Chapter 3.2

Maryland Biological Stream Survey Results for the Coastal Bays Watershed

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Abstract
To report overall stream health, freshwater fish and benthic macroinvertebrate indices of biotic integrity were calculated for all Maryland Biological Stream Survey and Maryland Stream Waders sites with adequate data. These indices of biotic integrity rate stream health according to ecological characteristics of fauna found in the sampled stream. Fish and benthic macroinvertebrate samples indicate most streams in the Coastal Bays are degraded but there are a few exceptions. Most fauna sampled were classified as pollution-tolerant. Benthic index of biotic inegrity results from both programs - 61 sites total - rated most sites as either poor (31%) or very poor (54%). Most of the remaining sites were rated fair (13%). One site was rated good by the benthic index of biotic integrity. Freshwater fish index results from 9 sites rated most sites as poor (33%) or very poor (44%), with 11% rated fair or good. Impacts to the biota of Coastal Bays streams are likely the result of physical habitat modification (e.g., ditching) and excess nutrients. Ditched streams generally have less habitat diversity and lower flows than minimally-altered streams in the Coastal Plain that retain a more natural wetland character.

The Maryland Biological Stream Survey

The Maryland Biological Stream Survey (MBSS) monitors freshwater streams throughout Maryland. Data are collected on physical habitat, water chemistry, and invertebrate and fish communities. Nine randomly-selected sites were sampled in the Coastal Bays watersheds in 2009. A total of 14 fish species were collected (Table 3.2.1), with species counts ranging from nine at one site in Newport Bay to no fish at two sites - one site in Newport Bay and one site in Chincoteague Bay. The average number of species among all Coastal Bays sites was 4.1 and the greatest number of individual fish per site (266) was sampled at a site in Newport Bay. The average number of fish per site among all Coastal Bays sites was 119. The dominant fish species was Eastern mudminnow, averaging 58 fish per site, while the largemouth bass was the rarest species (0.67 fish per site average). A list of fish species sampled in Coastal Bays streams by MBSS is below.

Eighty-seven taxa (mostly genera) of benthic macroinvertebrates were sampled at MBSS sites (Table 3.2.2). The number of taxa per site averaged 18.8 and ranged from eight to 32. Dominant taxa included isopods (Caecitodea sp., Crangonyx sp.); fingernail clams (Musculium sp.); midges (Orthocladius sp., Paratanytarsus sp.) and black flies (Simulium sp., Stegopterna sp.).

Table 3.2.1 Fish species sampled in MD Coastal Bays streams.

Species	Tolerance	Native or Introduced
American eel, *Anguilla rostrata*	NC	Native
Banded killifish, *Fundulus diaphanus*	NC	Native
Bluegill, *Lepomis macrochirus*	Tolerant	Introduced
Bluespotted sunfish, *Enneacanthus obesus*	NC	Native
Brown bullhead *Ameiurus nebulosus*	Tolerant	Native
Creek chubsucker, *Erimyzon oblongus*	NC	Native
Eastern mosquitofish *Gambusia holbrooki*	NC	Native
Eastern mudminnow, *Umbra pygmaea*	Tolerant	Native
Golden shiner, *Notemigonus crysoleucas*	Tolerant	Native
Largemouth bass, *Micropterus salmoides*	Tolerant	Introduced
Pirate perch, *Aphredoderus sayanus*	Tolerant	Native
Pumpkinseed, *Lepomis gibbosus*	Tolerant	Native
Redfin pickerel, *Esox americanus*	Tolerant	Native
Tessellated darter, *Etheostoma olmstedi*	Tolerant	Native

Management Objective: Healthy Stream Fauna

Indicator 1: Freshwater Fish Index >4
Indicator 2: Benthic Macroinvertebrate Index >4

Table 3.2.2 Benthic macroinvertebrate taxa sampled by Maryland Biological Stream Survey from Coastal Bays streams.

Taxon	Tolerant or sensitive	Taxon	Tolerant or sensitive
Agabus	NC	*Musculium*	Tolerant
Ancronyx	Tolerant	*Nanocladius*	Tolerant
Aspectrotanypus	Tolerant	*Oecitis*	Tolerant
Argia	Tolerant	*Ormosia*	NC
Bittacomorpha	NC	*Orthocladiinae*	Tolerant
Boyeria	NC	*Orthocladius*	Tolerant
Caecidotea	Tolerant	*Parachaetocladius*	Sensitive
Calopteryx	Tolerant	*Parametriocnemus*	Tolerant
Ceratopogonidae	NC	*Paraphaenocladius*	NC
Chaetocladius	Tolerant	*Paratanytarsus*	Tolerant
Cheumatopsyche	Tolerant	*Paratendipes*	NC
Clinotanypus	Tolerant	*Peltodytes*	Tolerant
Coenagrionidae	Tolerant	*Phaenopsectra*	Tolerant
Corynoneura	Tolerant	*Physa*	Tolerant
Crangonicyidae	Tolerant	*Pisidiidae*	NC
Crangonyx	NC	*Platycentropus*	NC
Cricotopus	Tolerant	*Polycentropus*	Sensitive
Cryptochironomus	Tolerant	*Polypedilum*	Tolerant
Dicrotendipes	Tolerant	*Potthastia*	Sensitive
Diplocladius	Tolerant	*Probezzia*	Sensitive
Dubiraphia	Tolerant	*Procambarus*	Sensitive
Dytiscidae	Tolerant	*Pseudolimnophila*	Tolerant
Enchytraeidae	Tolerant	*Ptilostomis*	Tolerant
Ferrissia	Tolerant	*Rheocricotopus*	Tolerant
Gammarus	Sensitive	*Rheotanytarsus*	Tolerant
Gomphus	Sensitive	*Simulium*	Tolerant
Gordiidae	Tolerant	*Spirosperma*	NC
Gyrinus	NC	*Stagnicola*	Tolerant
Helocombus	NC	*Stegopterna*	NC
Heloplectron	NC	*Stempellinella*	NC
Hydrobaenus	Tolerant	*Stygrobromus*	NC
Hydrochara	NC	*Synurella*	NC
Hydropsyche	Tolerant	*Tanypodinae*	Tolerant
Ironoquia	NC	*Tanytarsus*	Tolerant
Lepidostoma	Sensitive	*Thienemanniella*	Tolerant
Leptophlebiidae	Sensitive	*Thienemannimyia*	Tolerant
Limnephilidae	Sensitive	*Tipula*	NC
Limnodrilus	Tolerant	*Triaenodes*	NC
Lumbriculidae	NC	*Tribelos*	Tolerant
Lype	NC	*Tubificidae*	Tolerant

Maccaffertium	Sensitive	*Xylotopus*	NC
Menetus	NC	*Zavrelimyia*	Tolerant
Micropsectra	Tolerant		

Monitoring Programs:
Nine stream sites were sampled in the Coastal Bays watersheds during 2009 as part of the MBSS. Fish, benthic macroinvertebrate and water samples were collected and physical habitat was assessed according to methods described in Stranko (2008) and Boward and Friedman (2000). To report overall stream health, fish and benthic macroinvertebrate indices of biotic integrity (IBI) were calculated for all sites that had adequate data. Also, in 2009, 2011, and 2012, spring benthic macroinvertebrate samples were collected at 52 sites by volunteers as part of DNR's Stream Waders Program. A family level benthic IBI was calculated for these sites. Table 3.2.3 summarizes MBSS and Stream Waders sampling in Coastal Bays watersheds.

Table 3.2.3 Summary of Maryland Biological Stream Survey, MBSS, and Stream Waders sampling in the Coastal Bays between 2007 and 2013.

Site Type	Year	Number of Sites	Site Selection Method	Watersheds Sampled
MBSS	2009	9	Non-random (5) and random (4)	Chincoteague Bay, Newport Bay
Stream Waders	2009	29	Non-random	Chincoteague Bay, Isle of Wight Bay, Newport Bay
Stream Waders	2011	16	Non-random	Assawoman Bay, Chincoteague Bay, Isle of Wight Bay, Newport Bay, Sinepuxent Bay
Stream Waders	2012	7	Non-random	Chincoteague Bay, Newport Bay, Sinepuxent Bay

Management Objective: Healthy Stream Fauna

MBSS Indicator 1: Fish IBI (thresholds described below)
MBSS Indicator 2: Invertebrate IBI (thresholds described below)

The MBSS fish and benthic macroinvertebrate IBIs rate stream health according to ecological characteristics of each assemblage (Roth et. al 2000; Southerland et. al 2005). Table 3.2.4 explains the ranges of the IBI and the corresponding narrative stream health ratings. Reference conditions for the Coastal Bays

Table 3.2.4 Stream health ratings and associated IBI thresholds.

Good (IBI score 4.0 – 5.0)	Comparable to reference streams considered to be minimally impacted
Fair (IBI score 3.0 – 3.9)	Comparable to reference conditions, but some aspects of biological integrity may not resemble the qualities of minimally-impacted streams
Poor (IBI score 2.0 – 2.9)	Significant deviation from reference conditions, with many aspects of biological integrity not resembling the qualities of minimally-impacted streams.
Very Poor (IBI score 1.0 – 1.9)	Strong deviation from reference conditions, with most aspects of biological integrity not resembling the qualities of minimally-impacted streams.

Analyses

The fish index of biotic integrity (FIBI) were calculated for the nine MBSS sites in the Coastal Bays watersheds. Benthic macroinvertebrate IBIs were calculated for 61 sites (9 MBSS and 52 Stream Waders).

Indicators of Stream Condition

FIBI results from five sites ranged from 1.0 (very poor) to 4.0 (good) (Figure 3.2.1). Benthic macroinvertebrate IBI (BIBI) values ranged from 1.0 (very poor) to 4.7 (good) (figure 3.2.2). The percentage of sites in each IBI category is shown in Figure 3.2.5.

The following tables list conditions (based on FIBI and BIBI) for MBSS and Stream Waders sites in the Coastal Bays watersheds. Stream Waders sites have numbers only and the last four digits indicate the year the sample was collected. MBSS sites contain either a county or watershed code. A blank stream name indicates that the stream name is unknown. NA in the Benthic IBI and Fish IBI Stream Condition columns indicate no data collected.

Assawoman Bay – A single Stream Waders sample was taken in the Assawoman Bay watershed. The Benthic IBI for this site was 1.29 (very poor). There were no MBSS data available from this watershed (Table 3.2.5).

Table 3.2.5 Assawoman Bay stream stations and fish and benthic indicator of biotic integrity (IBI) results.

SITE	STREAM NAME	BENTHIC IBI	STREAM CONDITION	FISH IBI	STREAM CONDITION
0689-02-2011	Back Creek at Catepillar Road	1.29	very poor	NA	NA

Isle of Wight /St. Martin River – Twelve sites were sampled by Stream Waders volunteers in the Isle of Wight Bay watershed. Eight sites were rated very poor by the BIBI and three sites were rated poor (Table 3.2.6). Only one site (Birch Branch) was rated fair. There were no MBSS data available from this watershed.

Table 3.2.6 Isle of Wight Bay stream stations and fish and benthic indicator of biotic integrity (IBI) results.

SITE	STREAM NAME	BENTHIC IBI	STREAM CONDITION	FISH IBI	STREAM CONDITION
0690-02-2009	Turville Creek UT	1.00	very poor	NA	NA
0692-01-2009	Cemetery Creek	1.00	very poor	NA	NA
0691-03-2009	Middle Branch	1.29	very poor	NA	NA
0692-03-2009	Slab Bridge Creek	1.29	very poor	NA	NA
0687-01-2011	Jake Gut	1.29	very poor	NA	NA
0690-01-2009	Crippen Creek	1.57	very poor	NA	NA
0691-01-2009	Middle Branch	1.57	very poor	NA	NA
0692-04-2009	Carey Branch	1.57	very poor	NA	NA
0691-02-2011	Middle Branch	2.14	poor	NA	NA
0691-04-2009	Church Branch	2.14	poor	NA	NA
0691-02-2009	Birch Branch	2.71	poor	NA	NA
0691-01-2011	Birch Branch	3.29	fair	NA	NA

Sinepuxent – Three sites were sampled by Stream Waders volunteers in the Sinepuxent Bay watershed and all were rated very poor by the BIBI (Table 3.2.7).

Table 3.2.7 Sinepuxent Bay stream stations and fish and benthic indicator of biotic integrity (IBI) results.

SITE	STREAM NAME	BENTHIC IBI	STREAM CONDITION	FISH IBI	STREAM CONDITION
0681-01-2011	Eagles Nest Creek	1.29	very poor	NA	NA
0681-03-2011	Decatur Ditch	1.29	very poor	NA	NA

Newport – Seven MBSS and 11 Stream Waders sites were sampled in the Newport Bay watershed. Both FIBIs and BIBIs reflect steam conditions ranging from very poor to fair (Table 3.2.8). The two FIBIs reflect fair and poor conditions in Kitts Branch and Bottle Branch, respectively. Ayer Creek, Bassett Creek and Massey Branch all were rated fair by either a BIBI or a FIBI.

Table 3.2.8 Newport Bay stream stations and fish and benthic indicator of biotic integrity (IBI) results.

SITE	STREAM NAME	BENTHIC IBI	STREAM CONDITION	FISH IBI	STREAM CONDITION
0685-01-2009	Bottle Branch	1.00	very poor	NA	NA
0683-03-2009	Poplartown Branch	1.86	very poor	NA	NA
NEWP-103-R-2009	Tukesburgh Branch	1.86	very poor	1.67	very poor
0685-01-2011	Hudson Branch	1.86	very poor	NA	NA
NEWP-125-B-2009	Marshall Creek UT2	2.14	poor	1.00	very poor
NEWP-128-B-2009	Marshall Creek UT3	2.14	poor	1.00	very poor
NEWP-112-B-2009	Ayer Creek	2.14	poor	3.33	fair
NEWP-111-B-2009	Kitts Branch	2.43	poor	2.67	poor
0682-02-2011	Icehouse Branch	2.71	poor	NA	NA
0683-02-2009	Porter Creek	2.71	poor	NA	NA
NEWP-111-R-2009	Massey Branch	3.00	fair	2.33	poor
NEWP-115-B-2009	Kitts Branch	3.00	fair	2.33	poor
0682-01-2009	Marshall Creek UT	3.00	fair	NA	NA
0683-01-2009	Bassett Creek	3.29	fair	NA	NA
0682-01-2011	Massey Branch	3.29	fair	NA	NA
0683-01-2011	Bassett Creek	3.86	fair	NA	NA

Chincoteague - Two MBSS and 25 Stream Waders sites were sampled in the Chincoteague Bay watershed. FIBIs reflect very poor to good conditions in Waterworks Creek UT and Little Mill Creek, respectively (Table 3.2.9). The BIBI in Little Mill Creek indicates good conditions as well. This is the only stream in this report to be rated good either the FIBI or the BIBI.

Table 3.2.9 Chincoteague Bay stream stations and fish and benthic indicator of biotic integrity (IBI) results.

SITE	STREAM NAME	BENTHIC IBI	STREAM CONDITION	FISH IBI	STREAM CONDITION
0671-02-2009	Hancock Creek	1.00	very poor	NA	NA
0675-03-2009	Brimers Gut	1.00	very poor	NA	NA
0666-02-2012	Pusey Branch	1.00	very poor	NA	NA
0671-01-2009	Riley Creek	1.29	very poor	NA	NA
0679-01-2009	Robins Creek	1.29	very poor	NA	NA
0679-01-2011	Robins Creek	1.29	very poor	NA	NA
0672-01-2009	Bunn Ditch	1.57	very poor	NA	NA

0674-01-2009	Pikes Creek UT	1.57	very poor	NA	NA
0675-01-2009		1.57	very poor	NA	NA
CHIN-109-R-2009	Waterworks Creek UT	1.57	very poor	1.00	very poor
0680-01-2009	Waterworks Creek	1.86	very poor	NA	NA
0672-01-2011	Little Mill Creek	1.86	very poor	NA	NA
0678-01-2011	Paw Paw Creek	1.86	very poor	NA	NA
0671-01-2011	Purnell Bay UT	2.14	poor	NA	NA
0674-01-2011	Scarboro Creek	2.14	poor	NA	NA
0672-03-2009	Little Mill Creek	2.14	poor	NA	NA
0674-03-2009	Pikes Creek	2.43	poor	NA	NA
0675-02-2009	Brimers Gut	2.43	poor	NA	NA
0676-01-2011	Tanhouse Creek	2.71	poor	NA	NA
0671-03-2009	Powell Creek	2.71	poor	NA	NA
0672-02-2009	Little Mill Run	2.71	poor	NA	NA
0674-02-2009	Pikes Creek	2.71	poor	NA	NA
0675-01-2011	Brockanorton Bay UT	3.29	fair	NA	NA
CHIN-105-R-2009	Little Mill Creek	4.71	good	4.00	good

Summary

Fish and benthic macroinvertebrate data from MBSS and Stream Waders sampling suggest that most streams in the Coastal Bays are degraded. Most taxa from both assemblages are pollution-tolerant. Benthic IBIs from MBSS and Stream Waders samples rated most sites as either poor (15%) or very poor (75%) with the remaining sites (10%) rated fair. Fish IBIs from MBSS samples rated most sites as poor (14%) or very poor (43%), with 43% rated fair.

Impacts to the biota of Coastal Bays streams likely result from physical habitat modification (e.g., ditching) and nutrient enrichment. Ditched streams generally have less habitat diversity and lower flows than minimally-altered streams in the Coastal Plain that retain their more natural wetland character. For more information on the status of physical and water chemistry please see the MBSS Round Three Report (http://www.dnr.state.md.us/streams/R3ReportIntro.asp).

Acknowledgements

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Figure 3.2.1 Fish Index of Biotic Integrity (IBI) for freshwater streams of the Coastal Bays watershed sampled in 2001. Only streams with watersheds greater than 300 km² were calculated for fish IBI.

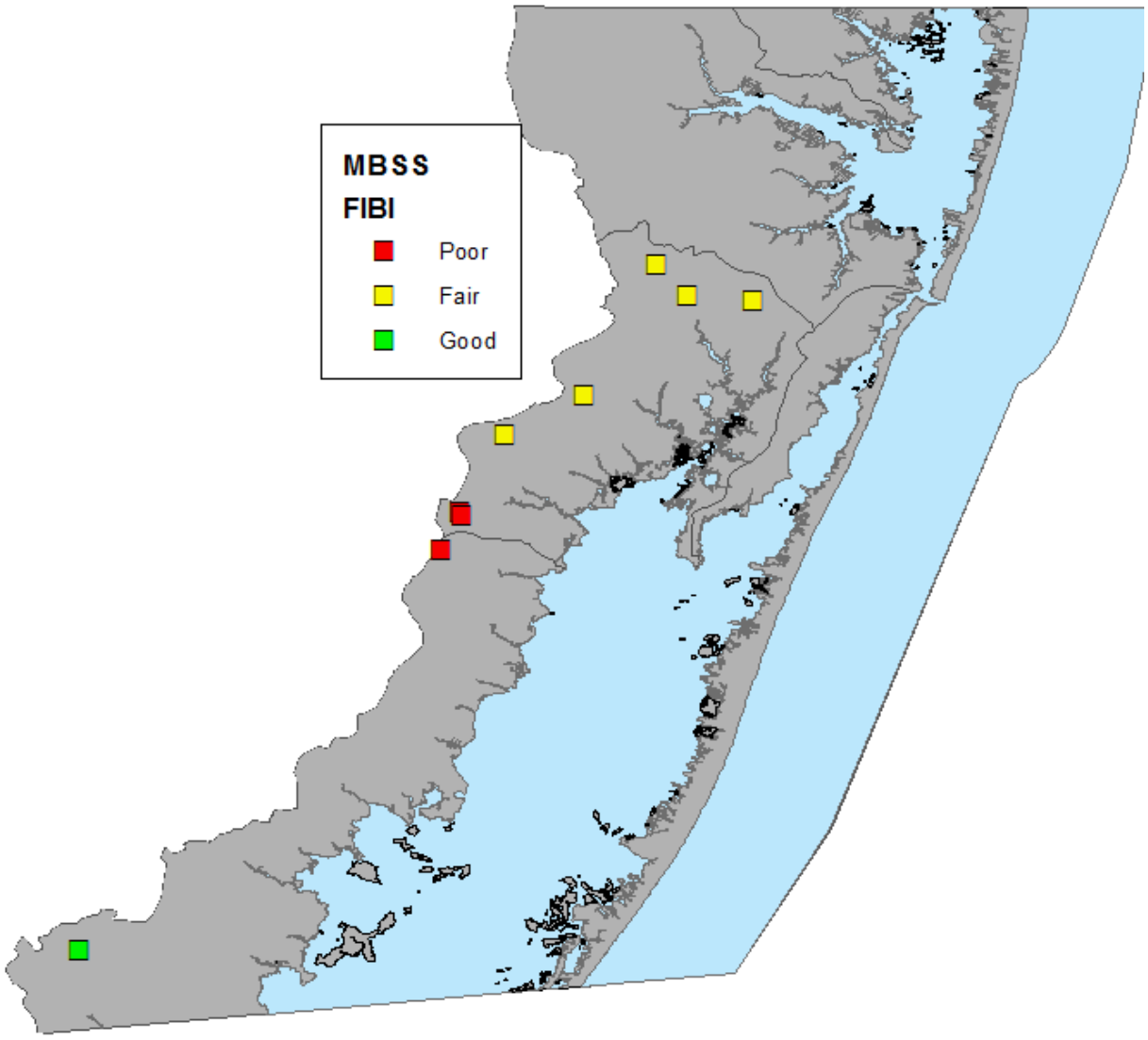


Figure 3.2.2 Benthic Index of Biotic Integrity (IBI) for freshwater streams of the Coastal Bays watershed sampled in 2009, 2011, 2012.

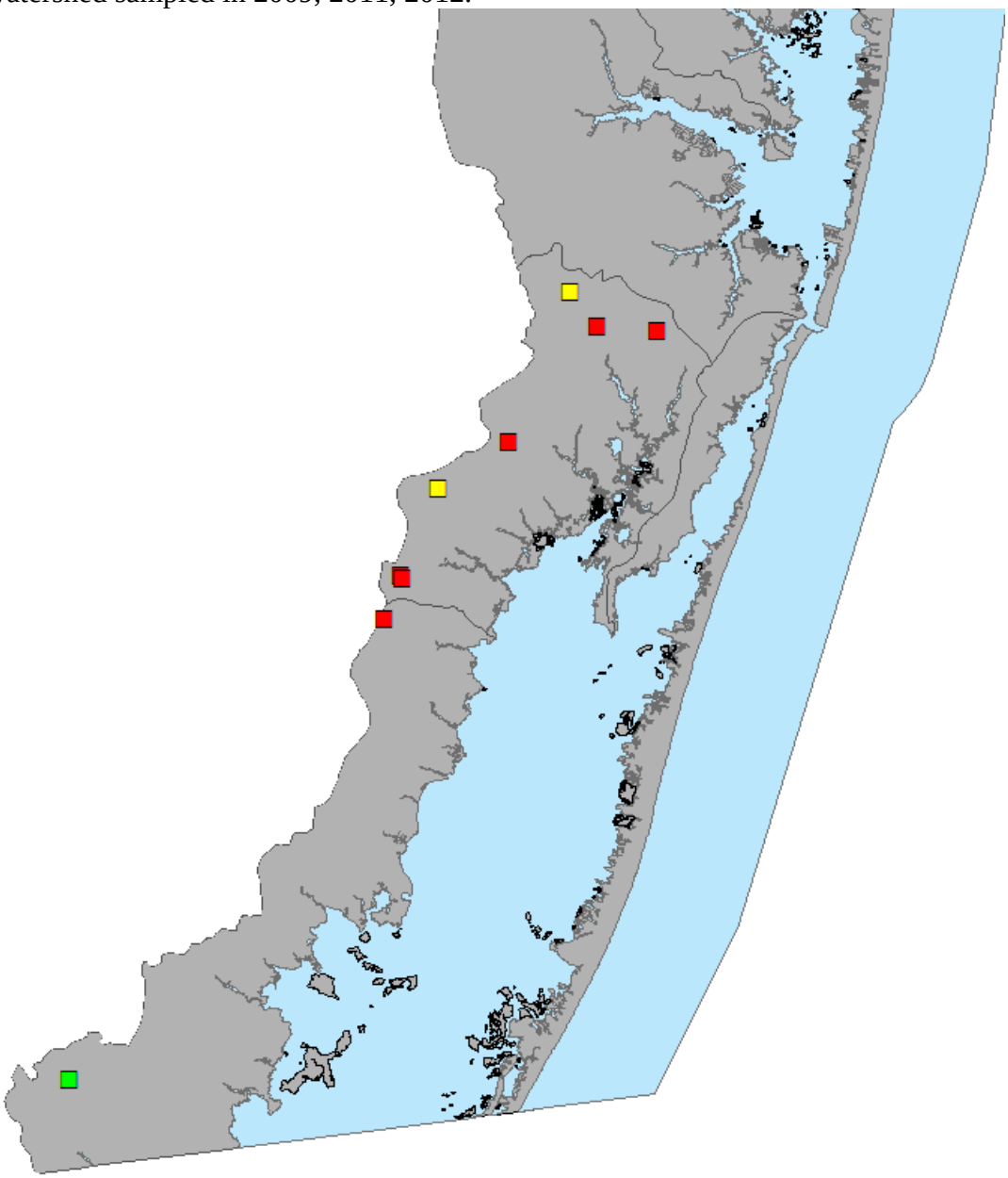


Figure 3.2.3 Streamwader results 2009, 2011 and 2012

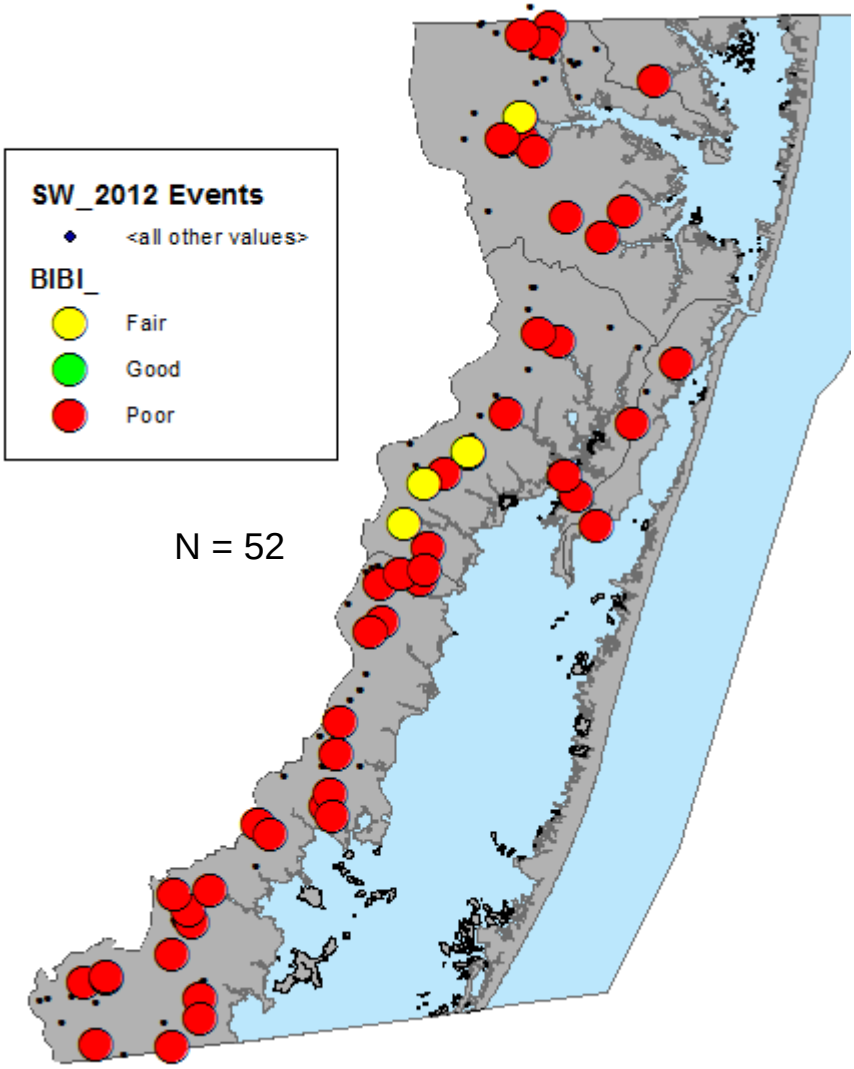
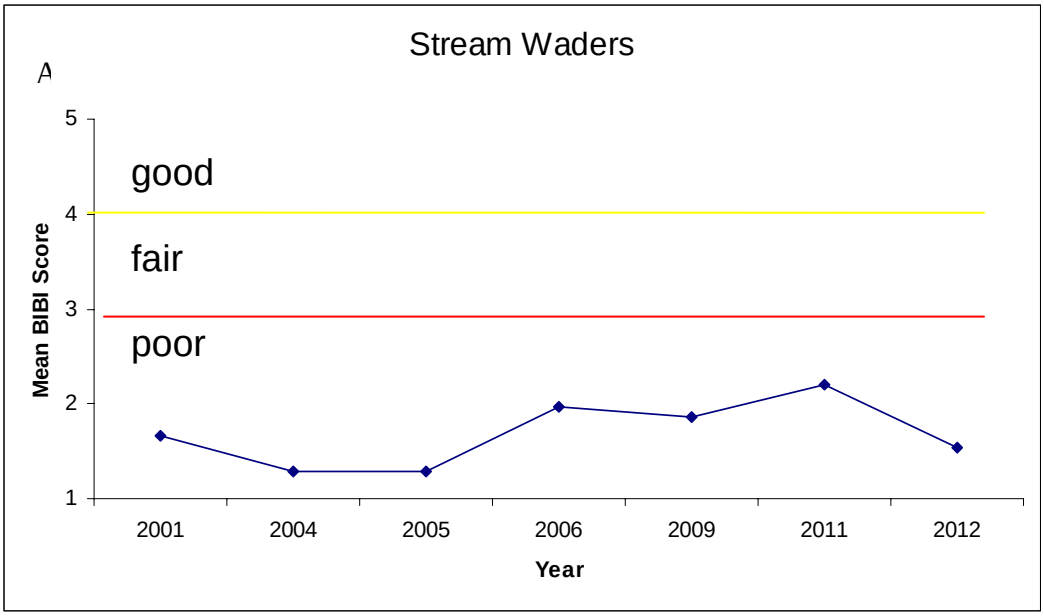


Figure 3.2.4 Streamwader mean abundance based on the benthic index of biotic integrity scores: 2001 – 2012. B. Percent of stream health that was ranked poor, fair and good.



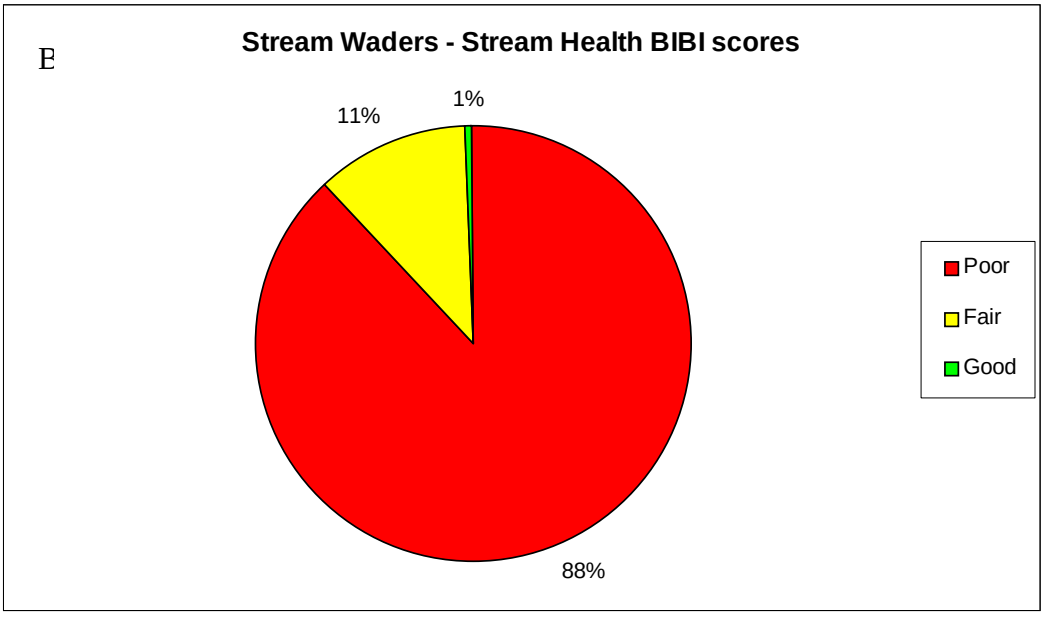


Figure 3.2.5 A.) Percentages of sampling sites falling within each of the Fish Index of Biotic Integrity cut-off points for 2001 MBSS sampling data. B.) Percentages of sampling sites falling within each of the Benthic Index of Biotic Integrity cut-off points for 2001 MBSS sampling data.