BEAR ISLAND
WILDLIFE MANAGEMENT AREA
WEST UNIT WETLAND MANAGEMENT REVIEW

Michael Prevost, Senior Author
Bob Perry, Chair of Waterfowl Advisory Committee
Lew Crouch
Bill Mace

May 3, 2023

INTRODUCTION

At the request of South Carolina Department of Natural Resources (DNR) through the South Carolina Waterfowl Advisory Committee (WAC), a four-member Ad Hoc Committee (review team) comprised of experienced South Carolina waterfowl habitat managers and DNR staff visited Bear Island Wildlife Management Area (WMA) on February 14, 2023, to perform a collaborative wetland management review of the West Unit (BIW) managed wetland complex (Figure 1). The review team members consisted of expert brackish marsh managers, Lew Crouch (Chehaw-Combahee Plantation), Bill Mace (Annandale Plantation), Michael Prevost (Rochelle Plantation), and Waterfowl Advisory Board Chair, Bob Perry. Collectively, these waterfowl biologists have over 150 years of wetland habitat management experience with emphasis in Managed Tidal Impoundments (MTIs) along the South Carolina coast. DNR Staff included Daniel Barrineau (Bear Island Project Manager), Molly Kneece (Statewide Waterfowl Biologist), Alicia Farrell (Region 4 Coordinator), and Billy Dukes (Chief of Wildlife Management).

The review consisted of a morning session and discussion covering short- and long-term harvest data and trends, regional public and private management practices and associated waterfowl use trends, disturbance influences, WMA hunt management structure, and current habitat management practices. A field review of individual management of BIW MTIs was conducted in the afternoon. The purpose of the review was to consider recent down-trending waterfowl harvest on BIW, waterfowl hunt management, and examine habitat to determine if conceptual recommendations have potential to improve wintering waterfowl numbers and hunter harvest opportunity.

We provide the following observations and recommendations which are intended to supplement, not replace, the findings of the recent external peer review of Bear Island WMA conducted by local and regional experts. These recommendations are presented in consideration of factors beyond the control of resource management (Perry 1995) including:

1) Climate change impacts (Perry *et al* 2011) resulting in:
    a) Dynamic precipitation influencing estuarine salinity (Livolsi *et al* 2021),
    b) Sea-level rise (Schuerch *et al* 2018),
    c) Extended growing seasons (Gallinat *et al* 2015), and
    d) Warmer winters influencing waterfowl migration (Meehan *et al* 2021),
2) Annual North American and Atlantic Flyway wintering waterfowl numbers,
3) Local wintering waterfowl energy needs,
4) Disturbance emanating from adjacent public water hunting,
5) Competitive influences of nearby large, well-managed properties, and
6) Bathymetric variation in the in the individual MTIs of the BIW managed wetland complex influencing habitat management targeted to specific wetland plant communities.

HARVEST DATA AND TRENDS

BIW harvest data from 2003-2004 through 2021-2022 was reviewed (Table 1, Figure 2). Harvest per unit effort (ducks/hunter/day) varied over the 18-year period (0.87 ducks/hunter in 2022-2023 to 3.99 in 2014-2015). Hunter success has declined throughout the past four waterfowl seasons including 2022-2023. Over the 18-year period, the top 3 birds in the hunter bag were gadwall (*Mareca strepera*)

Figure 1. Bear Island West and individual Managed Tidal Impoundments and acreages of each.

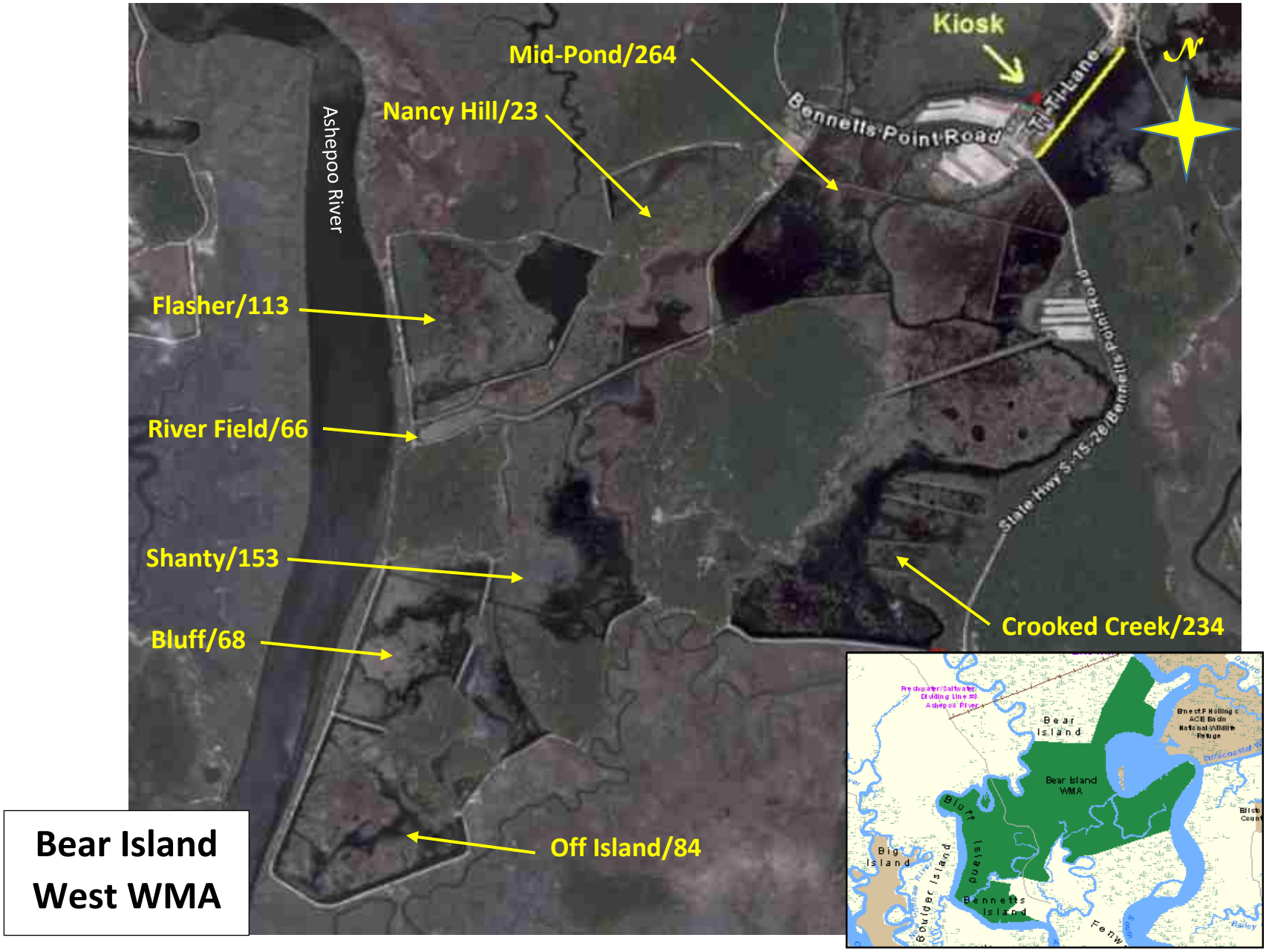
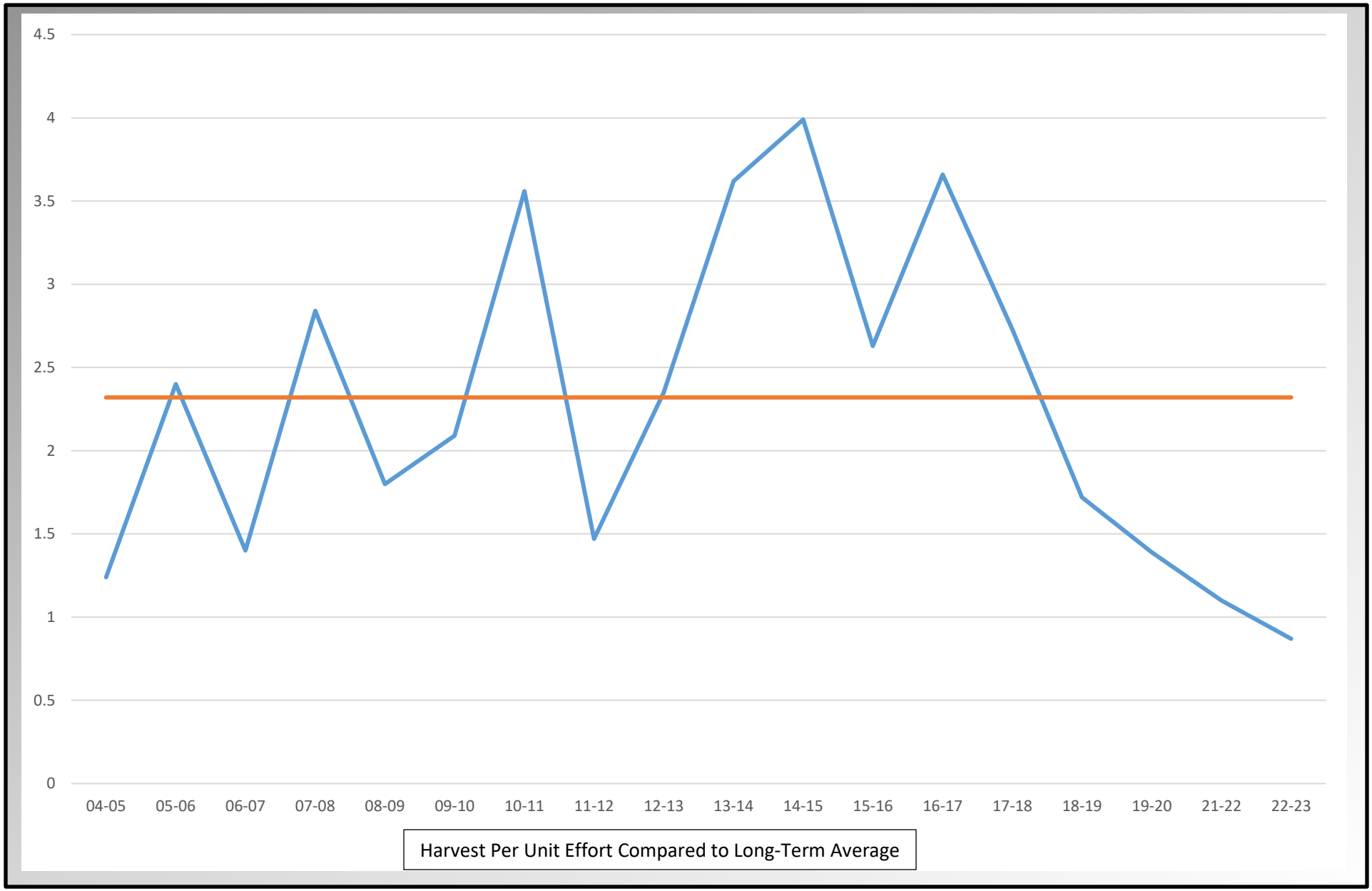


Table 1. Bear Island West Wildlife Management Area - Waterfowl Harvest 2004-05 through 2022-23.

	04-05	05-06	06-07	07-08	08-09	09-10	10-11	11-12	12-13	13-14	14-15	15-16	16-17	17-18	18-19	19-20	21-22	22-23	Avg
Mallard		17	1	4	3		1	5	2	3		6	8	1	1				2.89
Dom/Rel Mallard				1	1	1				1									0.22
Black Duck	4	2	1	2	2		2	3	1	1	2	3						1	1.33
Mallard x Black	1		1					2	1				1						0.33
Mottled Duck	19	7	5	15	8	17	14	16	20	12	11	21	7	1	9	15	13	15	12.50
Gadwall	3	2	13		12	24	21	17	17	101	150	62	74	57	31	36	12	9	35.61
American Wigeon	11	12	19	73	16	11	25	7	5	13	45	8	33	39	33	3	22	7	21.22
Green-winged Teal	1	3		5	5	13	58	14	20	22	13	23	65	16	11	6	5	2	15.67
Blue-winged Teal	1	37	4	3		15	45	13	14	25	32	27	21	31	7	8	4		15.40
Northern Shoveler		14		2	6	11	36	27	37	22	29	5	31	48	7	2	2	5	15.70
Northern Pintail	2			7	1	2	2	3		25		3	13	5	1	1			3.61
Wood Duck	1		2				1				2	5	4	1					0.89
Redhead				2	8		1		3	2	1							2	1.06
Canvasback					1														0.56
Scaup	1	2	3	7		1	4	6	1	2		6		1				3	2.06
Ring-necked Duck		1		4	6	2	6		2	1								1	1.28
Golden eye			10																0.56
Bufflehead		9		2		8	4	3	1	8	5	22	9	5	14		1		5.06
Ruddy Duck		2		1		4	4			2	2								0.83
Tree ducks																			0.00
Sea ducks																			0.00
Canada Goose		4		6	10	5	2												1.50
Snow Goose					3				1										0.22
Unknown ducks						1			1					1					0.17
Mergansers	18	8	14	8	10	21	16	12	3	6	11	6	5	18	13	7	8	15	11.06
# Harvested	62	120	73	142	92	136	242	128	129	246	303	197	271	224	127	78	67	60	149.73
# Hunters	50	50	52	50	51	65	68	87	55	68	76	75	74	82	74	56	61	69	64.61
Ducks/Hunter	1.24	2.4	1.4	2.84	1.8	2.09	3.56	1.47	2.35	3.62	3.99	2.63	3.66	2.73	1.72	1.39	1.1	0.87	2.32

Figure 2. Bear Island West Wildlife Management Area - waterfowl harvest per unit effort 2004-05 through 2022-23 as related to the long-term average.



averaging 35.6 birds per year, American wigeon (*Mareca americana*) averaging 21.2 birds per year, and Northern shoveler (*Spatula clypeata*) averaging 15.7 birds per year. In 2022-23 the numbers of these birds in the hunter bag for the year were 9, 7 and 5 respectively, a decrease of 71.1% from the 18-year average. Arguably the hunter's trophy duck for BIW, the mottled duck (*Anas fulvigula*), harvest was up 20.0% in 2022-23 from the long-term average. For the past 4 hunting seasons, harvest per unit effort has been below the 18-year average of 2.32 ducks/hunter/day.

Traditionally, harvest per unit effort has been one of the only metrics of success used on DNR waterfowl areas. We recommend the consideration of other success measures such as *total experience enjoyment*, *total number of shots fired*, *unretrieved ducks and census sampling*, may be used as supplementary measures of success, with the potential of statistically modeling these supplemental data to yield additional insight.

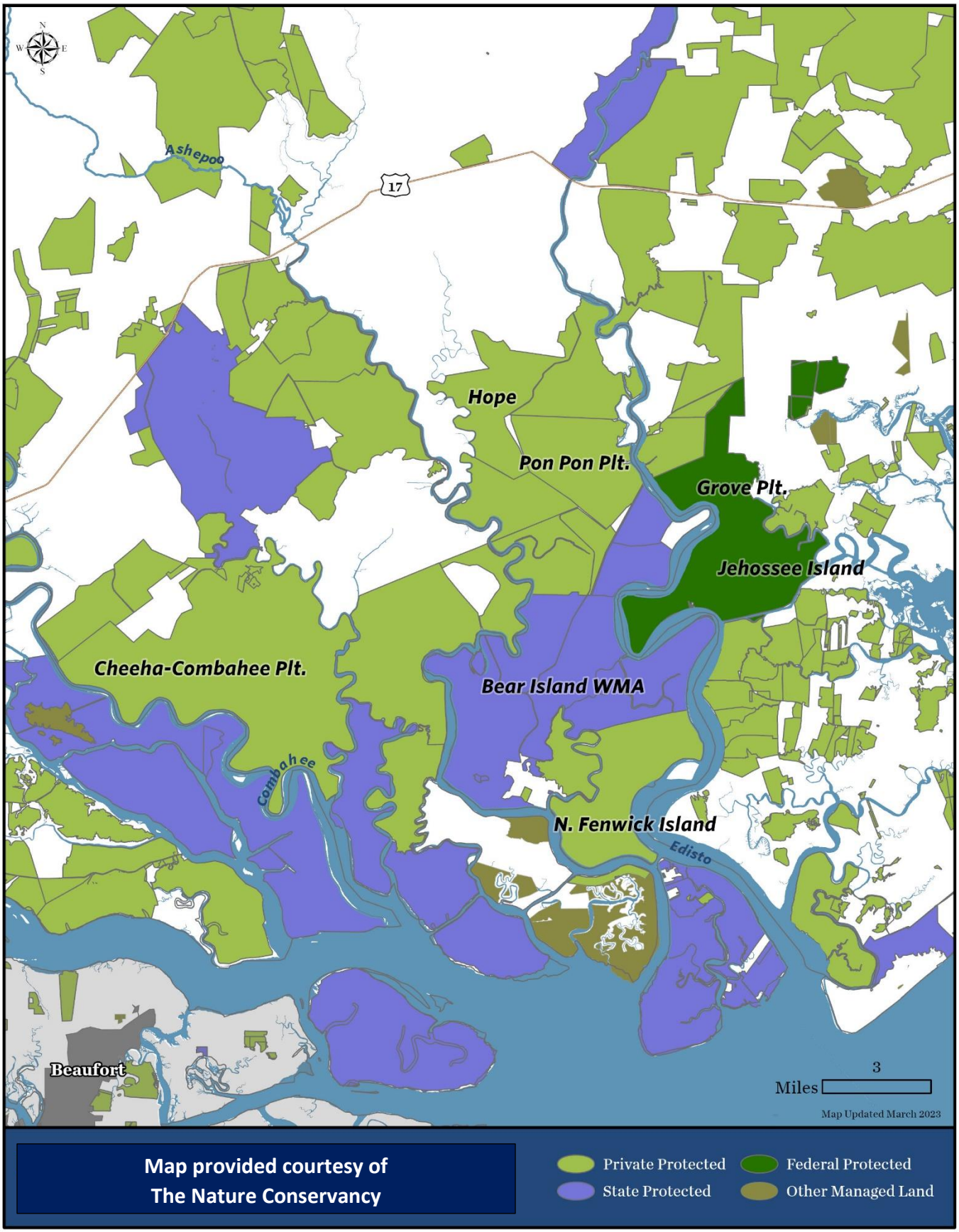
LOCAL HABITAT PERSPECTIVE

The review team and DNR staff recognize the local habitat matrix influences waterfowl use and behavior and therefore, harvest on Bear Island WMA. Large, well-managed properties proximate to Bear Island (Fenwick and Jehosse islands, Pon Pon, Hope, and Grove plantations) may have a measurable negative impact on Bear Island WMA daily wintering waterfowl utilization (Figure 3). Fenwick Island, Pon Pon and Hope plantations are privately owned and intensively managed providing high-quality habitat. On these private holdings, hunting schedule, level of participation, and intensity of disturbance are carefully structured at the discretion of the property owner/manager to sustain wintering waterfowl and a level of high-quality hunting. On units of the ACE Basin National Wildlife Refuge, Grove and Jehosse Island are inviolate sanctuaries located immediately across the South Edisto River from Bear Island WMA. An external and increasing disturbance factor affecting BIW is adjacent public hunting in the Ashepoo River and Crooked Creek. Professional opinion and scientific literature (Gammonly and Runge 2022) document that management of disturbance including internal and external hunt hunting is critical in sustaining quality hunting opportunities on any given waterfowl management unit. The current DNR lottery hunt system results in predetermined hunting schedules and fixed number of hunters allowing little ability to manage hunter related disturbance. Other than Mary's House Pond (62 acres) adjacent to Bennett's Point Road, on the East Unit, no sanctuary is provided on the 4,800-acre Bear Island WMA managed wetland complex.

ALTERNATIVE HUNT MANAGEMENT STRUCTURE

The review team recommends DNR consider an alternative structure to hunt management involving hunting select impoundments within all three of the geographic WMA units (East, West, and Cut/ Springfield) two days per week. Currently, a total of 40 hunters are selected to hunt across all three units on three days weekly. Under an alternative structure 20 hunters could be selected to hunt on two days weekly, e.g., Wednesday and Saturday leaving three rest days between hunts. On a weekly basis, the Bear Island Project Manager could select the hunt impoundments having the highest waterfowl use from among the 33 managed wetland units on the overall WMA. Under this option, DNR would be providing the same level of hunting opportunity (40 hunters per week) with the potential to enhance hunter success via selecting individual impoundments having the highest waterfowl use (St. James *et al* 2015).

Figure 3. Regionally significant waterfowl habitat proximate to Bear Island WMA.



SANCTUARY PROVISION

The review team recognized the importance of providing functional sanctuary (Bregnballe and Madsen 2004) to enhance consistently greater waterfowl use on the WMA. Mary's House Pond is the only managed wetland not hunted and functions as a spatiotemporal sanctuary. We recommend DNR establish a greater sanctuary purpose by selecting one managed wetland unit to provide sanctuary on each of the West, East and Springfield/Cut units. Large, well-managed, private ACE Basin properties provide such effective sanctuary contributing to sustaining waterfowl use through the hunting season on a broader scale. In selecting a sanctuary managed wetland, the following factors should be considered (Schummer *et al* 2020):

1) Adequate size,
2) Ability to practice effective habitat management and protection,
3) Adequate buffering from human disturbance, and
4) Central location amid hunt units, so sanctuary can positively influence duck use of adjacent MTIs.

HABITAT MANAGEMENT

All MTIs on BIW are managed under typical brackish marsh management (Morgan *et al* 1974, Prevost *et a*l 1978, Swiderek *et a*l 1988, Gordon *et al* 1989, Williams *et a*l 1998, Perry 2006/2015 and Bauer *et al* 2020) with target foods (seeds, vegetation, and tubers) being widgeon grass (*Ruppia maritima*), muskgrass (*Chara* spp), dwarf spikerush (*Eleocharis parvula*) and saltmarsh bulrush (*Bolboschoenus maritimus*). Generally, all impoundments are drained in late spring (April to mid-May) for 2-4 weeks followed by shallow reflooding, water circulation and gradual elevation of water levels throughout the summer. Careful monitoring of drawdown extent (water level relative to marsh elevation), duration (temporal period), and desired salinity (10-15 ppt) are important in the successful management of target species. Additionally, the importance of avoiding excessive drying of marsh soils is critically important to avoid acidification (associated ferric hydroxide-stained waters) as well as maintaining marsh soil-moisture levels to sustain invertebrate communities associated with submersed aquatic plant (SAV) species (Bauer *et al* 2020 and Bauer *et al* 2023).

INDIVIDUAL MANAGEMENT UNITS

We recommend consideration of the following management regimes for specific BIW MTIs.

Flasher, Bluff and Shanty: In late February or early March, we recommend these units be flooded to maximum depths to retard growth of competing emergent vegetation. Maintain maximum flooding until late June or early July then implement a complete drawdown to below marsh elevation for 7-14 days followed by shallow re-flooding, and water circulation. Due to typically high summer temperatures, we emphasize that soil-moisture conditions be carefully monitored to avoid excessive drying resulting in acidification and to maintain adequate moisture to sustain benthic invertebrate habitat. Additionally, units can be temporarily flooded during the drawdown phase to maintain desired soil-moisture levels with water removed before final flooding in mid- to late July. This alternative management regime has been successfully practiced in other regions of the coast leading to high quality SAV production. Benefits of delaying final flooding until mid/late summer include:

1) Ability to raise water levels into early fall when ambient air temperatures begin to moderate and inhibit growth of filamentous algae,
2) Avoidance of late summer widgeon grass die-back (Swiderek *et al* 1988), and
3) More palatable widgeon grass

The Pocket: This small unit, formerly a portion of Shanty impoundment, has been enhanced to provide independent management capability, and it is dominated by competing emergent vegetation such as smooth cordgrass (*Spartina alterniflora*) and black needle rush (*Juncus roemerianus*). We recommend this unit be flooded to maximum depth for at least one entire growing season to reduce emergent competition and allow for increased SAV production. Once the desired ratio (approximately 50:50 or a hemi-marsh effect) of emergent/SAV habitat is achieved, this unit should be managed similarly or in conjunction with the Bluff and Shanty units.

Off Island: This managed wetland is dominated by thick stands of smooth cordgrass and black needle rush, both limiting SAV production. We recommend the MTI undergo complete drawdown then be treated mechanically by roller chopper pulled by a marsh master. Once emergent vegetation is rolled down to the greatest extent practicable, the impoundment should be re-flooded to maximum depth (18-24 inches desirable) and maintained at this depth for at least one entire growing season. Mechanical vegetation crushing and deep flooding previously practiced on Bear Island East MTIs Minkey Island and Edisto Field (Prevost 1987), and elsewhere in the coastal zone has led to improved habitat and high waterfowl use believed to be associated with invertebrate production as the crushed/flooded vegetation decomposes. The Project Manager pointed out that currently, adequate deep flooding may not be possible due to the existing trunk location not being capable of supplying sufficient water volume. We recommend that an additional trunk be installed at the historic location on the Ashepoo River to provide enhanced water management. Should the deep flooding alternative not prove practicable or effective, smooth cordgrass and needle rush growth may be effectively controlled by complete drawdown promoting extreme drying for an entire growing season. While this alternative may result in effective emergent vegetation management, soil acidification of pH 2-3 can temporarily preclude or severely limit SAV production (Neely 1958, Neely 1962, Swiderek *et al* 1988). Additionally, wintering waterfowl will exhibit extreme avoidance of any SAV growth in iron oxide-stained waters associated with post-extended drawdown, following re-flooding (L. Crouch and M. Prevost *pers observation* and P. Wilkinson, *pers. communication*). Such soil acidification is typically remedied by maintaining the subject MTI continuously flooded with alkaline tide water for a period of 6-12 months. While this transition period to alkaline soils capable of supporting normal SAV production may vary, dwarf spikerush, believed to tolerate lower soil pH than widgeongrass, is the initial plant food to develop following extended complete drawdown as it is demonstrated to tolerate lower soil pH than widgeon grass (Gordon *et al* 1988). Soil pH of ~ 4 or 5 was necessary for growth of dwarf spike rush and widgeongrass, respectively (Neely 1962). Also, Joanen and Glasgow (1965) determined that soils with pH values between 5.8-7.0 supported good stands of widgeongrass.

River Field, Mid-Pond and Crooked Creek: The WMA Project Manager noted that these interconnected units function in concert and that under the current early summer flooding (June) scenario, the Mid-Pond unit often produces large stands of muskgrass providing a unique food

source contributing to waterfowl forage diversity (Swiderek *et al* 1988). Therefore, we recommend the continued practice of the existing water management scenario.

HUNTING SEASON WATER MANAGEMENT

We recognize that hunter access and mobility within hunted areas requires minimal navigability; however, managers should endeavor to provide water depths affording duck species optimal use of managed habitats (Fredrickson and Taylor 1982). Dominant species using BIW range in size from the small American green-winged teal (*Anas carolinensis*) to larger species such as the mottled duck (*Anas fulvigula*). We recommend the Project Manager target shallow flooding by mid-November through January (Williams *et al* 1998) approximating 6 inches to facilitate foraging by dabbling ducks with tipping-up body lengths generally ≤ 18 inches (Gordon *et al* 1989).

LATE SEASON WATER MANAGEMENT

Vegetative portions of SAV normally are depleted by late winter. Accordingly, we recommend that during the period of mid-January through early March, water levels in select impoundments be lowered to very shallow conditions (0 – 12 inches) affording ducks enhanced foraging opportunity for seeds and invertebrates. During the hunting season, hunter access is an essential consideration; therefore, selection of impoundments for late season shallow flooding should be at the discretion of the Project Manager.

WATER CONTROL STRUCTURES

Review team members noticed changes in water control (trunks and spillway boxes) design including dimensional modifications as well as installation of spillway sides internal to the box rather than external. These variations are small but could be important in decreasing the volume of water exchange during periods of seasonal brackish water circulation, a requisite in widgeon grass management. MTI habitat managers have noted sea-level rise along the entire coast of South Carolina including diminished daily low tides. We recommend consideration of installation of additional trunks and/or spillway boxes to compensate for dimensional changes and to maintain optimal water control to meet habitat management objectives.

The team all agreed the local Project Manager should have the freedom to seek consultation with local experts at any time, and such local expertise is available. We recommend the local Project Manager have final say in all decisions regarding installation of any water control structures or wetland management principles and practices that he wishes to implement.

STAFFING

In addition to Bear Island, the Project Manager is responsible for supervision of three additional WMAs: Donnelley, Botany Bay, and Edisto River. This significant responsibility together with the lack of a Technician IV on Bear Island results in inadequate personnel resources necessary to effectively manage the complexity of the 4,800-acre Bear Island WMA having 33 individual MTIs. Accordingly, we recommend a Wildlife Technician IV possessing aptitude for coastal wetland management be hired. A target candidate should have a strong background in southeastern coastal wetland plant ecology, wetland management and infrastructure (dike/trunk) construction and maintenance.

SUMMARY

Overall, we conclude that the area is managed by a very capable team who strive diligently to implement science-based habitat management appropriate for the site, its location, and to meet the objectives to maintain and enhance natural resources and provide for high-quality public use. The infrastructure of BIW appears to be maintained in excellent condition. We trust the recommendations provided herein will be determined by DNR staff to be valuable in furthering their long-term goals.

LITERATURE CITED

Bauer, B.A., R.M. Kaminski, J.D. Lanham, P.D. Gerand, and E.P. Wiggers. 2020. Hydrological management of submersed aquatic vegetation in South Carolina coastal impoundments. Wildl. Soc. Bull. 44(3):579-584.

_____, R.M. Kaminski, P.D. Gerand, E.P. Wiggers, and J.D. Lanham. 2023. Aquatic invertebrate biomass in coastal South Carolina impoundments managed for waterfowl. Proc. Annu. Southeast Assoc. Fish and Wildl. Agencies. 10:85-91.

Bregnballe, T. and J. Madsen. 2004. Tools in waterfowl reserve management: effects of intermittent hunting adjacent to a shooting-free core area. Wildlife Biology 10:261–268.

Gallinat, A.S., R.B. Primack, and D.L Wagner. 2015. Autumn, the neglected season in climate change. Trends Ecol. Evol. 30:169–176.

Gammonley, J.H. and J. P. Runge. 2022 Duck hunter activity, success, and satisfaction on public hunting areas. J. Wildl. Manage. 86:e22210.

Gordon, D.H., B.G. Gray, R.D. Perry, M.B. Prevost, T.H. Strange, and R.K. Williams. 1989. South Atlantic Coastal Wetlands. Pages 57-92 *in*: L.M. Smith, R.L. Pederson, and R.M. Kaminski, *eds*. Habitat Management for Migrating and Wintering Waterfowl in North America. Jackson, MS.

Fredrickson, L. H. and Taylor, S.T. 1982. Management of seasonally flooded impoundments for wildlife. – U.S. Fish and Wildlife Service, Resource Publication 148, USA.

Livolsi, M.C, C. K. Williams, J. M. Coluccy, and M.T. DiBona. 2021. The effect of sea level rise on dabbling duck energetic carrying capacity. J. Wild. Manage. 85(4)1-10.

Joanen, T. and L.L. Glasgow. 1965. Factors influencing establishment of widgeongrass stands in Louisiana. Proc. Annu. Conf. Southeast Assoc. Game and Fish Comm. 19: 78-92.

Meehan, T.D., R.M. Kaminski, G.S. Lebaron, N.L. Michel, B.L. Bateman, and C.B. Wilsey. 2021. Half-century winter duck abundance and temperature trends in the Mississippi and Atlantic flyways. J. Wildl. Manage. 85(4), 713-722.

Morgan, P.H. 1974. A study of tidelands and impoundments within a three-river delta system – the South Edisto, Ashepoo and Combahee rivers of South Carolina. M.S. Thesis, Univ. Georgia, Athens. 92 pp.

Neely, W.W. 1958. Irreversible drainage – a new factor in waterfowl management. Trans. North Am. Wildl. Conf. 14:30-34.

_____, W.W. 1962. Saline soils and brackish waters in management of wildlife, fish, and shrimp. Trans. North Am. Wildl. and Nat. Resour. Conf. 27:321-335.

Perry, R.D. 1995. Factors affecting migrating and wintering waterfowl utilizing habitats in South Carolina. S.C. Dept. of Nat. Resour. Unpublished report, 5 pp.

_____., V. Vejdani, L. Quatto, R. Self, D. Shipes, B. Chapman, R. Szivak, M. Malsack, H. Mizzell, M. Kiuchi, S. Howard, V. McCarty, and J. Scurry. 2011. Climate change impacts to natural resources in South Carolina. S.C. Dept. of Natural Resources. Columbia, SC. 101 pp. http://www.dnr.sc.gov/pubs/CCINatResReport.pdf.

_____. 2006/2015. Dabbling ducks and allies. *In:* L. Quatro and T. Kohlsaat, *eds.* South Carolina Comprehensive Conservation Strategy. S.C. Dept. of Natural Resour. Columbia, SC. http://www.dnr.sc.gov/cwcs/species.html. Reviewed and updated 2015. http://www.dnr.sc.gov/swap/supplemental/birds/waterfowlandalliesguild2015.pdf.

Prevost, M. B. 1987, Management plan for Bear Island Wildlife Management Area. S. C. Wildl. Mar. Resour. Dept. Columbia, SC. 58 pp.

_____, A. S. Johnson and J. L. Landers. 1978. Production and utilization of waterfowl foods in brackish impoundments in South Carolina. Proc. Annu. Conf. Southeast. Assoc. Game and Fish Comm. 32:60-70.

Schuerch, M.T. Spencer, and S. Temmerman. 2018. Future response of global coastal wetlands to sea-level rise. Nature. 561:231–234 https://doi.org/10.1038/s41586-018-0476-5.

Schummer, M. L., J. Simpson, J. B. Davis, B. Shirkey, and K. E. Wallen. 2020. Balancing waterfowl hunting opportunity and quality to recruit, retain, and reactivate. Wildlife Society Bulletin 44:391–395

St. James, E. A., M.L. Schummer, R.M. Kaminski, E.J. Penny, and L.W. Burger, 2015. Effect of weekly hunting frequency on rate of ducks harvested. J. of Fish and Wildl. Manage., 6(1), 247-254.

Swiderek, A.S. Johnson, P. E. Hale, and R. L. Joyner. 1988. Production, management and waterfowl use of sea purslane, gulf coast muskgrass, and widgeon grass in brackish impoundments. Pages 441-457 *in* M. W. Weller, *ed.* Waterfowl in Winter. Univ. Press, Minneapolis.

Williams, R.K., R.D. Perry, M.B. Prevost, and S.E. Adair. 1998. Management of South Atlantic coastal wetlands for waterfowl and other wildlife. Ducks Unlimited, Inc. Memphis, TN. 26 pp.