APPENDIX E

DESCRIPTIVE DATA ANALYSIS FOR CASE STUDY 2

The fish and benthic invertebrate response variables that showed the strongest responses in these correlations were the fish index of biotic integrity (FIBI) (2005), fish taxa richness, total number of fish, the Maryland benthic IBI (2005), total benthic taxa richness, and total EPT taxa richness. A series of these stressor response relationships are shown below, and are used for further exploration of stressor-response models.

Relationships between flashiness and a variety of environmental variables were investigated to identify variables that are potential stressors that may be related to a hydrologic characteristic that can be reflective of stream and surrounding watershed alterations, and may also be responsive to climate change. Figure E.1 shows the relationships between Baker's flashiness index scores (Baker et al., 2004) and eight other environmental parameters tested. In this and subsequent figures, the solid line is the LOWESS (local weighted smoothing) line. The strongest relationships were between % urban land use and Baker's flashiness index score, and between impervious surface and flashiness. Both of these are factors that contribute to alterations in watershed runoff that result in greater "flashiness". Some other variables that are closely associated with runoff, such as nutrient concentrations, had relatively weak relationships with flashiness, e.g., total phosphorus and total organic carbon.

The relationships between physical habitat index (PHI) and macroinvertebrate and fish IBI scores in the MBSS data are shown in Figure E.2. Overall, as habitat condition improved (PHI increased), the fish and benthic IBIs increased.

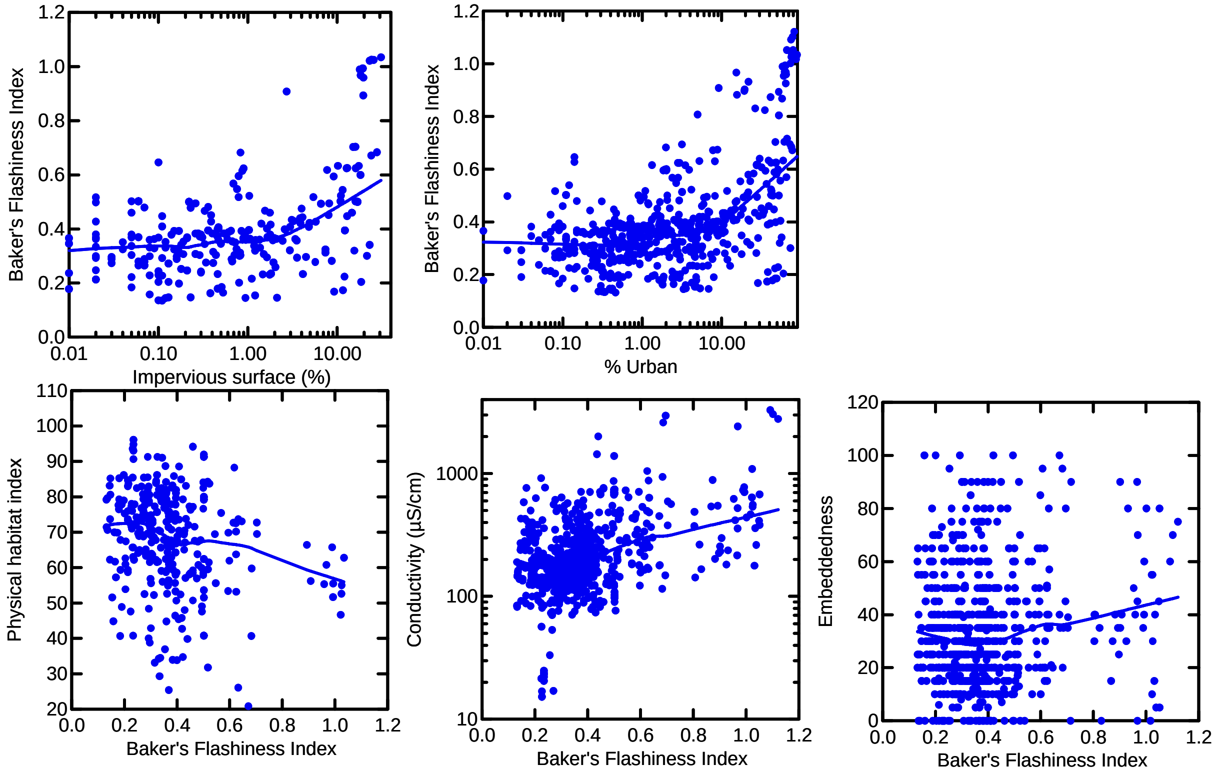

Figure E.1. Flashiness vs. environmental variables

Comparisons were made between three fish response variables and a suite of environmental parameters. Figure E.3 shows the relationships between fish IBI scores and dissolved oxygen (DO), instream habitat, temperature, flow, flashiness, and impervious surface. Fish IBI scores increased with increasing DO, habitat score, and channel flow. Fish IBI declined with increased impervious surface and flashiness. The lack of relationship between fish IBI and temperature is at least in part related to the factors that collections are made only during a seasonal (summer/fall) index period, and that these analyses are being conducted on a combination of only two very closely related ecoregions.

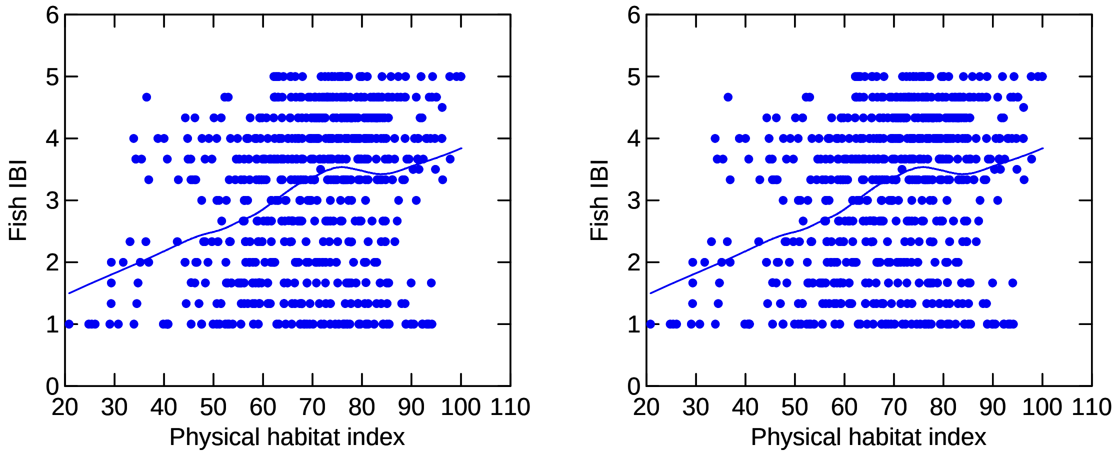

Figure E.2. Index comparison

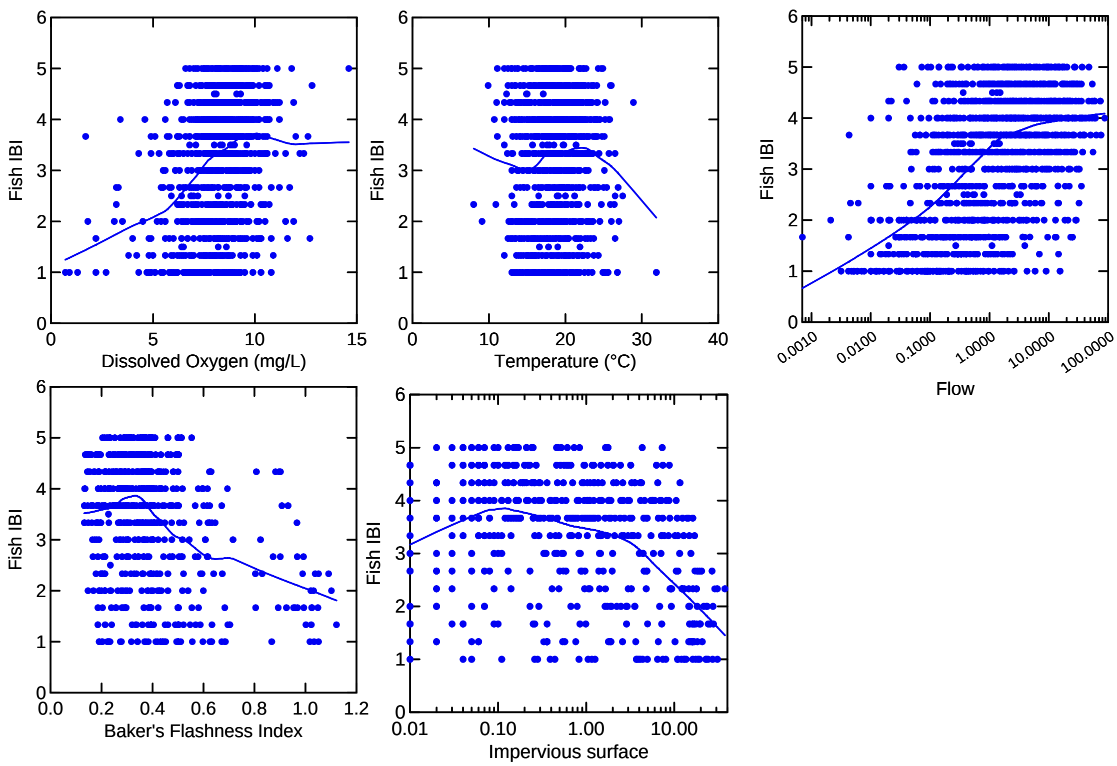

Figure E.3. Fish vs. environment

Figure E.4 shows the relationships between abundance of fish and the same suite of environmental variables (DO, habitat score, temperature, flow, flashiness, impervious surface). Fish abundance increased with increasing DO, though the relationship is very weak. Fish abundance also increased with increasing habitat score, PHI, and channel flow. Fish abundance declined with increasing impervious surface, though again in a very weak relationship. There was no meaningful relationship between fish abundance and flashiness.

Number of fish species present (richness) also increased with increasing instream habitat score and with flow (Figure E.5). Fish richness increased with increasing DO, but with a weaker relationship. Fish species richness declined with increased impervious surface, but showed no real relationship with flashiness.

For the benthic macroinvertebrate community, species richness increased very slightly with increasing PHI, and decreased slightly with increasing flashiness and impervious surface (Figure E.6). However, it appeared that total benthic taxa richness was not a strong response variable with most parameters. In comparison, EPT (Ephemeroptera, Plecoptera, Trichoptera) taxa richness showed reasonable stressor-response relationship with several environmental parameters (Figure E.7). The number of EPT taxa increased with increasing PHI, and decreased with increasing DOC, phosphorus, conductivity, embeddedness, Baker's flashiness index score, and impervious surface. EPT taxa had strong relationships with all these variables, and were therefore EPT selected as a primary response variable to examine potential climate change effects.

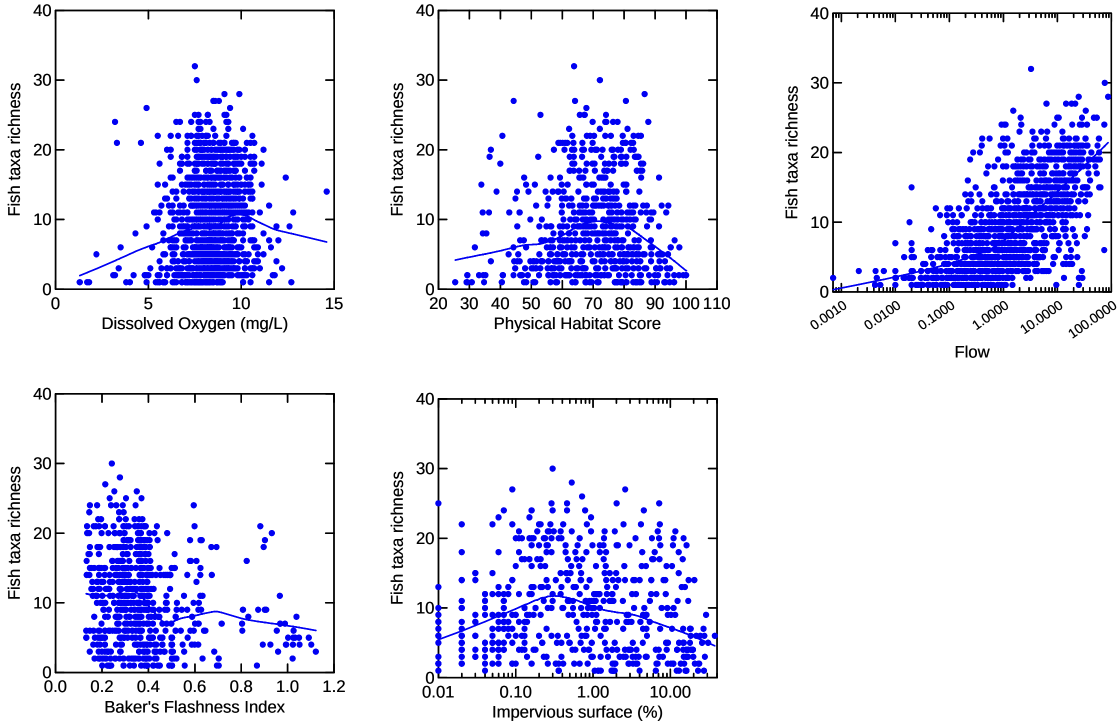

Figure E.4. Fish richness vs. others

Hydrologic parameters of greatest interest in the analysis here are summarized in Table E.1. Low flow events, high flow events, and Baker's flashiness were estimated by the FTSE model. Low flow and high flow events are the number of events during a year below the 25th and above the 75th percentiles, respectively, of the area-weighted mean discharge of all streams.

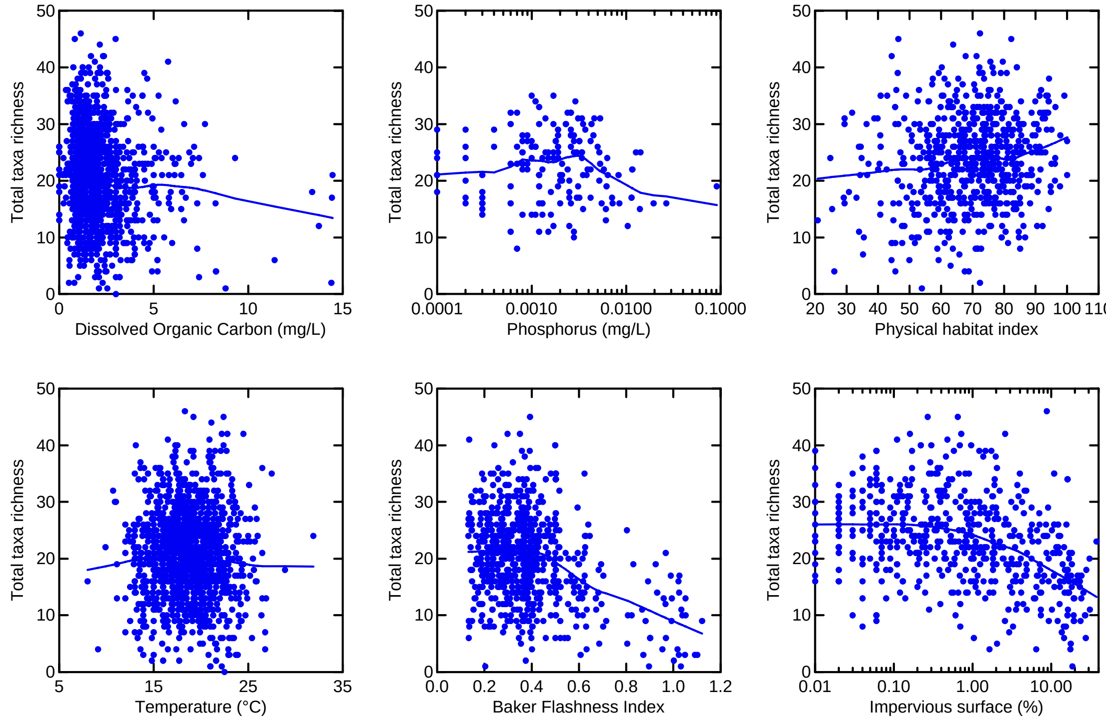

Figure E.5. EPT taxa vs. environmental 2

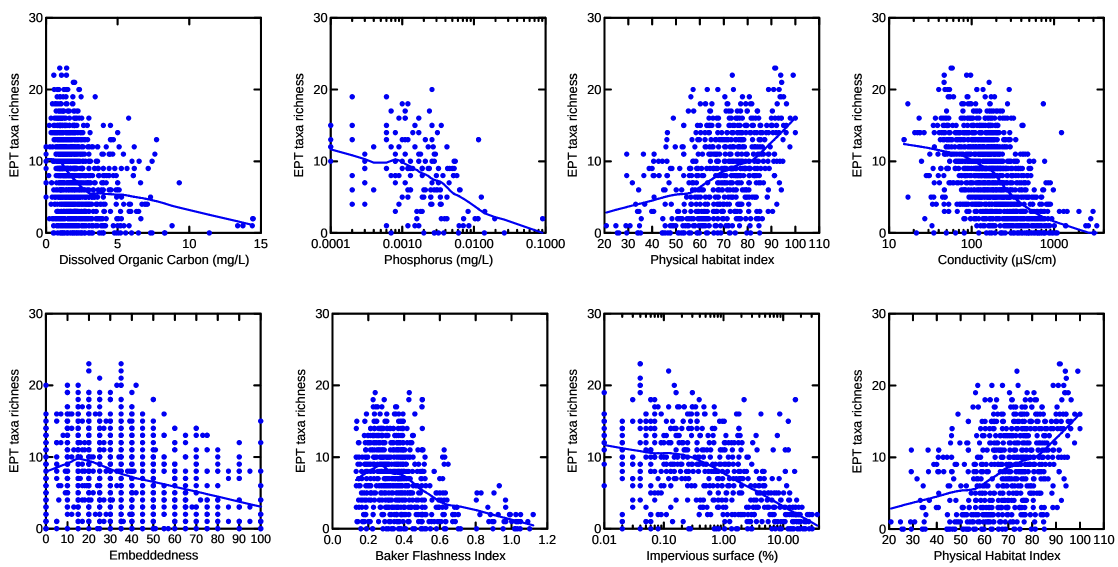

Figure E.6. EPT and environmental variables

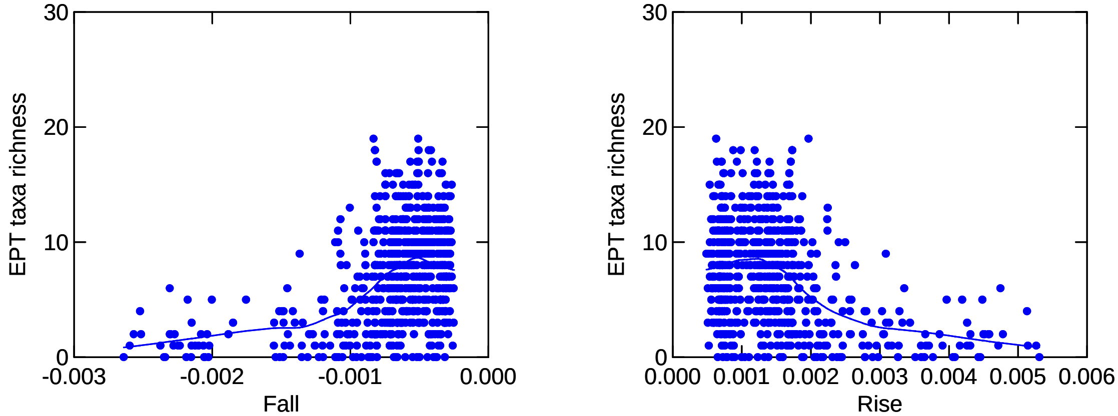

Figure E.7. EPT and hydrology

Table E.1. Summary of hydrologic parameters used in analyses

	Baker's F	**Palmer Hydro**
N of cases	764 (streams)	15 (months)
Minimum	0.132	-4.24
Maximum	1.121	4.75
Median	0.362	1.02
Mean	0.385	0.819
Standard Dev.	0.179	2.56