Chesapeake Bay Program | Indicator Analysis and Methods Document
Stream Miles Opened to Fish Passage | Updated 02/04/2021

Indicator Title: Stream Miles Opened to Fish Passage

Relevant Outcome(s): Fish Passage

Relevant Goal(s): Vital Habitats

Location within Framework (i.e., Influencing Factor, Output or Performance): Output

A. Data Set and Source

1. Describe the data set. What parameters are measured? What parameters are obtained by calculation? For what purpose(s) are the data used?

This dataset consists of stream miles in the Chesapeake Bay watershed opened to access by anadromous fish either through barrier removal (dam removal) or via fish passage structure. Data is collected for tracking progress toward the fish passage outcome in the 2014 Chesapeake Bay Watershed Agreement.

2. List the source(s) of the data set, the custodian of the source data, and the relevant contact at the Chesapeake Bay Program.
   - Source: Chesapeake Bay Program partners
   - Custodian: Fish Passage Coordinators at Maryland DNR, Pennsylvania FBC and Virginia Department of Wildlife Resources (who submit data to CBP), Mary Andrews at NOAA (fish passage workgroup chair) and Julianna Greenberg, CRC
   - Chesapeake Bay Program Contact (name, email address, phone number): Julianna Greenberg, Greenberg.julianna@epa.gov, 410-267-5775, Chris Guy chris_guy@fws.gov, 410-573-4529
3. Please provide a link to the location of the data set. Are metadata, data-dictionaries and embedded definitions included? Stream miles for each year are posted on ChesapeakeProgress and are available upon request.

B. Temporal Considerations

4. Data collection date(s): October 2019

5. Planned update frequency (e.g., annual, biannual, etc.):
   - Source Data: Annual
   - Indicator: Annual

6. Date (month and year) next data set is expected to be available for reporting: December 2020

C. Spatial Considerations

7. What is the ideal level of spatial aggregation (e.g., watershed-wide, river basin, state, county, hydrologic unit code)? Bay basin.

8. Is there geographic (GIS) data associated with this data set? If so, indicate its format (e.g., point, line polygon). Line (stream miles) and point (fish blockages and passages).

9. Are there geographic areas that are missing data? If so, list the areas. Dam removals and fish passage projects in WV, NY and DE are not included in this dataset.

10. Please submit any appropriate examples of how this information has been mapped or otherwise portrayed geographically in the past. Static annual maps to give a visual of watersheds reopened to anadromous fish have been produced in the past, but the interactive map on ChesapeakeProgress now fills this need.

D. Communicating the Data

11. What is the goal, target, threshold or expected outcome for this indicator? How was it established? In 2016, the Fish Passage Workgroup reached their 2025 goal to open an additional 1,000 stream miles, which was established in the 2014 Chesapeake Bay Watershed Agreement. After requesting public feedback, the Principals' Staff Committee (PSC), in January 2020, approved an outcome modification proposed by the Fish Passage Workgroup. This modification establishes a new target to open an additional 132 miles every two years to fish passage.

12. What is the current status in relation to the goal, target, threshold or expected outcome? During the reporting period including 2018 and 2019, 30.5 additional stream miles were opened to fish passage representing a 23% achievement of the 2-year target established in 2020.

13. Has a new goal, target, threshold or expected outcome been established since the last reporting period? Why? Yes. The Fish Passage Workgroup proposed an outcome change (approved in January of 2020) to be more consistent with the best available science. The original goal of "opening 1,000 additional stream miles" to fish passage was based on an outdated methodology for stream mile calculation. The group was able to surpass that goal in 2016. In 2020, the outcome was modified to open an additional "132 stream miles every two years to fish passage" which is the rate that would have been required to meet the original outcome when it was set in the 2014 Chesapeake Bay Agreement.

14. Has the methodology of data collection or analysis changed since the last reporting period? How? Why? No, but the method of reporting has changed to reflect the biennial target.

15. What is the long-term data trend (since the start of data collection)? Stream miles are continuously being opened for anadromous fish. Dam removal projects may open an enormous number of miles to be accessible by fish. Since 1988, when data started to be consistently reported, 11,017 river miles were opened to fish passage via dam removal and another 19,242 miles were opened via other fish passage projects. Over the past 10 years, the group has averaged 231.29 miles opened to fish passage per year.

16. What change(s) does the most recent data show compared to the last reporting period? To what do you attribute the change? Is this actual cause or educated speculation? The recent biennial period between 2018 and 2019 saw an increase of 30.5 miles from dam removal projects. The method of reporting has changed since the last reporting period in 2017, which showed a cumulative increase of 1,278 miles opened to fish passage above the 2011 baseline.

    In recent years, we see a decrease in the number of dam removals in all states. This change is because many of the dams that are feasible to remove have already been removed. In addition to this being the story told by the data, it is also the information we have received back anecdotally from our workgroup members.

17. What is the key story told by this indicator? Dams, culverts and other barriers inhibit stream flow, limit stream habitat and block migratory fish from reaching their spawning grounds. Removing these barriers can restore water flow, reduce sediment build-up and allow shad, herring and other migratory species to move between fresh- and saltwater habitats. Though this indicator met its original target of 1,000 additional stream miles early, it did not meet its current target of 132 additional miles every two years for the years 2018 and 2019, and there has been a recent decrease in miles added annually over the past few years. This may be because much of the "low hanging fruit" with regards to dam removal has been plucked. Future projects to open more of the watershed to fish passage may be difficult but are necessary for the health of local species. Culverts are being investigated as opportunities to open miles.

E. Adaptive Management

18. What factors influence progress toward the goal, target, threshold or expected outcome?

- **Co**mmunity/Landowner Willingness, Legislation to Incentivize or Mandate Barrier Removal Projects
  Now armed with a scientifically based prioritization list of dam removal projects, the

workgroup is facing another challenge. Obtaining permission from dam owners to move forward with projects has proven to be complicated with many private dam owners opting to keep their dams in place. Existing state fish passage laws require landowners to provide fish passage at dams and other blockages or install fish ladders, but legal action against all dams in noncompliance is costly and time consuming.

- **Funding**
  The ability to achieve change through fish passage projects is largely limited by a lack of resources.

- **Understanding the Ancillary Benefits of Dam Removal (Policy Makers, Dam Owners and Local Government)**
  Dam removal projects provide many ancillary benefits beyond restoring habitat for target fish species. For example, removal can result in reduced liability for dam owners when the dam is removed. Many dams are attractive nuisances and removal results in public safety improvements. One example of improvements to public safety is the pending removal of the Bloede Dam in the Patapsco Valley State Park where multiple deaths have occurred at the dam site. Flood reduction benefits can be realized in some cases and can result in less nuisance flooding of roadways and bridges. Furthermore, dam removal can result in improved public access to rivers and streams.

- **Target Species Populations in Decline Region-wide (unmanageable)**
  Populations of target species, particularly River Herring, Shad and American Eel, have been declining nationwide. For example, Maryland commercial harvest of River Herring has been falling since the early 1970s when the yearly average was about 700,000 pounds. Between 1990 and 1999 the yearly average was roughly 164,000 pounds. From 2005 to 2010 the average was just 35,200 pounds.

In addition, it is important to note the fish passage outcome is simply a mileage opened goal. There is no outcome established based on target species population size or whether the barrier removal project resulted in an increase or decrease in target population numbers. We list the following factors influencing target population size for the purpose of making the readers aware fish populations can be impacted by the following: habitat conditions and water quality, bycatch, climate change including possible changes in migratory patterns and spawning areas, overfishing, and many others. The workgroup does not see these factors directly influencing whether the mileage outcome is met but instead as factors influencing the overall recovery of a target fish species.

19. What are the current gaps in existing management efforts? N/A

20. What are the current overlaps in existing management efforts? N/A

21. According to the management strategy written for the outcome associated with this indicator, how will we (a) assess our performance in making progress toward the goal, target, threshold or expected outcome, and (b) ensure the adaptive

management of our work? The Fish Passage Workgroup is using the Chesapeake Fish Passage Prioritization tool to both calculate performance and assess potential future projects. The workgroup compares progress obtained to the overall goal when the number of miles is calculated each year.

F. Analysis and Interpretation

Please provide appropriate references and location(s) of documentation if hard to find.

22. What method is used to transform raw data into the information presented in this indicator? Please cite methods and/or modeling programs. Chesapeake Fish Passage Prioritization tool: http://maps.tnc.org/EROF_ChesapeakeFPP/

23. Is the method used to transform raw data into the information presented in this indicator accepted as scientifically sound? If not, what are its limitations? The tool has been reviewed and accepted by relevant partners.

24. How well does the indicator represent the environmental condition being assessed? The indicator represents stream miles opened. We can expect that fish will populate this habitat, but the efficiency is unknown. In order to verify the presence of fish in newly opened habitat, on-the-ground site assessment would need to be conducted.

25. Are there established reference points, thresholds, ranges or values for this indicator that unambiguously reflect the desired state of the environment? N/A

26. How far can the data be extrapolated? Have appropriate statistical methods been used to generalize or portray data beyond the time or spatial locations where measurements were made (e.g., statistical survey inference, no generalization is possible)? N/A

G. Quality

Please provide appropriate references and location(s) of documentation if hard to find.

27. Were the data collected and processed according to a U.S. Environmental Protection Agency-approved Quality Assurance Project Plan? If so, please provide a link to the QAPP and indicate when the plan was last reviewed and approved. **If not, please complete questions 28-31.** No

28. *If applicable:* Are the sampling, analytical and data processing procedures accepted as scientifically and technically valid? Yes, within the Bay program. The method to calculate miles opened is described at: http://maps.tnc.org/EROF_ChesapeakeFPP/assets/ChesapeakeFishPassagePrioritization_Report.pdf . Mileage is submitted to the Bay program by state fish passage coordinators and summed to provide annual watershed mileage increases.

29. *If applicable:* What documentation describes the sampling and analytical procedures used? N/A

30. *If applicable:* To what extent are procedures for quality assurance and quality control of the data documented and accessible? Not available

31. Are descriptions of the study design clear, complete and sufficient to enable the study to be reproduced? N/A

32. Were the sampling, analytical and data processing procedures performed consistently throughout the data record? A minor change in analysis/tracking methods occurred in 2005.

33. If data sets from two or more sources have been merged, are the sampling designs, methods and results comparable? If not, what are the limitations? Yes, counting of miles is consistent across states reporting.

34. Are levels of uncertainty available for the indicator and/or the underlying data set? If so, do the uncertainty and variability impact the conclusions drawn from the data or the utility of the indicator? No

35. For chemical data reporting: How are data below the MDL reported (i.e., reported as 0, censored, or as < MDL)? If parameter substitutions are made (e.g., using orthophosphate instead of total phosphorus), how are data normalized? How does this impact the indicator? N/A

36. Are there noteworthy limitations or gaps in the data record? No

H. Additional Information (*Optional)*

37. Please provide any further information you believe is necessary to aid in communication and prevent any potential misrepresentation of this indicator.

    Changes to the Indicator: The Chesapeake Bay Watershed Agreement was signed in June 2014. The Agreement includes a new Fish Passage Outcome, "During the period of 2011-2025, restore historical fish migratory routes by opening 1,000 additional stream miles, with restoration success indicated by the presence of blueback herring, alewife, American shad, Hickory shad, Brook Trout and/or American eel." In the past, state fish passage coordinators only counted American shad river miles as opened by fish passage projects towards achieving the previous goal. These miles were calculated by hand using USGS topographic maps where only the order stream plus the next lowest order were used in the calculation. Unfortunately, there are no historical records of these calculations. The updated Fish Passage outcome includes

brook trout and American eel as additional target species. When a dam is removed or a fishway is constructed, the entire upstream habitat (not just mainstem miles) is potential habitat for these species. Therefore, the adoption of a new methodology that measures the entire upstream network of functional miles is applicable. The updated Fish Passage outcome reads "Continually increase access to habitat to support sustainable migratory fish populations in the Chesapeake Bay watershed's freshwater rivers and streams. By 2025, restore historical fish migration routes by opening an additional 132 miles every two years to fish passage. Restoration success will be indicated by the consistent presence of alewife, blueback herring, American shad, hickory shad, American eel and brook trout, to be monitored in accordance with available agency resources and collaboratively developed methods"

The upstream functional network is defined by those sections of river that a fish could theoretically access from any other point within that functional network. Its terminal ends are barriers, headwaters, and/or the river mouth. The Fish Passage Prioritization Tool (developed by TNC in partnership with NOAA) has the ability to measure the functional network mileage when a new project is implemented. The tool is web accessible and all state fish passage coordinators are able to use the tool to ensure annual data reporting is consistent and comparable.

Starting in 2014, the Fish Passage Indicator reports functional mileage opened as measured by the Fish Passage Tool and tracks progress toward the new outcome included in the new Watershed Agreement. This involves the Chesapeake Fish Passage Prioritization Tool mapping and counting all miles upstream of the blockage available for anadromous fish (up to headwaters or next blockage), rather than the previous methodology for counting miles, which consisted of counting open miles on only the stream order of the blockage and one lower stream order (ex. blockage is on a 3rd order stream – miles counted for 3rd and 2nd order stream miles opened, but not the 1st order miles).