The algal turf scrubber (ATS) is an ecologically engineered system that develops natural periphytic algae (algal turf). ATS units are typically used to remove nutrients (especially nitrogen and phosphorus) and to inject oxygen into degraded waters. They have also been used in aquaculture production systems, and to remove heavy metals and break down toxic organics in industrially degraded waters. Larger ATS systems have been in constant operation for two decades and range from 0.1 to 3 hectares in size. In the ATS, algae grow attached to screens in shallow troughs over which pulsed, flowing water is passed. Algae in ATS systems are harvested on a weekly basis to remove the nutrients. The algal biomass can be used in a variety of by-products; both butanol and ethanol production, as well as fertilizer efficacy have been demonstrated.

In this study, two two-foot wide experimental ATS systems, one 50 ft. the other 80 ft. long, constructed of fiberglass, were studied from summer 2009 to summer 2011. These units were used on a mesohaline river to examine the role of substrate type and CO₂ introduction on algal species composition, biomass production, and biochemistry, preparatory to developing an amelioration system for the Chesapeake watershed. A total of 45 samples over 25 dates were taken on either floway. Partial results are presented here on algal abundance and dynamics, biomass data, nutrient data, and biochemical by-products.

### Results

- Oil is measured gravimetrically and consists of solvent-extractable materials.
- Fatty acids are components of the oil that are fatty-acid based, and are chemically analyzed as their methyl esters or FAMEs.
- EPA and DHA are plotted relative to the total fatty acid-based fraction (as FAMEs).
- Ash ranges from ~55-60 wt%; Carbohydrates ~20-25 wt%.

### Conclusions

ATS systems operating on degraded water bodies, that are naturally-seeded with ambient algae, can be both highly productive and diverse. Scale-up has been demonstrated and large river-scale amelioration, with resultant by-products is possible. We have seen interesting results in our algal assemblages and are currently trying to understand what drives these successions. Bacillariophyta and Cyanobacteria dominate our units. Significant seasonal changes occur. Species of Coelastrella and Thalassiosira are dominant in the colder months, while Borkhiasa militaris and Melosira varians dominate in warmer weather. Ulva intestinalis and Ulvella spp. increase in spring. Lower pH increases the growth of Lyngbya cf. salina. PUFAs increase in winter, however overall biomass decreases.