Autumn 2015

PINTAIL ACTION GROUP

Newsletter

in this issue...

- Report from outgoing Chair (Bob Clark)
- Next meeting – 7th NA Duck Symposium & Workshop
- Pintail Population - Status and Trends
- Web site status – looking for a new home!
- Research Updates - Wintering, Migration, Breeding Areas
- News (some old news!) about PAG and Members
- Recent Publications

Pintail Action Group

Report from outgoing Chair

(Bob Clark, Environment Canada and University of Saskatchewan)

The past three years seem to have flown by and - although the PAG met officially only once during this period (Feb 2015, Memphis) – there has been considerable progress in terms of both field- and model-based studies of pintails since 2012. Some of these advances are described in this Newsletter or in papers listed in Recent Publications.

Pintails remain a source of concern, as suggested by the ongoing low population estimate (see Status and Trends section below). We have an improved understanding of factors limiting population growth rate – low reproductive success of prairie-nesting pintails being a noteworthy reason – and probably the greatest conservation challenge is implementing (and evaluating) the actions needed to improve the productive capacity of prairie landscapes. We need to restore wetlands and native grasslands on breeding areas, but this is challenging process. Furthermore, retaining existing habitat on breeding and nonbreeding areas is by no means assured, given changing demands for food and water, expanding oil and gas development and the specter of more extreme climatic events, such as droughts and floods.

I have to extend well-deserved credit to the many members of the PAG who have continued to push forward with development of the pintail annual life-cycle model (led initially by Brady Mattsson and more recently by Erik Osnas).

Bart Ballard (Texas A&M University-Kingsville) is the incoming Chair of the PAG, and I wish him well. Bart and I will be tapping shoulders as we look for a co-Chair who will take over the reins from Bart in due course.

Pintail Action Group members attended a meeting in Memphis, Feb 2015, following on the footsteps of a NSST meeting on integration.

Left to right: Mitch Weegman, Caroline Brady, Greg Yarris, Barry Wilson, Josh Vest, Bart Ballard, Joe Fleskes, Erik Osnas, Mike Brasher, Jim Devries, Kevin Ringelman, Bob Clark, Todd Arnold, John Eadie; missing: Mike Anderson, Dave Duncan, Dave Howerter, Ken Richkus. PHOTO CREDIT: DALE HUMBURG

Next Meeting - 7th North American Duck Symposium

PAG members will meet jointly with the Scaup Action Team at the Duck Symposium in Annapolis (Feb 2016), and I hope there will be a great turnout for this meeting to discuss recent results, share experiences, concerns and opportunities, and look ahead to new challenges.

The meeting will be held at the Westin Hotel, Senate A/B room, on Tuesday, 2 Feb 2016 from 6 to 7:30 PM. Watch for more news about this meeting on the NADS7 web site: **www.northamericanducksymposium.org**.

Pintail Population Status and Trends

(source: Zimpfer et al. 2015. Trends in Breeding Duck Populations, 1955-2015. USFWS report, Laurel, MD)

For the traditional survey area, the northern pintail abundance estimate (3.0 ± 0.2 million) was similar to that of 2014, and 24% below the long-term average of 4.0 ± 0.04 million. Yet, prairie pond counts were 21% higher than the long-term average in 2015, and mallard populations estimates (11.6 ± 0.4 million) were the highest recorded, 51% above the long-term average of 7.7 ± 0.04 million.

Website

A new home for the PAG web site is needed. Prairie Habitat Joint Venture has offered to host the PAG site **http://phjv.ca/**, courtesy of Deanna Dixon, Canadian Wildlife Service. Other offers are welcomed and hopefully a decision can be reached at the February meeting in Annapolis.

Research Updates

Wintering areas

CALIFORNIA WATERFOWL ASSOCIATION - PRE & POST-SEASON PINTAIL BANDING EFFORTS

(communicated by Caroline Brady, CWA)

As a direct result of the Pintail Workshop held in California in 2001, a comprehensive pintail banding program was developed. Beginning in 2006, the California Waterfowl Association (CWA) in partnership with the California Department of Fish & Wildlife (DFW) has been trapping pintails in the Central Valley and North Eastern California (NECA). Banding goals for CWA during pre-season is 500 pintails; DFW has a goal of 1,000. Those capture events take place in the Central Valley beginning in September and conclude with the onset of the waterfowl season. Post-season trapping efforts are led by CWA with a goal of banding 1,000 pintails during the months of February and March. Trapping begins in the Sacramento Valley in February, and crews move north to the Klamath Basin as the birds begin their spring migration.

While weathering our third consecutive year of drought in 2014, the impacts on pintail banding became strikingly evident during the 2014 post-season pintail trapping efforts. Anecdotally, it seemed as though pintails did not stay in the Sacramento Valley as long as they usually do. There were significantly fewer acres of planted rice in 2014 coupled with reduced water for rice straw decomposition. As the crew moved up to NECA we were met with little to no water on the majority of Lower Klamath NWR and Tule Lake NWR. It seemed as though pintails either left the Klamath Basin shortly after arriving or they bypassed it all together. In addition to poor trapping conditions, there are always the typical issues crews run into; dropping water levels, eagles, bird watchers, coordinating trapping efforts around the youth hunt and late goose season, etc. As an aside, in 2014 despite our low pintail numbers we did succeed in capturing 694 American wigeon, and 6 Eurasian wigeon.

In contrast to last year's post-season all-time low, 2015 kicked off with a great start and was highly successful (see summary Table, right). The majority of birds were captured in the Sacramento Valley, breaking the record for most pintails trapped during post-season in the Valley. Water issues in the Klamath Basin continue to be a concern; conditions were still incredibly dry. Despite the limited opportunity we had one successful capture event which put us over our quota. Post-season trapping concluded with 1010 NOPI and a handful of other birds. The 2015 pre-season pintail trapping is currently underway in the Sacramento Valley. Although water is limited the banding crew has had one successful shot, and a few other sites with potential.

NORTHERN PINTAIL BANDING SUMMARY - CALIFORNIA WATERFOWL ASSOCIATION

POST-SEASON:

YEAR	BANDING REGION	TOTAL BY REGION	TOTAL
2006	Sacramento Valley	533	
	Klamath Basin	686	1219
2007	Sacramento Valley	366	
	Klamath Basin	908	1274
2008	Sacramento Valley	455	
	Klamath Basin	630	1085
2009	Sacramento Valley	283	
	Klamath Basin	752	1035
2010	Sacramento Valley	134	
	Klamath Basin	443	577
2011	Sacramento Valley	441	
	Klamath Basin	559	1000
2012	Sacramento Valley	586	
	Klamath Basin	519	1105
2013	Sacramento Valley	662	
	Klamath Basin	464	1126
2014	Sacramento Valley	250	
	Klamath Basin	139	389
2015	Sacramento Valley	920	
	Klamath Basin	90	1010
			9,820

PRE-SEASON:

YEAR	BANDING REGION	TOTAL BY REGION	TOTAL
2006	San Joaquin Valley	316	316
2007	San Joaquin Valley	522	
	Sacramento Valley	74	596
2008	Sacramento Valley	181	619
2009	San Joaquin Valley	115	
	Sacramento Valley	119	234
2010		0	
2011	Sacramento Valley	545	545
2012	Sacramento Valley	806	806
2013	Sacramento Valley	447	447
2014	Sacramento Valley	352	352
*2015	Sacramento Valley	63	63
			3,978

Pintail banding by California Waterfowl Association has been conducted in association with several collaborating agencies, including - California Department of Fish and Game, USGS Western Ecological Research Center, US Fish and Wildlife Service, and many private landowners.

** 2015 pre-season is currently in progress*

Research Updates

IMPACTS OF CLIMATE CHANGE ON WATERBIRDS OF THE CENTRAL VALLEY

(communicated by Joe Fleskes, USGS)

Dr. Joe Fleskes and Elliott Matchett, USGS Western Ecological Research Center, have a CA-LCC-supported project that is investigating the projected impacts of climate, urbanization, and water supply management on the habitats and ecology of waterbirds in California's Central Valley. The project has adapted a water management model to more accurately represent water needs of waterbird habitat in the Central Valley. After applying that model to estimate area of waterbird habitat that can be managed using projected water supplies, avian bioenergetics models are used to evaluate adequacy of food supplies for Central Valley Joint Venture goal waterfowl populations under each climate, urbanization, and water supply management scenario. This project illustrates a method that waterbird conservation managers can use to evaluate impacts of climate change and proposed changes in water supply management on their habitat planning and sheds light on future management needs for Central Valley waterbird species and habitats.

WINTERING PINTAIL RESEARCH ALONG THE TEXAS COAST

(communicated by Bart Ballard, Texas A&M University-Kingsville)

Texas Parks and Wildlife Department and the Caesar Kleberg Wildlife Research Institute at Texas A&M University-Kingsville initiated a project investigating nutrient reserve dynamics of female northern pintails along the Texas coast. Geographic variation in winter survival rates of female pintails provides uncertainty as to how this vital rate plays a role in the long-term population decline. In particular, recent research has shown considerably low survival rates for female pintails throughout the central coast of Texas. Additionally, pintails have been found to catabolize a high proportion of stored lipids and protein across winter along the lower Texas Coast. The Texas Coast is one of the most important wintering areas for waterfowl in North America and is the most important wintering area for waterfowl in the Central Flyway, wintering up to 78% of Central flyway pintails. However, wetland habitats along the Texas Coast have been lost or degraded over the past 5 decades, particularly habitats important to pintails. Collectively, these findings suggest that habitat conditions along the Texas Coast may not be optimal to support current wintering populations of northern pintails. The objectives of the research are to estimate nutrient reserve dynamics of female northern pintails collected throughout the Texas Coast across winter, estimate energy and nutrient composition of their diet, investigate changes in gut morphology, and determine molt chronology and intensity. Although the study area encompasses the entire Texas Coast, a focus is placed on the central coast where considerable land use changes are occurring due to a decline in acreage planted in rice. The project addresses the top research priority of Texas Parks and Wildlife Department's Waterfowl Strategic Plan and will be completed in March 2016.

Research Updates

Migration areas

KLAMATH BASIN

(communicated by Josh Vest, Science Coordinator, Inter-Mountain West JV)

The information from the Pin-Sat studies conducted in the Central Valley of California have been critical to conservation planning in the Intermountain West JV (IWJV) for spring-migrating waterfowl in southern Oregon-northeastern California (SONEC). The Pin-Sat studies were directly related to the PAG. IWJV has worked closely with Joe Fleskes and Mark Petrie in developing conservation objectives based on that work and results of subsequent studies regarding habitat selection, foraging ecology, and waterfowl food-energy density assessments in important habitats (Petrie et al. 2013). Born out of that planning a focused and substantial implementation partnership has evolved and is likely to focus several million dollars of habitat funding to bear on that landscape to benefit spring migrating waterfowl. At the core of this implementation strategy is a focus on working wetlands, particularly wet meadow and flood-irrigated habitats used for pasture and hay production. From this initiative the IWJV and partners have developed a technical report (Vest et al. 2014) and webinar (**https://vimeo.com/119271759**) for NRCS and other practitioners regarding working lands conservation for spring migrating waterfowl. See the IWJV website (**www.iwjv.org**) for more information.

Also, Oregon State Univ., UC-Davis, USGS, the western JVs, DU, and other Pacific Flyway partners are working on an assessment of drought impacts to waterfowl - and pintails make up a substantial part of that population. California and southern Oregon remain in historical drought conditions which have either triggered or accelerated water resource conflicts, and this does not bode well for migratory bird habitat. Related to this, Megan C. Zarzycki (MSc student) and Bruce Dugger at Oregon State University are looking at relationships between wintering and spring migration habitat conditions relative to continental production indices for pintails.

Breeding areas

PINTAIL BANDING IN SASKATCHEWAN AND ALBERTA

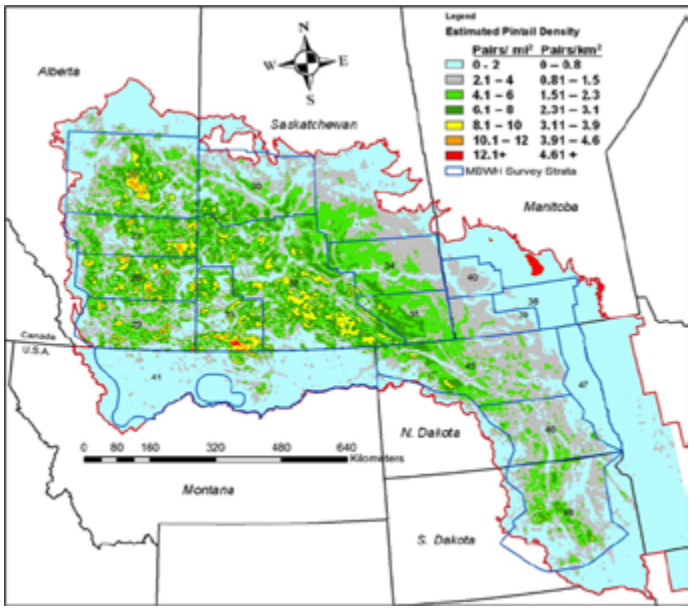
(communicated by Blake Bartzen, Kevin Dufour and Dave Duncan).

Since 2005, Canadian Wildlife Service (Saskatoon) has focused its pre-season banding efforts on pintails with funding and in-kind assistance from California Waterfowl Association, Alberta NAWMP (AB NAWMP), US Fish and Wildlife Service, Environment Canada Science and Technology Branch, and Alberta Environment and Sustainable Resource Development.

In 2015, CWS operated two banding sites. Although precipitation conditions were exceptionally dry from May to July, there was still a lot of residual water on the landscape from the previous wet years. After preliminary reconnaissance of several candidate sites throughout Alberta and Saskatchewan, CWS settled on Kutawagan and Barber Lake, SK, because of favorable water and duck conditions at those sites. In total, 3,084 ducks were banded, and 1060, 35%, were pintails; this number is considerably lower than the average (± SD) of the previous 10 years (2005-2014) of 3527 ± 1298 pintails but seems to be part of an ongoing decreasing trend also experienced by other duck banding crews working in Prairie Canada. Consequently, CWS will be considering some alternative capture methods for future years.

Preliminary survival/recovery analyses of Prairie Canada pintail data are underway. Initial analyses suggest survival rates for pintails banded in Prairie Canada are comparable to rates from other studies and regions. Although estimates of the rates have not changed in recent years, the precision of the estimates has increased by nearly 33 % due to the larger sample size resulting from the increased banding efforts. Further analyses will answer questions such as, how many birds do we need to band to achieve specified levels of precision (i.e., CV's) for banding periods of various lengths? These analyses will be used to inform conservation and management questions and will help guide future banding efforts.

Research Updates



MULTI-SCALE INFLUENCES ON PINTAIL HABITAT SELECTION AND NEST SURVIVAL IN THE PRAIRIE POTHOLE REGION

(communicated by Jim Devries; also see Devries, 2014 in the Recent Publications section)

Understanding the interplay between breeding habitat selection and breeding success at multiple scales is of interest for species conservation both from theoretical and applied perspectives. Declining pintail populations, especially on prairie breeding grounds, suggest that habitat loss and changing land use may have decoupled formerly reliable fitness cues from selection of suitable nest habitat. My objectives, therefore, were, 1) to better understand how pintails select breeding landscapes within the Prairie Pothole Region (PPR), 2) to understand factors affecting nest habitat selection and nest survival at local scales, and 3) to integrate these findings into predictive tools for use in conservation planning and population modeling.

I used data from 62 waterfowl nesting study sites in prairie Canada (1997–2009), to examine whether nest survival, a primary fitness metric, at nest and habitat patch scales, was predictive of habitat selection at corresponding scales (Devries 2014, see Recent Publications section below). In addition, I used systematic long-term annual pintail population monitoring data (1961–2009), and recruitment indices (juvenile:adult female ratio) from hunter harvest, to examine adaptive habitat selection among landscapes within the Prairie Pothole Region (PPR). The influences of breeding population density and landscape composition were examined at all scales. At nest and patch scales, pintail nest survival varied with nest initiation date, nest habitat, pair density, and landscape composition. Nest habitat preference reflected patterns in nest survival suggesting nest habitat preference is adaptive. Preference was generally low for habitats with low nest survival (e.g., spring-seeded cropland) and high for habitats with high nest survival (e.g., fall-seeded cropland, idle grassland). Differences in preference among habitats weakened at high breeding density and in landscapes with more grassland. Population-level recruitment tended to be greater when pintails settled in landscapes that were wetter than normal, contained more grassland, and were moderately variable in local elevation. Pintails were strongly associated with wetter than normal landscapes but shifted into cropland-dominated landscapes and flatter landscapes when populations were high. While spring-seeded cropland does not fit the definition of an ecological trap, a high percentage of pintail nests can occur in this habitat in landscapes that are crop-dominated.

Results from the above analyses were used to, 1) model and map the estimated long-term average spatial abundance of pintail pairs across the PPR as a function of landscape-level covariates, and 2) construct a deterministic model predicting pintail productivity (i.e., hatched nests) given local pintail population, nest habitat availability, and landscape attributes. These models allow spatially-specific analysis of various conservation and land use change scenarios on population productivity for conservation planning and population modelling.

Research Updates

ANNUAL LIFE-CYCLE AND OTHER MODELLING INITIATIVES

– also see Recent Publications.

MODELING PINTAIL POPULATION DYNAMICS TO LINK HABITAT AND HARVEST

(communicated by Erik Osnas)

Northern pintail have been selected as a priority species for implementing the integration of harvest management with habitat management policy. The mathematical framework has been developed for pintails in previous work (Mattsson et al. 2012). Efforts now underway are attempting to parameterize this model from existing data and test assumptions (i.e., function relationships) made during the development of that model. A key assumption of the developed model is that density-dependence in survival occurs during the post-hunting (winter) period, where resources are hypothesized to be limiting. Because little data are available to directly inform this process, the approach used is to build a hierarchical Bayesian "integrated population model" that simultaneously uses data from band recoveries, breeding population counts, and fall age ratios to estimate parameters of an annual population projection model. This allows for estimation of process and observation error variances in addition to survival, reproduction, and population count parameter estimates that are logically consistent with each other and with the mathematical structure imposed through the population model.

The main findings so far are that while there is considerable evidence for density-dependent recruitment in pintail, there is limited evidence of density-dependence in survival during the post-hunting season period over the range of population sizes from 1960-2012. Instead, there is remarkable consistency in hunting and non-hunting season survival rates across years that varied in harvest rates and presumably habitat conditions. An exception was for juveniles where survival was lower during the 1960s and 70s. Habitat effects, as indexed by cumulative rainfall on wintering areas, were not well estimated for survival but showed a limited effect on productivity ("cross-seasonal effect").

The habitat management implications of this pattern are obvious—proportionate habitat improvements through management interventions, agricultural practice, or climate will have much greater population impact when applied to the breeding grounds, at least at current demographic rates and within the range of historical experience. Thus, in terms of integrating habitat and harvest policy, higher harvest yields can be achieved through improved breeding habitat as compared to wintering habitat. Massive habitat loss on the wintering ground—beyond anything experienced during the last several decades—could of course reverse the expected payoff of habitat improvements and continued maintenance of quality wintering habitats is necessary.

Research Updates

MIGRATORY SPECIES ECONOMICS: PINTAIL CASE-STUDY FOR CONSERVATION INNOVATION

(communicated by Wayne Thogmartin and Brady Mattsson)

Brady Mattsson (BOKU), Wayne Thogmartin (USGS), Kenneth Bagstad (USGS), James Diffendorfer (USGS), James Dubovsky (FWS), Joshua Goldstein (TNC), John Loomis (CSU), Laura López-Hoffman (UofAz), Darius Semmens (USGS), Ruscena Wiederholt (UofAz)

Conservation spending on species, ecosystems, and their attendant biodiversity is approximately $7.48 billion in the United States and $1.08 billion in Canada. The challenge of optimally allocating such conservation spending is particularly acute for migratory species protection, especially when their breeding, migratory, and wintering habitats cross international borders. Many migratory species, such as the northern pintail, generate valuable ecosystem services and underlie important economic activities. When migratory species habitats cross multiple jurisdictions, successful conservation requires not only coordination among diverse stakeholders and governments but also information regarding how spatially explicit conservation strategies will influence their population dynamics and associated ecosystem services that they provide at multiple scales. We leveraged a model describing the population dynamics of the northern pintail (Mattsson et al. 2012[1]), along with economic valuation of pintail sport harvest ($22.4 million annually), recreational viewing ($26.2 million annually), and Arctic subsistence hunting ($63,000 annually[2]), along with estimates of population-level contributions to population dynamics, to determine how economic value moves through the system of populations as a function of migrational processes. Pintails are hatched in the prairie potholes, northern Canada, and Alaska, but much of the value of this species is collected (harvested) in California and the Gulf Coast. Our calculations indicate the prairie pothole region provides the largest subsidy to other regions – $11.9 million annually – with California receiving a similarly large annual subsidy from other regions ($12.6 million). Subsidies in the remaining regions are more modest, with northern Canada and the Gulf Coast providing annual subsidies of $2.1 and $1.2 million to other regions, respectively, and Alaska receiving an annual subsidy of $2.7 million from other regions. This information on spatial subsidies can help inform whether conservation funding is efficiently allocated across a species' range; this subsidy information can also inform cases where society is underinvesting in migratory species conservation.

This 'migratory species economics' effort began as an interdisciplinary collaboration under the auspices of a USGS John Wesley Powell Center for Analysis and Synthesis Working Group titled "Animal Migration and Spatial Subsidies: Establishing a Framework for Conservation Markets." The northern pintail subgroup of this working group will soon complete incorporation of Canada Nature Survey data into their preliminary valuation of pintail recreational viewing; these data will then allow the subgroup to submit their valuation findings to the Journal of Environmental Management[3].

The economics subgroup of this working group will follow soon thereafter with submission of a manuscript to Ecological Economics describing the spatial subsidies results. Finally, the group is using the pintail case study as part of a newly funded NIMBioS Working Group titled "Estimating area-specific contributions to the population dynamics of migratory species," which is a critical yet understudied element for estimating the spatial economic subsidies.

1 Mattsson, B. J., M.C. Runge, J.H. Devries, G.S. Boomer, J. M. Eadie, D.A. Haukos, J.P. Fleskes, D.N. Koons, W.E. Thogmartin, & R.G. Clark. 2012. A modeling framework for integrated harvest and habitat management of North American waterfowl: Case-study of northern pintail metapopulation dynamics. Ecological Modeling 225: 146–158.

2 Goldstein, J. H., W. E. Thogmartin, K. J. Bagstad, J. A. Dubovsky, B. J. Mattsson, D. J. Semmens, L. López-Hoffman & J. E. Diffendorfer. 2014. Replacement cost valuation of northern pintail (Anas acuta) subsistence harvest in Arctic and Sub-Arctic North America. Human Dimensions of Wildlife 19: 347-354.

3 Mattsson, B. J., J. A. Dubovsky, W. E. Thogmartin, K. J. Bagstad, J. H. Goldstein, J. Loomis, J. E. Diffendorfer, D. J. Semmens, and L. López-Hoffman. Recreation economics of an individual migratory species throughout its annual cycle: Northern pintail case study. Journal of Environmental Management, In revision.

News (and some old news!) about PAG members

- Mike Anderson, retired in 2013, and is now an Emeritus Scientist with DU Canada (Winnipeg). Mike remains a strong NAWMP activist!
- Dave Duncan, CWS, retired in 2015.
- Dave Haukos, moved to a COOP leadership position at Kansas State University.
- Karla Guyn is the Director of Conservation Programs for DU Canada's nation-wide operations.
- Brady Mattsson, USGS, has moved to Vienna, Austria, and remains engaged in the pintail modelling studies.
- Erik Osnas, accepted a position with US Fish & Wildlife Service and moved to Anchorage, Alaska.
- Kevin Ringelman currently holds a faculty position at Louisiana State University.
- Mitch Weegman completed his PhD at University of Exeter, UK, and is conducting a post-doctoral fellowship at University of Minnesota modelling population dynamics of pintails and other birds.

Recent Publications

(since 2012; note that all reports contain some information specific to pintails)

Ackerman, J.T., Herzog, M.P., Yarris, G.S.,Casazza, M.L., Burns, E. & Eadie, J.M. 2014. Chapter 5: Waterfowl ecology and management. In P.B. Moyle, A. Manfree & P.L. Fiedler (eds.), Suisun Marsh: Ecological History and Possible Futures, pp. 103–132 and maps 10 & 11. University of California Press, Berkeley, California, USA.

Austin, J., S. Slattery, & R.G. Clark. 2014. Waterfowl populations of conservation concern: Learning from diverse challenges, models and conservation strategies. Wildfowl Special Issue 4: 470-497.

Baldassarre, G.A. 2014. Ducks, Geese and Swans of North America, Volume 1. John Hopkins University Press.

Barker, N.K.S., S.G. Cumming, and M. Darveau. 2014. Models to predict the distribution and abundance of breeding ducks in Canada. Avian Conservation & Ecology 9: 7. **http://www.ace-eco.org/vol9/iss2/art7/**

Clark, R.G., J.P. Fleskes, K.L. Guyn, D.A. Haukos, J.E. Austin & M.R. Miller. 2014. Northern Pintail (Anas acuta), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: **http://bna.birds.cornell.edu/bna/species/163** *doi:***10.2173/bna***.163 (requires access to the BNA site).*

Casazza, M.L., P.S. Coates, M.R. Miller, C.T. Overton, and D.R. Yparraguirre. 2012. Hunting influences the diel patterns in habitat selection by northern pintails Anas acuta. Wildlife Biology 18(1): 1-13.

Coates, P.S., M.L. Casazza, B.J. Halstead, and J.P. Fleskes. 2012. Relative value of managed wetlands and tidal marshes for wintering pintails. Journal of Fish and Wildlife Management 3(1): 98-109.

Dalby, L., A.D. Fox, I.K. Petersen, S. Delany, and J.-C. Svenning. 2013. Temperature does notdictate the wintering distributions of European dabbling duck species. Ibis 155(1): 80-88.

Davis, J.B., M. Guillemain, R.M. Kaminski, C. Arzel, J.M. Eadie and E.C. Rees. 2014. Habitat selection and resource use by waterfowl in the northern hemisphere in autumn and winter. Wildfowl Special Issue 4: 17-69.

Devries, J.H. 2014. Fitness consequences of avian habitat selection in dynamic landscapes: multi-scale evaluations in northern pintails. PhD thesis, Biology, University of Saskatchewan **http://ecommons.usask.ca/bitstream/handle/10388/ETD-2014-10-1788/DEVRIES-DISSERTATION.pdf?sequence=4**

Fitzsimmons, O.N., B.M. Ballard, M.T. Merendino, G.A. Baldassarre, and K.M. Hartke. 2012. Implications of coastal wetland management to nonbreeding waterbirds in Texas. Wetlands 32(6): 1057-1066.

Goldstein, J.H., W.E. Thogmartin, K.J. Bagstad, J.A. Dubovsky, B.J. Mattsson, D.J. Semmens, L. López-Hoffman & J.E. Diffendorfer. 2014. Replacement cost valuation of northern pintail (Anas acuta) subsistence harvest in Arctic and Sub-Arctic North America. Human Dimensions of Wildlife 19: 347-354. DOI:10.1080/10871209.2014 .917345

Grant, T.A., T.L. Shaffer, E.M. Madden, and G.B. Berkey. 2011. Ducks and passerines nesting in northern mixed-grass prairie treated with fire. Wildlife Society Bulletin 35(4): 368-376.

Hagy, H.M. and R.M. Kaminski. 2012. Apparent seed use by ducks in moist-soil wetlands of the Mississippi Alluvial Valley. Journal of Wildlife Management 76(5): 1053-1061.

Johnson, W.P., P.M. Schmidt, and D.P. Taylor. 2014. Foraging flight distances of wintering ducks and geese: A review. Avian Conservation & Ecology 9: 2.

Kowalchuk, T.A. 2012. Breeding ecology of northern pintails in prairie landscapes: tests of habitat selection and reproductive trade-off models. PhD thesis, Department of Biology, University of Saskatchewan. 148 pp.

Loesch, C.R., J.A. Walker, R.E. Reynolds, J.S. Gleason, N.D. Niemuth, S.E. Stephens, and M.A.

Erickson. 2013. Effect of wind energy development on breeding duck densities in the prairiepothole region. Journal of Wildlife Management 77: 587-598.

O'Neal, B.J., J.D. Stafford, and R.P. Larkin. 2012. Stopover duration of fall-migrating dabbling ducks. Journal of Wildlife Management 76(2): 285-293.

Osnas, E.E., M.C. Runge, B.J. Mattsson, J. Austin, G.S. Boomer, R.G. Clark, P. Devers, J.M. Eadie, E.V. Lonsdorf & B.G. Tavernia. 2014. Managing harvest and habitat as integrated components. Wildfowl (Special issue) 4:305-328.

Petrie, M, J. Vest, D. Smith. 2013. Chapter Four: Waterfowl. Intermountain West Joint Venture Implementation Plan. Intermountain West Joint Venture, Missoula, MT, USA. Online: **http://iwjv.org/sites/default/files/iwjv_implementationplan-ch4.pdf**

Pieron, M.R., M.J.K. Darr, and F.C. Rohwer. 2012. Duck nest success adjacent to predator reduced sites. Journal of Wildlife Management 76(7): 1450-1455.

Pieron, M.R., F.C. Rohwer, M.J. Chamberlain, M.D. Kaller, and J. Lancaster. 2013. Response ofbreeding ducks pairs to predator reduction in North Dakota. Journal of Wildlife Management 77:663-671.

Sedinger, J.S. and M.P. Herzog. 2012. Harvest and dynamics of duck populations. Journal of Wildlife Management 76(6): 1108-1116.

Taylor, D.P., J.N. Vradenburg, L.M. Smith, M.B. Lovern, and S.T. McMurry. Effects of anthropogenic and environmental stress on the corticosterone levels of wintering northern pintails (Anas acuta). Canadian Journal of Zoology 92: 185-193.

Vest, J. L., W. D. Smith, D. Casey, J. P. Fleskes, and M. J. Petrie. 2013. Farm bill conservation programs can help meet the needs of spring-migrating waterfowl in Southern Oregon-Northeastern California. Natural Resources Conservation Service, Conservation Effects Assessment Project Insight. US Department of Agriculture, Natural Resources Conservation Service, Washington, DC, USA. Online: **http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb1241112.pdf**

Walker, J., J.J. Rotella, J.H. Schmidt, C.R. Loesch, R.E. Reynolds, M.S. Lindberg, J.K. Ringelman, and S.E. Stephens. 2013. Distribution of duck broods relative to habitat characteristics in the prairie pothole region. Journal of Wildlife Management 77: 392-404.

Walker, J., J.J. Rotella, S.E. Stephens, M.S. Lindberg, J.K. Ringelman, C. Hunter, and A.J. Smith. 2013. Time-lagged variation in pond density and primary productivity affects duck nest survival in the Prairie Pothole Region. Ecological Applications 23: 1061-1074.

Yamaguchi, N.M., J.W. Hupp, P.L. Flint, J.M. Pearce, Y. Shigeta, T. Shimada, E.N. Hiraoka, and H. Higuchi. 2012. Habitat use and movement patterns of northern pintails in northern Japan: the importance of agricultural lands. Journal of Field Ornithology 83(2): 141-153.