FACT SHEET
HUDSON RIVER
FRESHWATER MUSSELS:
Thin Sectioning Study

HUDSON RIVER TRUSTEES
ASSESSING AND RESTORING YOUR NATURAL RESOURCES

Past and continuing discharges of polychlorinated biphenyls (PCBs) from the Hudson River PCBs Superfund Site ("Site") have contaminated the natural resources of the Hudson River. The Hudson River Natural Resource Trustees – New York State, the U.S. Department of Commerce, and the U.S. Department of the Interior – are conducting a natural resource damage assessment (NRDA) to assess and restore those natural resources injured by PCBs.

Why Study Mussels: The Hudson River provides habitat for native freshwater pearly mussels (Unionidae). The mussel beds they form provide habitat for other species. In the Upper Hudson River and other ecosystems mussels are major contributors to benthic invertebrate biomass and serve important functions by filtering water, cycling nutrients, enhancing habitat complexity, and providing food for wildlife.

Remedial dredging in the Upper Hudson River from 2009-2015 harmed freshwater mussels through the physical removal of mussels themselves, along with the sediments they lived in. Additionally, the thickness and specifications of backfill and cap material in dredged areas of the river can smother mussels while reconstructed habitat can be unsuitable for mussels to recolonize, survive, grow and reproduce.

Study Area and Purpose: The current study investigated age class structure and growth of the native Eastern Elliptio (*Elliptio complanata*) using shells collected from non-remediated (no dredging) and before-remediation (pre-dredging) areas (strata) in the Thompson Island, Fort Miller, Northumberland, and Stillwater Pools (first 4 pools downstream of the General Electric plant sites). Age structure provides information on the number and proportion of native mussels collected in each age class, the amount of recruitment (the production and survival of juvenile mussels, based on individuals ≤3 years old) from reproducing adult mussels), and maximum age (minimum estimate of life span) in the Upper Hudson River. Growth and recruitment are among the indicators of habitat quality and food resources within each pool.

Mussels can be aged by counting external or internal growth rings (annuli) of the shell, similar to how internal growth rings are used to age trees. External rings are counted on the outside surface of mussel shells. As mussels age, the external rings grow closer together and can be more difficult to count, such that the number of external growth rings may underestimate the age of mussels and overestimate their growth rates. To count the internal rings, the Trustees thin-sectioned 589 of the 600 shells selected from the total collected in 2013 and 2015, to better understand the age of Upper Hudson River mussels. Thin-sectioning is a method whereby shells are thinly cut using a low-speed saw, mounted on a slide, and the cross-sectional layers of deposited shell material viewed and counted with a dissecting microscope. Because a goal of 100 shells per strata per pool was set for thin-sectioning, there were not enough after-remediation shells from the Thompson Island and Northumberland Pools; accordingly, those strata were not thin-sectioned as part of this study.

Results: The maximum age of thin-sectioned randomly selected mussel shells (n=529) ranged from 25 (Stillwater Pool – before-remediation) to 35 years (Thompson Island Pool – non-remediated) and ranged overall (n=589) from 31 (Fort Miller Pool – before-remediation and Northumberland Pool - non-remediated) to 39 years (Thompson Island Pool - non-remediated).

Recent recruitment was observed in all 4 pools. The overall level of recruitment within the past 3 years was 10.6% (5.7% age 1, 1.9% age2 and 3.0%age3) respectively), as indicted by the number of randomly selected thin-sectioned shells ≤3 years of age. The highest level of recruitment was recorded within the before-remediation areas of the Stillwater Pool (23.5%) while recruitment ranged from about 4-10% in non-remediated areas of the four pools and about 12% in the before-remediation areas of the Fort Miller Pool. Recruitment was higher in the before-remediation areas than the non-remediation areas of the Fort Miller and Stillwater Pools.

Growth curves (shell length vs age) showed a typically steeper increase in growth at an earlier age and then a slower or plateauing of growth with age. Growth of mussels (slope) ranged from a low of 1.515 mm/year (non-remediated areas Fort Miller Pool) to a high of 2.605 mm/year (non-remediated areas Stillwater Pool).

Study Conclusion: While *Elliptio* collected and analyzed in this study spanned a length of 16-114 mm, mean length was not necessarily a good predicator of age class due to overlapping confidence intervals, although mean and median age increased with size class. Recruitment of mussels ≤ 3 years old was documented in all four pools with 1-year olds being the youngest mussels thin-sectioned. The oldest *Elliptio* recorded by thin-sectioning shells was almost four decades at 39 years of age. This maximum age represents the minimum life span of *Elliptio* from the Upper Hudson.

Relevance to Injury: The thin-sectioning report provides compelling evidence of the age class structure and growth of mussels in before-remediation and non-remediated areas of the Hudson River PCBs Superfund Site. The results of these studies will be used to quantify injury to freshwater mussels as a consequence of the dredging remedy and to design necessary restoration actions.

This report is available here: https://pub-data.diver.orr.noaa.gov/admin-record/6306/Freshwater%20Mussel%20Shell%20Thin-Section%20Analyses%20for%20the%20Hudson%20River%20NRDA%20-Final.pdf

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New Hudson River Natural Resource Damage Assessment Documents Website:
https://www.diver.orr.noaa.gov/web/guest/diver-admin-record/6306