Science Foundation Chapter 5 Appendix 5.1 – Case Study Dabbling Ducks

Authors: Greg Yarris[1] and Joshua T. Ackerman[2]

[1] U.S. Fish and Wildlife Service, Central Valley Joint Venture, 2800 Cottage Way W-1916, Sacramento, CA 95825
[2] U.S. Geological Survey, Western Ecological Research Center, Dixon Field Station, 800 Business Park Drive, Suite D, Dixon, CA 95620

DESCRIPTION OF THE SPECIES

Dabbling ducks are the most abundant group of waterfowl that overwinter in the shallow wetlands and ponds of San Francisco Bay (SFB). Species within this group are primarily omnivorous, feeding on both plant material and macroinvertebrate prey by "tipping" to access benthic foods in bottom sediments or by foraging in the water column. Although the majority of these ducks are migratory, smaller numbers also nest locally in the SFB. These species vary in body size, ranging from the large mallard (*Anas platyrhynchos*) to the small green-winged teal (*Anas crecca*). Other dabbling duck species present in the SFB include American wigeon (*Anas americana*), gadwall (*Anas strepera*), cinnamon teal (*Anas cyanoptera*), northern shoveler (*Anas clypeata*), northern pintail (*Anas acuta*), and wood duck (*Aix sponsa*).

Most of these dabbling duck species are known to breed in the SFB with the exception of the American wigeon and green-winged teal. However, the majority of wintering ducks originate from breeding grounds in the Central Valley of California, Pacific Coast States, Alaska, and Intermountain States/provinces, prairie potholes, and boreal forest. Their wintering populations in SFB are greatest between October and January, and dabbling duck species are found in all SFB regions. However, most dabbling duck use is associated with former salt production ponds and in the north and south bays, and managed wetlands of the Suisun Marsh.

CRITEREA FOR SELECTION OF THE GUILD

The five most numerous dabbling duck species in the SFB during January 2012 included northern shoveler, northern pintail, American wigeon, gadwall, and mallard. Both dabbling ducks and diving ducks include species of special management interest, including northern pintail and lesser scaup (*Aythya affinis*). Waterfowl are popular game birds, and waterfowl hunting is a traditional use of the SFB wetlands and bays (Hall 2011). Waterfowl populations are monitored annually on both breeding and wintering grounds to determine population health and to establish annual hunting regulations. Dabbling ducks primarily use former salt ponds and managed wetlands, which could be vulnerable to impacts of climate change. Sea level rise and more frequent extreme storm events will stress exterior levees of managed ponds, which in the future could require considerable commitment and funds to maintain these habitats. Increased salinity in managed moist-soil wetlands of the Suisun Marsh could reduce wetland productivity and thus dabbling duck carrying capacity (Ackerman et al. 2014).

OTHER INFORMATION ABOUT THE GUILD

Dabbling ducks generally arrive earlier in the SFB than diving ducks, and account for about half the waterfowl in October (Accurso 1992). Peak populations generally occur annually in December and January, and dabbling ducks comprise about 30% of the total duck population in the SFB. For example, the Suisun Marsh hosts many of the dabbling ducks in the San Francisco Bay-Delta. There are currently about 60,000 waterfowl that over-winter in Suisun Marsh and 90% of them are dabbling ducks, 5% are diving ducks, 2% geese, 1% sea ducks, and 1% swans (Ackerman et al. 2014). While many dabbling ducks migrate north to breed in late winter and early spring, California and in particular the SFB-Delta region are unique in that many of the dabbling ducks that over-winter are also locally grown. In particular, mallards, and to a lesser extent gadwall, breed in significant abundance locally such that they contribute substantially to the local population (Ackerman et al. 2014). The Suisun Marsh, because of its proximity to the Delta and lower water salinity than other regions of the SFB, is the most important region for nesting ducks in the SFB (Anderson 1960, McLandress et al. 1996, Ackerman et al. 2014). Although total winter dabbling duck numbers (in January) were constant between 1981 and 2012 in SFB, there were significant population changes for certain species (Richmond et al. 2014). Pintail have demonstrated a severe decline in SFB, and in Suisun Marsh in particular (Ackerman et al. 2014). Specifically, the pintail population in Suisun Marsh went from 235,800 in the 1950s to only 14,000 pintail by the 2000s (Ackerman et al. 2014). This dramatic decline in the pintail population index in Suisun Marsh reflects both the decline in the continent-wide pintail population, and fewer pintail wintering in Suisun Marsh relative to other parts of the state. Mallards have declined slightly in both the SFB and Pacific Flyway. Both gadwall and shovelers have increased substantially in the Pacific Flyway although only gadwall have increased significantly in SFB. There is no significant trend in American wigeon numbers since 1981 in the Pacific Flyway or SFB.

Continentally, dabbling duck populations in general have been increasing over the past decade due to favorable wetlands conditions on the breeding grounds. The continental breeding populations of several species that winter in SFB are well above their long term averages (LTA, 1955-2013), including green-winged teal (LTA+50%), gadwall (+80%), and shoveler (+96%). American wigeon (+2%) and pintail (-17%) are near their LTA, but remain well below the continental population goals established by the North American Waterfowl Management Plan (NAWMP; USFWS 2013). Mallard breeding populations are above the LTA (+36%) and NAWMP goal in mid-continent, but down slightly in western states such as Oregon (-7%) and California (-18%) where most of SFB wintering mallards originate.

Distribution of dabbling ducks in SFB is largely concentrated in the Suisun Marsh, and wetlands adjacent to the North Bay and South Bay (Accurso 1992, Richmond et al. 2014). In the Suisun Marsh, dabbling ducks comprised over 90% of the waterfowl (Ackerman et al. 2014). Whereas, in the main regions of the SFB, dabbling ducks comprised only about 10-30% of the total waterfowl (Accurso 1992, Richmond et al. 2014).

REVIEW OF CLIMATE CHANGE EFFECTS ON THE GUILD

Within Suisun Marsh, dabbling ducks strongly select managed wetland habitats for foraging at night, and avoid tidal marshes, bays, and sloughs (Ackerman et al. 2014, Coates et al. 2012) as they do in other estuaries (Gordon et al. 1998). Therefore, any loss of diked wetlands and managed wetlands along the

bay's margins could impact local dabbling duck populations. Disturbance is also an important factor for dabbling duck habitat use, and undisturbed habitats provide important roosting and loafing habitats for dabbling ducks during the day (Cassaza et al. 2012). Climate change influences on both local continental temperature and precipitation patterns could have important influences on duck breeding, and ultimately local duck populations. Using two long term dabbling duck nesting datasets in California, including within the SFB-Delta at Suisun Marsh (23 years total), Ackerman et al. (2011) found that nest survival and clutch size declined with mean daily temperatures. Further, egg hatching success declined strongly with extreme temperatures. Rainfall was not consistently correlated with nest survival, but nesting season length was influenced by rainfall amounts during the pre-breeding season.

Finally, increased salinities could have a negative effect on dabbling ducks in two ways. First, duckling survival is known to decline with increased salinity in the brood-rearing habitat. Second, salinity influences the types of plants that can be grown within managed wetlands where the management focus is often food production for dabbling ducks. Higher salinity levels makes it difficult to manage for plant species which tend to be highly productive and provide abundant energy-rich seeds sought by waterfowl (Miller et al. 1975; Rollins 1973, 1981; Burns et al. 2003).

FACTORS THAT MAY AFFECT SPECIES RESILIENCE

Poor winter body condition can affect species' resilience by making them more susceptible to disease, reducing survival and possibly reproduction.

LIKELY CLIMATE CHANGE IMPACTS AND RISKS

Depending on a given potential climate change effect, impacts and risks will be different for each species and may differ for breeding and wintering ducks.

Primary impacts:

1. If levees not maintained, loss of shallow habitat (salt ponds, managed wetlands) important to foraging dabbling ducks.

2. Change in invertebrate prey availability due to increases in salinity may change available diet or diet composition.

3. Reduction in desirable food plants due to increased salinity.

4. Potential for reduced nesting success associated with altered temperatures and precipitation patterns due to climate change.

5. Potential for reduced duckling survival due to increased salinity levels.

MANAGEMENT ACTIONS TO BE CONSIDERED

1. Manage ponds (brackish to freshwater) of various depths and salinities to maximize foraging, nesting, and roosting habitat for waterfowl. Dabbling ducks "tip up" to forage, so food is unavailable in

wetlands deeper than 45 cm (<25 cm preferred). Higher salinity wetlands are harmful to young ducklings and provide less diverse and abundant foods. That is, prevent or reduce high salinity in ponds.

2. In the near term, consider re-enforcing dikes, raising dike crown heights, using large water pumps, and managing soil salinity levels (with leaching strategies) to overcome flooding events and salinity intrusion, such that sufficient diked wetlands be retained.

3. Enhance a portion of former salt ponds to establish managed wetlands. Maintain ponds with appropriate depths, islands, and varying salinities as habitat to benefit migrating, wintering, and breeding dabbling ducks.

4. Manage islands and levees to provide roosting and nesting habitats within managed wetlands, and possibly restored tidal marshes.

5. Evaluate potential use and value of submerged aquatic vegetation to dabbling ducks, to determine whether habitat conversions (to tidal) or other restorations (planting) will provide foraging opportunities for dabbling ducks (e.g, eelgrass [*Zostera marina]*, sago pondweed [*Stuckenia pectinata*], widgeongrass [*Ruppia maritima*).

6. Protect and manage uplands and agricultural lands (especially small grains, grazing/haying), especially in areas adjacent to low salinity wetlands and tributaries, as nesting habitat for locally breeding mallards.

7. Use a collaborative approach to Suisun Marsh restoration and consider the importance of maintaining strong stewardship that duck hunters have provided to the Marsh since the turn of the 20th century. Consider important societal impacts of converting portions of Suisun Marsh back to tidal marsh. Although some conversion is inevitable with changing policies, sea level rise, and the increasing pressure on the Delta's dike system, this may be best accomplished using a well-planned collaborative process.

UNCERTAINTY AND KNOWLEDGE GAPS

- It is uncertain how quickly local sea level rise will occur and whether levees will be maintained in salt ponds and managed wetlands.

- Future land use changes and restorations altering current habitats (i.e., conversion of managed ponds to tidal marsh habitats).

- More information is needed about the foraging behaviors (e.g., timing, duration, and movements) and food habits of dabbling ducks in the SFB region (information is available for some species in Suisun).

- Information is needed about the nesting biology of dabbling ducks in the SFB. Much is known about nesting in the Suisun Marsh (Ackerman et al. 2014), but very little is known about nesting densities in the North and South Bay regions of the SFB (where known breeding occurs).

- Salinity is known to reduce duckling survival at high levels, but the relationship between waterfowl brood survival and water salinity in SFB including Suisun Marsh is unknown. Grizzly Island in Suisun Marsh has some of the highest mallard nesting densities and success in North America but little is known about recruitment because fledging survival is not known.

- Little is known about waterfowl food availability in existing salt ponds, managed wetlands, and tidal (and muted tidal) wetlands, relative to management and salinity. This information is needed to estimate carrying capacity and inform future habitat restoration and mitigation efforts.

- Evaluate potential use and value of submerged aquatic vegetation to dabbling ducks, to determine whether habitat conversions (to tidal) or other restorations (planting) will provide foraging opportunities for dabbling ducks (e.g, eelgrass, sago pondweed, widgeongrass).

- Information is needed to inform best management practices (BMPs) to maximize waterfowl food production at varying salinity levels in managed wetlands of the Suisun Marsh and SFB.

- See additional data gaps listed in Ackerman et al. (2014) specifically for the Suisun Marsh area of the SFB (many apply generally to the SFB).

LITERATURE CITED AND RESOURCES

Accurso, L.M. 1992. Distribution and abundance of wintering waterfowl on San Francisco Bay. Thesis. Humboldt State University, Humboldt, California, USA.

Ackerman, J.T., M.P. Herzog, G.S. Yarris, M.L. Casazza, E. Burns, and J.M. Eadie. 2014. *Chapter 5: Waterfowl ecology and management*. Pages 103-132 and maps 10 and 11 in Moyle, PB, A Manfree, and PL Fiedler (editors): Suisun Marsh: Ecological History and Possible Futures. University of California Press: Berkeley, California. 239 pages.

Ackerman, J.T., M.P. Herzog, L. Salas, T. Gardali, G. Ballard, D. Loughman, G. Yarris, and J.M. Eadie. 2011. Avian Breeding Demographic Response to Climate Change: A Multi-Species and Multi-Landscape Approach to Synthesizing Risk Factors. Summary Report, U.S. Geological Survey, Western Ecological Research Center, Davis, CA; PRBO Conservation Science, Petaluma, CA; California Waterfowl Association, Sacramento, CA; University of California, Davis, CA. 133 pp.

Anderson, W. 1960. A study of waterfowl nesting in the Suisun Marshes. Calif. Fish and Game 46:217-226.

Burns, E.G., J.M. Eadie, and M.R. Miller. 2003. Food habits of green-winged teal, northern pintails and mallards wintering in the Suisun Marsh. Final Report. Sacramento: California Department of Water Resources, United States Bureau of Reclamation.

Casazza, M.L., P.S. Coates, M.R. Miller, C.T. Overton, and D.Y. Yparraguirre. 2012. Hunting influences the diel patterns in habitat selection by Northern Pintails. Wildlife Biology 18:1-13.

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

Goals Project. 1999. Baylands Ecosystem Habitat Goals. A report of habitat recommendations prepared by the San Francisco Bay Area Wetlands Ecosystem Goals Project. P.R. Olofson, editor. San Francisco Bay Regional Water Quality Control Board, Oakland, California, San Francisco Bay Estuary.

Gordon, D.H., B.T. Gray, and R.M. Kaminski. 1998. Dabbling duck-habitat associations during winter in coastal South Carolina. Journal of Wildlife Management 62:559-580.

Hall, F. 2011. They came to shoot: a history of California duck clubs and wetland conservation. California Waterfowl; 512 pages.

McLandress, M.R., G.S. Yarris, A.H. Perkins, D.P. Connelly, and D.G. Raveling. 1996. Nesting biology of Mallards in California. Journal of Wildlife Management 60(1): 94-107.

Miller, A.W., R.S. Miller, H.C. Cohen, and R.F. Schultze. 1975. Suisun Marsh Study. Davis, California: U.S. Department of Agriculture,Soil Conservation Service,

Richmond, O.M.W., Dulava, S., Strong, C.M., and Albertston, J.D. (2014) San Francisco Estuary Midwinter Waterfowl Survey: 2012 Survey Results and Trend Analysis (1981-2012). U. S. Fish and Wildlife Service, Pacific Southwest Region. National Wildlife Refuge System Inventory and Monitoring Initiative. Fremont, CA, USA.

Rollins, G.L. 1973. Relationships between soil salinity and the salinity of applied water in the Suisun Marsh of California. California Fish and Game 59:5-35.

Rollins, G.L. 1981. A guide to waterfowl habitat management in Suisun Marsh. Sacramento: California Department of Fish and Game.

Werner, B.A., W.C. Johnson, and G.R. Guntenspergen. 2013. Evidence for 20th century climate warming and wetland drying in the North American Prairie Pothole Region. Ecology and Evolution 2013; 3(10): 3471–3482

U.S. Fish and Wildlife Service (USFWS). 2013. Waterfowl Population Status, 2013. U.S. Department of the Interior, Washington, D.C., USA.