MARYLAND CHESAPEAKE BAY PROGRAM
IN VIVO FLUORESCENCE CHLOROPHYLL A
SURVEY DATA DICTIONARY

Maryland Chesapeake Bay Water Quality Monitoring Program: Mainstem and Tributary In Vivo Fluorescence Component

- Mainstem and Tributary Horizontal Fluorescence Data Dictionary
- Mainstem and Tributary Vertical Fluorescence Data Dictionary
- Potomac Fluorescence Data Dictionary

NOTES
1) THIS DICTIONARY WAS REVISED ON 10/9/2009 AND SUPERSEDES ALL OTHER DICTIONARIES FOR THE FLUORESCENCE DATA
2) THE POTOMAC FLUORESCENCE SURVEY PROGRAM WAS TERMINATED AS OF 31 DECEMBER 2002.
3) THIS PROGRAM WAS CONDUCTED BY THE ACADEMY OF NATURAL SCIENCES (ANS) FROM AUGUST 1984 THROUGH AUGUST 2004. MORGAN STATE UNIVERSITY (MSU) TOOK OVER THE ANS LABORATORY IN SEPTEMBER, 2004, BUT THE PROGRAM AND PERSONNEL REMAINED THE SAME.

PROJECT PURPOSE
The state of Maryland, in cooperation with the US EPA Chesapeake Bay Program, has used in vivo fluorescence to measure horizontal and vertical profiles of chlorophyll a between fixed monitoring stations in the Maryland Chesapeake Bay mainstem and tributaries since August 1984. A horizontal transect program was conducted in the Potomac estuary during the months of April-September from August 1990- September 2002. All of these programs were designed to give comprehensive spatial and temporal information on phytoplankton. Sampling is performed in conjunction with the Maryland phytoplankton and water quality monitoring programs.

NAMES AND DESCRIPTIONS OF ASSOCIATED DATA DICTIONARY FILES
The 2000 Users Guide to Chesapeake Bay Program Biological and Living Resources Data

PROJECT TITLE
Maryland Chesapeake Bay Water Quality Monitoring Program: Horizontal, Vertical and Potomac Fluorescence Components

CURRENT PRINCIPAL INVESTIGATORS
>PROGRAM MANAGER: Bruce Michaels, Renee Kahrr, Maryland Department of Natural Resources
>PRINCIPAL INVESTIGATOR: Richard V. Lacouture, Morgan State University Estuarine Research Laboratory
>TECHNICAL STAFF: Data collected by staff of Morgan State University Estuarine Research Laboratory. Data verified by T. Wohlford and R. V. Lacouture of Morgan State University Estuarine Research Laboratory
>PROGRAMMER/ANALYST: E. Perry, c/o Morgan State University Estuarine Research Laboratory
>DATA COORDINATOR: T. Wohlford and R. V. Lacouture, Morgan State University Estuarine Research Laboratory
>PREVIOUS PRINCIPAL INVESTIGATOR: Kevin Sellner, Chesapeake Bay Research Consortium

CURRENT FUNDING AGENCIES
US EPA Chesapeake Bay Program (program administered by Maryland Department of the Environment prior to July 1995 and subsequently by Maryland Department of Natural Resources)

PROJECT COST
$220,530 (July 1, 2008 - June 30, 2009), covers all plankton monitoring activities.

CURRENT QA/QC OFFICER
Tristan Wohlford and Richard V. Lacouture, Morgan State University Estuarine Research Laboratory

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LOCATION OF STUDY
Chesapeake Bay and tidal tributaries in state of Maryland

DATE INTERVALS
07/08/1984 – 06/30/2009

ABSTRACT

VERTICAL AND HORIZONTAL SURVEYS:

Vertical fluorescence profiles were measured at stations in the Chesapeake Bay and its tidal tributaries. Horizontal fluorescence profiles were measured on transects between fixed monitoring stations in the Chesapeake Bay and its tidal tributaries. Data were typically collected 18 times annually between 1984 and 1994; monthly from October - March and twice monthly from April - September (with the exception of the Choptank River stations and the station in Baltimore Harbor, which are not sampled in January and February). One station near the mouth of the Patuxent River, XCG8613, was dropped from the sampling scheme beginning in March 1992. A deviation in the normal cruise track of the main bay cruises occurred between April 1994 and June 1994 when the Maryland Department of the Environment (agency managing the program at that time) added two extra stations between CB3.1 and CB2.2. The two extra stations were only sampled by MDE. Beginning in January of 1996, the Patuxent River was only sampled in on one cruise in each January, June and September. On May 9 2005, the Patuxent River was sampled as usual. However, the data was unrecoverable from the disk to which it had been saved. On May 24, 2006 and June 19, 2006, the Chesapeake Bay was sampled as usual. However, some of the data was unrecoverable from the disk to which it had been saved.

All horizontal in vivo fluorescence reading was made at 0.5 below the surface. At all vertical stations, in vivo fluorescence readings were made at 0.5, 1.0, 2.0, and 3.0 meters below the surface. Thereafter, readings were made every three meters and at 1 meter above the bottom. At stations in located in the mainstem of Chesapeake Bay, additional readings are made at each station at either one or two meter intervals.

SPECIAL POTOMAC SURVEY:

Potomac River, near-surface in vivo fluorescence (IVF) was measured at 0.5 meter Depths along horizontal transects every two weeks for the periods: August - September 1990, June - September 1991, April - September 1992, April - September 1993, April - September 1994, April - September 1995, April - September 1996, April - September 1997. Due to program funding reductions in 1996, sampling was reduced to once a month for the months of April, May, June and September. Further monitoring budget reductions lead to the termination of all Potomac specific surveys at the end of 2003. Fluorometry measurements were made along a longitudinal transect between buoy 19 (RET2.2) and buoy 64 (XEA9075) and along cross-river transects: 1) from Wades Bay on the east to a point approximately 450

yards off the shoreline on the western side of the river, 2) from mid-channel in the mainstem of the river to the center of Mattawoman Creek mouth, 3) from approximately 250 yards off the eastern shoreline of the mainstem at Buoy 51 to the middle of Occoquan Bay, and 4) from mid-channel of the mainstem river to the western end of Gunston Cove. IVF values were subsequently converted to active chlorophyll a from regressions between IVF and chlorophyll a measured from grab samples collected during each trip. The position of each IVF reading on the transect path was determined by Loran-C. Note: Improper filters were used in the fluorometer during April and May 1991 so data is not included. This special program was terminated in October of 2002.

STATION NAMES AND DESCRIPTIONS
>Vertical Profile and Horizontal Transect End Point Stations.

CB1.1	Mouth of Susquehanna River-Main Bay
CB2.1	South West of Turkey Point-Main Bay
CB2.2	West of Still Pond near Buoy R 34-Main Bay
CB3.1	South East of Gunpowder Neck between Buoys 24A and 24B Main Bay
CB3.2	North West of Swan Point near Buoy R 10- Main Bay
CB3.3W	North West of Bay Bridge-Main Bay
CB3.3C	North of Bay Bridge-Main Bay
CB3.3E	North East of Bay Bridge-Main Bay
CB4.0W	South West of Thomas Point Shoal-Main Bay
CB4.0C	South of Thomas Point Shoal-Main Bay
CB4.0E	South East of Thomas Point Shoal-Main Bay
CB4.1W	South East of Horseshoe Point-Main Bay
CB4.1C	South West of Kent Point-Main Bay
CB4.1E	South of Kent Point-Main Bay
CB4.2W	North West of Plum Point-Main Bay
CB4.2C	South West of Tilghman Island near Buoy BW CR-Main Bay
CB4.2E	South West of Tilghman Island-Main Bay
CB4.3W	East of Dares Beach-Main Bay
CB4.3C	East of Dares Beach near Buoy R 64-Main Bay
CB4.3E	Mouth of Choptank River-Main Bay
CB4.4	North East of Cove Point-Main Bay
CB5.1	East of Cedar Point East of PR Buoy-Main Bay
CB5.2	East of Point No Point-Main Bay
CB5.3	North East of Smith Point at Virginia State Line-Main Bay
LE2.3	Mouth of Potomac River-Main Bay
ANPC	Annapolis City dock-Severn River
ANPS	Sandy Point Park near Annapolis-Main Bay
SOL	Solomons Island CBL dock-Patuxent River
TIL	West entrance of Knapps Narrows on Tilghman Island
TOLCHES	Entrance to marina south of Tolchester Beach
BENEDIC	Old Benedict Estuarine Reseach Laboratory-Benedict MD
CB5.1	Off Cedar Point at RB HI Buoy-Patuxent River
CB5.1W	Between Cedar Point and Cove Point in mid channel-Patuxent River
LE1.4	Between Drum Point and Fishing Point in mid channel-Patuxent River
LE1.3	North of Point Patience and ESE of Half Pone Point in mid channel-Patuxent River
LE1.2	South West of Petersons Point in mid channel-Patuxent River
LE1.1	Between Jack Bay sandspit and Sandgates in mid channel-Patuxent River
RET1.1	East North East of Long Point in mid channel-Patuxent River
TF1.7	East South East of Jacks Creek in mid channel-Patuxent River
TF1.6	Off wharf at Lower Marlboro in mid channel-Patuxent River
TF1.5	At Nottingham in mid channel-Patuxent River
TF2.3	Off Indianhead at Buoy N 54-Potomac River
RET2.2	Off Maryland Point at Buoy 19-Potomac River
LE2.2	Off Ragged Point at buoy BW 51B-Potomac River

ET4.2	South of Eastern Neck Island at Buoy 9-lower Chester River
ET5.1	Downstream of confluence with Tuckahoe Creek-upper Choptank River
ET5.2	Near Rt. 50 bridge at Cambridge-lower Choptank River
EE3.1	North Tangier Sound North of Buoy R 16-Main Bay
WT5.1	East of Hawkins Point at Buoy 5M-Patapsco River (Baltimore Harbor)
3S	South of Sandy Point Light House-Main Bay
4S	North of Sandy Point Light House-Main Bay

>Potomac River Horizontal Transects. Note, this station list represents only the start and ending stations of cross-river transects.

XEA9075	400 yds. N of buoy 64
XEA6000C	Red buoy 62 off Gunston Cove
XEA6000W	300 yds. Off boat ramp at Pohick Bay Regional Park
XEA5000C	Buoy 51
XEA5000E	250 yds. W. Of shoreline parallel to buoy 51
XEA5000W	Middle of Occoquan Bay parallel to buoy 51
XEA4000C	Green buoy 45, off Mattawoman Creek
XEA4000E	Red day marker 6, Mattawoman Creek
XDA3000C	Green buoy 33
XDA3000E	600 yds. W. Of shoreline in Wades Bay parallel to green buoy 33
XDA3000W	450 yds. E. Of shoreline parallel to green buoy 33
RET2.2	10 yds. N. Of buoy 19

STATION NAMES, LATITUDES (decimal degrees), LONGITUDES (decimal Degrees), TOTAL DEPTH (TDEPTH, meters), LATITUDES (degrees, minutes and decimal Seconds), AND LONGITUDES (degrees, minutes and decimal seconds). All station Positions provided here as NAD27 coordinates. All positions in datasets are in NAD83 coordinates. Missing T_DEPTHS are noted as 0.0.

>Horizontal Transect and Vertical Profile Stations. NOTE: For Horizontal transects the station position listed represents only the start and ending stations of cross-bay transects. Station type codes are as follows: B-Both Horizontal and Vertical Profile Station, H-Horizontal Transect End Point Station Only, V-Vertical Profile Station Only.

Station	Latitude	Longitude	T_Depth	Latitude	Longitude	Station _Type
CB1.1	39.5467	76.0817	6.1	39 32.8	76 04.9	B
CB2.1	39.4400	76.0250	6.2	39 26.4	76 01.5	B
CB2.2	39.3483	76.1750	12.1	39 20.9	76 10.5	B
CB3.1	39.2483	76.2383	12.7	39 14.9	76 14.3	B
CB3.2	39.1633	76.3067	11.7	39 09.8	76 18.4	B
CB3.3W	39.0033	76.3883	9.0	39 00.2	76 23.3	B
CB3.3C	38.9958	76.3600	23.7	39 59.7	76 21.6	B
CB3.3E	38.9967	76.3517	8.4	39 59.8	76 21.1	B
CB4.0W	38.9267	76.4317	0.0	38 55.6	76 25.9	B
CB4.0C	38.9267	76.3933	0.0	38 55.6	76 23.6	B
CB4.0E	38.9267	76.3867	0.0	38 55.6	76 23.2	B
CB4.1W	38.8133	76.4633	9.2	38 48.8	76 27.8	B
CB4.1C	38.8250	76.4000	31.9	38 49.5	76 24.0	B
CB4.1E	38.8167	76.3717	23.3	38 49.0	76 22.3	B

Station	Latitude	Longitude	T_Depth	Latitude	Longitude	Station_Type
CB4.2W	38.6433	76.5017	9.2	38 38.6	76 30.1	B
CB4.2C	38.6450	76.4183	26.9	38 38.7	76 25.1	B
CB4.2E	38.6450	76.4000	9.3	38 38.7	76 24.0	B
CB4.3W	38.5567	76.4933	9.6	38 33.4	76 29.6	B
CB4.3C	38.5567	76.4367	26.1	38 33.4	76 26.2	B
CB4.3E	38.5567	76.3900	22.3	38 33.4	76 23.4	B
CB4.4	38.4133	76.3433	29.5	38 24.8	76 20.6	B
CB5.1	38.3183	76.2933	33.9	38 19.1	76 17.6	B
CB5.2	38.1367	76.2283	30.1	38 08.2	76 13.7	B
CB5.3	37.9117	76.1683	26.6	37 54.7	76 10.1	B
LE2.3	38.0217	76.3483	19.9	38 01.3	76 20.9	B
ANPC	38.9717	76.4633	0.0	38 58.3	76 27.8	H
ANPS	39.0067	76.4033	0.0	39 00.4	76 24.2	H
SOL	38.3217	76.4500	0.0	38 19.3	76 27.0	H
TIL	38.7200	76.3333	0.0	38 43.2	76 20.0	H
TOLCHES	39.2133	76.2467	0.0	39 12.8	76 14.8	H
BENEDIC	38.5092	76.6792	0.0	38 30.6	76 40.6	H
3S	39.1050	76.3800	0.0	39 06.3	76 22.8	H
4S	39.2317	76.3217	0.0	39 13.9	76 19.3	H
CB5.1	38.3112	76.3130	17.0	38 18.7	76 18.8	B
CB5.1W	38.3265	76.3713	9.0	38 19.6	76 22.3	B
LE1.4	38.3133	76.4222	15.0	38 18.8	76 25.3	B
LE1.3	38.3413	76.4858	23.5	38 20.5	76 29.2	B
LE1.2	38.3800	76.5150	19.9	38 22.8	76 30.9	B
LE1.1	38.4250	76.6020	12.0	38 25.5	76 36.1	B
RET1.1	38.6607	76.8312	11.1	38 39.6	76 49.9	B
TF1.7	38.5820	76.6810	2.3	38 39.0	76 40.9	B
TF1.6	38.6582	76.6845	5.9	38 39.5	76 41.1	B
TF1.5	38.7100	76.7020	10.3	38 42.6	76 42.1	B
TF2.3	38.6080	77.1740	12.7	38 36.5	77 10.4	B
RET2.2	38.3520	77.2050	9.5	38 21.1	77 12.3	B
LE2.2	38.1670	76.5830	11.0	38 10.0	76 35.0	B
ET4.2	38.9820	76.2170	14.6	38 59.5	76 13.0	B
ET5.1	38.8070	75.9120	5.3	38 48.4	75 54.7	B
ET5.2	38.5800	76.0600	12.3	38 34.8	76 03.6	B
EE3.1	38.2000	75.9750	13.7	38 12.0	75 58.5	B
WT5.1	39.2080	76.5250	15.7	39 12.5	76 31.5	B

>Potomac River Horizontal Transect Stations. NOTE: This station positions list represents only the start and ending stations of cross tributary transects.

Station	Latitude	Longitude	Latitude	Longitude
XEA9075	38.6720	77.1322	38 40.3	77 07.9
XEA6000C	38.6593	77.1342	38 39.6	77 08.1
XEA6000W	38.6772	77.1657	38 40.6	77 09.9
XEA5000C	38.5940	77.2031	38 35.6	77 12.2
XEA5000E	38.5878	77.1950	38 35.3	77 11.7
XEA5000W	38.6182	77.2267	38 37.1	77 13.6

XEA4000C	38.5598	77.2385	38 33.6	77 14.3
XEA4000E	38.5632	77.1930	38 33.8	77 11.6
XDA3000C	38.4388	77.2752	38 26.3	77 16.5
XDA3000E	38.4311	77.2700	38 25.9	77 16.2
XDA3000W	38.4312	77.3150	38 25.9	77 18.9
RET2.2	38.3515	77.2070	38 21.1	77 12.4

Station depths are based on a ten-year average (1985-1995) of Maryland Department of the Environment water quality hydrographic data collected concurrently with the fluorescence data.

METHODOLOGY DESCRIBING CHAIN OF CUSTODY FOR LAB SAMPLES
Not Applicable for this data set.

BIOLOGICAL ENUMERATION TECHNIQUES
Fluorometer readings - Horizontal and Vertical profiles.

FORMULAS, CALCULATIONS, AND CONVERSIONS

>DETERMINATION OF FLUORESCENCE VALUES IN FIELD SURVEY
In vivo fluorescence (IVF) is measured on a Turner Designs Model 10000 fluorometer and beginning in June of 1996, a Turner Designs Model 10-AU-005 was used for some of the tributary stations. Beginning in March, 1999, a Turner Designs Model 10-AU-005 was used for all stations.

> DETERMINATION OF CHLORPHYLL a FOR DERIVATION OF FLUORESCENCE TO CHLOROPHYLL REGRESSIONS

Generally, a volume between 100-500 ml is filtered at < 10 p. s. i. vacuum pressure onto Whatman GF/F filters with ~ 10 drops of MgCO3 added just prior to completion of filtration. Spectrophotometric analysis of these grab samples is performed with a Milton Roy Spectronic 501. Each sample is first read at an absorbance of 750 nm. to determine turbidity and then read again at an absorbance of 665 nm. Each sample is then acidified with 3 drops of 2N HCl and reread at 665 nm and at 750 nm. Final chlorophyll a concentrations are then calculated using the formula outlined in Strickland and Parsons, Standard Methods for Seawater Analysis. Beginning in March, 1999, a new technique for determining chl a was initiated. The new procedure is as follows: The spectrophotometer is zeroed with the blank at 750nm. Each sample is read at this wavelength and the value is recorded in the data book. The spectrophotometer is then changed to a wavelength of 665nm and rezeroed. Then, the above process is repeated. After the initial reading at 665nm is recorded, 2 drops of 1N HCl is added to each sample. The spectrophotometer is then changed to a wavelength of 664nm and rezeroed. The samples are then read again at 664nm and 750nm. After this process is complete, the samples are removed from the cuvettes and each cuvette is rinsed with 90% acetone 3 times before being filled again. All values that have been recorded in the data book are entered into a spreadsheet that contains the formula for calculating chlorophyll concentration.
The formula used is from Standard Methods:

$$\text{chl a (mg/m3)} = 26.7((665b-750b)-(664a-750a)) * \frac{ve}{Vf * l}$$

where ve = volume of extracted sample
and Vf = volume filtered

The chlorophyll a concentrations are used to formulate a linear regression of chlorophyll a against IVF (in vivo fluorescence). These linear regressions are then used to convert the remaining IVF's to chlorophyll a. Only the resulting CHLA, and not the IVF itself, is contained in this data file. Beginning October, 1990, for the Patuxent, and for all systems in November, all IVF values were corrected for background-dissolved fluorescence. This fluorescence was estimated on samples passing 0.22 um Millipore filters. The y-intercept of the regression is analyzed with a t-test to determine whether it is significantly different than zero. If the intercept is not significantly different, zero is substituted in the regression equation. Beginning in March, 2000, separate regressions were generated for horizontal transects and vertical profiles and for the upper and lower portions of the Maryland Bay and for the horizontal transects and vertical profiles of the Patuxent

River. These regressions were applied to the corresponding data. Negative CHLA values reflect values below detection threshold of methods. In the ASCII version of the data set, prior to cruise 47, values proceeded by '>'indicate IVF values where the fluorometer was off scale indicating values greater than the highest value for that scale. Prior to March, 1987, horizontal IVF data was recorded directly onto a strip chart recorder.

For purposes of determining the actual geographical location of a reading, the following assumptions were made:

(1) The total distance between the two stations is represented by the total length of the strip chart.
(2) The course from one station to the next was a straight line.
(3) The speed was constant from one station to the next so that there is a linear relationship between units along the chart (or readings on the computer) and distance from the start station. The actual geographical location is a distance of DIST away from the start station along a straight line toward the destination station.

For horizontal transects on cruises conducted after January, 1987, IVF values are automatically transcribed onto a personal computer (instead of a strip chart recorder used on earlier cruises) directly from the fluorometer. The computer takes fluorescence readings every 5 seconds and records a mean value of these readings every 45 seconds. Beginning in March 1999, a Lowrance 212 GPS receiver is being used to record latitude and longitude coordinates for each mean fluorescence value.

>DETERMINATION OF LATITUDE AND LONGITUDE FOR ALL HORIZONTAL AND VERTICAL FLUORESCENCE SURVEY
-Chesapeake Bay Program Analytical Method Code CHL_F101
Sampling station location along transects was determined using the simple geometry of right triangles to compute latitude and longitude. Calculations were based on the following assumptions: a) the transect was over a straight line from departure station to arrival station, b) boat speed was assumed to be constant, c) the Latitudes and Longitudes of end point stations were consistent. Equations were based on the relationship of total strip recorder tape length being proportional to actual distance between stations. Sampling position was based on the distance from the starting position of the strip recorder tape of the at sample time against the total length of the tape at the destination station.

TOT_DIST=(((LONG_DES-LONG_DEP)**2)+((LAT_DES-LAT_DEP)**2))
ALPHA= ARCTAN((LAT_DES-LAT_DEP)/(LONG_DES-LONG_DEP))
SMP_DIST = TOT_DIST * (DIS_MM / TOT_LEN);
SAMPLE LONG ~IF LONG_DEP < LONG_DES THEN
LONG = LONG_DEP + ABS(COS(ALPHA) * SMP_DIST;
ELSE LONG = LONG_DEP - ABS(COS(ALPHA) * SMP_DIST;
SAMPLE LAT ~IF LAT_DEP < LAT_DES THEN
LAT = LAT_DEP + ABS(SIN(ALPHA) * SMP_DIST);
ELSE LAT = LAT_DEP - ABS(SIN(ALPHA) * SMP_DIST);

WHERE
TOT_DIST- Actual Total Distance Between Departure and Destination Station
LONG_DES- Longitude Destination Station
LONG_DEP- Longitude Departure Station
LAT_DES- Latitude Destination Station
LAT_DEP- Latitude Departure Station
SMP_DIST- Actual distance of sampling site from transect Departure Station
DIS_MM- Distance from beginning of strip chart recording to sampling point
TOT_LEN- Total Length of Strip Chart Recording in millimeters

-Chesapeake Bay Program Analytical Method Code CHL_F102
Fluorescence is measured with a turner model 10000 fluorometer, position by interpolation from loran-c fitx taken every 5 minutes. Positions on transect were interpolated using equation in method CHL_F 101.

-Chesapeake Bay Program Analytical Method Code CHL_F103
In vivo fluorescence (IVF) is measured on a Turner Designs Model 10000 fluorometer and beginning in June of 1996 Turner Designs Model 10-AU-005CE fluorometer was used. Station positions in data set are approximations of actual positions in the field. Between 1984 and 1997 station latitudes and longitudes are input into a Loran-C receiver and sampling begins when boat reaches pre-programmed coordinates. Loran-C is accurate to +/- 1500 ft. The actual Loran coordinates for each sampling event were not recorded in data set.

-Chesapeake Bay Program Analytical Method Code CHL_F104
Station positions in data set are actual positions in the field. For Vertical sampling stations Station latitudes and longitudes are input into a GPS receiver and sampling begins when boat reaches pre-programmed coordinates. For horizontal transect measurements actual latitudes and longitudes are output from a GPS receiver and recorded in data set. Beginning in 1999, a Turner Designs Model 10-AU-005CE fluorometer was used and a Lowrance GPS receiver was used for positioning. Prior to 1999 a Turner Designs Model 10000 fluorometer was used.

-Chesapeake Bay Program Analytical Method Code CHL_F109
Horizontal transect measured with a turner model 10-au-005 fluorometer, position by position by interpolation from fixed start and end points of transect.

MONITORING VARIABLES QA/QC PLAN FOR PROJECT
Please See MARYLAND CHESAPEAKE BAY PROGRAM PHTYTOPLANKTON PRIMARY PRODUCTION DATA DICTIONARY for details of discrete chlorophyll a samples processing for regression calibration samples.

VARIABLE NAMES, MEASUREMENT UNITS AND DESCRIPTIONS

>PARAMETER: CHL_F (Fluorescence Value in Micrograms Chlorophyll a per Liter)
-COLLECTION METHODS: pump/horizontal
-SAMPLE PRESERVATIVES: none
-SAMPLE STORAGE ENVIRONMENT: none
-TIME IN STORAGE: 0 days [Discrete chlorophyll a filters in freezer 1 week - 4 months before grinding and processing]
-LAB TECHNIQUES WITH REFERENCES: In vivo fluorescence methods; fluorometer readings are related to chlorophyll A concentrations by a regression calibrated with grab samples for chlorophyll a collected in the field.

Lorenzen, C.J. 1966. A method for the continuous measurement
of in vivo chlorophyll concentration. Deep-Sea Res. 13:223-227.
Strickland, J. D. H. and T. R. Parsons. 1972. A practical
handbook of seawater analysis. Fish. Res. Bd. Canada. Bull. 167.
Ottawa. 310PP.

>PARAMETER: LATITUDE (Decimal Degrees),LONGITUDE (decimal Degrees) VERTICAL AND HORIZONTAL SURVEYS.
-COLLECTION METHODS: Calculated for Horizontal Survey; Standard Position Reported for Vertical Surveys
-SAMPLE PRESERVATIVES: None
-SAMPLE STORAGE ENVIRONMENT: None
-TIME IN STORAGE: None
-LAB TECHNIQUES WITH REFERENCES: Between 1984 and 1995, station positions in data set are approximations of actual positions in the field. Loran-C and NAD-27 was used for position determination. See FORMULAS, CALCULATIONS AND CONVERSIONS for detailed explanation of position estimation in this data set. Note: Prior to 1996 this data set does not meet EPA sampling position policy. Sampling locations were not measured with GPS or Loran receivers and latitude/longitude values in the files are estimated. All data is provided in NAD83 coordinates.

PARAMETER: LAT(LATITUDE in Decimal Degrees),LONG (LONGITUDE in decimal Degrees) POTOMAC SURVEYS
-COLLECTION METHODS: Recorded to disk
-SAMPLE PRESERVATIVES: None
-SAMPLE STORAGE ENVIRONMENT: None
-TIME IN STORAGE: None
-LAB TECHNIQUES WITH REFERENCES: Between 1984 and present, station positions in data set are actual positions determined in the field. Loran-C and NAD-27 were used for position determination. Loran-C is accurate to +- 1500ft. The Loran receiver is interfaced with a computer simultaneously connected to the fluoromenter. All data is provided in NAD83 coordinates.

>PARAMETER: SALZONE (Salinity Zone),-Vertical Fluorescence Only
-COLLECTION METHODS: Hydrolab CTD
-SAMPLE PRESERVATIVES: None
-SAMPLE STORAGE ENVIRONMENT: None
-TIME IN STORAGE: None
-LAB TECHNIQUES WITH REFERENCES: Water column salinity is recorded concurrently with fluorescence measurements . Salinity values at depth are used for salinity classification. Salinity classes are as follows: Fresh 0 - 0.5 ppt (F), Oligohaline >0.5 - 5.0 ppt(O), Mesohaline >5.0 - 18.0 ppt (M) and Polyhaline >18.0 ppt (P).

>PARAMETER: SAMPLE_DEPTH (Sample Collection Depth in Meters)
HORIZONTAL AND POTOMAC FLUORESCENCE SURVEYS
-COLLECTION METHODS: A hull pump mounted 0.5 meters below the boat waterline is used to pump water through the fluorometer.
-SAMPLE PRESERVATIVES: None
-SAMPLE STORAGE ENVIRONMENT: None
-TIME IN STORAGE: None
-LAB TECHNIQUES WITH REFERENCES: N/A

>PARAMETER: SAMPLE_DEPTH (Sample Collection Depth in Meters)
VERTICAL FLUORESCENCE SURVEYS
-COLLECTION METHODS: Water is pumped from depth. A Hydrolab CTD and hose mounted on the sampling array are lowered through the water column to obtain profiles.
-SAMPLE PRESERVATIVES: None
-SAMPLE STORAGE ENVIRONMENT: None
-TIME IN STORAGE: None
-LAB TECHNIQUES WITH REFERENCES: N/A
>DATA ENTRY METHOD: Manual entry of fluorometry readings
>DATA VERIFICATION: Visual comparison and parameter checking programs

>PARAMETER: VOLTS (Fluorometer Instrument Voltage in Mill volts)
-COLLECTION METHODS: pump/horizontal
-SAMPLE PRESERVATIVES: none
-SAMPLE STORAGE ENVIRONMENT: none
-TIME IN STORAGE: 0 days [Discrete chlorophyll a filters in freezer 1 week - 4 months before grinding and processing]
-LAB TECHNIQUES WITH REFERENCES:
For Data collected after 1997, original fluorometer readings (voltages) are retained in the database for users who wish to recalculate chlorophyll concentration data for any reason. In vivo fluorescence methods; fluorometer readings are related to chlorophyll A concentrations by a regression calibrated with grab samples for chlorophyll a collected in the field.

Lorenzen, C.J. 1966. A method for the continuous measurement of in vivo chlorophyll concentration. Deep-Sea Res. 13:223-227.
Strickland, J. D. H. and T. R. Parsons. 1972. A practical handbook of seawater analysis. Fish. Res. Bd. Canada. Bull. 167.

Ottawa. 310PP.

SPECIES IN-HOUSE CODES AND SCIENTIFIC NAMES
Not Applicable in this data set

#VARIABLE NAMES AND DESCRIPTION FOR DATA FILES
Structure for data files on: http://www.chesapeakebay.net

Name	Type	Width	Variable Definitions
SOURCE	Text	10	Data Collection Agency
CRUISE	Text	6	Chesapeake Bay Program Cruise Number
SAMPLE_DATE	Date/Time	8	Sampling Date (YYYYMMDD)
SAMPLE_TIME	Date/Time	8	Sample Collection Time(HH:MM:SS)
LATITUDE	Number	8	Latitude in Decimal Degrees
LONGITUDE	Number	8	Longitude in Decimal Degrees
STATION	Text	15	Sampling Station
SAMPLE_TYPE	Text	7	Sample Type
SAMPLE_DEPTH	Number	4	Sample Collection Depth (Meters)
PARAMETER	Text	10	Parameter
VALUE	Number	4	Parameter Value
UNITS	Text	10	Parameter Reporting Units
QUALIFIER	Text	10	Chlorophyll a Detection Limit
METHOD	Text	5	Chlorophyll a Method Code
SALZONE	Text	2	Salinity Zone
R_DATE	Date/Time	8	Version Date of Data(YYYYMMDD)

The following field may also appear in a downloaded data set:

Name	Type	Width	Variable Definitions
BASIN	Text	20	Chesapeake Bay Basin Designation
HUC8	Text	8	USGS Eight Digit Hydrologic Unit Code
CATALOGING_UNIT_DESCRIPTION	Text	50	USGS Cataloging Unit Code Description
FIPS	Text	5	Federal Information Processing Code
STATE	Text	3	Federal Information Processing Code State Designation
COUNTY_CITY	Text	30	Federal Information Processing Code City or County Designation
LL_DATUM	Text	5	Latitude and Longitude Geographic Datum
VOLTS	Number	8	Fluorometer Voltage Reading (mill volts)

REFERENCE CODES IN DATA FILES AND TAXONOMIC KEY
See 2000 Users Guide to Chesapeake Bay Program Biological and Living Resources Data for full listing.

>MISSING SAMPLING_TIME: Missing sampling times have been replaced with 00:00

>SAMPLE_TYPES-Sample Type

SAMPLE_TYPE	DESCRIPTION
ISM_H	IN-SITU MEASUREMENT, COLLECTED AS PART OF A HORIZONTAL TRANSECT
ISM_V	IN-SITU MEASUREMENT, COLLECTED AS PART OF A VERTICAL PROFILE

>PARAMETER and UNITS-Parameter Description and reporting units

PARAMETER	DESCRIPTION	UNITS
CHL_F	CHLOROPHYLL a FLUORESENCE	ug/l

>PROJECT- Chesapeake Bay Program Project Id

PROJECT	DESCRIPTION
MAINSTEM	CHESAPEAKE BAY MAINSTEM
POTOMAC	POTOMAC RIVER SPECIAL SURVEY

>SOURCE: Data Collection Agency
MSU – Morgan State University Estuarine Research Center-Previously the Academy of Natural Sciences, Benedict Estuarine Research Laboratory

>QUALIFIER- Chlorophyll a Detection Limit Code

QUALIFIERS	DESCRIPTION
“”	Greater than zero
#	Trace (less than an unknown detectable value)
<	Less than the detection limit of the method
J	Estimated value
N	Not detected
NA	Not recorded/not applicable/parameter value acceptable

>METHOD: Chlorophyll a Method Code

PARAMETER	METHOD	DESCRIPTION
CHL_F	101	Fluorescence Is Measured With A Turner Model 57, model 1000 Or model 10-AU-005CE Fluorometer, Position By Interpolation From Fixed Start And End Points Of Transect
CHL_F	103	Fluorescence Is Measured With a Turner Model 571000 or model 10-AU-005CE Fluorometer, Position By Loran-C At Sampling Time
CHL_F	104	measured with a turner model 10000 fluorometer, position by GPS.
CHL_F	105	Measured With A Turner, Model 10-Au-005ce Or Model 10-005r Fluorometer, Position By GPS At Sampling Time
CHL_F	109	Measured with a turner model 10-au-005 fluorometer, position by position by interpolation from fixed start and end points of transect

>CRUISE: Chesapeake Bay Program Cruise Number
See 2000 Guide to Biological and Living Resources Data

>SALZONE: Salinity Zone
F - Tidal fresh (0 - 0.5 ppt)
O - Oligohaline (>0.5 - 5.0 ppt)
M - Mesohaline (>5.0 - 18.0 ppt)
P - Polyhaline (>18.0 ppt)
N - Not Available

>STATION: Sampling Station- Vertical Surveys only
See STATION NAMES, LATITUDES, LONGITUDES, and AND TOTAL DEPTHS for details.

>LL_DATUM: Latitude and Longitude Geographic Datum

LL_DATUM	DESCRIPTION
NAD27	NORTH AMERICAN DATUM 1927
NAD83	NORTH AMERICAN DATUM 1983

>BASIN - Chesapeake Bay Basin Designation

Chesapeake Bay	Chester River	Patuxent River	Baltimore Harbor
Choptank River	Potomac River	Tangier River	

>HUC8 -USGS Eight Digit Hydrologic Unit Code

HUC8	CATALOGING_UNIT_DESCRIPTION
02050306	LOWER SUSQUEHANNA
02060001	UPPER CHESAPEAKE BAY
02060002	CHESTER-SASSAFRAS
02060003	GUNPOWDER-PATAPSCO
02060004	SEVERN
02060005	CHOPTANK
02060006	PATUXENT
02060007	BLACKWATER-WICOMICO
02070010	MIDDLE POTOMAC-ANACOSTIA-OCCOQUAN
02070011	LOWER POTOMAC
02080101	LOWER CHESAPEAKE BAY

>FIPS -Federal Information Processing Code

FIPS	NAME
24003	ANNE ARUNDEL
24005	BALTIMORE
24009	CALVERT
24015	CECIL
24017	CHARLES
24019	DORCHESTER
24025	HARFORD
24029	KENT
24033	PRINCE GEORGES
24035	QUEEN ANNES
24037	SAINT MARYS
24039	SOMERSET
24041	TALBOT
51001	ACCOMACK
51059	FAIRFAX
51153	PRINCE WILLIAM

NUMERICAL VARIABLE NAMES - WARNING AND ERROR BOUNDS

VARIABLE	VALID RANGE
CHL_F	0.00 - 881.4
SAMPLE_DATE	19840802 - 20051230
LAT	37.9117 - 39.5463
LONG	75.9167 - 77.2028
R_DATE	19950501 - 20040130
SDEPTH	0.5
SAMPLE_TIME	5:00:00 - 20:20:00 Missing Time Denoted as 00:00

IMPORTANT DATA REVISONS
THE LIVING RESOURCES DATA MANAGER RECOMMENDS THAT ALL DATA ANALYSES BE PERFORMED WITH THE MOST RECENT DATA SET VERSIONS AVAILABLE. HOWEVER, IF YOU HAVE BEEN WORKING WITH OLDER DATA SETS THE FOLLOWING ARE IMPORTANT CHANGES TO BE AWARE OF:

Note: The horizontal Fluorescence data prior to 1999(excluding the special Potomac Horizontal fluorescence) does not meet EPA sampling position policy. Sampling locations were not measured with GPS or Loran receivers and latitude/longitude values in the files are estimated.

The following stations had their station names changed to the standard Chesapeake Bay Program Names in 1998. Previous alternate station names appearing in Previous Living Resources Data Sets are as follows:

LRNAME	CBP NAME
MEE3.1	EE3.1
MET4.2	ET4.2
MET5.1	ET5.1
MET5.2	ET5.2
MLE2.2	LE2.2
MLE2.3	LE2.3
MWT5.1	WT5.1
PXT0402	TF1.5
XCF8747	LE1.4
XCF9575	CB5.1W
XCG8613	CB5.1
XDA1177	RET2.2
XDE2792	LE2.1
XDE5339	LE1.1
XDE9401	RET2.1
XDF0407	LE3.1
XEA6596	TF2.3
XED4892	TF1.7
XED9490	TF1.6

5/31/95 - CRUISE NUMBERS BAY004 - BAY211 were supplied by the Chesapeake Bay Program office and modified by Amy Imirie and Elgin Perry to reflect true start and end dates with corresponding Academy of Natural Sciences trip numbers. This prevents the occurrence of two sampling events for one station during a bay cruise period.

4 APRIL 1995 - For the period 1991 - 1993, the chlorophyll data in the Horizontal profiles from the tributaries (Potomac, Choptank and Patapsco) were miscalculated because the blank of the dissolved fraction was mistakenly subtracted twice from the sample. This mistake was realized and those data have been corrected as of the 4/15/95 data submittal. The implication of this mistake was also reflected in the productivity data set since assimilation ratios are calculated as part of this program.

OCTOBER 1997- Salinity Zoneation placed in 1984-1996 Vertical Fluorescence data sets based on available Maryland DNR Water Quality

01/01/2000- All Latitudes and Longitudes converted to NAD83 coordinates.

10/01/2002- The Special Potomac Fluorescence survey program was terminated.

09/01/2004- This program was conducted by the Academy of Natural Sciences (ANS) from August 1984 through August 2004. Morgan State University (MSU) took over the ANS laboratory in September, 2004, but the program and personnel remained the same. All data previously codes with the data source as ANS was updated to MSU.

10/23/2006- Most data for sampling on May 22, 2006 and on June 19, 2006, is missing. The data was lost due to a computer failure.

11/14/2008- Inclement weather caused alterations in the sampling routine of the Main Bay on several occasions. The first and second days of the March cruise (sampled 18 March 2008) were combined with only center stations sampled through MCB4.3C while sampling of MCB3.3C was included in sampling on the third day (21 March 2008). Similarly, the stations typically sampled on the second day of the second May cruise were not sampled until the third day (30 May 2008) with only center stations sampled. Water depths were too shallow for the research boat to reach station PXT0402 during the Patuxent River cruises on 10 January, 10 March, and 18 June 2008.

11/14/2008- Chlorophyll versus IVF regressions were necessarily adjusted for several cruises. For the following cruises, outliers in which the IVF was high but the calculated chlorophyll was low (ex: IVF = 37.0, chl a = 4.0) were removed: Main Bay cruises 18 - 21 March, 14 – 16 May, and 23 – 25 June, Patuxent River Cruises 10 March, 5 May, 19 May, and 18 June, and Eastern Shore Cruise 28 May 2008. For the Main Bay cruise on 18 – 21 March 2008, data for the Upper and Lower portions of the Bay were combined for each of the vertical and horizontal transects. For the Main Bay cruise on 27 – 29 May 2008, the vertical and horizontal transects were combined for each of the Upper and Lower Bay segments. Vertical and horizontal transects were also combined for the following Patuxent River cruises: 21 April and 18 June 2008.

KEY WORDS (EXCLUDING VARIABLE NAMES)
In vivo fluorescence
Fluorometer
Chlorophyll a

THIS IS THE END OF THE MARYLAND CHESAPEAKE BAY PROGRAM IN VIVO FLUORESCENCE CHLOROPHYLL A SURVEY DATA DICTIONARY
