

Information Paper
Delaware River Shad Egg Collection

Prepared by
Bureau of Fisheries
Pennsylvania Fish and Boat Commission

Background: The Fish and Boat Commission was created in 1866 with the purpose of restoring American Shad to Pennsylvania. Shad restoration has been a major program area for the Commission for the last 30 years. The PFBC has continually improved our methods and approach to collection, handling, hatching, rearing and stocking of American shad. Likewise, we have developed and refined methods to determine the success or lack thereof of our restoration efforts.

Issue: Should the Fish and Boat Commission impose a moratorium on collection of shad eggs from the Delaware River?

Positions: The Fish and Boat Commission believes the benefits of the shad egg collection effort are substantial, and the effort should be continued. The Delaware River Shad Fisherman's Association has expressed concerns about the use of adult American shad from the Delaware River for restoration efforts. PFBC staff have delivered presentations to the Association membership at their meeting, provided detailed written reports about the technical aspects of shad restoration, responded to letters and telephone calls and have provided presentations to the Delaware River Fish and Wildlife Management Cooperative. The Delaware River Fish and Wildlife Management Cooperative is an organization of state and federal fisheries agencies which have responsibility for fishery resources of the Delaware River and includes New York, New Jersey, Delaware, Pennsylvania, United States Fish and Wildlife Service, National Marine Fisheries Service as well as the Delaware River Basin Commission. The Delaware River Fish and Wildlife Management Cooperative supports restoration of American shad and they continue to approve the use of adult shad from the Delaware River as a source of eggs for both the Delaware River basin and the adjacent Susquehanna River Basin.

Egg Collection History: Eggs collected from Delaware River shad have been used in our restoration efforts on two Delaware River tributaries, the Lehigh and Schuylkill Rivers, as well as in the Susquehanna River basin. Since 1973, our egg-take operation on the Delaware River has resulted in the use of an average of 765 adult shad per year. Eggs from these shad are fertilized and transported to our Van Dyke Anadromous Research Station in Juniata County. After hatching, the resulting larvae are reared to 10-30 days of age and stocked in areas above dams on the Susquehanna, Lehigh and Schuylkill Rivers where fish passage projects are in place or are planned. When high water events occur, such as in 2003, the larvae are held in the hatchery until the water recedes, or until we are forced to stock them due to other operational considerations. Since 1985, our top priority for Delaware source larvae has been the Lehigh and Schuylkill Rivers. Approximately 18 million larvae have been stocked in the Lehigh and Schuylkill Rivers. Since 2000, **all** Delaware River source shad larvae have been allocated to the Lehigh and Schuylkill Rivers.

Impacts: PFBC staff are confident that the egg-take operation has had no detrimental impact on the American shad population in the Delaware River. In fact, the data indicate that the hatchery operation has resulted in an increase in the number of shad returning to the Delaware River. The table below shows the number of shad counted moving through the Easton Dam Fish Ladder for the years 1996 through 2002 (row 1). Samples of shad collected at the next dam upstream revealed a high percentage of hatchery fish (row 2). Multiplying the number of fish passed by the percent that were of hatchery origin, we can estimate the number of hatchery fish in the Lehigh River (row 3). In every case, this number exceeds the number of brood fish used for the hatchery operation (row 4). This conclusively shows that the hatchery program has resulted in a net gain of 10,925 shad (row 5) over the 7-year period. We can say with certainty which shad are of hatchery origin because all shad reared by the Commission receive a chemical tag which is absorbed into the otolith or earstone of the shad.

Impact of egg-take on Delaware River Basin American shad.

	1996	1997	1998	1999	2000	2001	2002	Total
Lehigh River Fish Passage (Easton Dam)	1,141	1,428	3,293	2,346	2,060	4,740	3,314	18,322
% Hatchery (based on otolith marking of sample)	92%	94%	98%	92%	90%	92%	88%	
Number of Hatchery shad in Lehigh R.	1,050	1,342	3,227	2,158	1,854	4,368	2,916	16,916
Harvest for egg-take	885	1,269	1,257	714	541	925	400	5,991
Net Gain	165	73	1,970	1,444	1,313	3,443	2,516	10,925

The gain in number of shad returning to the Delaware River can be attributed to high survival of fish in the hatchery, compared to low survival in the wild. Dr. Vic Crecco, a prominent shad researcher from Connecticut, has estimated that survival of shad from hatch to 20 days of age is 4 to 7 percent in the wild (“Daily mortality rates of larval and juvenile American shad (*Alosa sapidissima*) in the Connecticut River with changes in year-class strength”, Canadian Journal of Fisheries and Aquatic Sciences, Vol. 40, 1983, p 1719-1728). In the hatchery, shad average 77 percent survival to 20 days, a 14 fold increase over that found in the wild!

In addition to the use of Delaware River shad for their eggs, our biologists also collect length, weight, sex ratio, age and tagging data (wild vs. hatchery origin) . Over the last several years we have recorded gill net mesh size so that the netting effort can be used as Catch Per Unit Effort (CPUE) data. This data is used to develop an index of abundance and is provided to satisfy our reporting requirements to the Atlantic States Marine Fisheries Commission. Because we value these fish, we strive to collect as much information as possible from each and every one.

Data provided by the Delaware River Fish and Wildlife Management Cooperative indicate that the number of shad harvested for egg-take is extremely small compared to other measures (see Appendix A, Figures 1-4) . For example, since 1985, the average population estimate was 440,000, the average commercial harvest in Delaware Bay was 61, 000, and the average commercial harvest of Delaware River origin shad in the open ocean was 130,000, compared to an average of 898 shad harvested in the egg-take for the same time period.

Future Plans: It is the PFBC's intention to continue to utilize Delaware River eggs for the shad restoration efforts on the Delaware River tributaries, specifically the Lehigh River and Schuylkill River. These rivers receive stockings of the first 1.5 million larvae produced from eggs provided by Delaware River shad. After the Lehigh and Schuylkill allotments have been met, remaining excess eggs will be used to support the Susquehanna restoration effort. The PFBC believes it would be unwise (and unnecessary) to abandon our egg collection efforts on the Delaware River. Hopefully, our continuing efforts to develop Susquehanna origin eggs will be successful and will eliminate the need to consider use of the Delaware egg take for Susquehanna Basin restoration efforts over the next several years. However, with the continuing Lehigh River and Schuylkill River shad restoration efforts, we expect to use shad eggs from the Delaware to support those projects.

Conclusions: The information provided in this information paper emphasizes the importance of Delaware River shad egg collections and puts them into their proper perspective relative to the overall goals of improved shad populations in Pennsylvania. The PFBC's goal of restoring American shad is shared by Pennsylvania anglers. Everyone wants to experience more robust shad populations. The PFBC's egg collection efforts have produced a net increase of shad as measured in the number of returning adults of hatchery origin. Shad populations continue to build in the Lehigh and Schuylkill Rivers. The PFBC remains committed to finding new and innovative ways to reach our shad restoration goals in the Delaware and Susquehanna Basins.

Additional Information: Statistics and other information on shad passage and stocking are available on the PFBC's website: <http://www.fish.state.pa.us>. The PFBC has always been very open in reporting the fishway and stocking numbers and other activities regarding shad restoration. The PFBC welcomes public comments on our activities and programs.

**Figure 1. Harvest for egg take vs. Population Estimate,
Delaware River American shad**

(Harvest for egg take is too small to appear on chart)

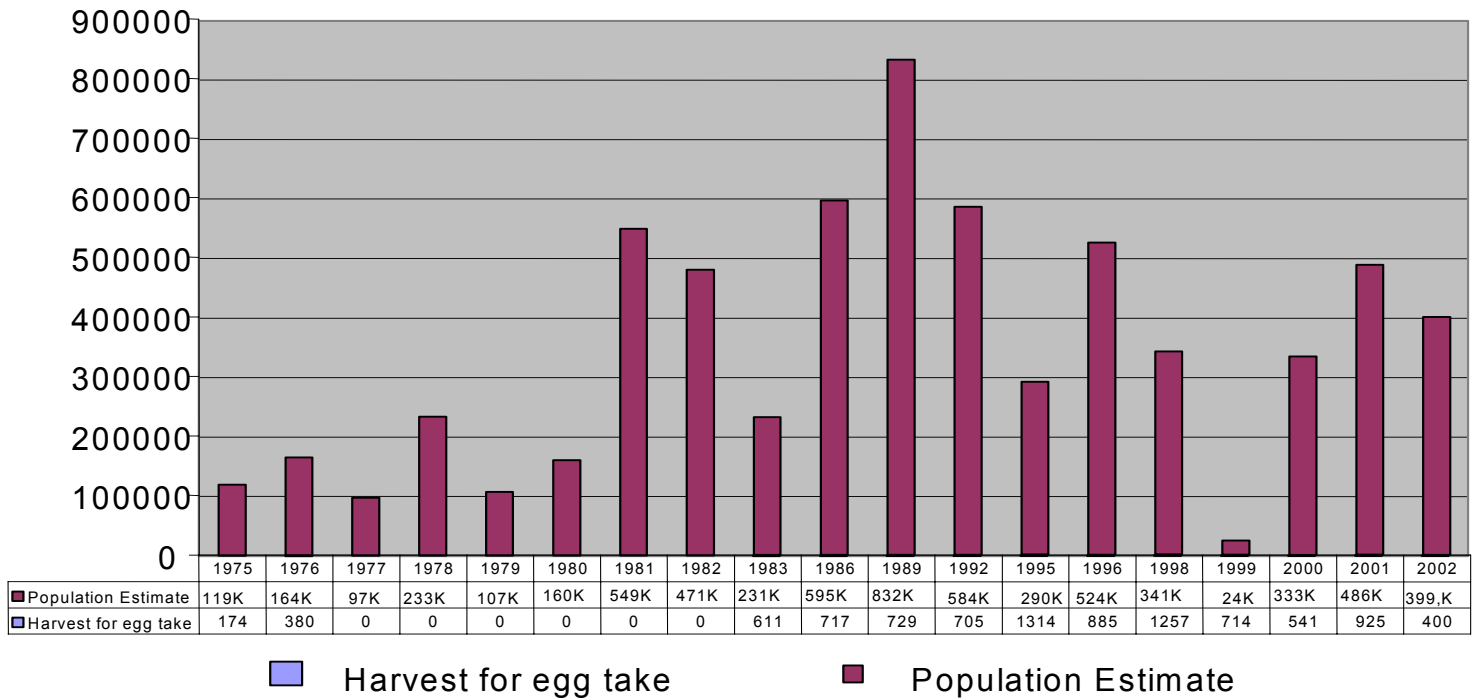
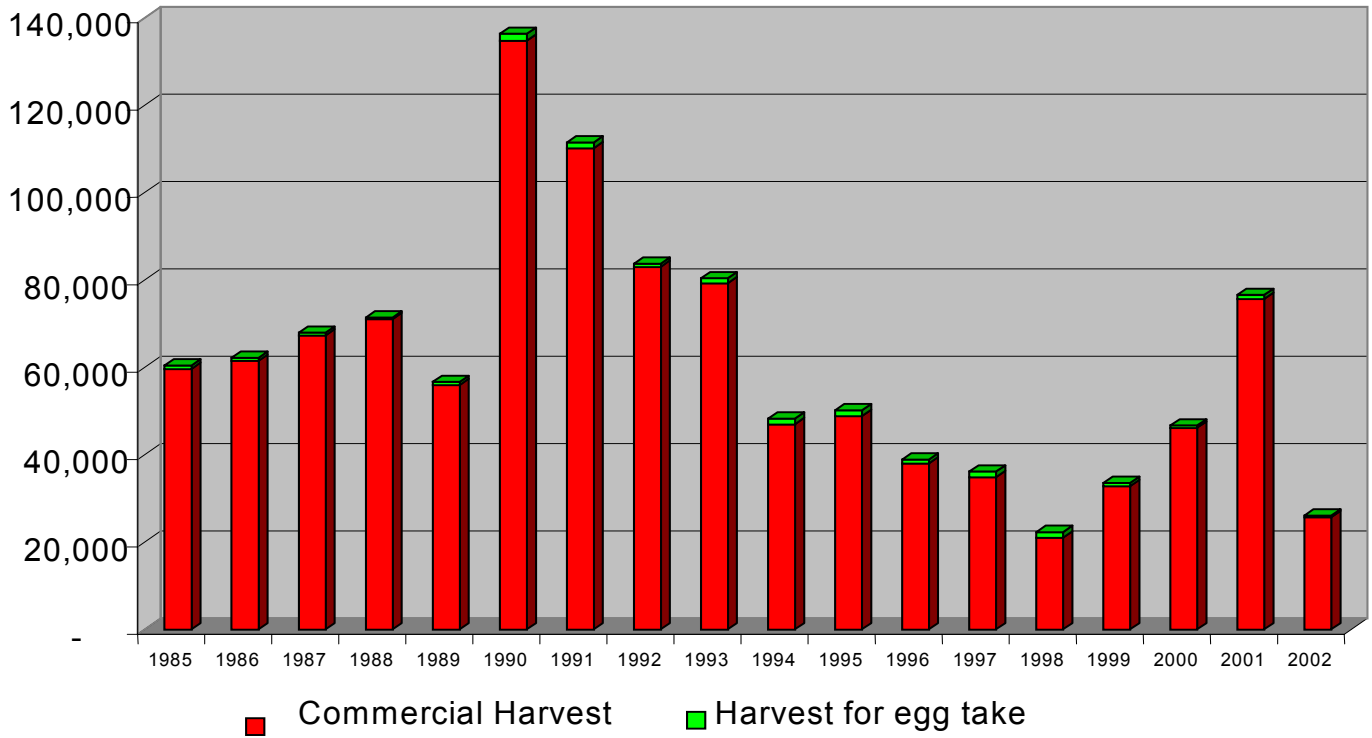
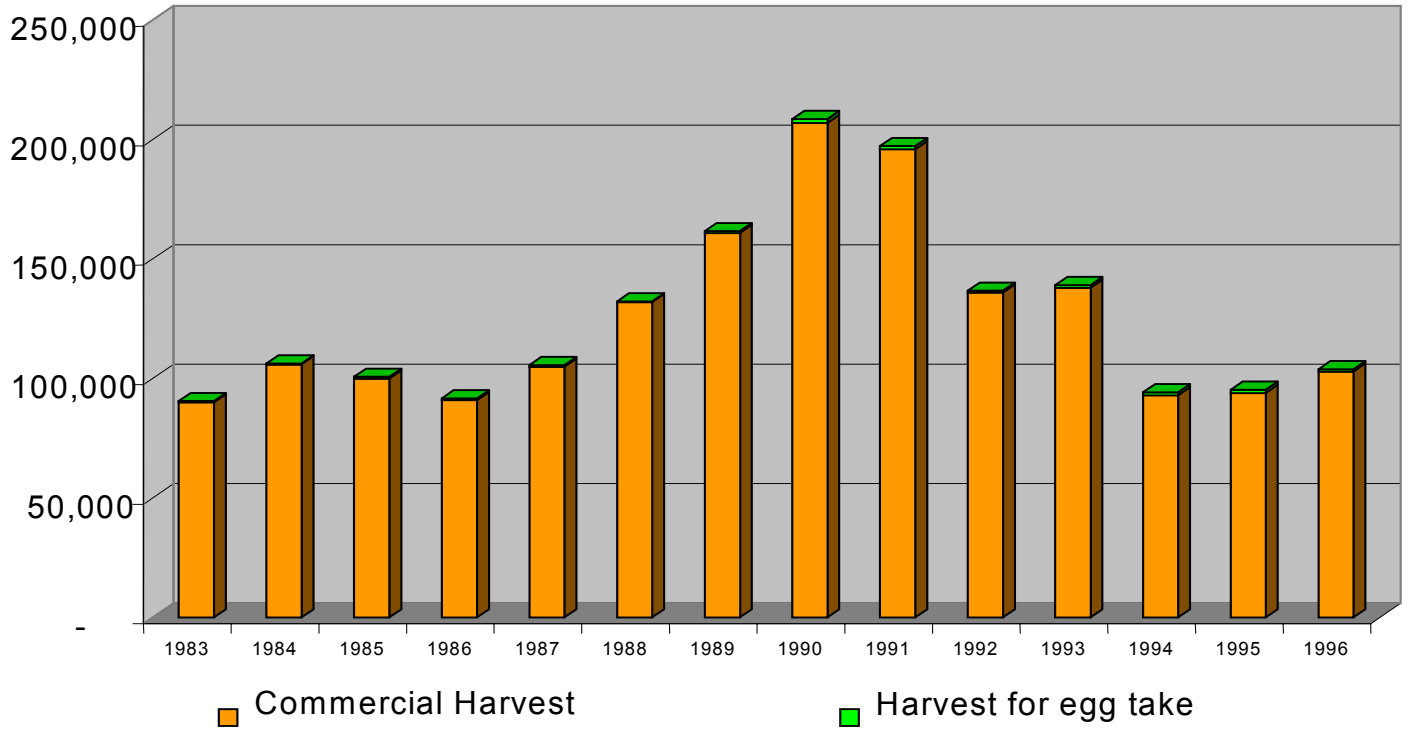


Figure 2. Commercial Harvest (Delaware Bay and River) and harvest for egg-take, Delaware River American shad



**Figure 3. Ocean Intercept Harvest vs. Harvest for egg-take,
Delaware River American shad**



**Figure 4. Sport harvest and harvest for egg take,
Delaware River American shad**

