Puritan Tiger Beetle
(Cicindela puritana)

Draft 5-Year Review:
Summary and Evaluation

U.S. Fish and Wildlife Service
Chesapeake Bay Field Office
Annapolis, Maryland

May 2007

5-YEAR REVIEW

Species reviewed: Puritan tiger beetle (*Cicindela puritana*)

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5-YEAR REVIEW
Puritan tiger beetle *(Cicindela puritana)*

1.0 GENERAL INFORMATION

1.1 Reviewers:

U.S. Fish and Wildlife Service: Susi von Oettingen, Mary Parkin
Others: Dr. Barry Knisley, Randolph-Macon College
Jim McCann, Maryland Department of Natural Resources
Julie Victoria, Connecticut Department of Environmental Protection

Lead Regional Office: Northeast Regional Office, Mary Parkin, 413-253-8617

Lead Field Office: Chesapeake Bay Field Office, Andy Moser, 410-573-4537

Cooperating Field Office: New England Field Office, Susi von Oettingen, 603-223-0104

1.2 Methodology used to complete the review: This 5-year review was developed by Chesapeake Bay Field Office (CBFO) staff. Andy Moser, the lead biologist and primary author, was assisted by Dr. Cherry Keller. Data for the review were solicited from interested parties through an April 21, 2006, Federal Register notice and through a May 16, 2006, email soliciting new information from interested parties. Data were provided by staff of the Connecticut Department of Environmental Protection, the Maryland Department of Natural Resources, the New England Field Office of the U.S. Fish and Wildlife Service, and other experts including Dr. Barry Knisley of Randolph-Macon College and Chris Davis, a biologist who has conducted numerous surveys and studies of Puritan tiger beetles in New England. On November 30, 2006, a preliminary draft of the scientific assessment portion of the review was sent out to state wildlife agencies, appropriate U.S. Fish and Wildlife Service Offices, and other interested parties for technical input, which was used in developing the final version of this 5-year review.

1.3 Background: This 5-year review summarizes the biological status of Puritan tiger beetle (*Cicindela puritana*) and provides an analysis of the threats to the species based principally on information collected since the 1993 recovery plan was written. Since 1993, annual reports have documented the results of surveys of adult beetle numbers as well as information on habitat conditions. In addition, a population viability analysis for the Chesapeake Bay population of the beetle has recently been conducted (Gowan and Knisley 2005), and translocation and vegetation management studies have been conducted in the species' habitats in New England. Much of the information used in this review was derived from information gathered during the preparation of a September 2006 Biological

Opinion for a shore erosion control project in Calvert County, Maryland (USFWS 2006).

1.3.1 FR Notice citation announcing initiation of this review:
71 FR 20178 (April 21, 2006): Notice of Endangered and Threatened Wildlife and Plants; Initiation of a 5-Year Review of Nine Listed Species

1.3.2 Listing history:

FR notice: Determination of Threatened Status for the Puritan Tiger Beetle and the Northeastern Beach Tiger Beetle (55 FR 32088-32094)
Date listed: August 7, 1990
Entity listed: Species
Classification: Threatened

1.3.3 Associated rulemakings: Not applicable

1.3.4 Review History: The Puritan tiger beetle was included in a cursory 5-year review conducted for all species listed before 1991 (56 FR 56882, November 6, 1991). Prior to listing, Dr. C. Barry Knisley conducted a status survey (dated February 10, 1987) of the species.

1.3.5 Species' Recovery Priority Number at start of 5-year review: 5

This ranking is indicative of a species facing a high degree of threat and with a low recovery potential.

1.3.6 Recovery Plan

Name of plan: Puritan Tiger Beetle (*Cicindela puritana*) Recovery Plan
Date issued: September 29, 1993

2.0 REVIEW ANALYSIS

2.1 Application of the 1996 Distinct Population Segment (DPS) policy

2.1.1 Is the species under review a vertebrate? No. The DPS policy is therefore not applicable.

2.2 Recovery Criteria

2.2.1 Does the species have a final, approved recovery plan containing objective, measurable criteria? Yes

2.2.2 Adequacy of recovery criteria:

2.2.2.1 Do the recovery criteria reflect the best available and most up-to date information on the biology of the species and its habitat? No. There is new information on population viability, population trends, and threats, which was not considered during development of the existing recovery criteria. It should be noted, however, that this new information may not necessarily require the modification of recovery criteria.

2.2.2.2 Are all of the 5 listing factors that are relevant to the species addressed in the recovery criteria (and is there no new information to consider regarding existing or new threats)? The listing factors addressed in the recovery criteria include Factor A (habitat loss and degradation) and Factor E (inadequacy of regulatory mechanisms). Factors B (overutilization) and C (disease or predation) are not considered relevant to this species' status. Factor E (other) includes threats to the Puritan tiger beetle's status, i.e., climate change/sea level rise and invasive species, that have been identified since the 1993 recovery plan was approved.

2.2.3 List the recovery criteria as they appear in the recovery plan and discuss how each criterion has or has not been met:

1. A minimum of six large (500-1000+ adults) populations and their habitat are protected in perpetuity at current sites along both shores of the Chesapeake Bay. **Criterion 1 has not been met. Two populations along the western shore and one on the eastern shore of the Chesapeake Bay have been protected, but only one of these is a large population.**

2. Sufficient habitat between these populations is protected to support smaller populations, thereby providing an avenue for genetic interchange among large populations and ensuring a stable metapopulation. **Criterion 2 has not been met.**

3. A minimum of three metapopulations, at least two of which are large (500-1000+ adults), are maintained (at extant sites) or established (= self-maintained for at least 10 years) within the species' historical range along the Connecticut River, and the habitat they occupy is permanently protected. **Criterion 3 has not been met. Only one metapopulation exists along the Connecticut River – it is a large**

population (as defined by the recovery plan), but its habitat has not been permanently protected.

4. There exists an effective long-term program for site-specific management that is based on an adequate understanding of life history parameters, human impacts, factors causing decline, population genetics, and taxonomy. **Criterion 4 has not been met. There is no site-specific management at most tiger beetle sites, since they are privately owned. An experimental vegetation management program began in 2006 at the state-owned Sassafras Natural Resource Management Area in Maryland, but its effectiveness cannot yet be determined. An experimental vegetation management program was conducted at the Rainbow Beach site along the Connecticut River in Massachusetts, but it was not effective (Davis 2004).**

2.3 Updated Information and Current Species Status

2.3.1 Biology and habitat:

Figures 1 and 2 (from the species recovery plan), showing the distribution of the species, have been attached to this review to supplement the following discussion.

2.3.1.1 New information on the species' biology and life history: Recent information on mating behavior was provided in Fielding and Knisley (1995).

2.3.1.2 Abundance, population trends, demographic features, or demographic trends: New information on population trends has been gathered since the recovery plan was completed in 1993 (Abbott 2004, 2005, 2006; Davis 2000, 2002, 2003 and e-mail of 7/31/2006; Knisley 1994-2001, 2003, 2004, 2005a, 2005b, 2007). This information is summarized in Abbott 2006, Davis 2006, and Knisley 2007. Graphs of the annual tiger beetle counts by metapopulation are included in Figures 3 through 6. These graphs illustrate the highly variable nature of tiger beetle populations from year to year, as well as population trends for each of the four population centers. They show a downward trend in the Chesapeake Bay metapopulations over the period of record (Figures 3 and 4). Although a population increase was seen between 2005 and 2006, this may be short-lived and the 2006 numbers are still well below all of the peaks in population seen in the 1990's. Neither the Connecticut metapopulation nor the small Massachusetts population has shown a similar downward trend (Abbott 2006). The Connecticut metapopulation has shown a general increasing trend over the period of record, but there has been a noticeable decline over the last two years which may signal a

leveling off of the population (Figure 5). After declining to very low numbers (under 50 adult beetles) in the late 1980's, the Massachusetts population maintained a small but relatively stable number of adults each year through 2001 (Davis 2006) (Figure 6). From 2002 through 2006, however, the Massachusetts population has shown a small increase from as a result of the population augmentation conducted during that period (Davis 2006 and 07/31/2006 e-mail). It is not known whether the increase will be maintained after augmentation ceases.

A population viability analysis for the Puritan tiger beetle in the Chesapeake Bay Region (Gowan and Knisley 2005) has also been completed since the recovery plan was finalized. In this analysis, starting populations for each of the subpopulations of tiger beetle were calculated by multiplying the average index count for the last 5 years available by two. This multiplication factor was based on various studies that showed that index counts underestimated true abundance of tiger beetles by a factor of about 0.5 (Gowhan and Knisley 2005). This PVA concludes that both Chesapeake Bay metapopulations face serious risk of extinction. This risk is particularly high for the Sassafras River metapopulation. Even if all its extant subpopulations are protected, the analysis predicts that over the next 100 cohorts, the latter metapopulation will almost certainly fall below 200 individuals. To put this in perspective, it should be noted that Gowan and Knisley (2005) indicate that if the total population of a metapopulation falls below 500 individuals, the chances of extinction from catastrophic events, Allee effects, and from loss of genetic diversity (factors not included in the PVA model) will be very high.

2.3.1.3 Genetics, genetic variation, or trends in genetic variation: Preliminary data indicating the genetic distinctness of the Chesapeake Bay and New England Puritan tiger beetles were already available at the time the Recovery Plan was completed (Vogler et al. 1993). Additional information demonstrating the distinctness of these two geographic populations was provided in Vogler and Desalle (1994) and Knisley and Hill (1994).

2.3.1.4 Taxonomic classification or changes in nomenclature: No new information.

2.3.1.5 Spatial distribution, trends in spatial distribution, or historic range: No major changes since 1993. One small subpopulation (Camp Roosevelt) in the Calvert County metapopulation appears to be extirpated (see Figure 2). Loss or degradation of habitat due to construction of shoreline erosion control structures (principally breakwaters) has reduced the value of some habitat areas and may lead to fragmentation of populations (USFWS 2006).

2.3.1.6 Habitat or ecosystem conditions (e.g., amount, distribution, and suitability of the habitat or ecosystem): There has been a substantial decrease in suitable habitat along the shores of the Chesapeake Bay for the Puritan tiger beetle over the last 5 years, as breakwaters and groins are constructed along eroding shorelines (USFWS 2006) and cliff faces in several locations have been increasingly invaded by vegetation (Knisley 2005a). It has been suggested that vegetative encroachment may be one of the principal causes of the declining trend in Chesapeake Bay metapopulations (See 2.3.1.2) (Knisley 2005a and 2005b). However, at some sites, the reasons for this increase in vegetative encroachment are unclear.

In addition, increased degradation of suitable habitat is occurring in Massachusetts and Connecticut as a result of intensive recreational use of the Connecticut River shoreline in these areas (Abbott 2004, and J. Victoria, Connecticut Department of Environmental Protection 2007, *in litt.*.). This intensive recreational use is degrading habitats currently occupied by Puritan tiger beetles as well as sites that would otherwise provide suitable habitat for reintroductions, as called for in the recovery plan.

2.3.2 Five-factor analysis (threats, conservation measures, and regulatory mechanisms:

2.3.2.1 Present or threatened destruction, modification or curtailment of its habitat or range: This remains the primary threat to the species, especially for the Maryland population. Because increasing numbers of houses built along the Chesapeake Bay near the cliffs providing habitat for the species are now threatened by erosion, the demand for shore erosion control measures, which destroy or degrade tiger beetle habitat, has greatly increased (USFWS 2006). Decreases in overall shoreline habitat availability in the Maryland counties supporting Puritan tiger beetle habitat has recently been documented by the Virginia Institute of Marine Science (VIMS 2006). In addition, Puritan tiger beetle habitat along the Chesapeake Bay has been curtailed, or reduced in value, by increased vegetation growing on habitat cliffs in the last 5+ years (Knisley 2005a, 2005b). Increased degradation of suitable habitat is also occurring in Massachusetts and Connecticut, but this is primarily a result of intensive recreational use of the Connecticut River shoreline in these areas (Abbott 2004, J.Victoria 2007, *in litt.*).

2.3.2.2 Overutilization for commercial, recreational, scientific, or educational purposes: Although there is a single instance where over-collecting was a potential problem for the New England population, overall, it is not a significant threat to the species (and was not considered to be a factor at the time of listing).

2.3.2.3 Disease or predation: There is currently no evidence that these are significant threats to the species. Predation was considered a potential threat at the time of listing, while disease was not mentioned as a threat. No new information has become available concerning the significance of these factors since the time of listing. Any effects of diseases on the population dynamics of this species are unknown because they have not been investigated.

2.3.2.4 Inadequacy of existing regulatory mechanisms: Regulatory mechanisms are only inadequate to the extent that they fail to prevent the destruction or degradation of habitat covered in 2.3.2.1. A lack of ability by the State of Maryland and its counties to strictly enforce the state Critical Areas Program has allowed increased loss of habitat in recent years. Along the Connecticut River in New England, enforcement of existing rules and regulations has had limited success in preventing violation of restrictions on trespassing, camping, and other recreational activities on Connecticut River beach habitats of the Puritan tiger beetle.

2.3.2.5 Other natural or manmade factors affecting its continued existence: There is some limited new anecdotal information for Chesapeake Bay population sites supporting the statement in the listing rule that hurricanes and winter storms can have a dramatic effect on the species' population size during certain years. While storms may cause significant temporary reductions in population size, they help maintain beetle habitat over the long term through shoreline and cliff erosional processes. However, the species' ability to recover from storm events and recolonize newly created habitat may be increasingly compromised as populations become smaller and more isolated due to human-related habitat loss and degradation (e.g. shore erosion control projects) and, possibly, as storm frequency and severity increase due to global climate change.

Along the Connecticut River in Massachusetts there is evidence that prolonged periods of high water during flood events and the resulting prolonged inundation of larval habitat may result in reduced beetle populations (Davis 2006).

Other factors include sea level rise and increasing prevalence of invasive species. Sea level rise is an emerging threat with the potential to reduce the requisite beach shoreline habitat for this species in the forseeable future. The prevalence of invasive, non-native plant species along cliff and shoreline habitats may be increasing. This could lead to more rapid vegetative encroachment and cliff stabilization. It could also make cliff habitat restoration more difficult.

2.4 Synthesis

The information discussed in section 2.23 of this review provides a clear indication that the Puritan tiger beetle is not recovering. It has not met any of the four recovery criteria and, in fact, is further from these goals today than at the time the recovery plan was written: there are fewer large populations, none of the required new metapopulations in New England, no site-specific management at most tiger beetle sites, and few protected populations or corridors. In addition, residential development and recreational use activities continue to threaten the species' habitat rangewide, as do storm and flooding events that could increase in frequency and/or intensity due to changing climate conditions.

New information indicates that there is a declining trend in population numbers and a substantial decline in suitable habitat for the Chesapeake Bay populations of the Puritan tiger beetle. This is significant because, range-wide, the majority of Puritan tiger beetles and Puritan tiger beetle habitat occurs along the Chesapeake Bay. The decline in suitable habitat results partly from recent construction of shore erosion control projects (the number one threat for the species according to the recovery plan) and partly from a newly recognized threat—significant vegetative encroachment on the cliffs along the Chesapeake Bay supporting the species. In addition, the recent population viability analysis for the Chesapeake Bay Puritan tiger beetle populations (Gowan and Knisley 2005) provides evidence that both Chesapeake Bay metapopulations are vulnerable to extinction; this is particularly true for the Sassafras River metapopulation.

In New England, the Massachusetts population remains extremely small and vulnerable, while the Connecticut population has shown a small increase. However, there is a marked trend toward increasing degradation of habitat by intensive recreational usage at sites supporting both of these populations.

In summary, information presented in the biological assessment and threat assessment, above, indicate that the species has declined substantially since listing and recovery plan approval, that the species is highly vulnerable to extinction, and that threats to the species have markedly increased. As a result, the species now meets the definition of an "endangered species".

3.0 RESULTS

3.1 Recommended Classification: Reclassify to Endangered

3.2 New Recovery Priority Number: 5C

Rationale: The addition of the "C" reflects the increased conflict between species protection and the construction of shore erosion control projects.

3.3 Listing and Reclassification Priority Number: Priority 2

Rationale: The taxonomic unit is "species" and threats are of high magnitude and imminent.

4.0 RECOMMENDATIONS FOR FUTURE ACTIONS

It is recommended that:

1. A high priority be given to identifying private landowners who are willing to enter into conservation easements for the protection and management of their Chesapeake Bay or Connecticut River shoreline habitats supporting Puritan tiger beetles.

2. The Service and its partners develop, and then implement, management strategies to improve habitat quality and quantity for this species at as many locations as feasible.

3. The species recovery group review the recovery criteria in the 1993 recovery plan in light of new information on threats and population numbers. At a minimum, adding criteria to address threats that have emerged since 1993 will require revision of the plan.

4. The annual counts of tiger beetle populations be continued to allow further analysis of population trends.

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U.S. FISH AND WILDLIFE SERVICE
5-YEAR REVIEW of the Puritan tiger beetle

Current Classification: Threatened

Recommendation resulting from the 5-Year Review: Uplist to Endangered

Appropriate Listing/Reclassification Priority Number: 2

Review Conducted By: Andy Moser, Chesapeake Bay Field Office

FIELD OFFICE APPROVAL:

Lead Field Supervisor, Fish and Wildlife Service

Approve Mary Ratnaswamy, Acting Deputy ~~For~~ / John Wolflin, Field Supervisor Date 3/29/2007

REGIONAL OFFICE APPROVAL:

Lead Regional Director, Fish and Wildlife Service

Approve _____ Date 6-13-07

Richard O. Bennett, Ph.D. Acting

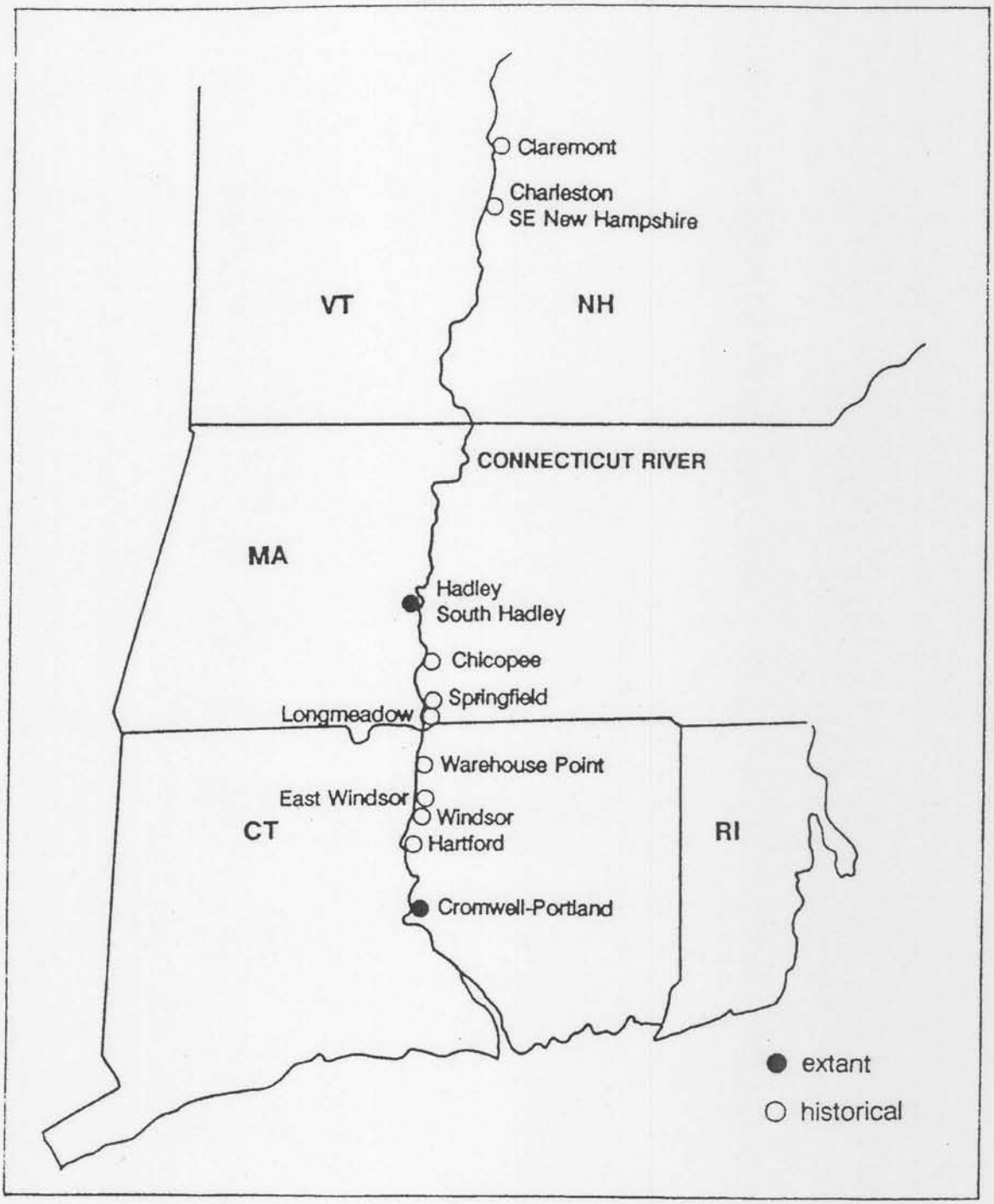

Figure 1. Current and historical Cicindela puritana distribution in New England

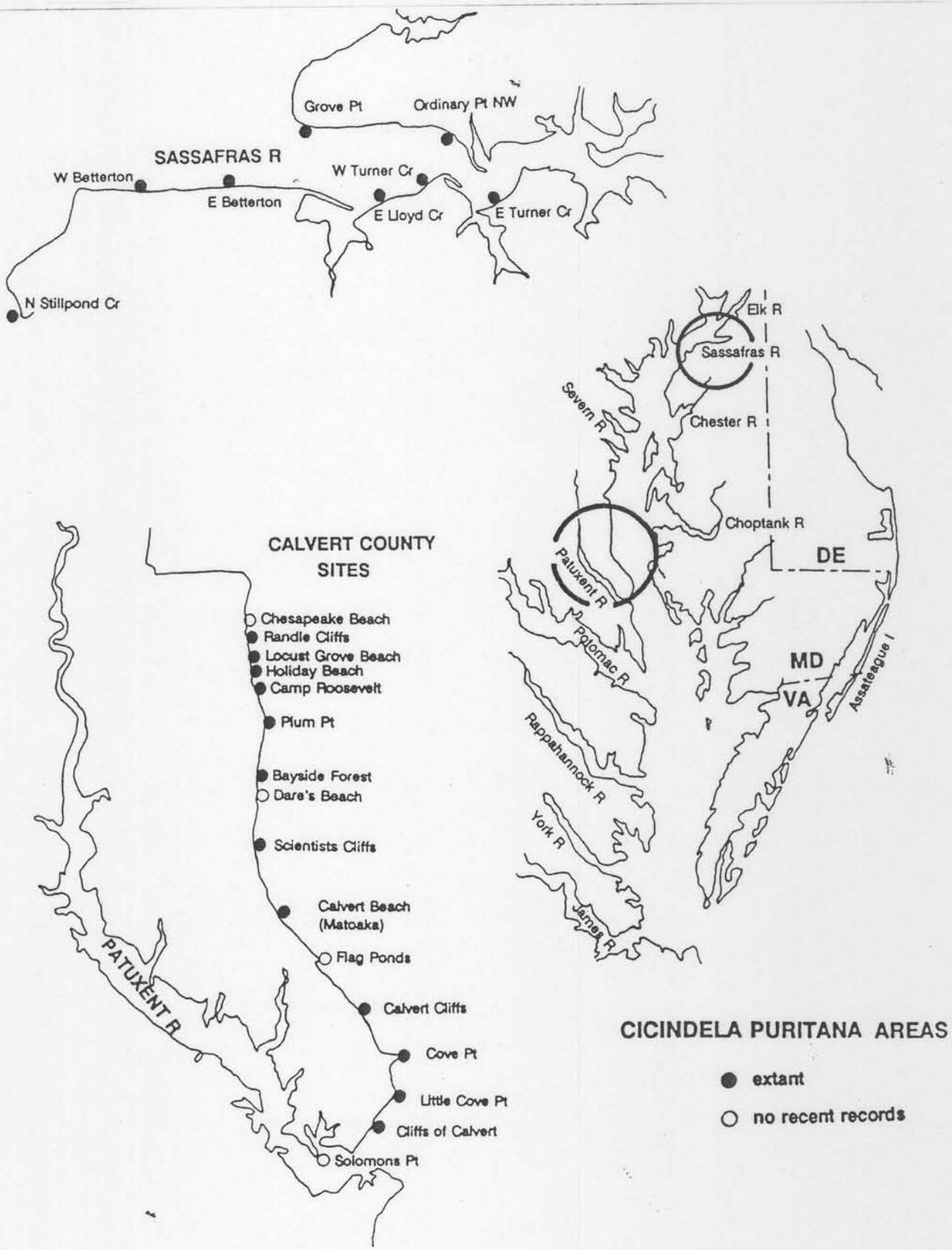

Figure 2. Current and historical Cicindela puritana distribution in the Chesapeake Bay region

Figure 3. Calvert County, MD

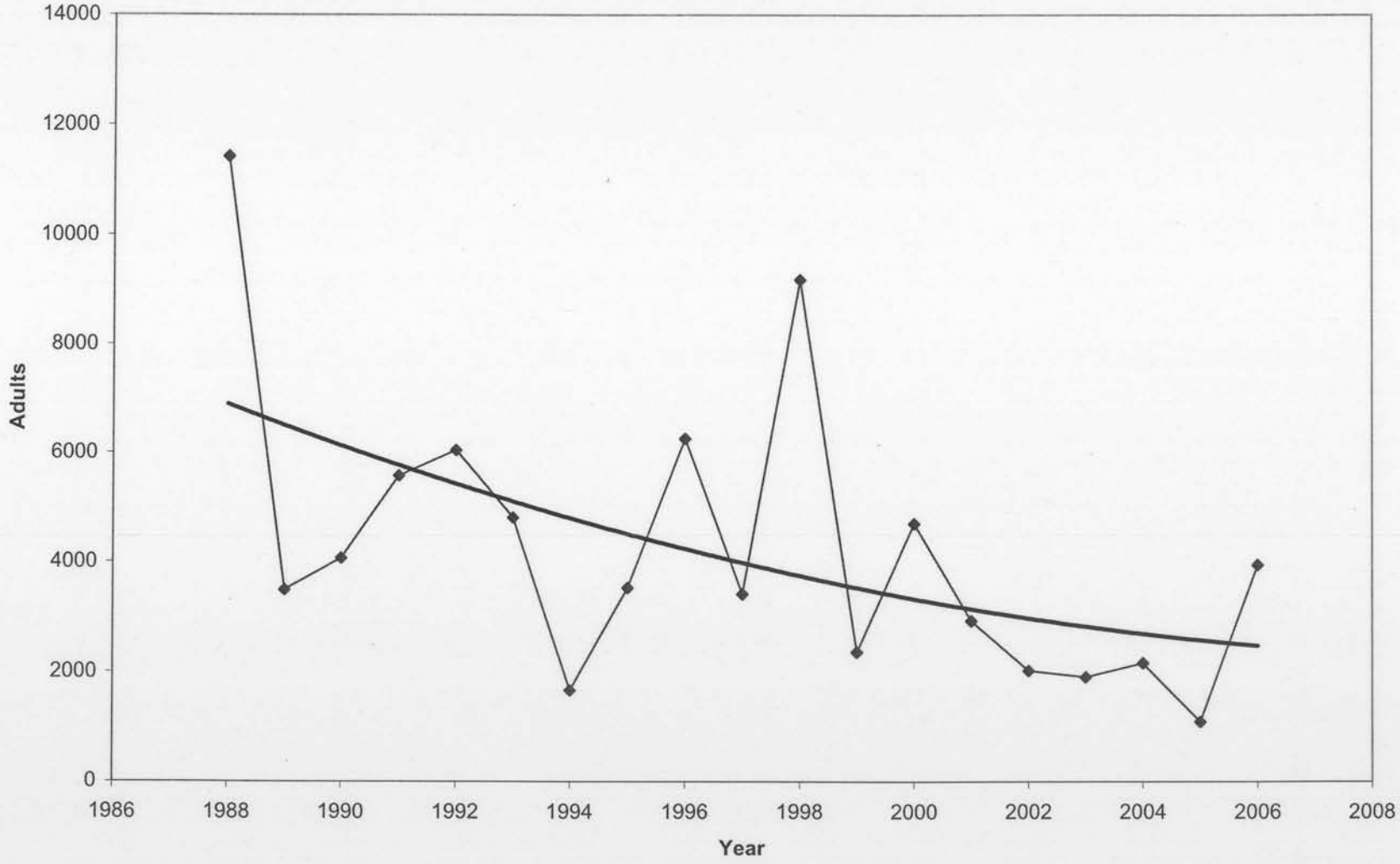

Figure 4. Sassafras River, MD

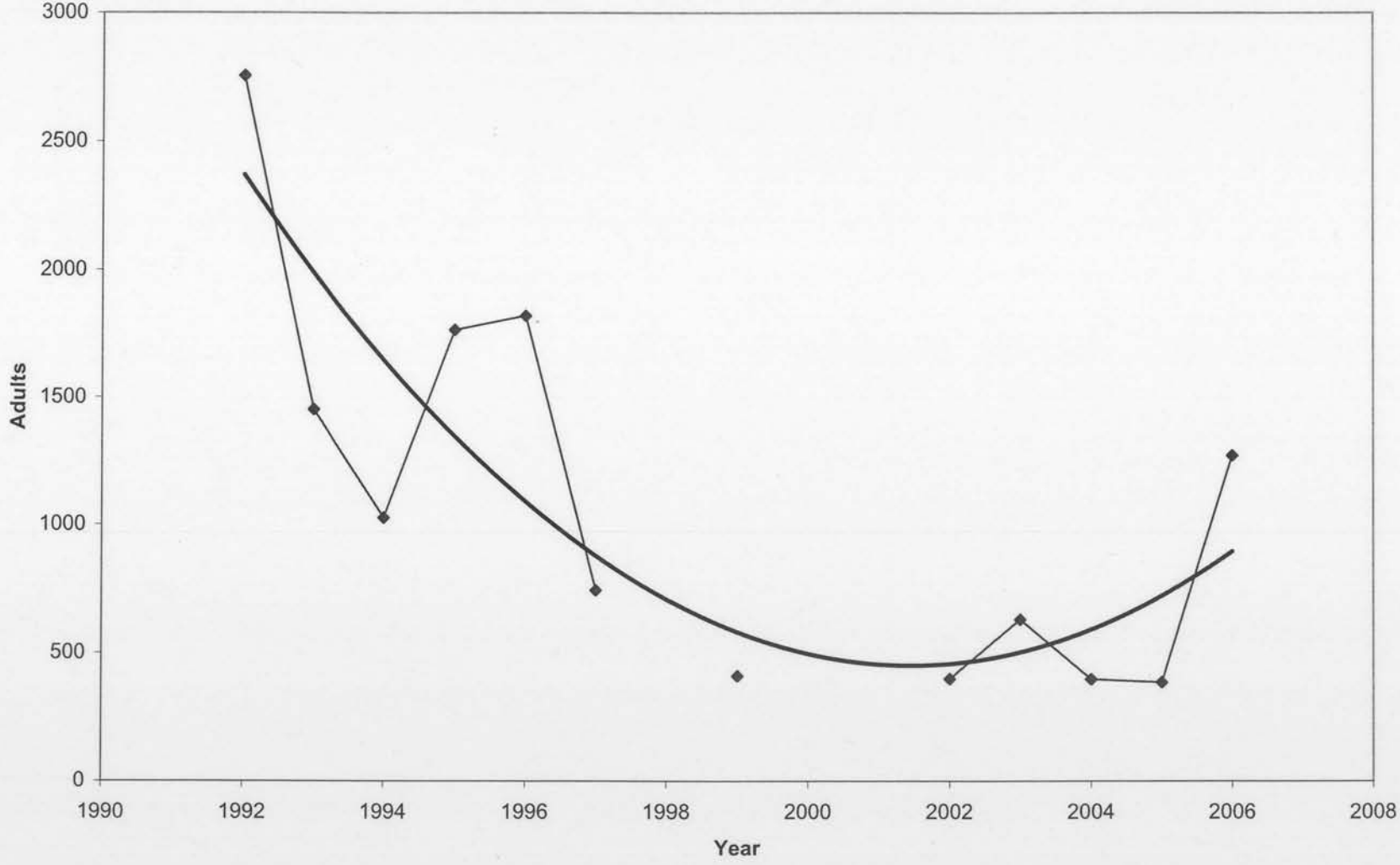

Figure 5. Middlesex County, Connecticut

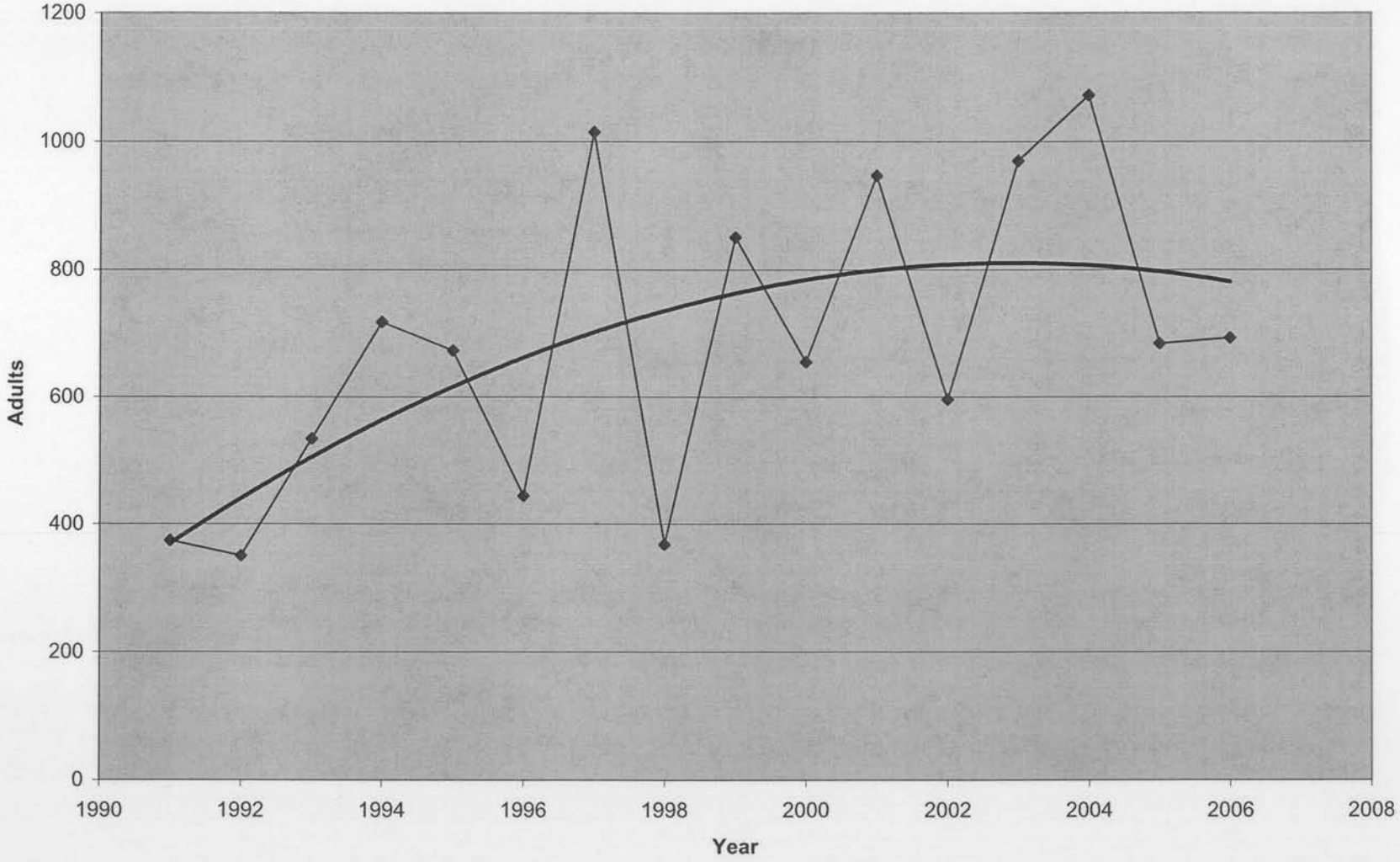
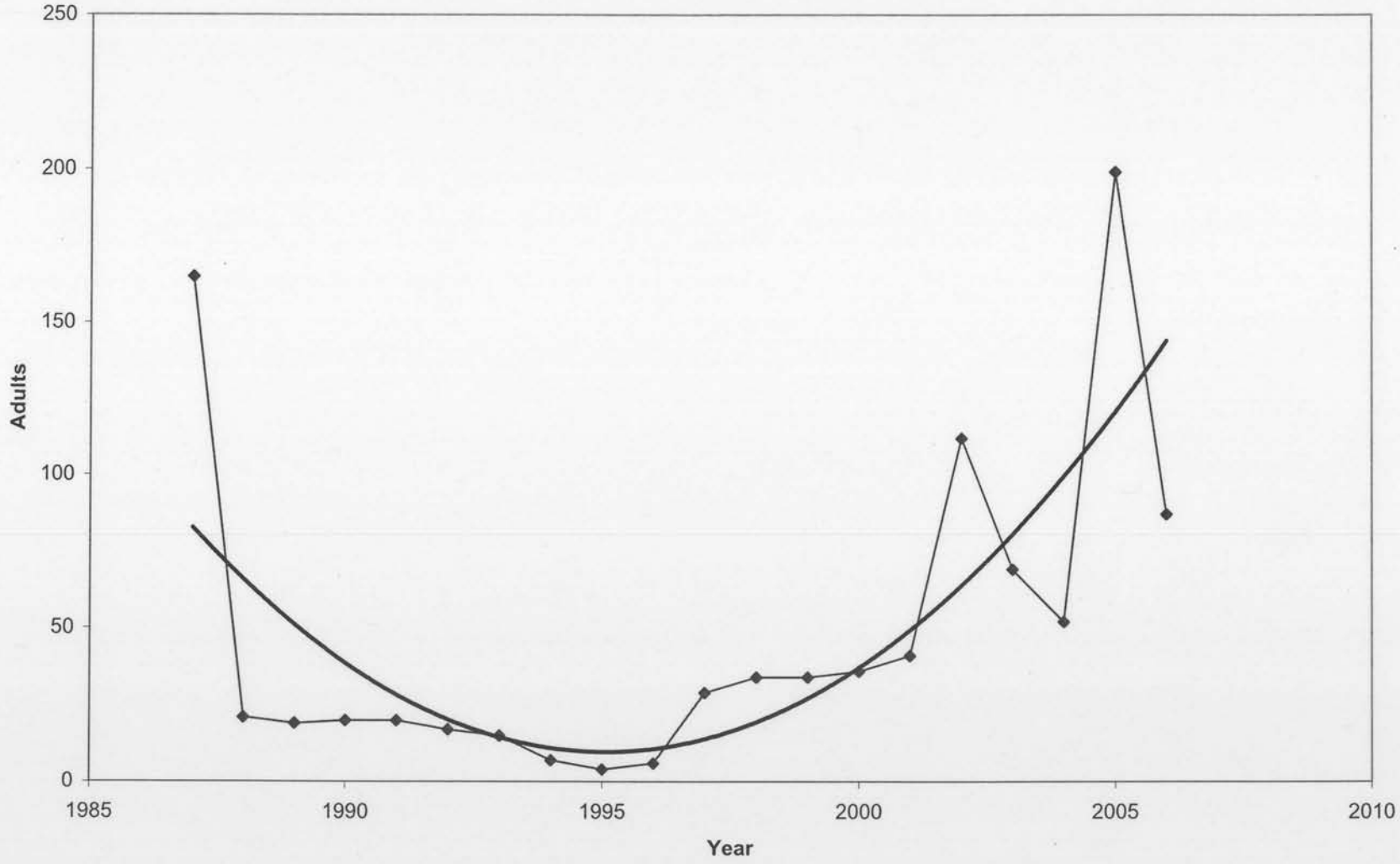
Figure 6. Connecticut River, Massachusetts