

Striped Bass and Hybrid Striped Bass Management Plan for Virginia Reservoirs

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Introduction

Striped Bass *Morone saxatilis* are an anadromous fish native to Virginia. Their annual spring migrations occur in all major Atlantic slope river drainages with fish ascending from the ocean to tidal freshwater below the fall line to spawn (Jenkins and Burkhead 1994). They have tremendous economic value fueling substantial recreational and commercial fisheries. Striped Bass and their hybrids (typically a female Striped Bass crossed with a male White Bass *M. chrysops* in a hatchery) are widely stocked into Virginia reservoirs (for purposes of this management plan, “reservoirs” are those impoundments exceeding 500 acres vs. “small impoundments”). This management plan encompasses the use of Striped Bass and Hybrid Striped Bass (hereafter referred to simply as “hybrids”) in Virginia reservoirs.

Striped Bass and hybrids have historically been stocked in Virginia reservoirs to provide a diversification of the fishery and exploit unused or marginally used habitat (pelagic zone) and forage (clupeid species; typically Gizzard Shad *Dorosoma cepedianum* and herrings of genus *Alosa*). All Striped Bass populations in Virginia are maintained entirely through stocking (put-grow-and-take fisheries) with the exception of Kerr Reservoir which has some natural reproduction (Jenkins and Burkhead 1994). However, Kerr’s natural reproduction and highly variable year classes are not capable of supporting the current recreational fishery.

Striped Bass have been stocked in numerous Virginia reservoirs for decades with fish sourced from both Chesapeake Bay and Roanoke River broodstock. Striped Bass have fairly stringent habitat requirements and require adequate levels of oxygen and thermal regimes within tolerance levels. These requirements change as the fish grows – a phenomena known as

an ontogenetic shift. These parameters during summer months frequently limit Striped Bass habitat in thermally stratified southeastern U.S. reservoirs in a scenario known as “temperature-oxygen squeeze” (Coutant 2013). Generally, this condition is more common in eutrophic systems (e.g., Lake Anna) and less so in mesotrophic reservoirs such as Smith Mountain Lake. In severe situations, acute fish kills can occur; as Striped Bass are sequestered into a thin marginally suitable habitat layer near the thermocline separated from forage. For example, summer Striped Bass kills occurred at Claytor Lake several years between 2002 and 2016 and were attributed to a temperature-oxygen squeeze exacerbated by drought and low flows in the New River.

Striped Bass fish kills have been rare in Virginia. However, even without overt fish kills; poor habitat conditions manifest in reduced growth rates, poor body condition and lowered immunity to fungal, bacterial, and viral infections. Although many studies have described suitable habitat for Striped Bass and hybrids in reservoirs, findings have been generally consistent with regards to the needs of adult Striped Bass. For example, Young and Isely (2004) found Striped Bass avoided temperatures above 25C and dissolved oxygen concentrations below 2.3 mg/l in a South Carolina reservoir, while Cheek et al. (1985) found adult Striped Bass were confined to water with temperature below 24C and dissolved oxygen greater than 4 mg/l in a Tennessee reservoir. All reservoirs exhibit different hydrological conditions and summer thermal stratification patterns. Stocking Striped Bass into reservoirs without adequate summer habitat for adult fish is not recommended. Striped Bass are currently stocked in Lake Anna, Smith Mountain Lake, Leesville Reservoir, Kerr Reservoir, Claytor Lake and the “tidewater lakes”

(Western Branch, Prince and Meade) among others (Table 1). There are several small impoundments also stocked with Striped Bass and hybrids that are not listed in this report.

In reservoirs with marginal or poor habitat, hybrids may be more suitable; as they are more tolerant of degraded water quality conditions and may display “hybrid vigor”. However, hybrids are not functionally sterile; and care must be given to ensure stocked fish do not escape into Atlantic slope river systems and corrupt the genetic integrity of anadromous stocks. Thus, hybrids have not historically been stocked in Atlantic slope reservoirs due to concern over escapement, downstream migration, and mixing of *Morone* sp. in tidal waters (this was observed below Occoquan Dam in the tidal Occoquan River in 1989 following hybrid stocking of Occoquan Reservoir). In 2014, hybrids were stocked in Lake Anna (York River drainage) for the first time after VDWR consulted with VMRC and determined that the probability of hybrid escapement from Lake Anna was low. Other stockings followed in subsequent years, and no escapement has been observed (the North Anna River is sampled annually by Dominion Power as part of their North Anna operating permit). Lake Anna remains one of two Atlantic slope reservoirs receiving hybrids and joins Claytor Lake, Carvins Cove and Flannagan Reservoir (Tennessee River drainage) as Virginia reservoirs receiving annual stockings of hybrids. Carvins Cove is the other Atlantic slope reservoir, but any escapees would have to negotiate an extremely unlikely passage through 5 downstream dams to reach tidal water.

As water quality parameters change over time, hybrid stocking may supplement or even replace Striped Bass in some reservoirs. Lake Anna is gradually becoming warmer (Via 2012),

and if trends continue; Striped Bass will not survive. Lake Anna and Claytor Lake have the distinction of being the only two Virginia reservoirs stocked with both Striped Bass and hybrids.

Production/Stocking

Waters stocked, and stocking rates have varied over time; thus production has fluctuated. Some of this was due to rate adjustments in efforts to determine the most appropriate stocking density in a given water (typically standardized as number of fish per acre), as reservoirs differ in productivity, forage base and habitat. One stocking rate does not fit all scenarios. Even within reservoirs, stocking rates are often adjusted based on predator growth rates and/or forage abundance estimates. It is imperative to not overstock predators and deplete clupeid forage and/or reduce abundance of forage species (e.g., Gizzard Shad) within preferred size ranges. Correlations have been documented in Smith Mountain Lake between Gizzard Shad abundance and size structure and Striped Bass abundance. Striped Bass and hybrids are not stocked in reservoirs without clupeid forage. Current stocking rates are listed in Table 1. Striped Bass stocking typically precedes hybrid stocking which may play a role in limited dietary overlap between juveniles during the growing season (Rash and Ney 2013).

Production efforts for Striped Bass are centralized at King and Queen and Vic Thomas Fish Hatcheries. Striped Bass broodstock are typically collected from Chesapeake Bay and Roanoke River drainages in April with resulting progeny stocked into appropriate waterbodies within these watersheds. Historically, hybrids were occasionally produced at DWR hatcheries

when fry were available following fish trades with other states (providing pond space was available), but recently hybrids needed to fill stocking requisitions have been procured via the private sector for approximately \$0.40 per 2-3" fish. This trend appears likely to continue.

Current Striped Bass production appears to satisfy statewide demand but is at the upper limit of hatchery capabilities given other warm water production needs and a precarious pond situation at King and Queen Hatchery. There needs to be a plan implemented for putting 11 of 18 dormant ponds back into operation, and input from staff aquaculture personnel should be considered in every step of the planning, bidding and construction processes. Providing adequate maintenance of existing pond space and initiatives to meet deficiencies outlined above, Striped Bass production should meet demand until at least 2026.

In 2020, over 1.63 million Chesapeake Bay and Roanoke strain Striped Bass fingerlings were produced at the King and Queen and Vic Thomas Hatcheries surpassing the requisition of 1.01 million. Two ponds repaired at King and Queen Hatchery in 2020 facilitated the boost in production, and repairs to two others are pending. Use of larger, Phase II fingerlings should theoretically improve survival and may be a useful tool to improve recruitment in some waters. Requests for these fish has been variable (but typically low), and their use is still being evaluated in Region 2. Future production needs for Striped Bass are likely to be stable, as waters with available habitat and forage are already stocked; and new reservoir construction is unlikely. However, demand for hybrids is likely to increase due to popularity and possible expansion of hybrid stocking into Chesapeake Bay drainage reservoirs and small impoundments

with limited emigration potential. In 2020, there were 155,000 hybrids requested and stocked statewide.

Stocking rates in Virginia reservoirs have fluctuated but have generally been between 5 and 30 fish/acre. Fingerling stockings of Striped Bass are usually conducted in spring at multiple locations (boat ramps) based on reservoir size. For larger systems, three to five stocking locations at mid to upper lake sites are used to better disperse fish and maximize productivity gradients in tributary storage impoundments. Stocking success can be highly variable and has been linked to various biotic and abiotic variables (Sutton et al. 2013). Hybrid stocking usually occurs in summer due to production and bid procurement logistics. When both fish are stocked in the same reservoir, it is beneficial to have stockings temporally separated to maximize survival.

Sampling

Striped Bass and their hybrids are typically sampled during late fall or winter months with monofilament horizontal gill nets in reservoirs (McRae et al. 2013). Some biologists use experimental (multi-panel) nets, while others use (previously standardized) mono-panel nets of various mesh sizes designed to capture young-of-year (YOY) and adult fish. Catch rates are expressed as number of fish caught per net night which will obviously vary based on gear selection. For example, the Lake Anna pelagic fishery is sampled annually with 36 net nights of 200' experimental gill nets with a resulting Striped Bass mean catch rate of 4.6 fish/net night

(CV=38% in 2018, $n=22$). Over the past five years, hybrids added an additional 1.2 fish/net night increasing the overall *Morone* catch rate. Alternatively, Kerr Reservoir was sampled with 18 net nights of 200' mono-panel gill nets in 2018 with a resulting catch rate of 11.7 fish/net night and a CV of 46%. Care must be taken when interpreting catch per effort results to specify gear, as "net night" has not been historically standardized. The term has been equally applied to 100' and 200' nets as well as other lengths.

Otoliths are usually removed from sampled fish for exact age determination to elucidate year class contribution, growth, survival and mortality rates. Growth rates vary substantially among Virginia reservoirs and are largely driven by summer habitat and individual reservoir hydrographic conditions. In a recent study of Striped Bass growth rates in 15 southeastern U.S. reservoirs, Virginia populations ranked from near lowest (Lake Anna) to near highest (Leesville and Claytor Lakes) (Wilson et al. 2013). After age-0, high variability of length at age generally precludes the use of age-length keys.

Creel surveys have documented the importance of *Morone* fisheries to Virginia anglers and local economies. For example, a recently conducted one-year Lake Anna creel survey (2018-2019) estimated 15% of 331,183 angler hours targeted *Morone* populations. Previous surveys at Lake Anna suggested over 20% of users targeted Striped Bass. Seasonal rates were even higher with 83% of directed effort in December targeting *Morone* – popular winter fisheries at many Virginia reservoirs. This same survey demonstrated an overall economic impact of \$7.76 million from the 12-month period. Another survey technique - angler diaries -

has been successfully used at Smith Mountain Lake to supplement standard fishery dependent and independent data (Wilson 2013).

Smith Mountain Lake could be called the crown jewel of Virginia reservoir Striped Bass fisheries due to excellent habitat, and a creel survey during a portion of 2014 indicated nearly 40% of all anglers were targeting Striped Bass resulting in an estimated 141,000 hours in just 8 months at this reservoir. However, anglers targeting Striped Bass at Claytor Lake declined from 19% to 6% over the past decade with changes in regional fish populations. It is believed pressure at Claytor Lake was higher when Smith Mountain Lake's Striped Bass fishery experienced a downturn during the early 2000s, and anglers turned their attention to a relatively local alternative. A 2017 9-month creel survey at Kerr Reservoir documented 10% of anglers targeted Striped Bass resulting in an estimated 18,000 hours of angling time. Historically, this figure was higher at Kerr, but the fishery is recovering from a depressed status. The balance of these surveys clearly implicates the great importance of this fisheries across the Commonwealth.

Many, if not most, Striped Bass anglers on Virginia reservoirs are highly specialized (for example; many use high-end electronics, catch their own live bait and troll multiple rigs with planer boards). As specialization increases, dependency on a particular resource also increases; and anglers demonstrate high knowledge and commitment to a resource (Bryan 1977). Thus, these anglers are intuitively valuable candidates to keep satisfied under the agency's "R3" initiative.

Plan Implementation/evaluation

This plan has been, and will continue to be, implemented by District Biologists under supervision of Regional Aquatic Managers (RAMs) amid concurrent oversight of the Reservoir Technical Committee. Success of this reservoir *Morone* management plan will be measured using fisheries-dependent data (primarily fall/winter gill net surveys) to monitor stocking success and population dynamics combined with creel surveys to evaluate angler satisfaction. This plan will be revisited biannually by the Reservoir Technical Committee beginning in 2023.

Table 1. Annual Stocking Rates of Striped Bass and hybrids in Virginia reservoirs.

Reservoir	Size (acres)	VDWR Region	STB/acre	HSB/acre
Chesdin	3100	1	25	
Little Creek	947	1	25	
Western Branch		1	25	
Prince		1	25	
Meade		1	25	
Kerr	48900	2	5	
Gaston		2		
Carvins Cove	800	2		6.2
Smith Mountain	20600	2	15-18	
Leesville	3270	2	15	
Claytor	4363	3	15	7.5
Flanagan	1143	3		15
Anna	9600	4	15	10

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