composition of the migratory population using a molecular probe that will identify birds to population of natal origin; 2) assess the relative contribution of various breeding populations to the migratory populations at Assateague and Padre; 3) examine how changes in weather patterns and migratory patterns influence the size of the migratory populations; and 4) possibly draw conclusions about changes in the size of breeding populations. Johnson and Dr. David Mindell presented a conference poster assessing the temporal genetic stability of migrating Peregrine Falcons sampled at Padre Island between the years 1985-2007 (Johnson *et al.* 2007). Further analyses were published in Johnson *et al.* (2010).

Stable Isotope Research

We maintain feather collections from juvenile falcons at Padre for future stable isotope analyses to continue research initiated by Dr. Nancy Clum of the Wildlife Conservation Society. Dr. Clum's research assesses the feasibility of using stable isotopes as a means of identifying natal origins of migrant birds. If successful, this technique may allow us to: 1) evaluate the relative importance of different breeding habitats to populations of Arctic peregrines; 2) identify the dominant trophic position of Arctic peregrines; and 3) identify any temporal patterns of migration related to breeding habitat. Isotope data will be combined with data on plumage and morphological variation, which have also been suggested to vary geographically among peregrine populations. In addition, future comparative analyses of isotopic signatures of Gulf and East Coast HY falcons have potential to reveal the effects of continental weather patterns on juvenile tundra peregrines.

Population Monitoring

We provided the chapter on migration studies (Seegar *et al*. 2003) in Return of the Peregrine, the Peregrine Fund book documenting the species' recovery. Our studies at Padre and Assateague Islands formed the basis of that chapter. Mike Yates developed a presentation, delivered by Tom Maechtle at the 2014 raptor Research Foundation Conference in Corpus Christi Texas, updating the summary of our long-term standardized studies of migrating Tundra Peregrine Falcons on the East and Gulf Coasts of the US. Please see the abstract in Appendix II.

Satellite Telemetry

Advances in the miniaturization of satellite-received transmitters have only recently allowed the tracking of medium sized raptors such as Peregrine Falcons. Seegar and Yates first equipped migrating peregrines with 30-gram Platform Transmitter Terminals (PTTs) at Assateague Island in 1993. After the successful deployment and tracking of these first two individuals, we radio marked seven adult female Peregrine Falcons at Padre Island in the spring of 1994. In the spring of 1996, we radio marked the first migrant male peregrines at Padre Island with 20-gram PTTs. To date 20 Peregrine Falcons (two males, 18 females) have been radio marked with PTTs at Padre Island. Three Second Year peregrines were outfitted with new cellular GPS/GSM transmitters (~24g, North Star Science and Technology, LLC) during the 2012 spring Survey. Satellite tracking data sets from Padre and Assateague migrants, as well as those we have tracked from Alaska, Canada, Mexico, Greenland and Russia were consolidated. They have been archived at MoveBank (https://www.movebank.org/) so we may better address research questions in collaboration with other users of that repository.

Dr. Michael McGrady is analyzing data collected from these instrumented birds. Building on the Yates *et al*. (1988) collation of band return data, this information has identified important areas in the Western Hemisphere for the conservation of peregrines and their prey.

Dr. Mark Fuller presented analyses of our satellite tracking results, including peregrines tagged on Padre Island, during the Raptor Migration, Ecology and Conservation in the New World Symposium, held in conjunction with the North American Ornithological Conference, Veracruz, Mexico, in October 2006. This analysis examined peregrine migration strategies, migratory corridors, wintering areas, staging areas and the influence of weather patterns on peregrine migration. Please refer to the Fuller *et al*. (2006) abstract in Appendix II.

Satellite telemetry has also spurred many of the recent advances in migration research. An applied example of its value was demonstrated in Swainson's Hawks (*Buteo swainsoni*). From concerns generated by declining demographics in nest monitoring surveys, Earthspan was part of a multi-agency effort to monitor Swainson's Hawk populations throughout the year using satellite-received telemetry. Use of this technology led researchers to areas in Argentina, where large numbers of Swainson's Hawks were found dead. Subsequent investigations determined that secondary poisoning due to contact with the insecticide Monochrotophos caused the mortalities. This chemical was used to protect crops from grasshoppers, a primary food source for Swainson's Hawks wintering in Argentina. Winter use areas were delimited through the satellite tracking of radio marked Swainson's Hawks. Once the cause of mortality was discovered, researchers working with government representatives and environmental groups were able to convince the product's manufacturer to voluntarily withdraw its use from the region. They replaced farmers' stocks with a reportedly less toxic product for controlling insect pests. This case demonstrates the utility of tracking migrants with the aid of satellite telemetry to monitor environmental health. Field evaluations would have been more difficult and costly without the location estimates for Swainson's Hawk wintering areas provided by satellite tracking. Most significantly, the needless mortality of Swainson's Hawks was quickly curtailed. Besides conserving Swainson's Hawks, this proactive management saved an untold amount of multi-agency resources.

The situation described above indicates the need for continued and more extensive field evaluations of highly toxic, but less persistent (therefore more difficult to detect) chemicals. It also illustrates the advantages of proactive monitoring, as embodied by our Program efforts. The threat of poisoning for Neotropical migrants continues to be a problem in Latin America, where organophosphates appear to have largely replaced the use of persistent organochlorines.

CONCLUSIONS AND RECOMMENDATIONS

The recovery of the peregrine is one of the few success stories for an Endangered Species. Continued research and monitoring further our understanding of peregrine population health, dynamics and migration ecology. While we supported delisting the Arctic subspecies from the List of Threatened and Endangered Species in 1994, we continue to recognize its importance as a sentinel species of environmental conditions that affect a myriad of other avian species. Through the integration of several technologies, (e.g., tracking of peregrines by satellite, analyses of genetic make-up and investigation of contaminant burdens and emerging pathogens) the Padre Island Peregrine Falcon Survey can be used to assess demographic parameters and environmental health within the Western Hemisphere. This includes diverse habitats used by peregrines, as revealed by satellite derived location estimates and band returns. These habitats are shared by a wide variety of avian species and can serve to identify areas where inquiries or assessments may be warranted (particularly in Latin America).

The current NA Migratory Peregrine Program efforts at Padre and Assateague Islands, in partnership with The Peregrine Fund, continue under the auspices of our original Survey objectives to assess Nearctic migratory peregrine population dynamics, health and annual distributions. In addition, by applying the sentinel capacity of migratory peregrines, we monitor potential stressors of peregrines and Neotropical migrants in changing environments. These include contaminants and pathogens that pose human health and conservation concern. We concurrently build data for understanding population status, phenology, migration strategies and distribution assessments over time. Technological advances and the gracious support Earthspan receives allow us to seasonally augment our tissue archive to address currently unforeseen population influences. Our > 5-decade foundational data form a basis for identifying the general habitat conservation needs of migratory peregrines throughout their annual cycle and to monitor future relationships of peregrine movements and status relative to environmental change. Recently we have been assessing the development of this body of work as a basis for environmental education with Earthspan's *Eye of the Falcon* program. Our overall research, while focused on peregrines, serves to benefit society and avian conservation.

Within the > 5 decades of research and monitoring at Padre and Assateague Islands the NA Migratory Peregrine Program holds a wealth of information and insights to assist understanding of the Tundra Peregrine Falcon recovery and current population trajectories for conservation. A review and restructuring of our datasets at Padre Island will enhance this program-associated input. Environmental and ecological factors strongly influence migrant behaviors at our migration sites and throughout the annual cycle. Teasing these influences apart from a population stressor could also be invaluable to accurate assessment of current populations.

We recommend that the Padre Survey efforts continue during spring and fall migrations, and winter studies in South Texas be revisited. By maintaining continuity using similar protocols, these efforts can be adapted as specific needs dictate.

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APPENDIX – I
Padre Island Peregrine Falcon Survey Totals 1977-2024

Year	Season	Survey Hours	Sighting Rate # s./10h	Peregrines Sighted	Peregrines Captured	Vehicles used
1977	Autumn	467	2.59	121	19	Trucks/beachfront
1978	Autumn	384	0.31	118	34	TBF(12) & PTS (21)
1979	Spring	154	3.77	58	8	TBF (8) & PTS (0)
1979	Autumn	420	8.98	377	89	TBF (41) PTS (24) ATV (24)
1980	Spring	542	8.73	473	54	TBF-PTS-ATV
1980	Autumn	0	0.00	0	0	Hurricane Allen
1981	Spring	448	6.05	271	32	ATV&TBF
1981	Autumn	602	9.95	599	135	ATV&TBF
1982	Spring	950	8.22	781	92	ATV&TBF
1982	Autumn	734	11.10	815	156	ATV&TBF
1983	Spring	1150	11.86	1364	149	ATV&TBF
1983	Autumn	986	11.08	1092	265	ATV&TBF
1984	Spring	1240	7.31	906	88	ATV&TBF
1984	Autumn	809	14.47	1171	157	ATV&TBF& PTS
1985	Spring	895	10.06	900	152	ATV&TBF
1985	Autumn	409	11.02	451	124	ATV
1986	Spring	597	15.63	933	102	ATV
1986	Autumn	632	13.29	840	208	ATV
1987	Spring	828	12.75	1056	140	ATV
1987	Autumn	433	15.98	692	185	ATV
1988	Spring	770	19.44	1497	209	ATV
1988	Autumn	656	14.53	953	298	ATV/begin using dye in fall.
1989	Spring	864	14.51	1,254	129	ATV
1989	Autumn	701	11.10	778	249	ATV
1990	Spring	817	13.61	1112	128	ATV
1990	Autumn	735	18.24	1341	298	ATV&TBF
1991	Spring	670	13.64	914	114	ATV
1991	Autumn	580	13.45	780	252	ATV&TBF
1992	Spring	578	10.80	624	90	ATV
1992	Autumn	114	18.42	210	63	ATV&TBF
1993	Spring	618	13.06	807	129	ATV
1993	Autumn	995	24.28	2,416	693	ATV&TBF
1994	Spring	319	12.23	390	43	ATV/hovercraft
1994	Autumn	276	22.32	616	115	ATV/TBF-SPI only
1995	Spring	139	15.04	209	43	ATV/SPI only
1995	Autumn	192	16.30	313	85	ATV/TBF-SPI only/hurricanes
1996	Spring	54	17.04	92	19	ATV/SPI only
1996	Autumn	397	12.19	484	195	ATV/TBF-SPI only
1997	Spring	46	11.74	54	16	ATV/SPI only
1997	Autumn	328	13.41	440	181	ATV/TBF-SPI only
1998	Spring	164	15.37	252	41	ATV/SPI only
1998	Autumn	605	19.04	1152	317	ATV/SPI only
1999	Spring	160	20.38	326	40	ATV/SPI only
1999	Autumn	512	17.40	891	273	ATV/SPI only
2000	Spring	195	24.62	480	74	ATV/SPI only
2000	Autumn	400	19.75	790	151	ATV/SPI only
2001	Spring	251	21.67	544	106	ATV/SPI only
2001	Autumn	290	24.66	715	186	ATV/SPI only

APPENDIX – I (cont.)
Padre Island Peregrine Falcon Survey Totals 1977-2024

Year	Season	Survey Hours	Sighting Rate # s./10h	Peregrines Sighted	Peregrines Captured	Vehicles used
2002	Spring	309	14.72	455	50	ATV/SPI only
2002	Autumn	197	16.95	334	68	ATV/SPI only
2003	Spring	162	19.44	315	38	ATV/SPI only
2003	Autumn	302	19.50	589	170	ATV/SPI only
2004	Spring	150	18.07	271	42	ATV/SPI only
2004	Autumn	263	18.48	486	129	ATV/SPI only
2005	Spring	107	25.14	269	34	ATV/SPI only
2005	Autumn	262	12.98	340	117	ATV/SPI only
2006	Spring	111	17.93	199	17	ATV/SPI only
2006	Autumn	359	28.66	1029	200	ATV/SPI only
2007	Spring	112	17.14	192	30	ATV/SPI only
2007	Autumn	258	21.32	550	92	ATV/SPI only
2008	Spring	154	14.87	229	40	ATV/SPI only
2008	Autumn	318	14.65	466	133	ATV/SPI only
2009	Spring	166	20.42	339	60	ATV/SPI only
2009	Autumn	387	14.60	565	144	ATV/SPI only
2010	Spring	104	15.67	163	42	ATV/SPI only
2010	Autumn	401	18.20	730	181	ATV/TBF-SPI only
2011	Spring	178	16.24	289	33	ATV/SPI only
2011	Autumn	371	24.69	916	202	ATV/TBF-SPI only
2012	Spring	145	21.31	309	37	ATV/SPI only
2012	Autumn	480	20.79	998	228	ATV/TBF-SPI only
2013	Spring	144	21.92	330	42	ATV/SPI only
2013	Autumn	532	19.32	1028	212	ATV/TBF-SPI only
2014	Spring	196	28.01	549	51	ATV/SPI only
2014	Autumn	358	16.34	585	114	ATV/TBF-SPI only
2015	Spring	143	28.88	413	52	ATV/SPI only
2015	Autumn	356	22.23	793	151	ATV/TBF-SPI only
2016	Spring	169	28.58	483	58	ATV/SPI only
2016	Autumn	345	20.35	702	180	ATV/SPI only
2017	Spring	201	22.74	457	36	ATV/SPI only
2017	Autumn	429	14.80	635	131	ATV/SPI only
2018	Spring	244	19.18	468	56	ATV/SPI only
2018	Autumn	434	10.21	443	74	ATV/SPI only
2019	Spring	230	25.3	582	51	ATV/SPI only
2019	Autumn	395	13.97	552	95	ATV/SPI only
2021	Spring	199	6.33	126	19	ATV/SPI only
2021	Autumn	416	13.85	576	158	ATV/SPI only
2022	Spring	252	12.62	319	26	ATV/SPI only
2022	Autumn	496	11.13	552	150	ATV/SPI only
2023	Spring	261	10.27	268	24	ATV/SPI only
2023	Autumn	479	9.89	474	120	ATV/SPI only
2024	Spring	262	7.79	204	18	ATV/SPI only
2024	Autumn	394	9.62	379	101	ATV/SPI only
Totals		**37,337**		**54,403**	**10,732**	

Codes: ATV – All terrain vehicles, TBF- Trucks on beach front, PTS – Permanent trapping station

APPENDIX – II
Abstracts of Recent Publications and Presentations

Oliphant, L.W, M.A. Yates, G.E. Doney. 2019. Determining Your Passage Peregrine's "Size" From Migration Data. Hawk Chalk-LVIII (3):38-41. Published by the North American Falconers Association.

Background: Falconers want their birds to enthusiastically pursue wild quarry with the strength and stamina of a wild bird, while still remaining responsive to the falconer. In earlier times assessing the condition of a bird was accomplished by paying close attention to its behavior, feeling the keel, or palpating fat deposits. Although modern falconers still utilize these subjective methods, the use of accurate scales to determine a bird's weight is now the most common method of assessment. We ask other falconers what weight their bird flies at. The assumption is that at some particular 'flying weight' their bird is in 'optimum condition'. This is a big assumption.

Methodology/Summary: In a creative applied and informative publication designed by Dr. Lynn Oliphant, professor emeritus from the University of Saskatchewan, also collaborating with and the Cape May Raptor Banding Project; this effort serves as a guide to assist falconers in determining a relative flying weight for a new immature peregrine. We utilized a large sample of morphology data collected during the Assateague and Padre surveys and at Cape May, to explore the relationship between weight and "body size" as reflected by a wing cord measurement. Using simple linear regression and based on a wing chord measurement, we provide simple predictive equations for East and Gulf Coast birds, which estimate the average weight of wild-trapped immature peregrine for comparison. Variation between the East and Gulf Coast peregrine weights and relative comparisons with a freshly trapped passage bird are discussed.

Barnes, J.G., G.E. Doney, M.A. Yates, W.S. Seegar, S.L. Gerstenberger.2019. A Broadscale Assessment of Mercury Contamination in Peregrine Falcons across the Northern Latitudes of North America. Journal of Raptor Research53(1):1-13.

ABSTRACT—We document concentrations of total mercury (THg) in feathers of Peregrine Falcons (*Falco peregrinus*; hereafter peregrines) collected during autumn migration at South Padre Island, Texas and Assateague Island, Maryland from 2009–2015. We detected THg in all sampled fourth primary (p4; range = 0.44–37.46 μg/g) and axillary feathers (range = 0.09–62.68 μg/g). We found no significant difference in THg concentrations between hatch-year (HY) peregrines by study site. Mean THg concentrations were greater in after-hatch-year peregrines in both feather types than in HY peregrines, but concentrations in p4 feathers of second-year peregrines (mean = 14.9 μg/g) were significantly greater than after-second-year individuals (mean = 8.5 μg/g). Pooling samples from HY birds across both sites and all years, we found no significant differences between the concentrations in the axillaries of females (mean = 2.4 μg/g) vs. males (mean = 2.2 μg/g), nor between the two feather types. The concentration associated with toxic effects in peregrines is unknown; however, peregrines have recently experienced broad population expansion across the presumed breeding area of the birds we sampled, and the THg concentrations we measured were lower than those in an apparently healthy breeding population in the southwestern USA. We documented widespread THg exposure in peregrines migrating from the northern latitudes of North America, but additional research is needed to assess trends in mercury exposure in the face of increasing global anthropogenic release of mercury into the environment and the release of long-term sequestered mercury in melting permafrost from climate change.

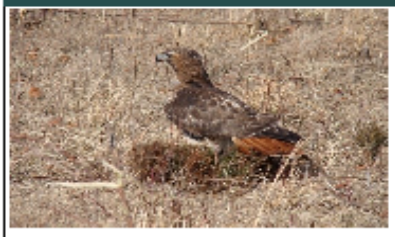
Deliberto, Thomas. 2018. Investigating Exposure of Raptors to Avian Influenza. Program Activity Report - National Wildlife Disease Program, US Department of Agriculture. 15 August 2018.

National Wildlife Disease Program

15 August 2018

PROGRAM ACTIVITY REPORT (PAR)

Investigating Exposure of Raptors to Avian Influenza



Red-tailed hawk. *Photo courtesy of USDA Wildlife Services.*

Avian influenza is a Type A influenza virus that has been documented in more than 100 bird species, but some species of waterfowl, shorebirds, and gulls are considered the primary reservoirs. Certain strains of avian influenza are termed highly pathogenic avian influenza viruses (HPAIV) because they cause high morbidity and mortality rates in poultry.

During 2014-2015, Eurasian HPAIV H5N8, and Eurasian/North American HPAIV H5N2 and H5N1 resulted in significant mortality of poultry and some species of wild birds. In particular, 7 wild raptors were found dead and tested positive for HPAIV after being submitted for diagnostic testing. Three falconry birds also tested positive for HPAIV.

In response, the National Wildlife Disease Program (NWDP) developed a project to explore how HPAIV might be affecting raptors. The main objective was to survey live raptors for antibodies in blood serum to influenza A virus and, more specifically, to Eurasian H5 HPAIV. Oropharyngeal and cloacal swabs were also collected from raptors to determine if birds were actively shedding influenza virus at the time of sampling.

Raptors were sampled in 13 states from 2014 to 2017. Samples were submitted to the USDA Wildlife Services' National Wildlife Research Center and Colorado State University Veterinary Diagnostic Laboratory in Fort Collins, CO, for initial testing. Non-negative samples requiring further testing were sent to the USDA National Veterinary Services Laboratory in Ames, IA.

Overall, 459 serum and 522 swab samples were collected from a total of 586 birds. All swab samples were negative for type A influenza via RRT-PCR. Only four serum samples tested positive by ELISA for antibodies to influenza A. Of those, none were identified as known HPAIV subtypes, suggesting that the birds were likely exposed to native North American wild bird influenza viruses.

The survey did not find evidence for widespread exposure of raptors to Type A influenza. Furthermore, no evidence of exposure to the Eurasian HPAIV strains was documented. Given that this work occurred simultaneous to the Eurasian HPAIV outbreaks, during which raptors were confirmed with HPAIV, it is likely that infection with Eurasian H5 HPAIVs in raptors resulted in mortality rather than morbidity and recovery.

Species	n
Red-tailed Hawk	227
Peregrine Falcon	127
Black Vulture	62
Northern Goshawk	32
Great-horned Owl	27
American Kestrel	22
Barred Owl	14
Turkey Vulture	14
Red-shouldered Hawk	13
Cooper's Hawk	10
Bald Eagle	9
Golden Eagle	6
Broad-winged Hawk	4
American Crow	3
Swainson's Hawk	3
Eastern Screech Owl	2
Northern Harrier	2
Osprey	2
Rough-legged Hawk	2
Barn Owl	1
Ferruginous Hawk	1
Merlin	1
Prairie Falcon	1
Sharp-shinned Hawk	1
TOTAL	586

Willard Heck sampling a peregrine falcon on Padre Island in Texas. *Photo courtesy of Kate Davis with Earthspan, Inc.*

Collaborators:
Earthspan, Inc.
Hawk Ridge Bird Observatory
HawkWatch International
Cape Fear Raptor Center
Rocky Mountain Raptor Program
Colorado State University
National Veterinary Services Laboratory
USDA/APHIS Wildlife Services

For more information, please contact Tom Deliberto.

USDA United States Department of Agriculture
Animal and Plant Health Inspection Service
Wildlife Services

The original artwork on this page was created by Erika Kampe and Sarah Goff

Seegar, W.S., M.A. Yates, G.E. Doney, T.C.M. Seegar, J. P. Jenny, C. Perkins, M. Giovanni. 2015. Migrating Tundra Peregrine Falcons (*Falco peregrinus tundrius*) accumulate polycyclic aromatic hydrocarbons along the Gulf of Mexico following the Deepwater Horizon oil spill. Ecotoxicology24(5): 1102-1111.

Monitoring internal crude oil exposure can assist the understanding of associated risks and impacts, as well as the effectiveness of restoration efforts. Under the auspices of a long-term monitoring program of Tundra Peregrine Falcons (*Falco peregrinus tundrius*) at Assateague (Maryland) and South Padre Islands (Texas), we measured the 16 parent (unsubstituted) polycyclic aromatic hydrocarbons (PAHs), priority pollutants identified by the United States Environmental Protection Agency and components of crude oil, in peripheral blood cells of migrating Peregrine Falcons from 2009 to 2011. The study was designed to assess the spatial and temporal trends of crude oil exposure associated with the 2010 Deepwater Horizon (DWH) oil spill which started 20 April 2010 and was capped on 15 July of that year. Basal PAH blood distributions were determined from pre-DWH oil spill (2009) and unaffected reference area sampling. This sentinel species, a predator of shorebirds and seabirds during migration, was potentially exposed to residual oil from the spill in the northern Gulf of Mexico. Results demonstrate an increased incidence (frequency of PAH detection and blood concentrations) of PAH contamination in 2010 fall migrants sampled along the Texas Gulf Coast, declining to near basal levels in 2011. Kaplan–Meier peak mean PAH blood concentration estimates varied with age (Juveniles-16.28 ± 1.25, Adults-5.41 ± 1.10 ng/g, wet weight) and PAHs detected, likely attributed to the discussed tundra peregrine natural history traits. Increased incidence of fluorene, pyrene and anthracene, with the presence of alkylated PAHs in peregrine blood suggests an additional crude oil source after DWH oil spill. The analyses of PAHs in Peregrine Falcon blood provide a convenient repeatable method, in conjunction with ongoing banding efforts, to monitoring crude oil contamination in this avian predator.

Yates, M.A., W.S. Seegar, T.L. Maechtle, G.E. Doney. 2014. Long-term standardized studies of migrating Tundra Peregrine Falcons (*Falco peregrinus tundrius*) on the East and Gulf Coasts of the U.S. 2014 Raptor Research Foundation Conference in Corpus Christi, TX. 30 September 2014.

Range-wide DDT-related declines among Peregrine Falcon populations led to endangered species status in the U.S. in 1970. Standardized autumn studies of migrating Tundra Peregrine Falcons were begun at two well-documented focal points of migration (Assateague Island, MD/VA, 1970, and Padre Island, TX, 1977). Padre Island was identified as the only known vernal migration concentration point in the Western Hemisphere, and spring studies were added there in 1979. To date we have expended > 50,000 man-hours in sighting ~64,000 Tundra Peregrines and capturing 14,639. Our long-term database on this subspecies since 1970 is unparalleled. At Assateague it can also be directly related to data collected during 1938-1969 by falconer/naturalists, effectively providing a continuous database of > seven decades at this migration focal point. Our data document the recovery of migratory peregrine populations after the 1972 U.S ban of DDT, and we plan to continue these monitoring efforts. We have tracked 58 peregrines from these study sites and coastal Mexico by satellite-received telemetry, defining migratory routes and areas of critical use by subjects and their associated prey species. We have archived thousands of blood samples from Tundra Peregrines; these apex predators are an established bioindicator of environmental health. Samples can be analyzed to provide current and retrospective insights into known and emerging chemical and biological threats to the environment and to our living world. We documented the decline and virtual disappearance of DDE in Tundra Peregrine blood. We have also utilized samples in genetic and natal origin studies, as well as the investigation of West Nile Virus, Avian Influenza, and PAH contamination resulting from the 2010 Deepwater Horizon Gulf of Mexico oil spill. These important studies will continue indefinitely into the future.

Maechtle, T.L., W.S. Seegar, M.A. Yates, G.E. Doney, T.C.M. Seegar, J. P. Jenny, C. Perkins, M. Giovanni. 2014. Migrating Tundra Peregrine Falcons (*Falco peregrines tundrius*) accumulate polycyclic aromatic hydrocarbons along the Gulf of Mexico following the Deepwater Horizon oil spill. 2014 Raptor Research Foundation Conference in Corpus Christi, TX. 30 September, 2014.

Monitoring internal crude oil exposure can assist the understanding of associated risks and impacts, as well as the effectiveness of restoration efforts. Under the auspices of a long-term monitoring program of Tundra Peregrine Falcons (*Falco peregrinus tundrius*) at Assateague (Maryland) and South Padre Islands (Texas), we measured circulating parent polycyclic aromatic hydrocarbons (PAHs), components of crude oil, in peripheral blood cells of migrating Peregrine Falcons from 2009-2011. The study was designed to assess the spatial and temporal trends of crude oil exposure associated with the 2010 Deepwater Horizon oil spill (DWH). This sentinel species, a predator of shorebirds and seabirds during migration, was potentially exposed to residual oil from the spill in the northern Gulf of Mexico. Results demonstrate an increased incidence of PAH contamination in 2010 fall migrants sampled along the Texas Gulf Coast, declining to near basal levels in 2011. Kaplan-Meier peak mean ∑PAH blood concentration estimates varied with age (Juveniles-16.28 ±1.25, Adults-5.41 ±1.10 ng/g, wet weight) and PAHs detected, likely attributed to the discussed tundra peregrine natural history traits. Diagnostic sourcing ratios are not possible due to the few PAH analytes detected. Yet increased incidences of fluorene, pyrene and anthracene, with the presence of other PAHs in peregrine blood suggest an additional crude oil source after DWH. Continued monitoring is recommended until parent PAH profiles return to basal constituents and to include alkyl PAH analyses. The analyses of PAHs in Peregrine Falcon blood provide a convenient repeatable method, with little disturbance to birds, for monitoring crude oil contamination in coastal environments and their avian prey base.

Redig, P. T. and S. M. Goyal. 2012. Serologic evidence of exposure of raptors to influenza A virus. Avian Diseases, 56(2):411-413.

SUMMARY. Serum or plasma samples from raptors that prey or scavenge upon aquatic birds were tested by a commercially available blocking enzyme-linked immunosorbent assay for the evidence of antibodies to influenza A virus. Samples were taken from birds (n=616) admitted to two rehabilitation centers in the United States. In addition, samples from 472 migrating peregrine falcons (Falco peregrinus) trapped on autumnal and vernal migrations for banding purposes were also tested. Only bald eagles were notably seropositive (22/406). One each of peregrine falcon, great horned owl (Bubo virginianus), and Cooper's hawk (Accipiter cooperi) from a total of 472, 81, and 100, respectively, were also positive. None of the turkey vultures (n=21) or black vultures (n=8) was positive. No clinical signs referable to avian influenza were seen in any bird at the time of capture. These data indicate that, among raptors, bald eagles do have exposure to influenza A viruses.

Perkins, C., A. Provatas, W. Seegar, M. Yates, D. Evers, and P. Jenny. 2011. Analysis of PAHs 9500 from MC-252 in whole blood and RBCs from live-captured birds using ultra performance liquid chromatography (UPLC): Method development and assessment. SETAC North America 32nd Annual Meeting in Boston, MA. Nov. 15, 2011.

The explosion of the Deepwater Horizon oil platform on April 20, 2010, resulted in an unprecedented release of crude oil in the Gulf of Mexico. Much of the oil and the dispersants used impacted salt marshes and beaches around the Gulf, with numerous species of birds documented as being exposed. While the use of dispersants in an oil spill response involves tradeoffs between effects to the shoreline and effects to pelagic and deep-sea environments, relatively little is known on the effects that the oil-associated polycyclic aromatic hydrocarbons (PAHs) have upon the health of avian populations. Circulating blood-borne, parent PAHs can provide a direct link for exposure assessment and

reconstruction since they are not as affected by differences in metabolism and excretion. There are a couple of challenges in analyzing whole blood and red blood cells (RBCs) from live-captured birds that make quantitation more difficult; minimal sample volume (0.1- 0.5 ml) can be obtained without being detrimental and the target analytes are less abundant by volume in circulating RBCs in contrast to whole blood. We developed a novel method for the analysis of 16 PAHs utilizing ultra-performance liquid chromatography coupled to photodiode array, fluorescence, and tandem mass spectrometry detectors. This rigorous method obtained good recoveries of standard reference material (60-95%), matrix spikes (60-95%), calibration verifications (90-95%), and surrogates (85%) while obtaining good sensitivity of at least 5ng/g for PAHs and for Dispersants. This method was developed in support of an ongoing study examining uptake and exposure in migrating Peregrine Falcons and other birds.

Johnson, J.A., S.L. Talbot, G.K. Sage, K.K. Burnham, J.W. Brown, T.L. Maechtle, W.S. Seegar, M.A. Yates, B. Anderson, D.P. Mindell. 2010. The Use of Genetics for the Management of a Recovering Population: Temporal Assessment of Migratory Peregrine Falcons in North America. PLoS ONE 5(11): e14042. doi: 10.1371/journal.pone.0014042

Background: Our ability to monitor populations or species that were once threatened or endangered and in the process of recovery is enhanced by using genetic methods to assess overall population stability and size over time. This can be accomplished most directly by obtaining genetic measures from temporally spaced samples that reflect the overall stability of the population as given by changes in genetic diversity levels (allelic richness and heterozygosity), degree of population differentiation (FST and DEST), and effective population size (Ne). The primary goal of any recovery effort is to produce a long- term self-sustaining population, and these genetic measures provide a metric by which we can gauge our progress and help make important management decisions.

Methodology/Principal Findings: The Peregrine Falcon in North America (Falco peregrinus tundrius and anatum) was delisted in 1994 and 1999, respectively, and its abundance will be monitored by the species Recovery Team every three years until 2015. Although the United States Fish and Wildlife Service makes a distinction between tundrius and anatum subspecies, our genetic results based on eleven microsatellite loci suggest limited differentiation that can be attributed to an isolation by distance relationship and warrant no delineation of these two subspecies in its northern latitudinal distribution from Alaska through Canada into Greenland. Using temporal samples collected at Padre Island, Texas during migration (seven temporal time periods between (1985–2007), no significant differences in genetic diversity or significant population differentiation in allele frequencies between time periods were observed and were indistinguishable from those obtained from tundrius/anatum breeding locations throughout their northern distribution. Estimates of harmonic mean Ne were variable and imprecise, but always greater than 500 when employing multiple temporal genetic methods.

Conclusions/Significance: These results, including those from simulations to assess the power of each method to estimate Ne, suggest a stable or growing population, which is consistent with ongoing field-based monitoring surveys. Therefore, historic and continuing efforts to prevent the extinction of the Peregrine Falcon in North America appear successful with no indication of recent decline, at least from the northern latitude range-wide perspective. The results also further highlight the importance of archiving samples and their use for continual assessment of population recovery and long-term viability.

Henny, C.J., M.A. Yates, W.S. Seegar. 2009. Dramatic Declines of DDE and Other Organochlorines in Spring Migrant Peregrine Falcons from Padre Island, Texas, 1978–2004. J. Raptor Res. 43(1):37-42.

Peregrine Falcons (Falco peregrinus) captured in the spring at Padre Island, Texas, nest across the arctic and subarctic from Alaska to Greenland and winter throughout Latin America. Padre Island, located immediately north of the Mexican border, is the peregrines' first landfall in the U.S.A. after spending about 6 mo in Latin America. Blood plasma was collected from spring migrants at Padre Island between 1978 and 2004 to monitor trends in organochlorine (OC) pesticides and their metabolites. Geometric mean concentrations of p, p9-DDE (mg/g, ww) decreased throughout the study: 1978–1979 (0.879), 1980 (0.617), 1984 (0.551), 1994 (0.406) and 2004 (0.013). Most other OC pesticides, with detection limits used during the earlier portion of this study, were no longer detected during the last two sampling periods. The reduced concentrations of OC pesticides suggest that other pesticides (including carbamates, organophosphates and pyrethroids) are likely being used as replacements. These replacement compounds are not as persistent and cannot be readily evaluated at migration sites like Padre Island. However, concentrations of flame retardants (polybrominated diphenyl ethers; PBDEs) have recently increased in bird eggs in many regions and have been reported in blood plasma. Concentrations of PBDEs in peregrine plasma could be evaluated at Padre Island for assessment of trends in the Americas.

Johnson, J.A. and D. P. Mindell 2007. Temporal population genetic stability of Peregrine Falcons migrating through Padre Island, Texas. Poster presentation at throne Hundred and Twenty-Fifth Stated Meeting of the American Ornithologists' Union**,** University of Wyoming, Laramie, WY. August 2007.

Temporal samples were collected from Peregrine Falcons during both fall and spring migration at Padre Island, TX. Three temporal periods (1985 - 1986, 1988 - 1989, and 2006 - 2007) were analyzed using 11 microsatellite loci. No significant differences in genetic diversity (number of alleles and heterozygosity) were observed within a migration period or between years, and no significant differences in allele frequencies were identified across temporal periods. Estimates of variance effective population size (Ne) were also quite high. Assuming panmixia across breeding territories in North America for migrant Peregrine Falcons, these genetic results indicate that the population is doing well due to extensive efforts to prevent extinction following their precipitous decline in the mid-20th Century.

Fuller, M.R., W.S. Seegar, L. Schueck, G. Young., K. Thorup, A. Hedenstrom. Peregrine Falcon Migration in the Western Hemisphere. Presentation at the Raptor Migration, Ecology and Conservation in the New World Symposium, held in conjunction with the North American Ornithological Conference, Veracruz, Mexico. October 2006.

We radio marked adult female Arctic Peregrine Falcons (*Falco peregrinus tundrius*) at nests in West Greenland, the northern Ungava Peninsula and Rankin Inlet, Canada, and on Assateague and Padre Islands, USA. During southward migration, falcons leaving Greenland often paused before crossing the Davis Strait. Some individuals stopped for 4 or more days during migration, but we found no consistent stopover strategy. Analyses of meteorological data from Canada and the USA during sample southward migrations suggest that peregrines are affected more by the winds on the morning of migration than by winds the morning after, and that tailwinds affect the likelihood of migration and the migration distance. Some falcons migrated near coastlines, but others made water crossings of more than 1,000km. However, detours from direct routes occurred commonly. Generally, the movement patterns are described best by geographical courses, and in no cases do the tracks indicate the use of constant geomagnetic courses. At least five Peregrine Falcons made a loop migration, southward along the eastern seaboard to Central and South America, then north into southern Canada via the central USA. Average migration rates varied from 142 to 282 km per day among bands of latitude. The average southward migration was 162 km/day and northward was 149 km/day.

Dusek, R. J., E. K. Hofmeister, W. S. Seegar, M. A. Yates, T. L. Maechtle, and B. J. Dayton. 2005. Prevalence of West Nile Virus in Peregrine Falcons. Poster presentation, Proceedings of the Raptor Research Foundation annual meeting, Green Bay, WI.

Since West Nile Virus (WNV) was discovered in New York City, New York in 1999, it has quickly spread throughout the continental United States, much of Canada, central America and the Caribbean. Yearly outbreaks of this disease have continued into 2005 causing mortality in tens of thousands of wild birds and likely will never disappear from the western hemisphere. Morbidity and mortality from WNV have been reported quite commonly in raptors, especially in Ohio in 2002 and then again in Colorado in 2003, but little is known about the impact or prevalence of this disease in this group of birds. In 2001 we initiated a study to determine the prevalence of specific WNV neutralizing antibody in Peregrine Falcons during migration at Assateague Island, Maryland and Virginia (fall only), and South Padre Island, Texas (spring and fall). Peregrine Falcons have been monitored through observation and banding for 35 and 28 years respectively at these two locations. From fall of 2001 through the spring of 2005 more than 650 blood samples have been tested by PRNT for WNV antibody. Prevalence of antibody has increased from 2.0% in fall 2001 to 14.7% in spring of 2005. During 1999-2004 capture success and observations have declined when compared against the 10-yr average 1988-1998 at Assateague Island, however, this decline cannot be directly attributed to WNV based on our data. Results from this study reflect the increasing prevalence of WNV throughout North America. Based on our data continued monitoring and research are warranted.

APPENDIX – III - Band Information - 2024

Previously Banded Padre Returns:

Band #	Date	Age	Sex	Captured By	First Banded By	Age	Date	Comments
2447-04533	4/11/2024	SY	F	W. Seegar	R. McGuire	HY	9/29/2023	
2447-04503	4/13/2024	ASY	F	M. Yates	N. Todd	SY	9/29/2023	
2447-04572	4/14/2024	SY	F	M. Yates	H. Weaver	HY	10/9/2023	
1947-56036	4/25/2024	ASY	F	M. Yates	G. Doney	HY	10/9/2022	4th RTRN - 2023- SPR (MAY), Fall (GED)
1947-48432	9/29/2024	ASY	F	R. McGuire	S. Voss	HY	10/15/2021	3rd RTRN- G. Doney-SY- 9/30/2022
2447-04503	10/22/2024	ASY	F	G. Doney	N. Todd	SY	9/29/2023	3rd RTRN - M. Yates-4/13/2024

Foreign Captures & Recoveries:

Band #	Band Date	Age	Sex	First Banded	Location	Captured/ Reported By	Date	Age	Location	Status	Comments
1947-50631	6/26/2023	HY	F		Ashland, WI	M. Yates	4/11/2024	SY	SPI, TX	FCAP	Nestling

Status Codes:

RTRN – Padre Returns, FCAP – Foreign capture of falcon banded at Padre, FRTR – Capture of a falcon banded elsewhere, RCOV – Band recovery – found dead