

Mussel Estimation Program

Version 1.1.4



USGS-LSC, Aquatic Ecology Lab



Introduction

The purpose of this program is to compute population density and abundance of freshwater mussels based on the survey protocol presented by [Smith et al. \(2001\)](#). The protocol calls for systematic sampling of quadrats, but there are 3 possible variations of the protocol:

1. no excavation (only counts of mussels at the surface of each quadrat) to estimate density of mussels at the substrate surface,
2. excavation of a subset of the quadrats and use of a regression estimator to estimate total density, or
3. all quadrats excavated to estimate total density.

Species-specific estimates of density and abundance will be written to the screen and saved in a database, which can then be saved to a separate text file. In addition, we included computations to help you with survey design.

Please send questions, comments, and suggestions to Dave Smith at david_r_smith@usgs.gov.

Installation

A link on <http://aegis.er.usgs.gov/groups/stats/mussel/> allows you to download a zip file that contains the Mussel Estimation Program and all of its required components. When asked to open or save the file, choose save.

After downloading, extract the zipped files to a file/folder of your choice using WinZip. Retrieve the extracted files and run Setup, which will install the application.

Otherwise, if you are working from a CD then you can extract the zipped file to a file/folder of your choice using WinZip. Retrieve the extracted files and run Setup, which will install the application.

During installation you might encounter some or all of these problems:

1. Some files that are being copied to your computer might be older than those already installed on your computer. If so, you will be given a chance to keep the more recent versions.
2. Some library files might fail to register properly. We've encountered this problem with the following files: msolapui.dll, msado21.tlb, msadomd.dll. In each case, you can choose to ignore the error and proceed with installation. This will not interfere with the functioning of the program.

The file mdac_typ.exe is in the installation package. If you will be installing this package on a Windows 95/98 system, it will require DCOM98 to install properly.

Structure of the program

- [Main screen](#)
- [Managing site information](#) (the place to start)
- [Uploading observations](#)
- [Estimating density and abundance](#)
- [Help with survey design](#)

The main screen

The main screen shows an aerial photograph of a survey site on the Allegheny River at West Hickory, PA and a column of buttons on the right side, which controls the program's functions.



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Managing site information

The topmost button on the main screen with the label "Manage Site Information" is the place to start.



When you click the "Manage Site Information" button, a window will open with a form to select, update, insert, or delete site information.

The information that you need to provide for the site includes:

- **Site name** -- a descriptive name, no more than 30 characters long
- **Study site area** -- the area over which sampling was conducted (m²)
- **Quadrat area** -- the size of the quadrat (m²)
- **Reference bank** -- river bank from which the location of a quadrat is measured. This information is useful when mapping the distribution of mussels at a site. (Although not included in Mussel Estimation Program at this time, we hope to incorporate a mapping capability at some time. We developed a [web-based software package](#) that does have a rudimentary mapping capability and which can be used to visualize where at a site the mussels are concentrated.)
- **Distance interval up** -- the distance between systematically placed quadrats in the up/down river direction (m)
- **Distance interval across** -- the distance between systematically placed quadrats in the across river direction (m)
- **Amount of excavation** -- selection to indicate how many of the quadrats were excavated: none, a subsample, or all.
- **Label for surface quadrats** -- label to denote observations taken at the surface of a quadrat. This label is fixed to be 'Q' and so it must be 'Q' in your input file as well.

- **Label for excavated quadrats** -- label to denote observations taken below the surface of a quadrat via excavation. This label is fixed to be 'Qb' and so it must be 'Qb' in your input file as well.

Click the "Return" button to return to the main screen.

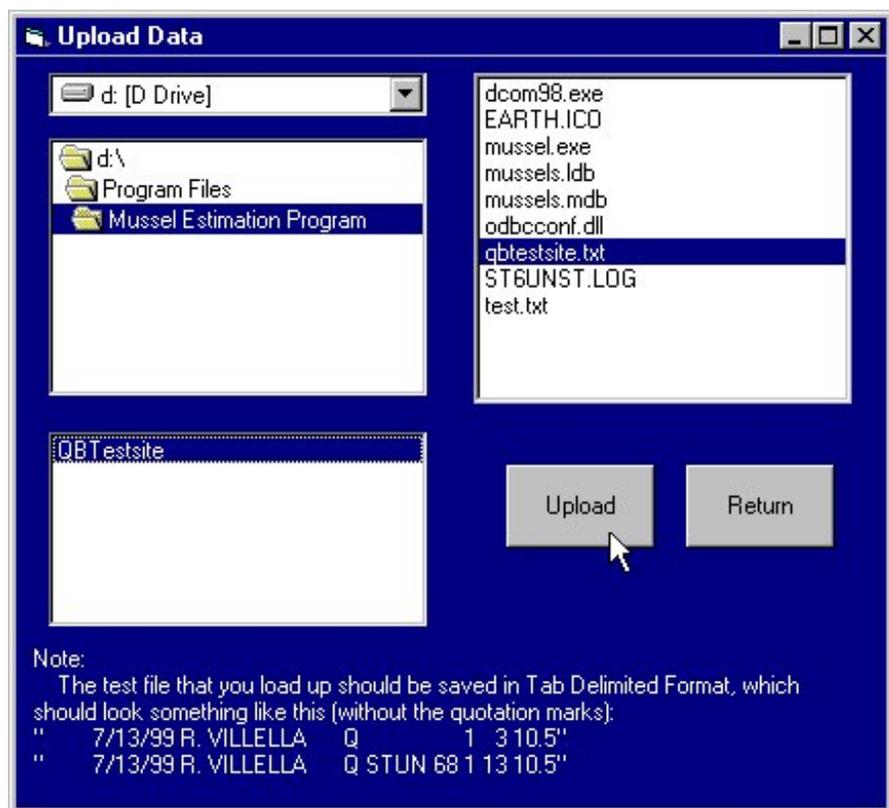
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Uploading observations

After you provide information about your site, then you can upload the file that contains observations from each quadrat that you sampled. The program will automatically associate the observations with the site information.



When you click the "Input Data From a File" button, a window will open with a form that allows you to select the file with observations from each quadrat.



Uploading instructions--Please read first
✕

You can upload data that is in tab delimited format. The dataset must have the following ordered columns: the first column needs to be a blank column (this will allow the computer to link the dataset to your site information), date, observer, unit, species, size, systematic sample number, distance up, distance across. (Refer to data dictionary below for column definitions.)

Saving data tables in tab delimited format is an option in all Windows based database programs (at least the ones that we know of). Within your database program, click "File" and "Save As" and select "Tab Delimited" under the "Save as type" option box. Typically, the file will be saved with an ".txt" extension. Next, open the text file and delete column headings, if present. The data are now ready to be uploaded. As an example, your file should look like the following data (recall that the first column is blank and date is the second column). Note that some rows might not line up because of long values; that will not be a problem as long as the columns are separated by a tab (i.e., tab delimited).

Data Dictionary

DATE: Date of sampling in mm/dd/yy format.

OBSERVER: Name of observer, not to exceed 35 characters.

UNIT: Label that denotes whether observations were made at the surface or during excavation. 'Q' = surface quadrats and 'Qb' = excavated quadrats

SPECIES: Abbreviation to denote species, no more than 4 characters.

SIZE: Measure of size, which is useful for assessing size distributions.

Systematic Sample Number: Number that denotes which systematic sample the quadrat belongs to. A systematic sample starts at a random location, and the quadrats that follow at regular intervals belong to the same systematic sample. Each random start begins a unique systematic sample. We recommend 3 random starts, so each quadrat would belong to either systematic

Distance Up: Distance from the downstream boundary of your site to the quadrat. The Distance Up is measured along a vector that is perpendicular to the downstream boundary of your site. This distance is useful for mapping of mussel counts.

Distance Across: Distance from the side boundary of your site to the quadrat. The side boundary is near the reference bank (left descending or right descending) and is perpendicular to the downstream boundary. The Distance Across is measured along a vector that is parallel to the downstream boundary. This distance is useful for mapping of mussel counts.

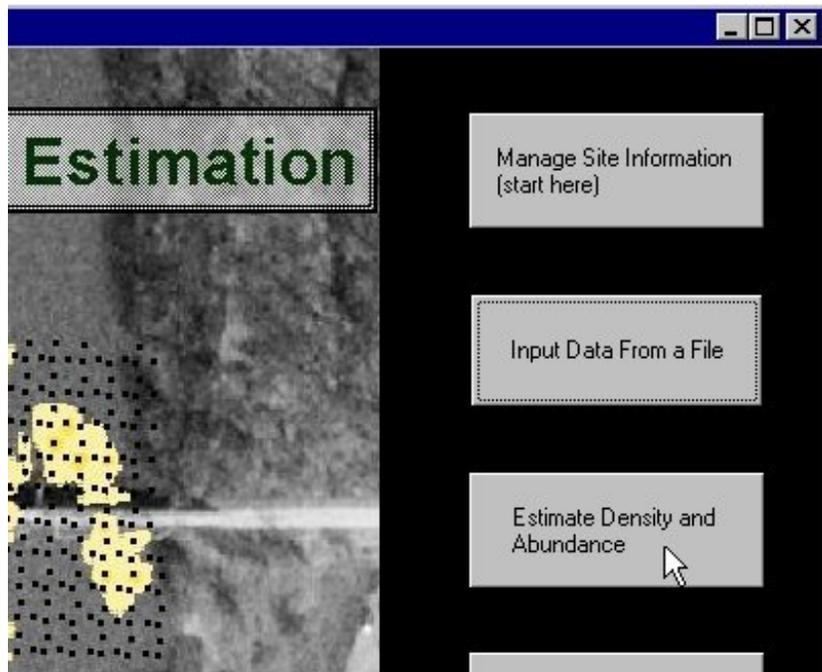
Read the uploading instructions, which are provided in an adjacent window, for information on how to format your observations file. To upload your observations file, select the site and the observations file and then click the "Upload" button.

Click the "Return" button to return to the main screen.

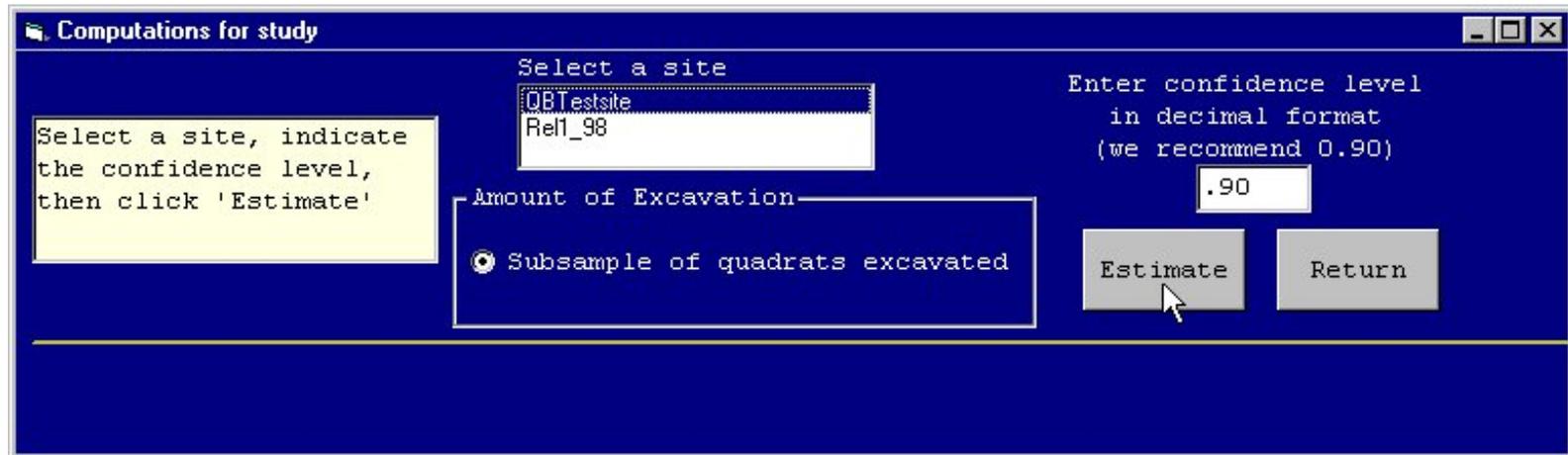
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Estimating density and abundance

After providing information on the site and observations, you are ready to estimate density and abundance.



When you click the "Estimate Density and Abundance" button, a window will open with a form that allows you to select the observations file, choose level for confidence intervals, and estimate species-specific density and abundance.



Please be patient after clicking the "Estimate" button; it might take several minutes before results start to appear.

Results are the species-specific estimates of density and abundance with measures of uncertainty.

Computations for study

Select a site, indicate the confidence level, then click 'Estimate'

Select a site
QBTestsite
Rel1_98

Enter confidence level in decimal format (we recommend 0.90)
.90

Amount of Excavation
 Subsample of quadrats excavated

Estimate Return

Estimated Density and Abundance of Mussels at QBTestsite

Species	Relative Abundance (%)	Density Estimate (no./m ²)	SE	CV	90% CI	Abundance Estimate (no./18600 m ²)	SE	90% CI
ACLI	27.74	0.806	0.11	0.1365	0.644-1.009	15000	2047.18	11984-18775
ALMA	0.24	0.007	0.012	1.7473	0-0.126	132	230.91	7-2340
ELDI	28.27	0.822	0.131	0.1589	0.633-1.067	15285	2428.46	11770-19850
EPRF	3.2	0.093	0.033	0.353	0.052-0.166	1730	610.66	968-3092
EPRM	13.73	0.399	0.089	0.2234	0.276-0.577	7426	1659.21	5142-10724
FUSU	0.24	0.007	0.012	1.7473	0-0.126	132	230.91	7-2340
LACO	0.73	0.021	0.012	0.5824	0.008-0.056	396	230.91	152-1033
LACR	0.75	0.022	0.022	1.0006	0.004-0.113	407	406.82	78-2108
*LAFA	0.73	0.021	0.0123	0.5752	0.008-0.055	396	228.02	154-1021
LASI	0.75	0.022	0.022	1.0006	0.004-0.113	407	406.82	78-2108
LIRE	1.5	0.044	0.031	0.7056	0.014-0.14	813	573.74	255-2595
PLCL	13.18	0.383	0.087	0.2266	0.264-0.556	7129	1615.56	4911-10350
PLSI	2	0.058	0.033	0.5723	0.023-0.149	1079	617.51	421-2766
PTFA	1.47	0.043	0.021	0.5016	0.019-0.097	793	397.75	347-1810
STUN	2.26	0.066	0.038	0.5745	0.025-0.169	1220	700.74	474-3138
UNKN	0.24	0.007	0.012	1.7473	0-0.126	132	230.91	7-2340

Save Results

Notes:
 A '*' placed before 'Species' indicates that none were found in excavated quadrats; thus estimates relate to substrate surface only.
 A '*' before 'SE' indicates that counts were identical in all systematic samples (in this case simple random sample formulae are used, which affects variance estimate and tends to be conservative - i.e., variance tends to be overestimated).

Results can be saved in a text file by clicking the "Save Results" button.

Help with survey design

We added a form to help address some basic questions about survey design. You can access this form from the main screen by clicking on the "Survey Design" button.



The form that opens will be helpful if you are in the process of planning a survey. This form can provide guidance on

- Sample size (number of quadrats)
- Interval between systematically placed quadrats
- Effective sampling fraction of a timed search

Survey Design

To determine sample size (number of quadrants), you need to first decide on :

- 1) the desired level of precision in terms of coefficient of variation (CV) or margin of error (MOE)
- 2) the anticipated density at the study site (mussels per m^2).

Given this information you can use the accompanying table to look up the sample size needed to achieve that level of precision. Instead of focusing on precision, you can determine sample size need to assure a minimum probability of encountering at least one individual of a species that occurs at low density. Click on the command button to view a sample size table that can be used to determine sample size for surveys of freshwater mussels.

[View the sample size table](#)

Interval Between Systematically Placed Quadrats

Study site area	Quadrat size	Number of random starts	Number of quadrats	Calculate	Interval in quadrats	Interval in meters
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>		<input type="text"/>	<input type="text"/>

Effective Sampling Fraction of a Timed Search

Site area (m^2)	Search time (min.)	Effective Search Rate ($m^2/min.$)	Calculate	Effective Sampling Fraction
<input type="text"/>	<input type="text"/>	<input type="text"/>		<input type="text"/>

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Exiting the program

You can close the program by clicking on the "Exit Program" button.



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