



*Maryland Department of Transportation*  
*State Highway Administration*

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## **STATE HIGHWAY ADMINISTRATION**

### **RESEARCH REPORT**

## **DEER-VEHICLE COLLISION DATA USING GIS**

### **EARTHSPAN**

**SP107B4H**  
**FINAL REPORT**

**November 2002**

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16. Abstract:  <p>This project, a cooperative effort among Earthspan, the University of Maryland Baltimore County, and the Maryland State Highway Administration (SHA) Office of Policy &amp; Research, sought to assess and analyze deer-vehicle collision data for the state of Maryland using a geographic information system (GIS). As a surrogate for deer-vehicle collision data, deer carcass removal data was used. To execute such an effort, this project sought specifically to: (1) assess previous reporting systems and procedures used by SHA shops and districts; (2) capture all existing data from all shops and districts that had collected such data until September 1, 2001 (classified as "historic data"); (3) recommend and establish standardized procedures for prospective data collection starting in September of 2001 (classified as "prospective data"); (4) compile, map, and report on all such data (both historic and prospective); and (5) design and develop an Access 97 database capability to automate the process of data compilation and report generation in the future.</p> <p>This final project report builds on the Interim Report submitted to SHA in June of 2002 and includes all of the data and maps provided therein. These data and maps from the Interim Report included all historic data, as well as prospective data collected from September 2001 through April of 2001. This Final Report expands on the Interim Report by providing new data tables reflecting all "prospective data" of deer carcass removals collected between September 2001 and end of September 2002, as well as an assessment of the MARRS data and a comparison of MARRS data vs. a like sample of carcass removal data collected under this project.</p>					
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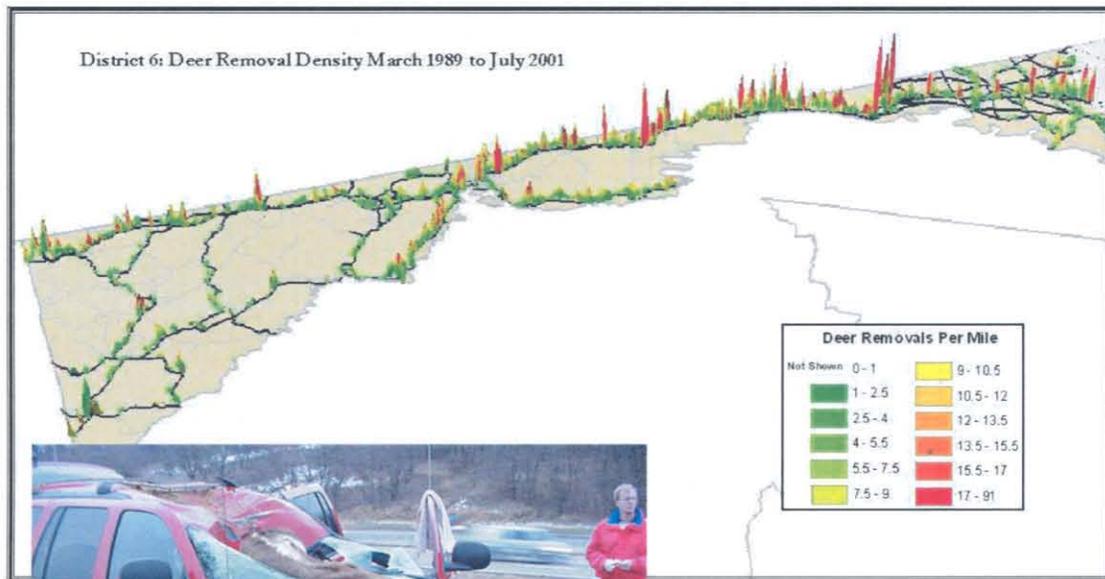


November 15, 2002

## Final Project Report

### Assessment of Deer-Vehicle Collisions in MD Using GIS

Submitted by Earthspan, Inc.  
1450 South Rolling Road  
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## Executive Summary

This project, a cooperative effort among Earthspan, the University of Maryland Baltimore County, and the Maryland State Highway Administration (SHA) Office of Policy & Research, sought to assess and analyze deer-vehicle collision data for the state of Maryland using a geographic information system (GIS). As a surrogate for deer-vehicle collision data, which was not readily available, deer carcass removal data was used. To execute such an effort, this project sought specifically to: (1) assess previous reporting systems and procedures used by SHA shops and districts; (2) capture all existing data from all shops and districts that had collected such data until September 1, 2001 (classified as “historic data”); (3) recommend and establish standardized procedures for prospective data collection starting in September of 2001 (classified as “prospective data”); (4) compile, map, and report on all such data (both historic and prospective); and (5) design and develop an Access 97 database capability to automate the process of data compilation and report generation in the future.

This final project report builds on the Interim Report submitted to SHA in June of 2002 and includes all of the data and maps provided therein. The data and maps from the Interim Report included all historic data collected, as well as all prospective data collected from September 2001 through April of 2001. This Final Report expands on the Interim Report by providing new analysis and data tables reflecting all “prospective data” of deer carcass removals collected between September 2001 and the end of September 2002. Also included in this Final Report are (1) a total carcasses removed table covering the period from September 1, 2001 to September 30, 2002; (2) a discussion of the MARRS database and its potential utility as a data resource; and (3) an analysis of carcasses removed by month for all shops and districts that provided such data throughout the state.

Obviously, deer-vehicle collisions are a growing concern throughout the country, but particularly in the eastern states. This study represents a necessary first step toward better understanding this problem and its implications for road safety in Maryland, where it is estimated that deer populations have grown significantly over the past several years. It is hoped that the results of this project, particularly the Access 97 database and standardized deer carcass removal reporting procedures throughout the state, will allow the Maryland SHA and other interested parties to better understand and manage this issue.



## Assessment of Deer-Vehicle Collisions in MD Using GIS

Contract Number SP107B4H

### Final Project Report

November 15, 2002

**Performer:** Earthspan, formerly the Center for Conservation Research & Technology (CCRT) at the University of Maryland Baltimore County (UMBC).

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**Background:** This final project report follows an 17-month effort to collect and analyze existing, electronic and paper sources of deer-vehicle collision data in Maryland (or more specifically, deer carcass removal data), as well as new data collected in a standardized format starting in September of 2001 to the present. This project also included an effort to design and implement a central reporting database for collecting and archiving *prospective* deer carcass removal data throughout Maryland.

**Introduction:** Earthspan's initial goal was to create a "Deer Strike Office" at UMBC, which would compile and analyze existing data sources of deer strikes in Maryland by district offices. Data analysis was to be done primarily in a GIS system. This has largely been done, although historic data from many SHA Districts has not been obtained. But even if more data had been provided, a larger proportion exist only in paper form and therefore would be too burdensome to use for digital data analysis. Two SHA Districts that provided historic deer carcass removal data in electronic form are District 6 (Garrett, Allegany, Washington) and District 4 (Baltimore and Harford). Other digital and paper datasets have been identified and were in the possession of Peter Bendel (DNR). The paper versions of these data have been obtained by Earthspan, and they are summarized below. The electronic version of the Bendel data has been destroyed (see below for more information).

The SHA envisioned this project to collect data of deer-vehicle accidents on Maryland roadways and to map the resulting data in a GIS system for analytical display and scientific investigation. At the beginning of this project, Earthspan was to perform an assessment of the various methods by which the Maryland SHA regional and local offices reported and catalogued deer carcass removal data. Earthspan conducted numerous interviews with SHA employees at various levels in order to complete this task. As a result of these interviews, Earthspan determined that:

- Deer carcass removal data was being collected by most SHA shops and/or district offices.
- There was no standard method to capture data that SHA shops and district offices recorded regarding deer carcass removals.
- There were several different ways by which the locations of deer carcass removals were referenced, most of which were fairly imprecise.
- Most of the data was collected only in paper format, which limited its usefulness and curtailed managers' ability to distribute the data to others (including to Earthspan).

After this initial survey, Earthspan and the SHA decided that a statewide, uniform system for collecting deer carcass removal data should be implemented, and that this data should be made easily analyzable within a GIS. This has been accomplished; see "Database Development Section" below.

In the meantime, Earthspan collected as much existing data as possible from all SHA Districts. Below is a summary of all historic and prospective data received from the SHA District Offices.

#### **Summary of Data Received During Project; Historic and Prospective**

**NOTE:** For the purposes of this report, Earthspan is considering data "historic" if it was collected during or before August 2001. Data is being classified as "prospective" if it was collected after Sept. 1, 2001, when a new interim data collection system was implemented throughout many of the state's SHA shops.

#### **The following SHA Districts have provided deer carcass removal data:**

##### **SHA District 1:**

**Prospective Data:** Dist. 1 provided prospective data from the following shops for the following time periods:

- **Snow Hill** – September 2001 to June 2002

##### **SHA District 2:**

**Prospective Data:** Dist. 2 tried to use the pilot version of the database; but problems arose getting the database to work. The decision was made to wait for the final version of database before addressing these problems.

### **SHA District 3:**

**Historic Data:** A request for information on historic data was sent and forwarded to individual shops. The four shops responded as follows:

- **Marlboro** – All data was turned over to Pete Bendel (see note about Pete Bendel below).
- **Fairland** - Paper records exist on ADC maps; i.e., in the format used by Pete Bendel. (See note about Pete Bendel below).

**Prospective Data:** The pilot deer database was distributed to the Dist. 3 office. Below is a report describing how each shop has collected prospective data using the database:

- **Fairland** - This shop started reporting deer carcass removals via the new pilot database in September. Since that time, the database is no longer working properly. Paper data is being supplied to us.
- **Gaithersburg** - This shop has been reporting prospective data through the pilot database since September. Data was last received from this shop on January 10<sup>th</sup>.

### **SHA District 4:**

**Historic Data:** The District provided 3.5 years of historic data (1998 to mid-2001). The '98-'00 data included a text description of the geographic location of each deer carcass removed. This data would require an extensive number of hours to map effectively. The '01 data was in a format consistent with Pete Bendel's reporting system and requires manual manipulation to be mapped. Due to constraints of time, CCRT/Earthspan did not manually enter this data.

**Prospective Data:** Dist. 4 has been collecting deer removal data on paper in our format since September and they are waiting for the final version of the database to become available to enter it digitally.

### **SHA District 5:**

**Prospective Data:** Dist. 5 has provided prospective data from the following shops for the following time periods:

- **Annapolis** – September 2001 to July 2002
- **Glen Burnie** – October 2001 sporadically through August 2002
- **Prince Fredrick** – September 2001 to April 2002, then sporadically through August 2002

- **LaPlata** – September 2001 only
- **Leonardtown** – March 2002 through August 2002 (except July)

#### **SHA District 6:**

**Historic Data:** Earthspan received almost 11 years of historic data from Dist. 6. All of this data was collected in a database, which served as the model for the pilot database we distributed in September. The data contained in this database is of varying quality, and there are some small gaps in the data of about 1 month in size. The database contained records for 6,550 deer carcass removals. Of these, about 4,500 were able to be mapped without modification. Of the other roughly 2,000 records, 1,500 were able to be mapped after data cleanup efforts. Approximately 500 of these records were not usable even after data cleanup processes were completed. Much of the data has a resolution of only 1 mile because of the way the data was entered. Some of the data has a 0.1 mile resolution.

**Prospective Data:** Dist. 6 reported prospective data starting in September 2001. They ceased providing data during the summer months of 2002.

**NOTE:** The historic data received from Dist. 6 contained over 6,000 deer carcass removals collected over a period of more than 11 years. This data did not, however, contain the data in a format compatible with display in a GIS. Earthspan created a script that would read the historic data and extract various information from different fields in the database to create an ID that could be referenced to road data within a GIS. After running the database through this script, about 2/3 of the data were usable without further manipulation. For the other roughly 2,000 remaining locations, Earthspan manually looked up each location in a Highway Location Reference book and reviewed the record for errors. These errors ranged from improper route prefixes (i.e., US instead of IS) to milepoints referenced to actual milemarkers on the highway and not to the Highway Location Reference book, which is what the GIS road data is based on. After manually editing the data, roughly 1,500 more locations were able to be plotted on the map. The other 500 did not contain enough information to provide a decisive location, even with the manual editing. It is because of the time consuming nature of this task that Earthspan believes the key to a good reporting system is the quality of the data when first entered.

#### **SHA District 7:**

**Prospective Data:** Dist. 7 has provided prospective data from the following shops for the following time periods:

- **Westminster** – May 2002 to September 2002
- **Fredrick** – September 2001, January 2002 through September 2002
- **Dayton** – September 2001 through September 2002

**GENERAL NOTE: SHA Data collected by Peter Bendel of Maryland DNR:** Much of the existing (historic) deer carcass removal data that we have learned of was collected by Mr. Peter Bendel of DNR between 1999 and mid-2001. Much of the data that Mr. Bendel collected in association with SHA was apparently converted to a useable GIS database. This data was reportedly digitized by Mr. Pat Patterson, also of DNR. Requests for this data were made to Pete Bendel before he left his position with DNR, but the data was never supplied. Subsequent requests for this data have revealed that there was, in fact, a GIS database created by Mr. Pat Patterson of DNR, and that deer carcass removal data from 1999 to 2001 were collected from five counties, and at least some of it had been digitized (exactly how much is unknown). Paper records of some or most of Mr. Bendel's data were acquired from Mr. George Timko of DNR in April of 2002. The useful components of these data records are summarized below. These data have little accompanying documentation describing exactly what the data consists of, who it was collected by, or how it should be interpreted. Most of the paper records are noted as "entered" into a database. We believe this refers to the GIS database created by Mr. Patterson. Unfortunately, this database has been destroyed; no digital copies remain in existence.

**Description of Pete Bendel/George Timco paper data:**

**NOTE:** The data described below is Earthspan's best interpretation of what was found in the box of paper records supplied to us by Mr. George Timko of DNR. The box of paper records appears to represent all of the paper records from Pete Bendel's data collection efforts in 5 MD counties from roughly 1999 to 2001. The exact dates of some of this data is unknown. Earthspan has no way of knowing if this box contains **all** of the data collected by Mr. Bendel. With a great deal of effort, this data could probably be screened for accuracy and digitized in a GIS database, but that effort is beyond the scope of the current Earthspan project and will not be attempted. Once the new database is placed in operation, this historic data will become less relevant fairly quickly.

**The paper records in the box supplied by Mr. Timko include:**

Note: The records below are grouped in pairs or triples by region.

Computer printout records of deer carcass removal service calls:

- Montgomery County from 1/3/00 to 6/29/00; appears to be for Rockville.
- Montgomery County from 7/1/00 to 12/31/00; appears to be continued for Rockville. Data suggests 333 for this period and 517 total for Rockville in 2000.
  
- Montgomery County from 1/2/00 to 6/28/00; appears to be for Bethesda.
- Montgomery County from 7/1/00 to 12/31/00; appears to be continued for Bethesda. Data suggests 116 for this period and 130 total for Bethesda in 2000.

- Montgomery County from 1/4/00 to 6/22/00; appears to be for Silver Spring
- Montgomery County from 7/1/00 to 12/31/00; appears to be continued for Silver Spring. Data suggests 91 for this period and 137 total for Silver Spring in 2000.
- Montgomery County from 1/1/00 to 6/26/00; appears to be for Wheaton. Data suggests 181 for this period.
- Montgomery County from 7/1/00 to 12/31/00; appears to be for Wheaton. Data suggests 367 for this period and 548 total for Wheaton/Glenmont in 2000.
- Montgomery County from 1/1/00 to 4/10/00; appears to be for Germantown.
- Montgomery County from 4/11/00 to 6/17/00; appears to be continued for Germantown. Data suggests 261 for the period from 1/1/00 to 6/17/00.
- Montgomery County from 7/1/00 to 12/31/00; appears to be continued for Germantown. Data suggests 440 for this period and 701 total for Germantown in 2000.

Raw data sheets:

To the best of our ability, Earthspan has screened the following data to ensure that it is not duplicated or double counted. The overlapping date ranges for individual data sets (i.e., bullets) appear to denote different shops or different individuals reporting. Gross total numbers for each county are provided below the raw data for each county. These gross totals can be viewed as accurate but not necessarily complete because some raw data was not counted (because its date range or some other component could not be ascertained). In other words, the following data is accurate (according to the original data) but is not comprehensive. Thus, the actual totals of deer carcasses removed for each county below are probably higher than these numbers indicate, but to what degree we cannot tell.

- Anne Arundel Co. 8/4/99 to 7/14/00: Deer killed along state roads; 142 counted.
- Anne Arundel Co. 9/2/99 to 7/3/00: Deer killed along county roads (data from animal control); 108 counted.
- Anne Arundel Co. 7/28/99 to 7/11/00: Deer killed along state roads (deer collected); 47 counted.
- Anne Arundel Co. 3/20/01 to 9/4/01: 102 counted.

TOTAL: From 7/28/99 to 9/4/01 there were at least **399** deer carcasses removed.

- Calvert Co. 8/10/99 to 5/17/00: Deer killed along state roads; 108 counted
- Calvert Co. 8/13/99 to 4/13/00: Deer killed along county roads; 49 counted
- Calvert Co. 1/2/01 to 5/1/01: 52 counted
- Calvert Co. 3/9/01 to 10/15/01: 158 counted

TOTAL: From 8/10/99 to 10/15/01 there were at least **367** deer carcasses removed.

- Charles Co. 8/11/99 to 6/28/00: Deer killed along county roads; 101 counted
- Charles Co. 7/3/00 to 11/15/00: Deer killed along state roads; 128 counted

- Charles Co. 11/26/99 to 11/26/00: Deer killed along state roads; 222 counted
- Charles Co. 2/1/01 to 3/29/01: 33 counted
- Charles Co. 3/8/01 to 5/3/01 La Plata Shop; 42 counted
- Charles Co. 3/27/01 to 9/21/01: 153 counted

TOTAL: From 8/11/99 to 9/21/01 there were at least **679** deer carcasses removed.

- Saint Mary's Co. 7/29/99 to 7/10/00: Deer killed along state roads; 151 counted
- Saint Mary's Co. 8/5/99 to 7/18/00: Deer killed along county roads; 56 counted
- Saint Mary's Co. 1/04/01 to 4/30/01: 60 counted.
- Saint Mary's Co. 3/30/01 to 12/31/01: 179 counted

TOTAL: From 7/29/99 to 12/31/01 there were at least **446** deer carcasses removed.

- Prince George's Co. 5/16/99 to 10/25/00: Deer road kill data, Beltsville Agr. Res. Center; 26 counted (10 males, 14 females, 2 unknown).
- Prince George's Co. 4/30/99 to 5/25/00: Deer killed along state roads; 203 counted
- Prince George's Co. 6/1/99 to 5/26/00: Deer killed along county roads; 141 counted.
- Prince George's Co. March and April 2001: 35 counted.
- Prince George's Co. April to end of August 2001: 186 counted

TOTAL: From 4/30/99 to 8/31/01 there were at least **591** deer carcasses removed.

In summary, in these 5 counties alone, there were at least **2,482** deer carcasses removed from state and county roads during the period 4/30/99 to 12/31/01.

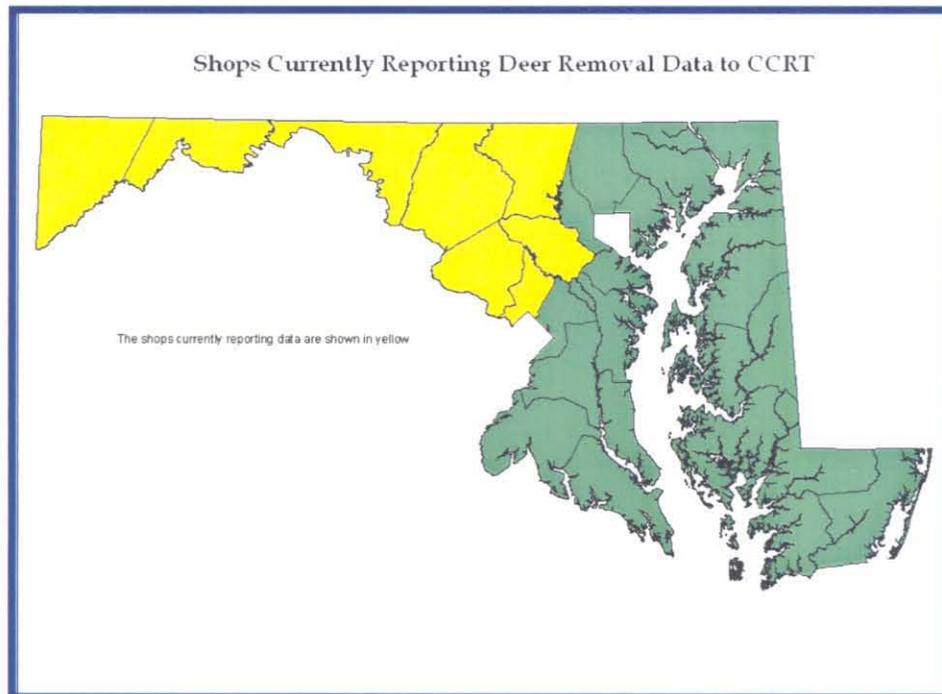
#### **HISTORIC DEER CARCASS REMOVAL DATA**

Historic deer carcass removal data is provided in map form for SHA Region 6 in Appendix II to this report.

#### **PROSPECTIVE DEER CARCASS REMOVAL DATA**

Earthspan was to recommend a reporting structure/procedure and to begin collecting *prospective* deer strike data from the SHA Districts beginning in September 2001. All RME shops were supplied with the new report forms (crew cards) in August/September 2001, and they are being used. Several of the Districts have also been reporting their data to Earthspan on a weekly or monthly basis via e-mail, since September 2001. This limited version of the database was distributed to all SHA shops in August 2001 along with the new report forms, and several shops have been using this initial database to report deer removals since September 2001 (see map below).

These SHA Districts (in yellow) have provided *prospective* deer-vehicle collision data, since September 1 2001. Detailed maps showing deer carcass removal density for each county is contained in Appendix III to this report.



### **Database Development Work**

After initial surveys with SHA personnel, Earthspan decided along with SHA that a statewide, uniform system for collecting deer carcass removal data should be implemented and that this data should be made easily analyzable within a GIS. Several methods were discussed with various personnel within SHA. The first conceptual attempt at a statewide reporting system was to create a web-based mapping application that could be used both for entering data and for viewing data already collected. This approach was deemed too complicated to be practical.

In the course of meetings with SHA District 6 personnel, Earthspan learned about their method of collecting and cataloging deer carcass removals. Maintenance crews would report removals via a “crew day card,” and one person in each shop had the responsibility of entering the data into a spreadsheet. Then one person in the district would take this data and enter it into an Access database for storage. The locations were referenced to the Highway Location Reference system. After reviewing this database Earthspan decided that this was the best option for recording and storing deer carcass removals for later analysis.

Earthspan obtained this database from SHA and proceeded to make changes to it to fulfill other requirements of the project. In order to get the data to interact properly within a GIS, Earthspan needed to modify the database to make the GIS road layer compatible with the deer carcass removal data through a process called linear referencing. Linear referencing is a process by which data can be placed along a line on a map representing a feature such as a road, as long as the road layer and the data to be plotted contain some of the same information. In this case it is a field referred to as "nlfid" in the data. The nlfid is a unique id given to all roads in the state. By matching this id between the road layer and the deer removal data, a point can be placed on the appropriate road on the map. The milepoint field is used to determine where on the appropriate line that point is placed. Earthspan modified the database so that an nlfid was generated in the deer carcass removal records. This database was initially distributed to all SHA districts in August 2001. For the purposes of this report, we refer to this version of the database as the 'interim database.'

Upon distribution of the interim database, some shops/districts began using it right away. Others attempted to use it but were unable to do so due to technical difficulties. Still other shops and districts did not appear to use the database. The interim database worked by distributing Microsoft Access files to all users. The users would enter data for their jurisdiction. The information entered by the user was enough to determine location (i.e., Milepoint and nlfid). As the user entered data, they needed to push a button to create the nlfid field in the database. After a given period of time, usually one month, the user would push a button that would trigger an e-mail function that would send the data to Earthspan for compilation.

The "database" development was not a major component of the project at that time, but after assessing the interim database and receiving feedback from SHA, the decision was made that the shortcomings of this interim database needed to be addressed in order to ensure the future collection of high quality data. This became the primary focus of the project. The database was delivered in beta form in April of 2002; revisions were made from June to September; and the final version was supplied to SHA in October 2002.

Earthspan delivered the "final" database for the project in October 2002. This Access 97 database will be housed on a SHA server that all users who currently have access to the SHA network can access. The data entry form and all resulting data will be stored on this server. Since users can access the form on the network, no additional files will need to be installed on their computers. The database uses the SHA universal roads database to generate lists of valid roads and milepoints, depending on what shop index you are entering data for. This will result in much more accurate data, as most errors in data collected by the interim database were caused by errors in these two values. The form for entering data was designed to look like the form on which crews report deer carcass removals for ease of data entry.

The advantages of the second, or final, version of the database are that it:

1. Restricts users to only enter routes that are valid for a particular shop index number
2. Restricts users to only enter mile points that are valid for the selected road in the selected shop index number.
3. Enables users to record several deer carcass removals at once without entering duplicate information (date and shop) repeatedly.
4. Uses a data entry form that was designed to resemble the form that is to be placed on the back of the crew day card for recording deer carcass removals.
5. Includes a direction field for each carcass removal record; this can be used to record the direction of traffic where the deer was hit.
6. Features file storage in a central location.
7. Obviates the need to place any additional files on individual client computers.

This database is to be maintained by the Office of Traffic and Safety. They have expressed interest in beginning the process of migrating it to an Oracle database in the next 6 to 12 months.

The database data entry form is shown below.

LARRS Incident Viewing Data Entry Form

Index # 8113 Maint Shop Salisbury County Wicomico

Records below are ordered by date, the most recent at the top. Enter new data in the blank record (marked \*). If necessary, scroll down using the scrollbar on the right to find a blank record to enter new data.

Date	Route	Milepoint	Direction	Specific Location	Animal	Sex
11/12/2001		0.00				
*						

Delete Current Record

Enter New Index # and/or Date

QUIT LARRS DATABASE

Date carcass was picked up NUM

## **Recommendations and future database considerations**

Earthspan has the following general comments and considerations for the future of the database.

1. If the roads change over time (e.g., new construction, modifications, etc), the database will need to be updated and maintained to account for this. This will mean that periodically someone be assigned to look after the database and check to see that the roads listed in the "road table" correspond to actual roads, and the same for mile points.
2. In a future version of the database, it should be set up such that a user cannot move to next record until all required fields are filled in for the current record. This was a feature that was intended to be included in the current database, but limitations of Access 97 prevented it.
3. SHA should train its staff regarding how to properly input the deer carcass removal data.
4. SHA should pursue proactive measures to solicit full participation from the entire state.
5. Future versions of the database should be programmed to include several standard reporting forms so that standard reports can be printed out easily without any programming required.

## **MARRS Data Analysis**

Maryland SHA provided Earthspan with a selection of data from the statewide MARRS database regarding accidents involving deer-vehicle collisions. The MARRS database is populated by information from Maryland Police agencies' accident reports. Earthspan compared the sample of data supplied from MARRS with data collected under this project – housed in what is now called the Large Animal Removal Reporting System (LARRS) – over the same time period. The results are summarized in the table below (next page).

Generally, the MARRS database captured only a very small portion (approximately 14% overall) of the deer-vehicle collisions that were collected by the LARRS database over the same time period and locations. This comparison is based on the assumption that a deer carcass that has been removed from the side of the road was, in fact, hit by a car or truck and therefore represents evidence of a deer-vehicle collision. The MARRS database likely contains only the more serious accidents, i.e., the ones where the driver remained in the location of the accident long enough to report the incident to the Police. But clearly, the incidence of deer-vehicle collisions is more prevalent than that reflected in MARRS alone.

The MARRS database does have the advantage that it includes witnesses to the deer-vehicle collisions, which provides additional information about time of day, weather, and other factors that the LARRS database does not capture.

**Comparison of a sample of MARRS data vs. a like sample of LARRS Deer Carcass Removal Data**

County	2001				2002			TOTALS	% captured
	Sept	Oct	Nov	Dec	Jan	Feb	Mar		
Allegany	23	2	1	79	42			147	
MARRS	4	3	2	1	2			12	8%
Anne Arundle <sup>3*</sup>		33*		65	34		12	111	
MARRS	5	18	36	15	8		5	87	78%
Baltimore	36	77	129	51	37	27	29	386	
MARRS	5	13	9	7	3	4	1	42	11%
Calvert	6	23	65	26	19	15		154	
MARRS	1	2	19	5	2	1		30	19%
Fredrick	46				73	35		154	
MARRS	3				7	1		11	7%
Garrett	29	75	141	54	31	24	33	387	
MARRS	2	2	11	2	2	1	1	21	5%
Harford	20				20	32		72	
MARRS	3				5	7		15	21%
Howard	33	133	220	114	64	43	39	646	
MARRS	1	16	19	10	4	0	2	52	8%
Somerset	1	11	17	7	4	3	4	47	
MARRS	0	5	14	4	4	1	1	29	62%
Washington	6	118	168	78	41	21		432	
MARRS	7	10	18	6	7	4		52	12%
Worcester	6	23	48	10	11	5	5	108	
MARRS	2	6	12	2	2	0	1	25	23%

\* Denotes likely incomplete data  
Blank fields represent unreported data

2644 total deer carcass removals recorded  
376 were captured in MARRS

Of this sample, approximately 14% of the recorded data points were captured in MARRS

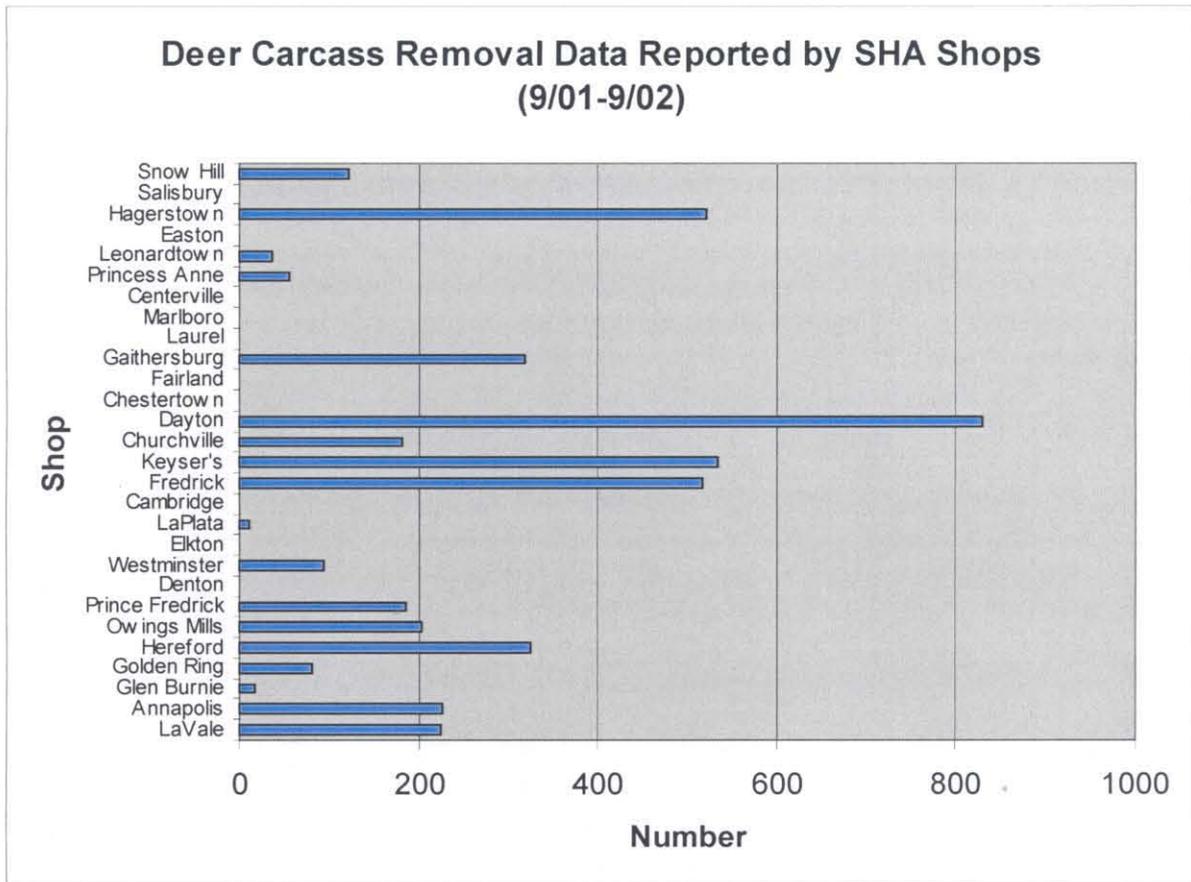
The LARRS/MARRS comparison data table (last page) illustrates that between 5% to 78% of the total number of deer-vehicle collisions collected through LARRS were captured in MARRS. This was not a one-to-one comparison but rather a gross comparison of the total numbers collected in each system over the same geographic area over the same time period.

This analysis is presented here simply as an example to illustrate the extent to which records of deer vehicle collisions that Earthspan collected as part of this project were captured in MARRS. The fact is that both systems are likely incomplete in one way or another. Earthspan is aware, for example, that the LARRS data for Anne Arundle County is probably incomplete, as noted above with an \*.

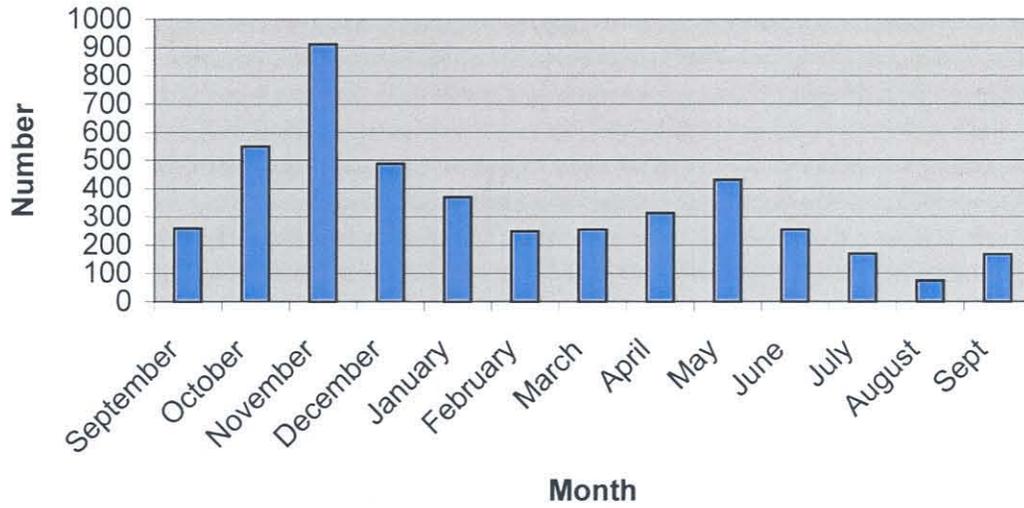
A more thorough analysis could be done, but it would probably make more sense to conduct such an analysis *after* the LARRS database is fully functional on the central SHA server and has been collecting information for some period of time. All efforts should be made to ensure that all SHA shops use the LARRS system once it is initiated and functioning on the SHA server.

**LARRS Data Analysis**

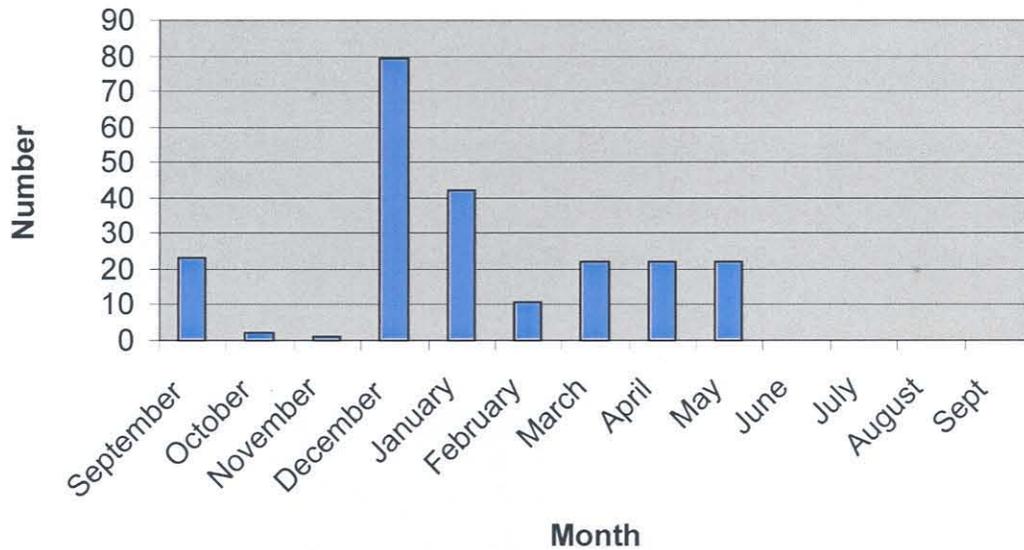
The following bar graphs describe, in detail, the information that is contained in Appendix I. These bar graphs highlight the data first by SHA Shop, and then by month on a statewide basis. Note that these bar graphs only report on data that was submitted by the SHA shops; there are a number of shops for which data was not provided, and there are other instances where data was provided for a given month but it appears to be incomplete. See the table at Appendix I for more details of the actual data.



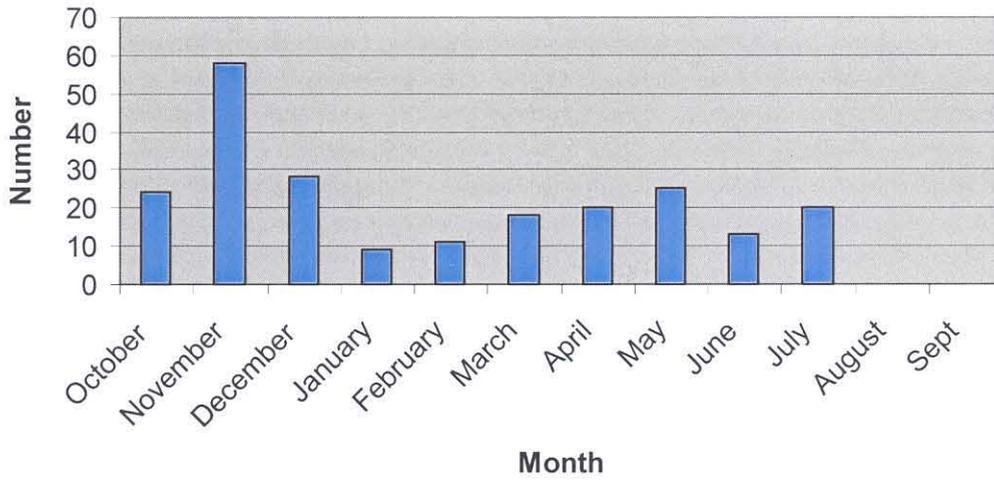
**Deer Carcass Removals Reported By All SHA Shops By Month (9/01 - 9/02)**



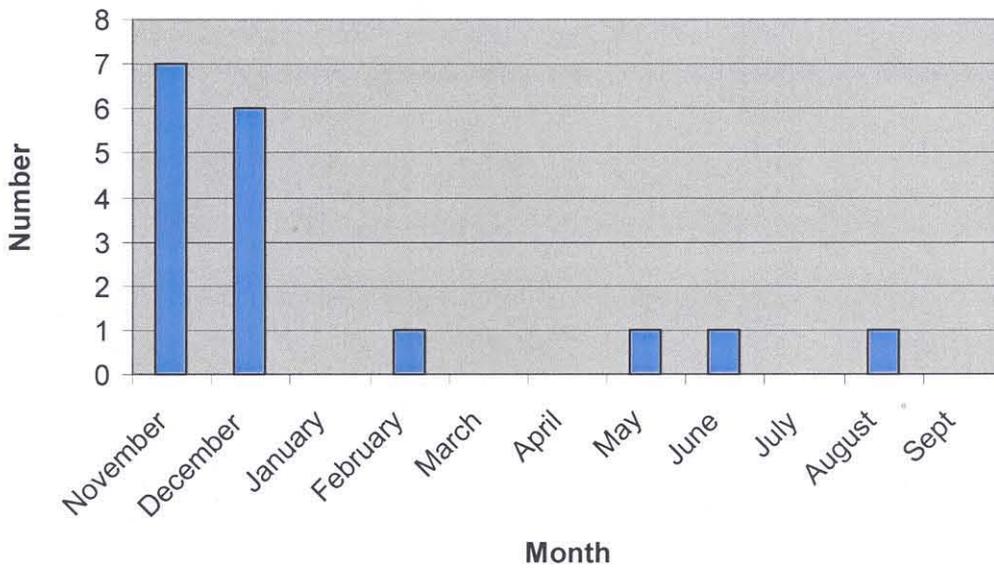
**Deer Carcass Removals Reported by LaVale shop**



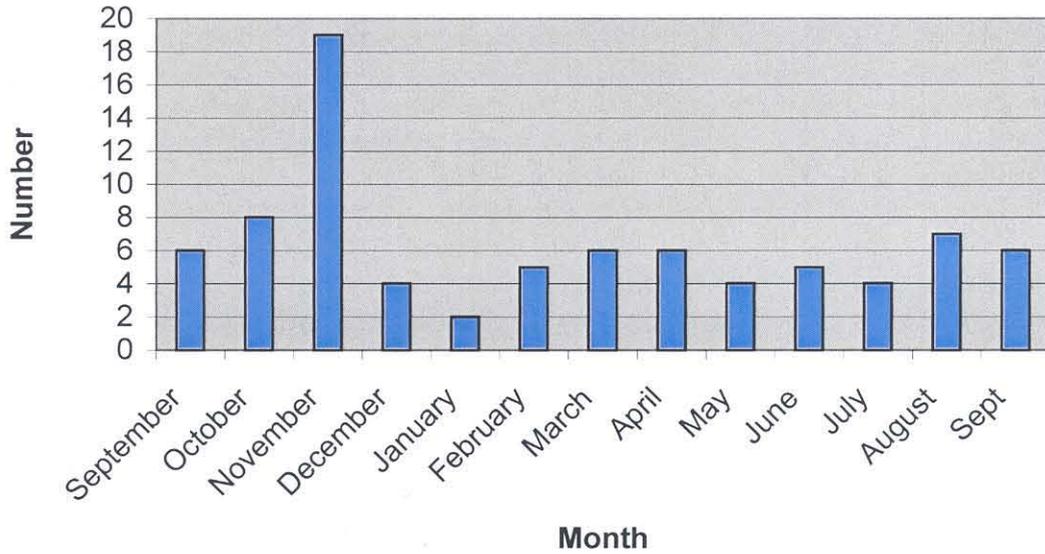
**Deer Carcass Removals Reported by Annapolis Shop**



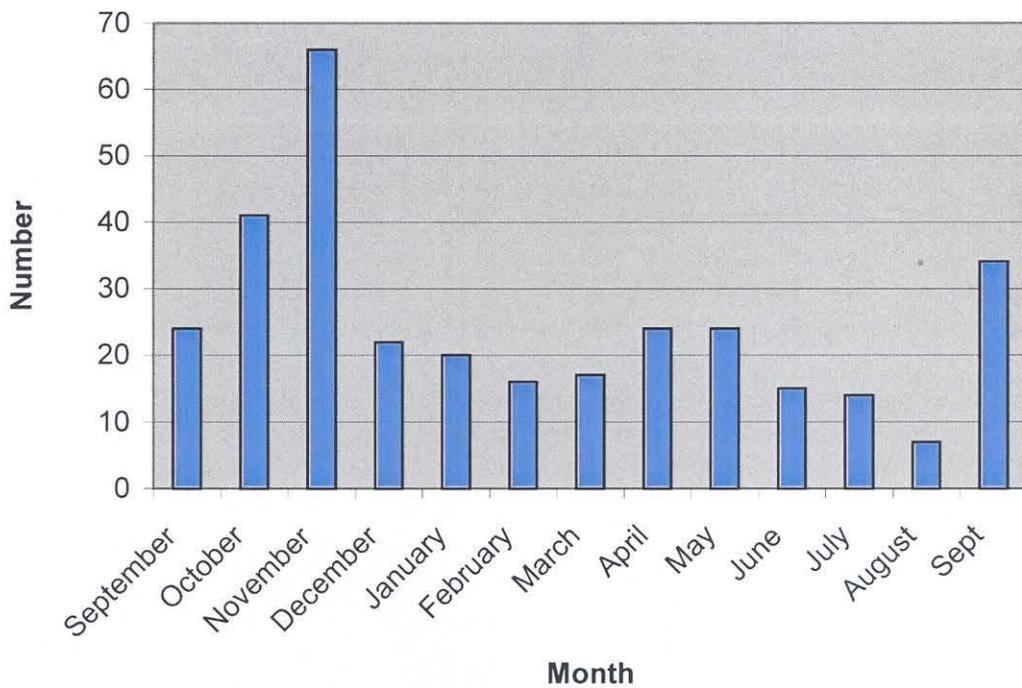
**Deer Carcass Removals Reported by Glen Burnie Shop**



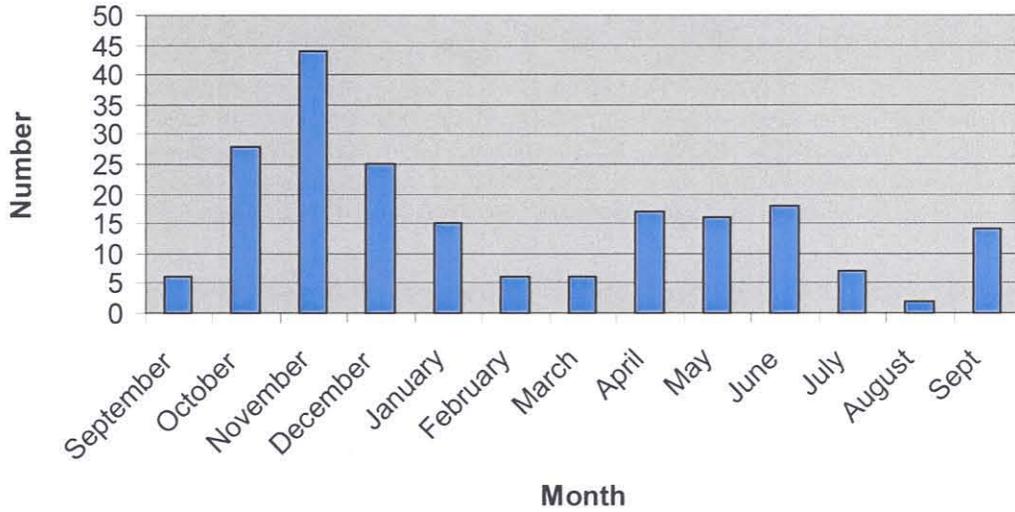
Deer Carcass Removals Reported by Golden Ring Shop



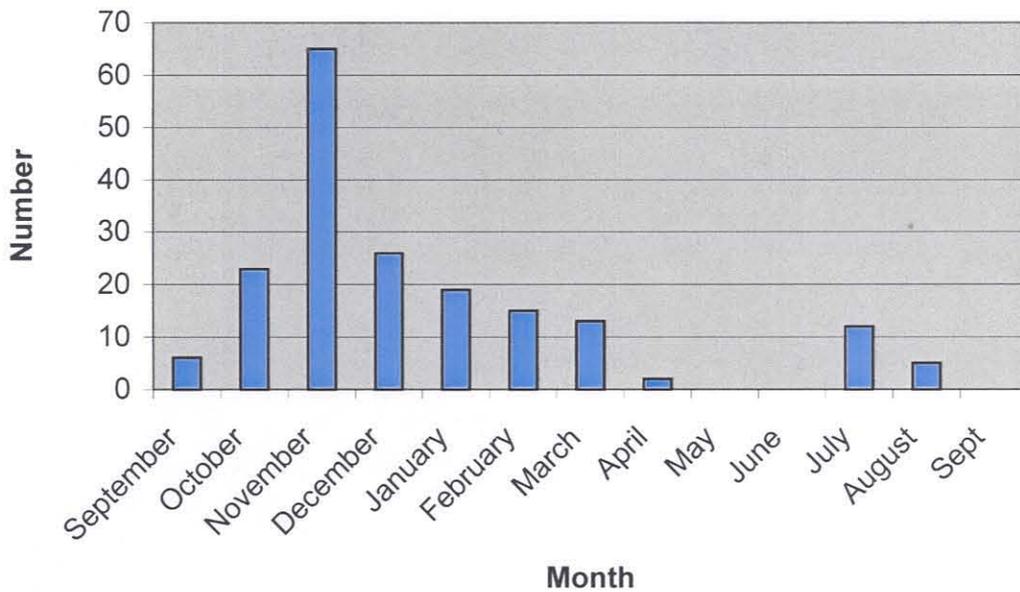
Deer Carcass Removals Reported by Hereford Shop



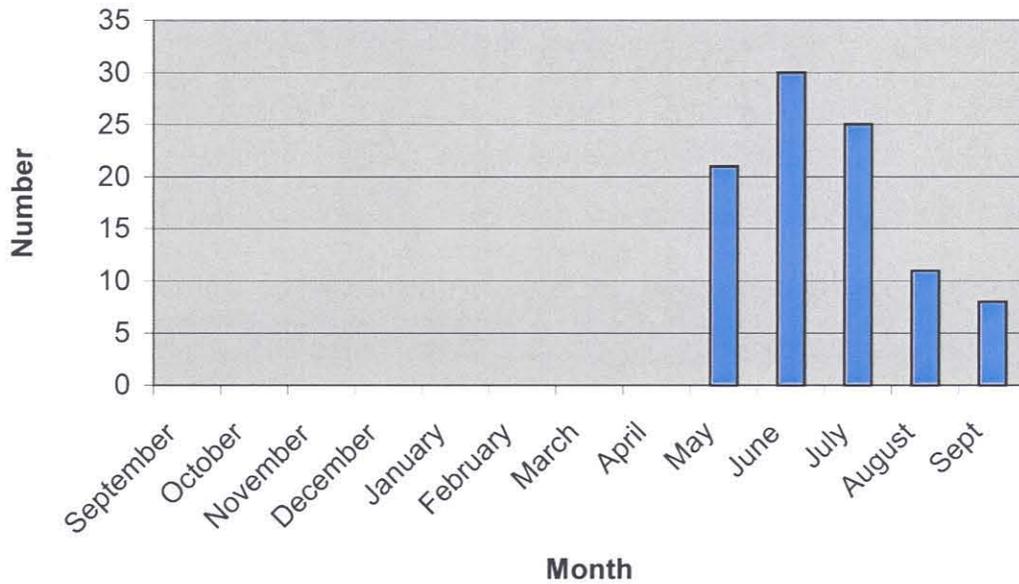
Deer Carcass Removals Reported by Owings Mills Shop



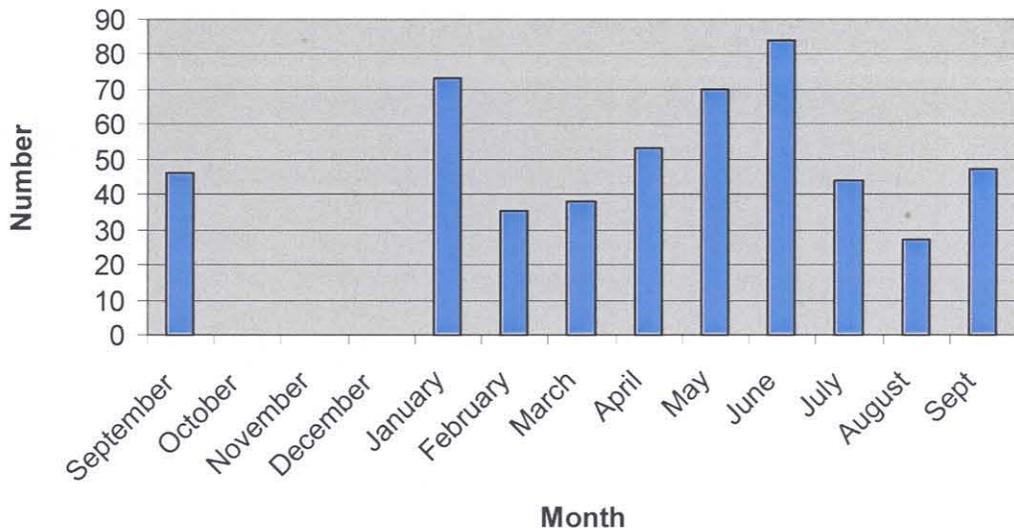
Deer Carcass Removals Reported by Prince Fredrick Shop



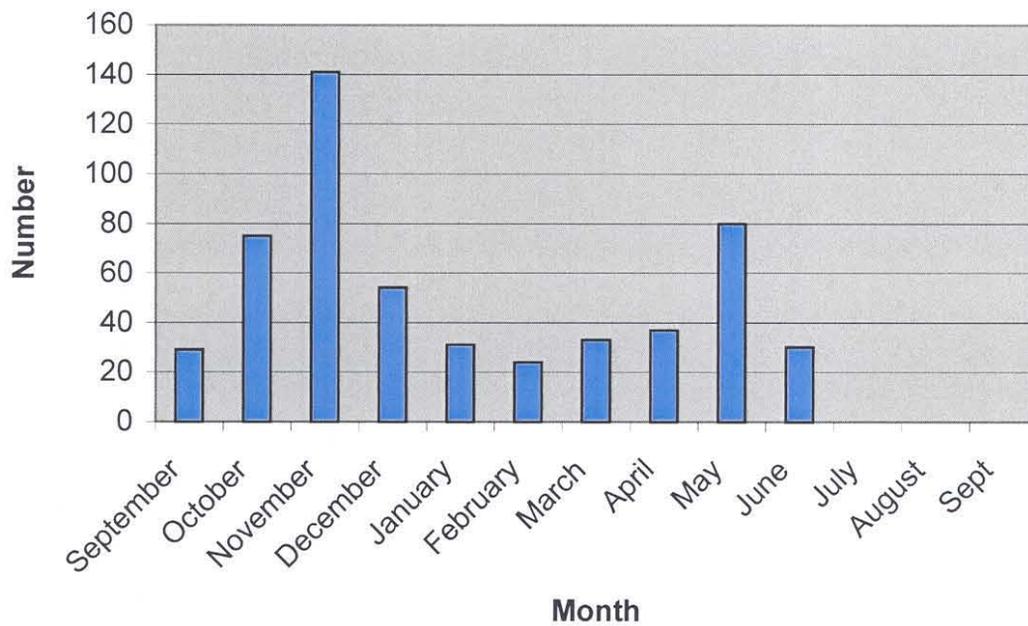
Deer Carcass Removals Reported by Westminster Shop



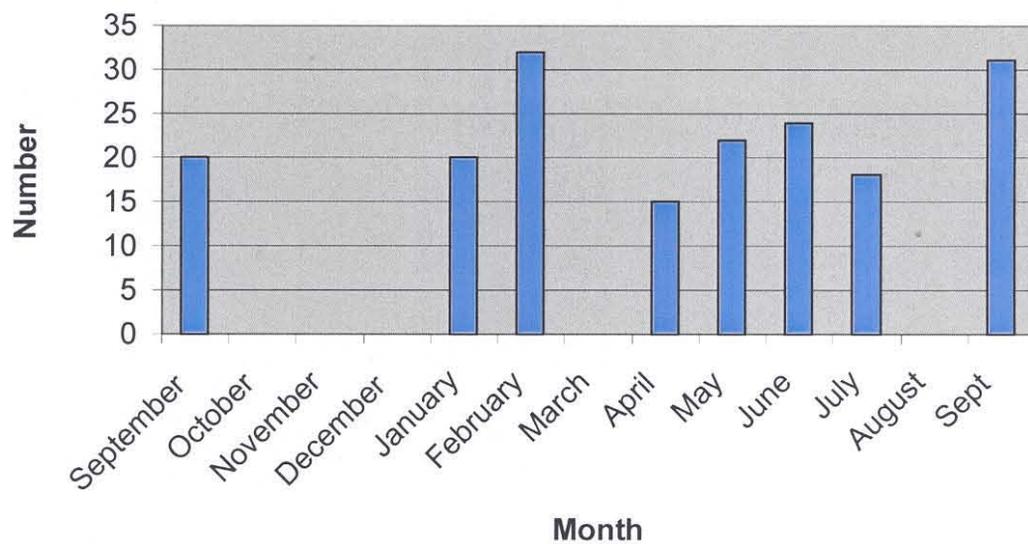
Deer Carcass Removals Reported by Fredrick Shop



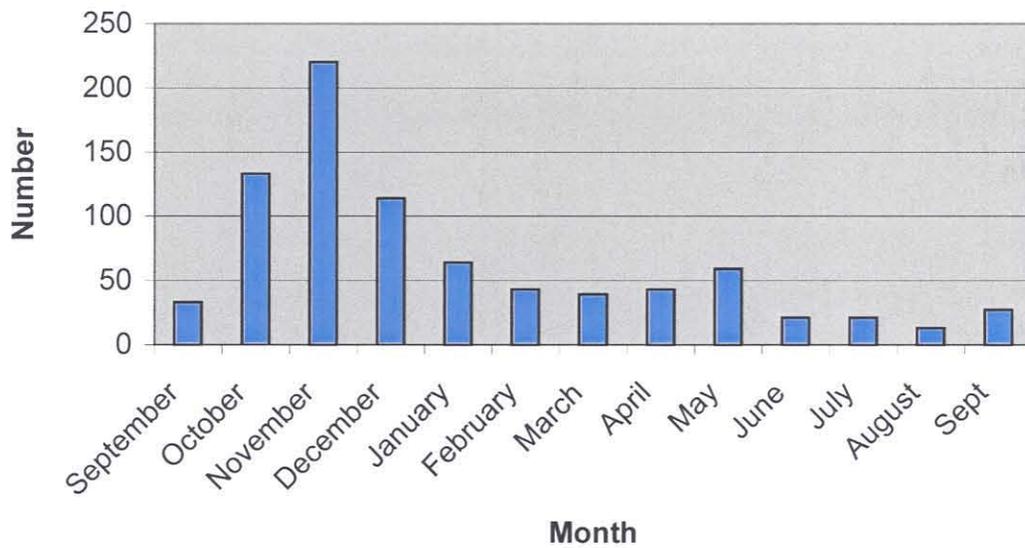
Deer Carcass Removals Reported by Keyser's Ridge Shop



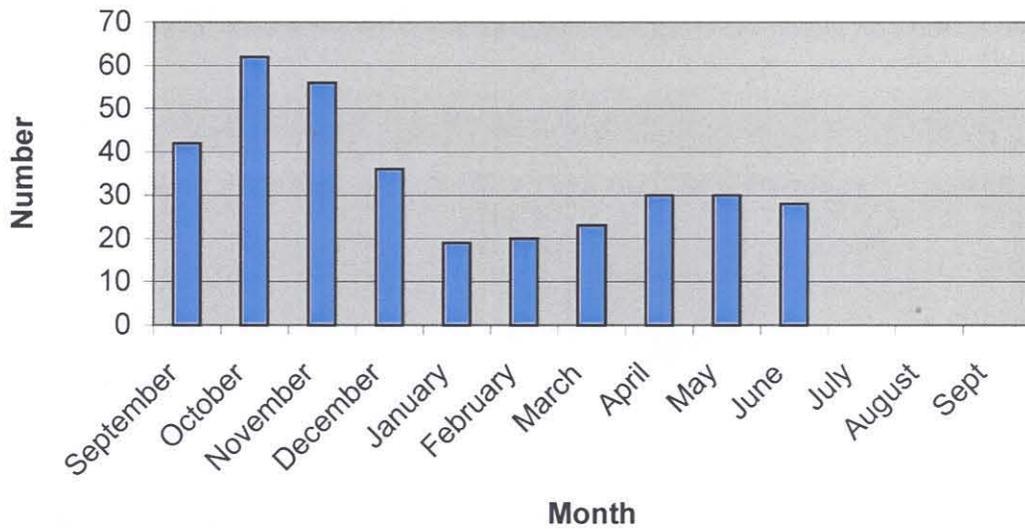
Deer Carcass Removals Reported by Churchville Shop



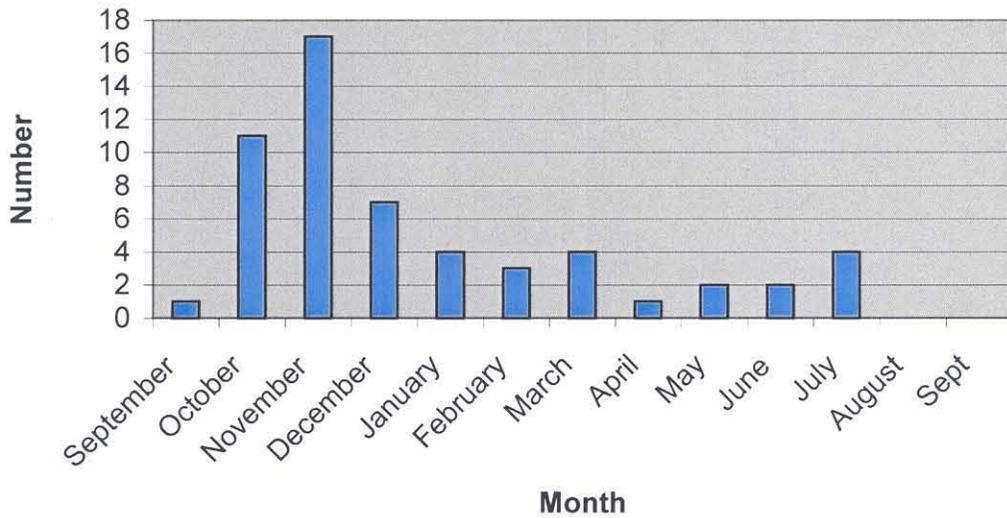
Deer Carcass Removals Reported by Dayton Shop



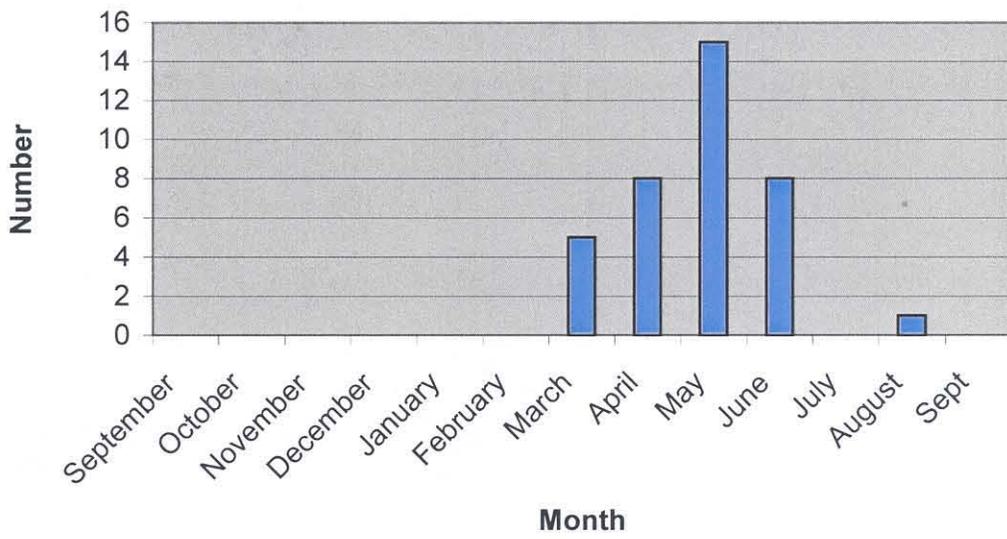
Deer Carcass Removals Reported by Gaithersburg Shop



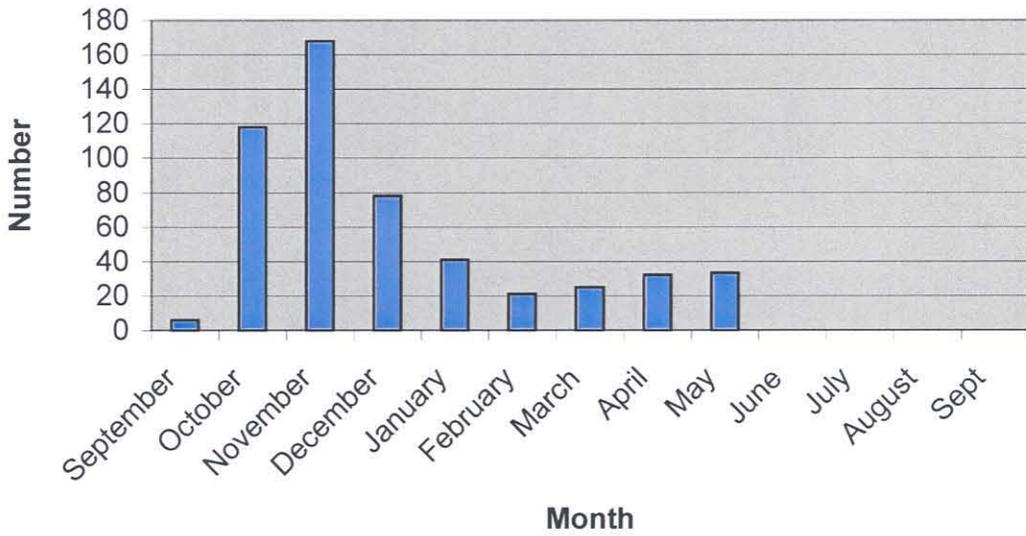
Deer Carcass Removals Reported by Princess Anne Shop



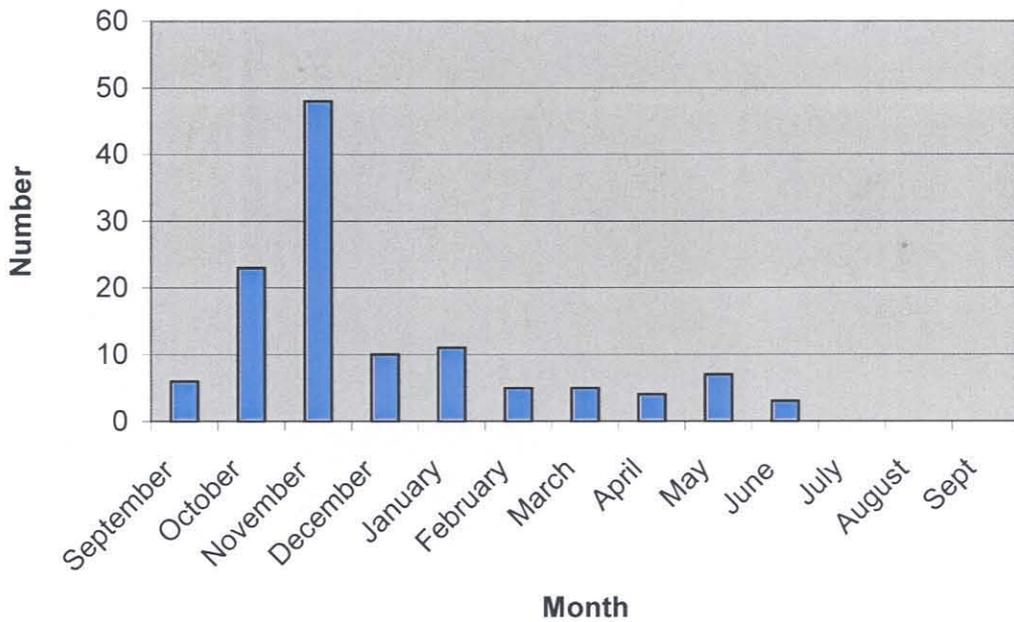
Deer Carcass Removals Reported by Leonardtown Shop



Deer Carcass Removals Reported by Hagerstown Shop



Deer Carcass Removals Reported by Snow Hill Shop



## **APPENDIX I**

**Data table Reporting on Deer Carcass Removals Reported by  
County and SHA Shop for the period September 1, 2001 to  
September 30, 2002.**

## Deer Carcass Removals by Month by County and SHA Shop

Sept. 2001 to Sept. 2002

County	Shop	2001				2002												TOTAL
		September	October	November	December	January	February	March	April	May	June	July	August	Sept				
Allegany	LaVale	23	2	1	79	42	11	22	22	22	22	22	22	22	22	22	224	
Anne Arundel	Annapolis	3*	24	58	28	9	11	18	20	25	13	20					226	
	Glen Burnie		9*	7	6		1			1	1				1		17	
Baltimore	Golden Ring	6	8	19	4	2	5	6	6	4	5	4	7	6			82	
	Hereford	24	41	66	22	20	16	17	24	24	15	14	7	34			324	
	Owings Mills	6	28	44	25	15	6	6	17	16	18	7	2	14			204	
Calvert	Prince Fredrick	6	23	65	26	19	15	13	2			12	5				186	
Caroline	Denton																	
Carroll	Westminster									21	30	25	11	8			95	
Cecil	Elkton																	
Charles	LaPlata	11															11	
Dorchester	Cambridge																	
Fredrick	Fredrick	46				73	35	38	53	70	84	44	27	47			517	
Garrett	Keyser's Ridge	29	75	141	54	31	24	33	37	80	30						534	
Harford	Churchville	20				20	32		15	22	24	18		31			182	
Howard	Dayton	33	133	220	114	64	43	39	43	59	21	21	13	27			830	
Kent	Chesterstown																	
Montgomery	Fairland																	
	Gaithersburg	42	62	56	36	19	20	23	30	30	28*						318	
Prince George's	Laurel																	
	Marlboro																	
Queen Anne's	Centerville																	
Somerset	Princess Anne	1	11	17	7	4	3	4	1	2	2	4					56	
St. Mary's	Leonardtown							5	8	15	8		1				37	
Talbot	Easton																	
Washington	Hagerstown	6	118	168	78	41	21	25	32	33							522	
Wicomico	Salisbury																	
Worcester	Snow Hill	6	23	48	10	11	5	5	4	7	3						122	
	<b>TOTAL</b>	<b>259</b>	<b>548</b>	<b>910</b>	<b>489</b>	<b>370</b>	<b>248</b>	<b>254</b>	<b>314</b>	<b>431</b>	<b>254</b>	<b>169</b>	<b>74</b>	<b>167</b>			<b>4487</b>	

Blank fields represent unreported data

\* Indicates possible incomplete data for the month

All data reported by SHA shops, as it was provided to Earthspan and SHA headquarters

## Appendix II

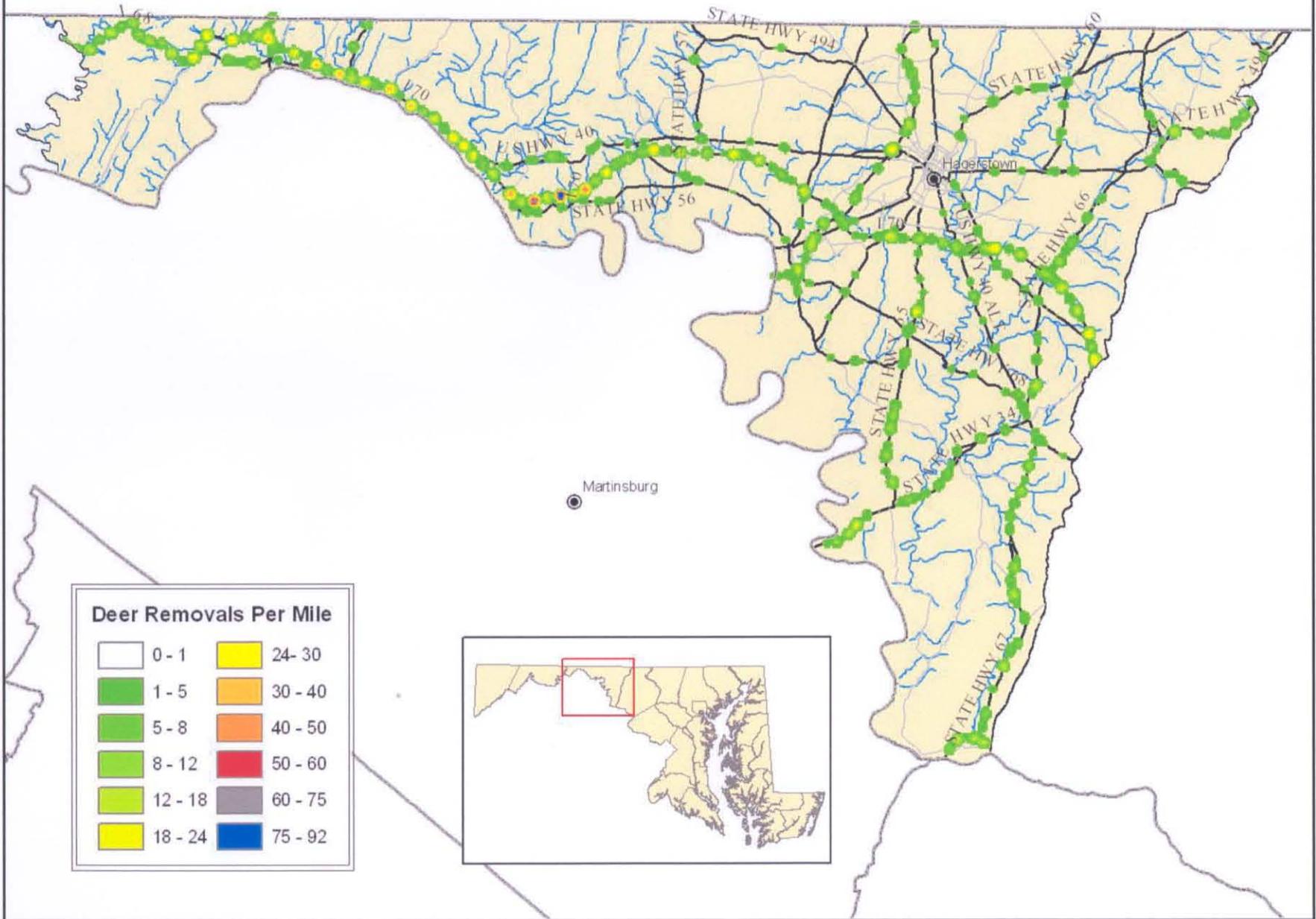
### Large Animal Removal Reporting System; Names of Authorized Read/Write Users

District	Shop/Area	Name	Novell Account	Access Rights	
District 1	Computer	Kim Musser	Kmusser	Read/Write	
	Salisbury	Sheila Sehman	Ssehman	Read/Write	
	Salisbury	Terri Zimmer	Tzimmer	Read/Write	
	Cambridge	Joan Frazier	Jfrazier	Read/Write	
	Cambridge	Toni Alexander	Talexander	Read/Write	
	Snow Hill	Gale Lank	Glank	Read/Write	
	Snow Hill	Pat Doyle	Pdoyle	Read/Write	
	Snow Hill	Jay Jackson	Jjackson	Read/Write	
	Snow Hill	Roy Brewington	Rbrewington	Read/Write	
	Princess Anne	Bea Daniels	Bdaniels	Read/Write	
	Princess Anne	Linda Labo	Llabo	Read/Write	
	District 2	Computer	John Hansen	Jhansen	Read/Write
		Denton	Robby Blackiston	Tblackiston	Read/Write
Denton		Nancie Hall	Nhall	Read/Write	
Centreville		Shirley Dixon	Sdixon1	Read/Write	
Centreville		Phillip Whitlock	Pwhitlock	Read/Write	
Easton		Debbie Dill	Ddill	Read/Write	
Easton		John Lancaster	Jlancaster	Read/Write	
Easton		Scott Cole	Scole	Read/Write	
Easton		Dan Voshell	Dvoshell	Read/Write	
Elkton		Francis Wright	Fwright	Read/Write	
Elkton		Denise Brooks	Dbrooks1	Read/Write	
Elkton		Mary Jane Kelly	Mkelly	Read/Write	
Chestertown		Elma Myers	Emyers	Read/Write	
Chestertown		Matt Voshell	Mvoshell	Read/Write	
Chestertown		Donna White	Dwhite1	Read/Write	
District 3		Computer	Stephen Day	Sday	Read/Write
	Laurel	Garness Stewart	Gstewart	Read/Write	
	Laurel	Sheilita Leftwich	Sleftwich	Read/Write	
	Laurel	Andre Beckles	Rbeckles	Read/Write	
	Marlboro	Sandy Moufi	Smoufi	Read/Write	
	Marlboro	Joe Geckle	Jgeckle	Read/Write	
	Marlboro	Darlene Boswell	Dboswell	Read/Write	
	Marlboro	Patrice Proctor	Pproctor	Read/Write	
	Gaithersburg	Brooke McClelland	Bmcclelland	Read/Write	
	Gaithersburg	Candice Polk	Cpolk	Read/Write	
	Gaithersburg	Lisa Hopkins	Lhopkins	Read/Write	
	Fairland	John Ritter	Jritter	Read/Write	
	Fairland	Ron Ergott	Rergott	Read/Write	
	Fairland	Wayne Mowdy	Wmowdy	Read/Write	
Fairland	Xiomara Lozano	Xlozano	Read/Write		
District 4	Computer	Mike Rinkus	Mrinkus	Read/Write	
	Golden Ring	Robin Richardson	Rrichardson	Read/Write	
	Golden Ring	Vickie Taylor	Vtaylor	Read/Write	
	Hereford	Pat Murray	Pmurray	Read/Write	
	Hereford	Linda Palmer	Lpalmer2	Read/Write	
	Hereford	Debbie Thompson	Dthompson	Read/Write	
	Owings Mills	Mary Andrews	Mandrews	Read/Write	
	Churchville	Frances McMillan	Fmcmillan	Read/Write	
	Churchville	Clyde Harrell	Charrell	Read/Write	
	District 5	Computer	Jim Krehely	Jkrehely	Read/Write
Annapolis		Linda Steele	Lsteele	Read/Write	
Annapolis		Luan Danzy-Gross	Ldanzygross	Read/Write	
Glen Burnie		Dana Shade	Dshade	Read/Write	
Glen Burnie		Marie Denner	Mdenner	Read/Write	
LaPlata		Linda Simms	Lsimms	Read/Write	
LaPlata		Becky Dickerson	Rdickerson	Read/Write	

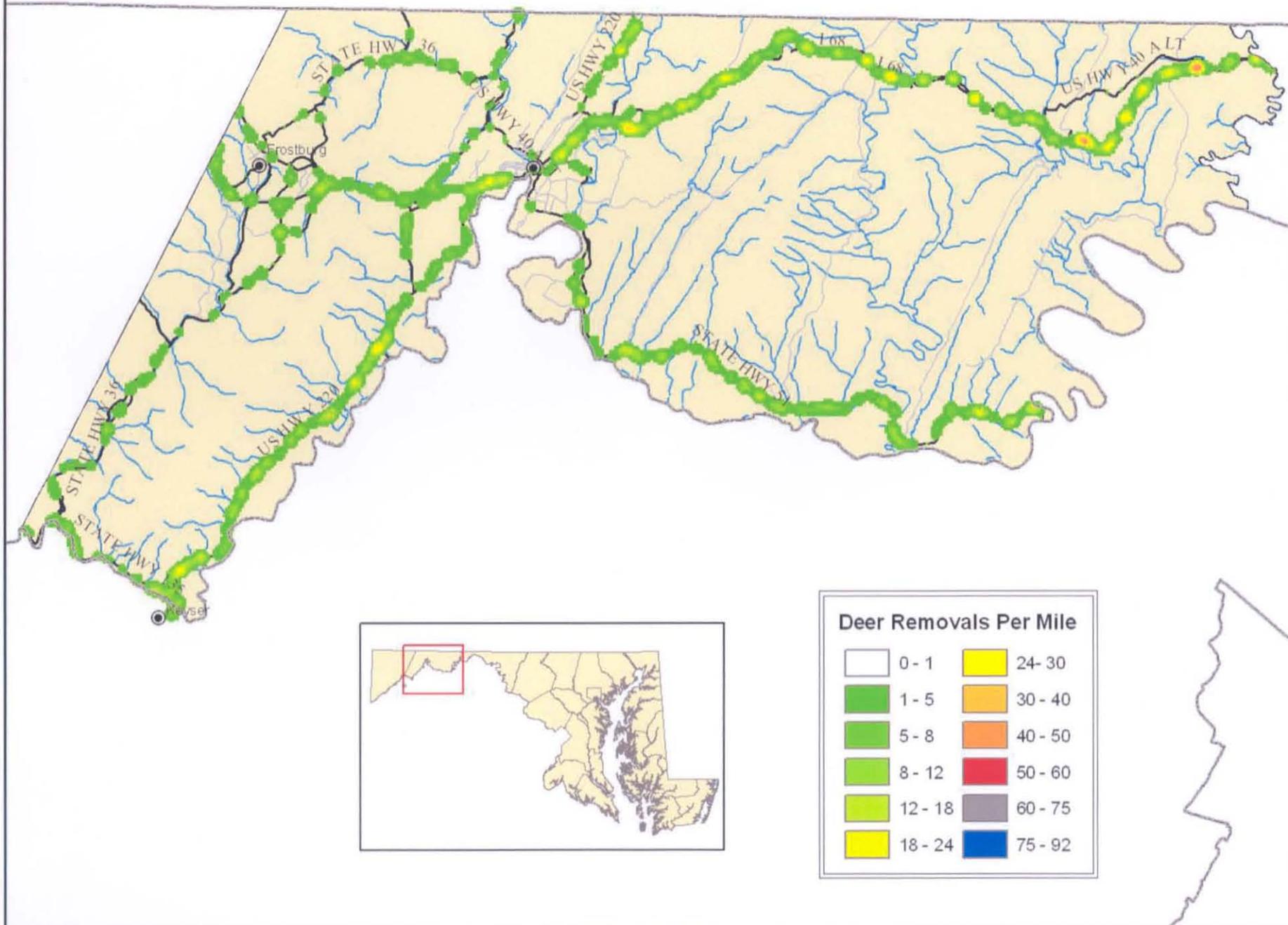
District	Shop/Area	Name	Novell Account	Access Rights
District 5 (continued)	Prince Frederick	Lona Drake	Ldrake	Read/Write
	Prince Frederick	Kristen Kissinger	Kkissinger	Read/Write
	Leonardtown	Sandie Jackson	Sjackson	Read/Write
	Leonardtown	Brenda Wathen	Bwathen	Read/Write
District 6	Computer	Rick Cosner	Rcosner	Read/Write
	Computer	Joe Eshleman	Jeshleman	Read/Write
	LaVale	Patty Grove	Pgrove	Read/Write
	LaVale	Sue Wilson	Swilson	Read/Write
	Hagerstown	Diane Michael	Dmichael	Read/Write
	Keyser's Ridge	Teresa Beechie	Tbeechie	Read/Write
	Keyser's Ridge	Phil Fisher	Pfisher	Read/Write
District 7	Computer	Joel Benyowitz	Jbenyowitz	Read/Write
	Westminster	Bonnie Argabright	Bargabright	Read/Write
	Westminster	Pat Newsome	Pnewsome	Read/Write
	Frederick	Rita Escobar	Rescobar	Read/Write
	Frederick	Heather Wright	Hwright	Read/Write
	Dayton	Lisa Lawler	Llawler	Read/Write
	Dayton	Estella Williams	Ewilliams1	Read/Write
Office of Maintenance	Highway Maintenance	Sandi Sauter	Ssauter	Read/Write
	Highway Maintenance	Dorothy Antlitz	Dantlitz	Read/Write
	Highway Maintenance	Len Schultz	Lschultz	Read/Write

**Appendix III: Historic Deer Carcass Removal Maps  
by County (District 6)**

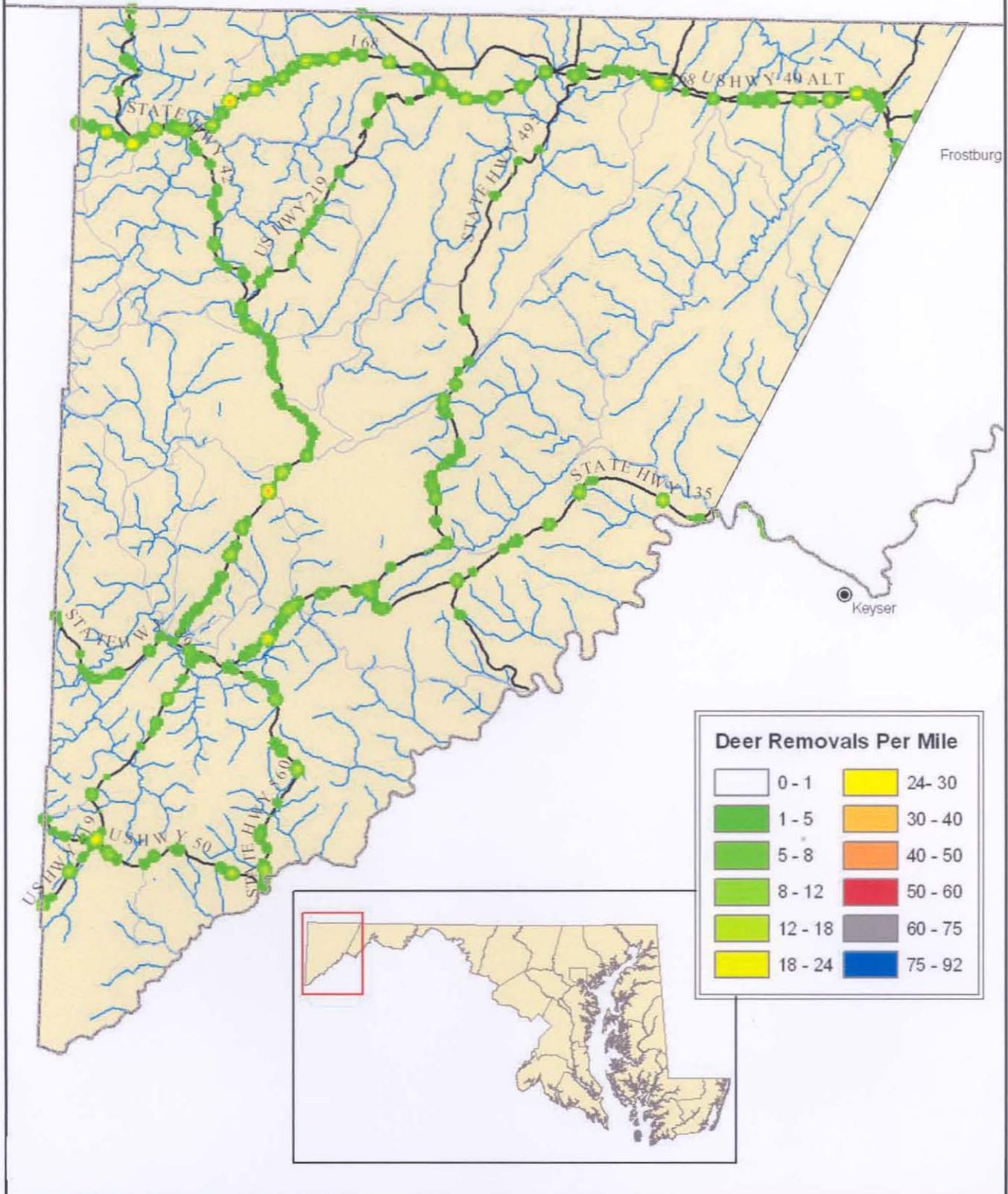
### Washington County Deer Removal Density 1989 to 2001



# Allegheny County Deer Removal Density 1989 to 2001

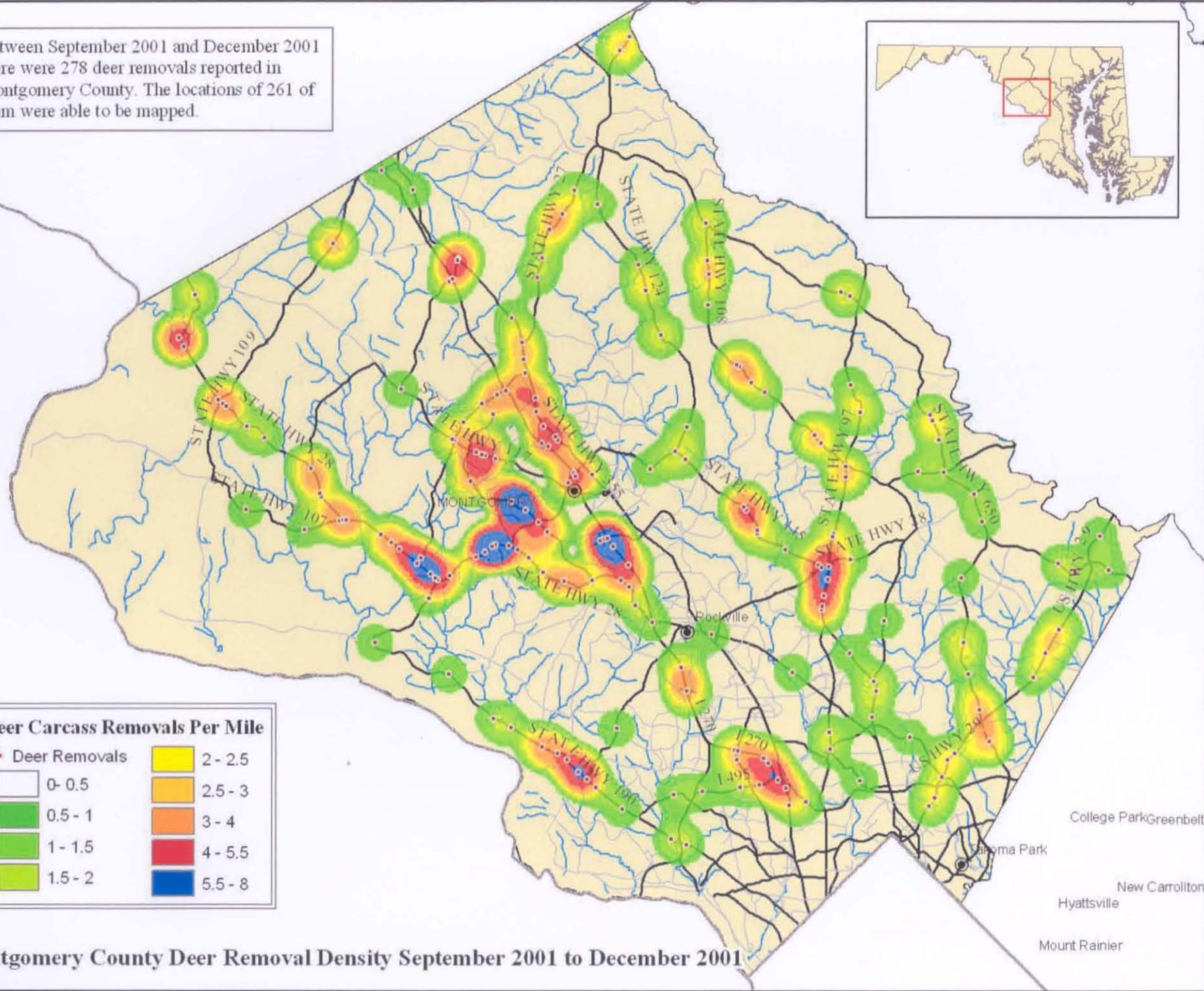
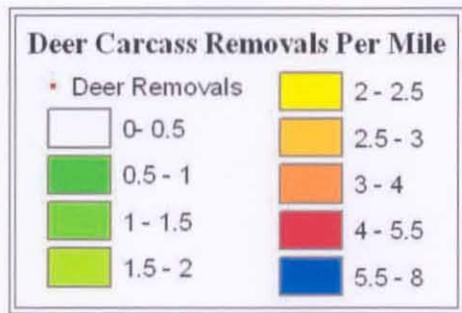


### Garrett County Deer Removal Density 1989 to 2001



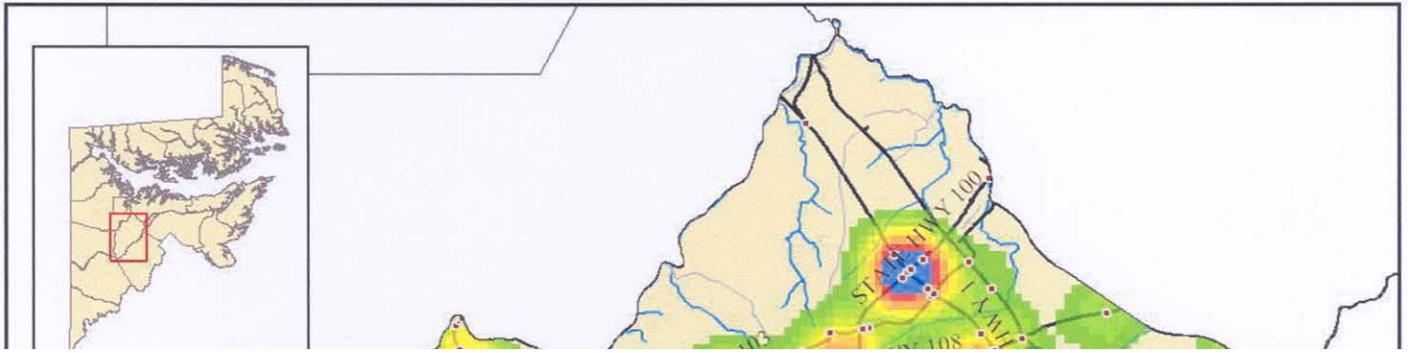
**Appendix IV: Prospective Deer Carcass Removal Maps by  
County (September 2001 to April 2002)**

Between September 2001 and December 2001 there were 278 deer removals reported in Montgomery County. The locations of 261 of them were able to be mapped.

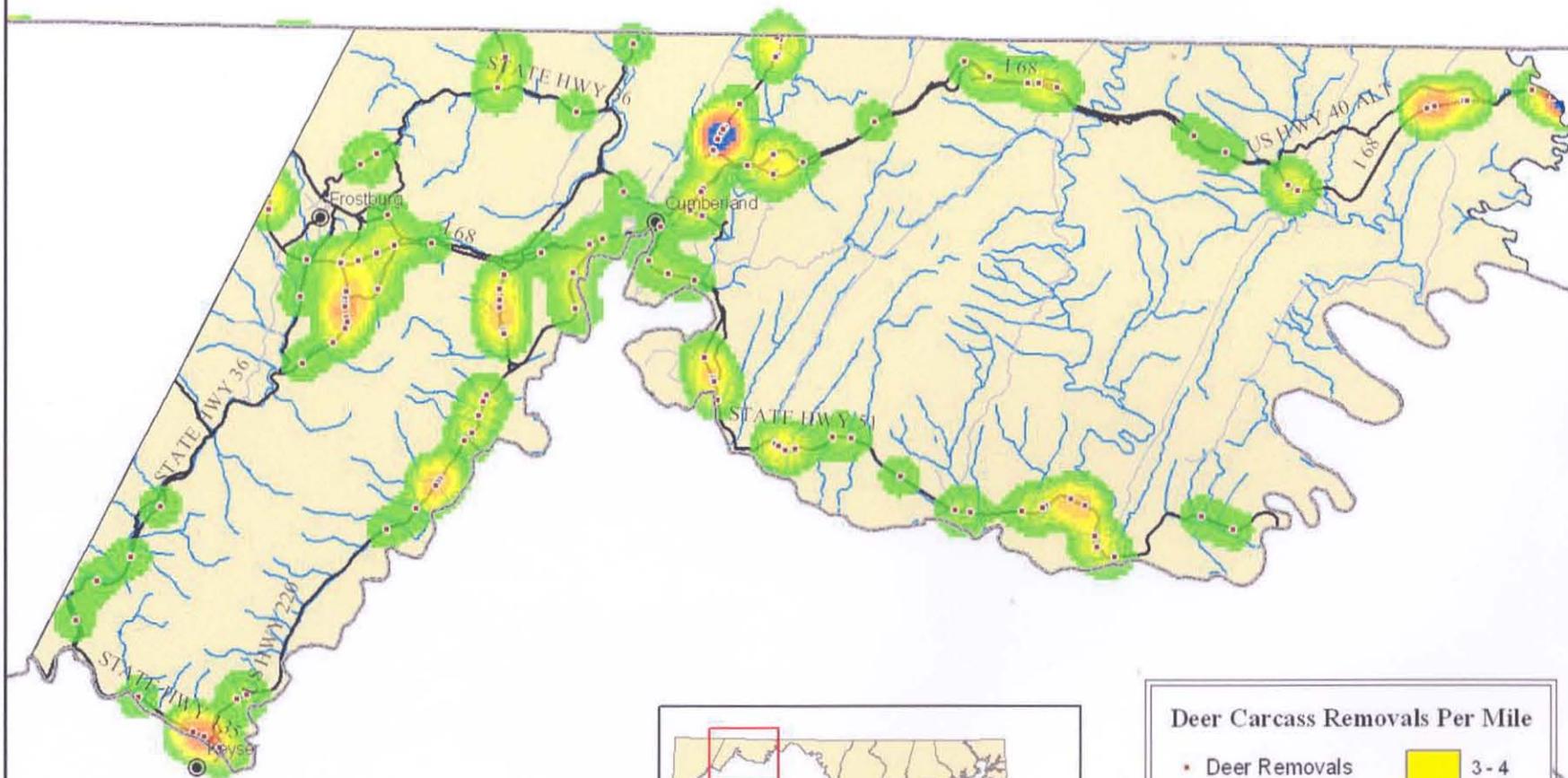


Montgomery County Deer Removal Density September 2001 to December 2001

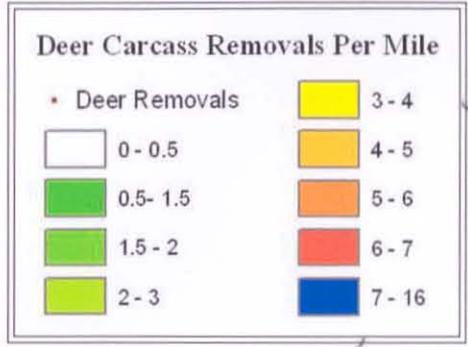
College Park Greenbelt  
 Hyattsville  
 New Carrollton  
 Mount Rainier

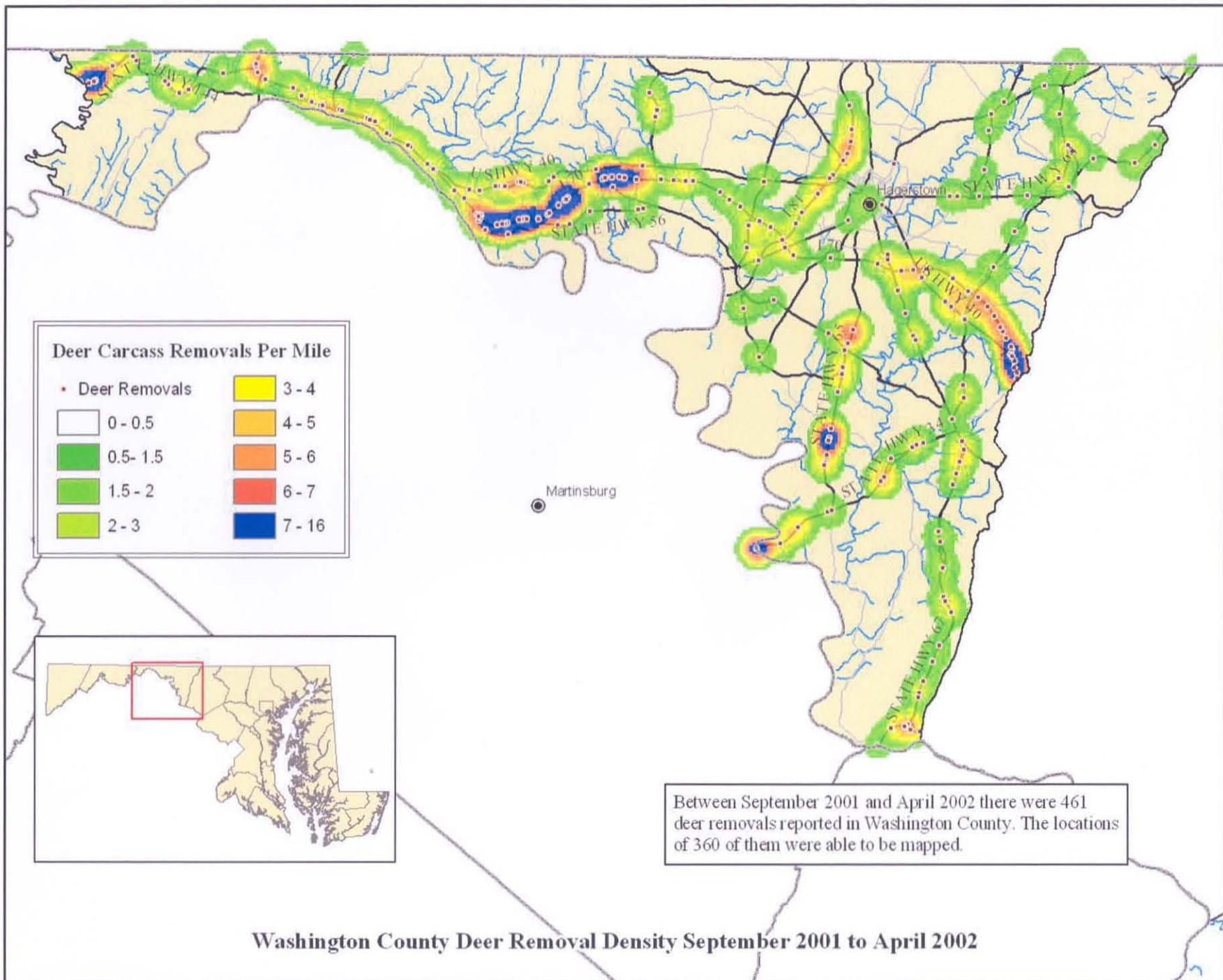


### Allegheny County Deer Removal Density September 2001 to April 2002

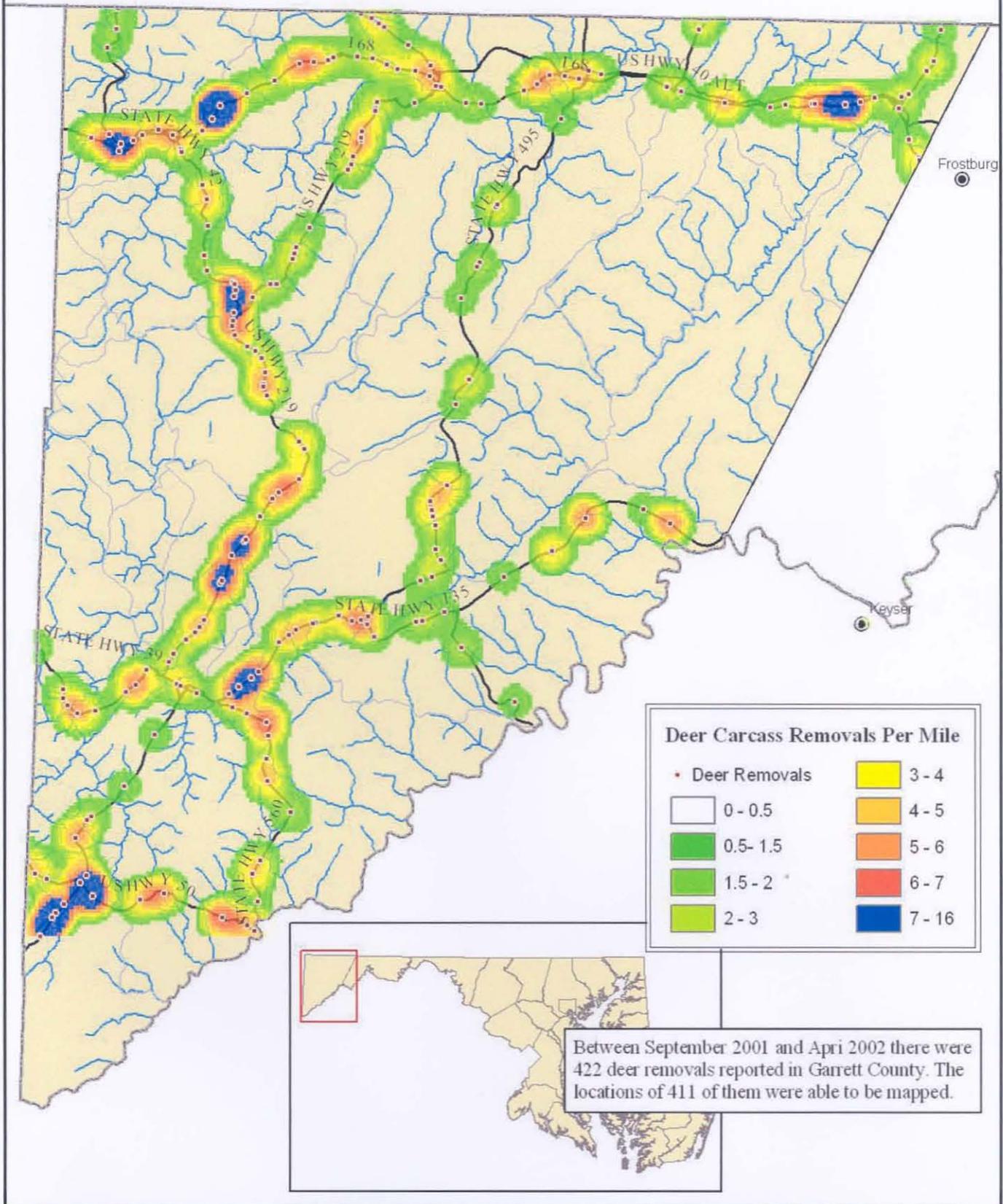


Between September 2001 and April 2002 there were 180 deer removals reported in Allegheny County. The locations of 158 of them were able to be mapped.



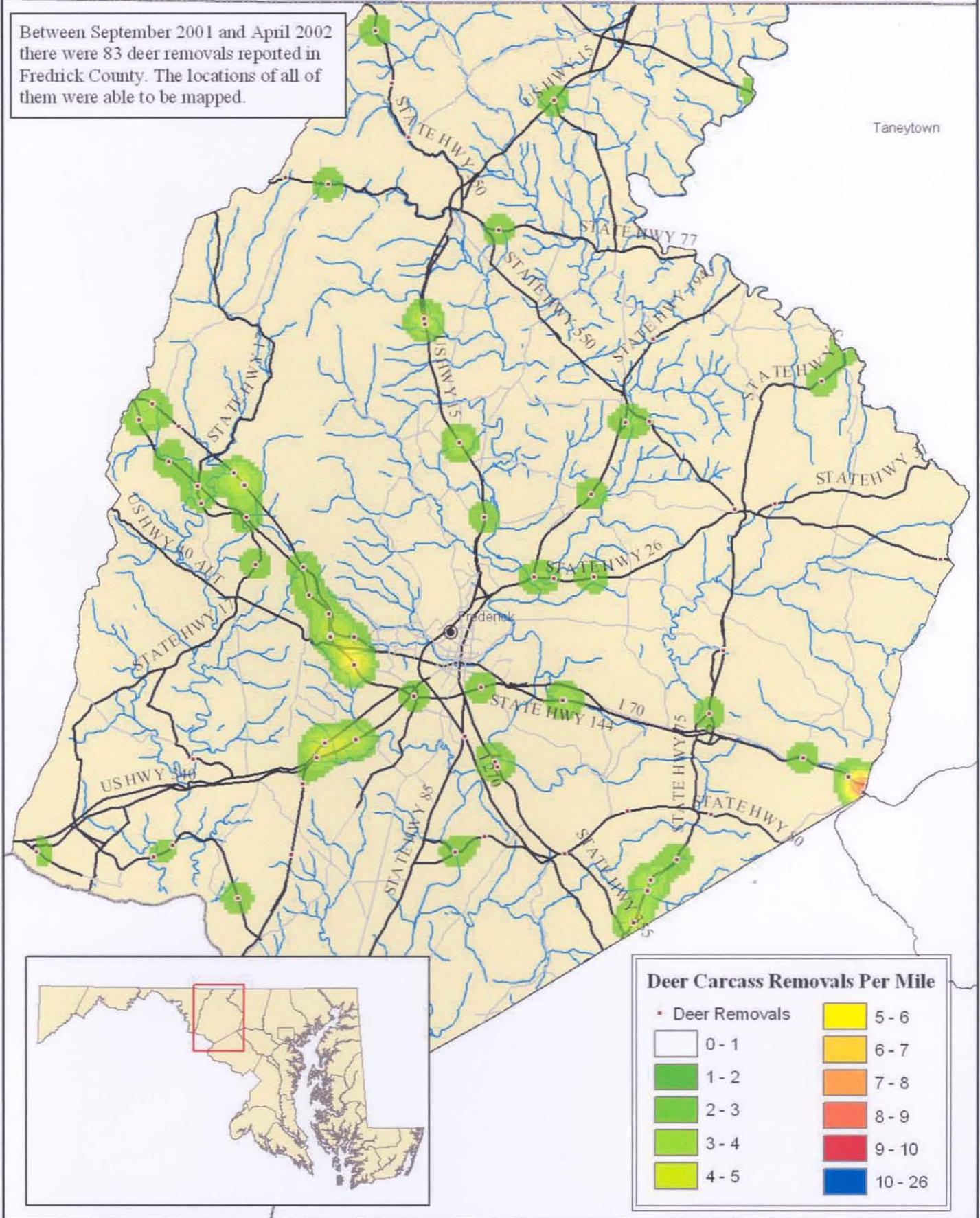


## Garrett County Deer Removal Density September 2001 to April 2002



## Fredrick County Deer Removal Density September 2001 to April 2002

Between September 2001 and April 2002 there were 83 deer removals reported in Fredrick County. The locations of all of them were able to be mapped.



## Carroll County Deer Removal Density September 2001 to April 2002

