

2012-2015 Benthic Invertebrate Summary

Benthic monitoring by the Environmental Monitoring Program is conducted monthly at 10 sampling sites distributed throughout several estuarine regions from San Pablo Bay upstream through the Sacramento-San Joaquin Delta (Figure 1). EMP staff collected four replicate bottom grab samples at each station using a Ponar dredge with a sampling area of 0.052 m².

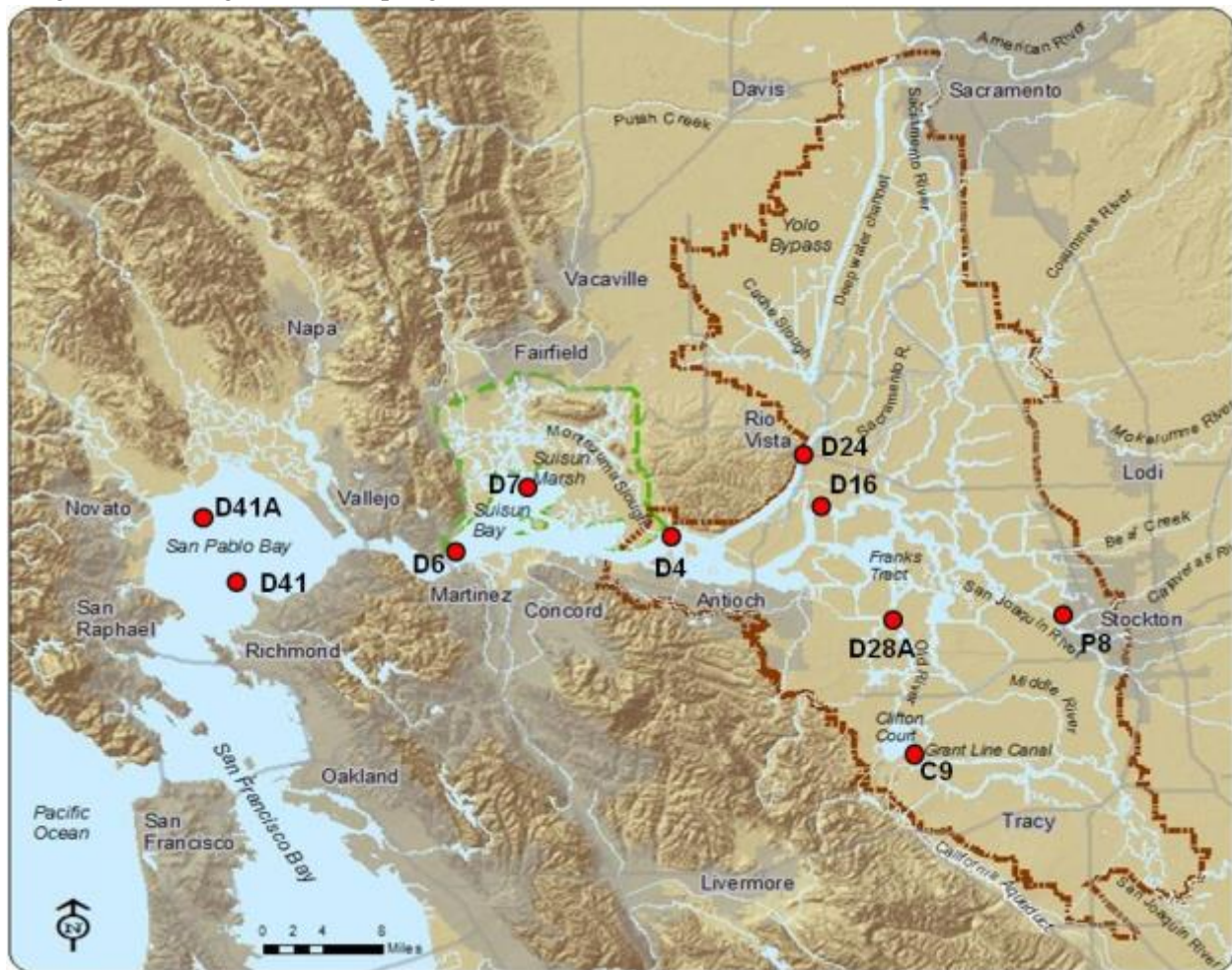


Figure 1. Locations of the Environmental Monitoring Program's (EMP) benthic monitoring stations

The Sacramento-San Joaquin Delta's invertebrate benthic community is highly diverse. Over 450 different species in twelve different phyla have been collected since 1976. Each site's community composition is determined largely by how fresh or salty its water is, but is also affected by many other factors.

The years 2012-2015 brought a period of increasing drought effects. Many benthic invertebrate species demonstrate extreme interannual and seasonal variability even in relatively average water years, and the drought likely contributed to some of the patterns of changes we saw during this time.

The most saline of our sites, D41 and D41A, are polyhaline sites in San Pablo Bay. At both sites, one of the most numerous species was the amphipod *Ampelisca abdita*. At D41 there was also a significant increase from 2012-2015 of the phoronid *Phoronopsis harmeri*, likely because of the increased salinity in San Pablo Bay due to drought (Figure 2). At D41A, the invasive overbite clam *Potamocorbula amurensis* saw a brief boom in the years after the wet winter of 2011, but likely decreased in 2012-2015 due to increasing salinity (Figure 3).

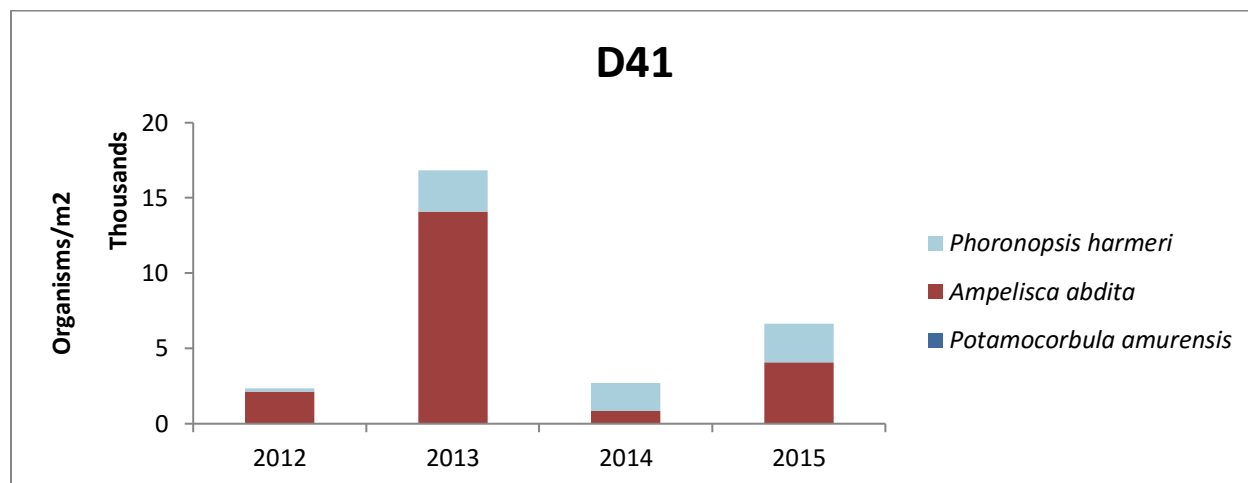


Figure 2. Annual Abundance of Benthic Organisms at site D41: San Pablo Bay near Pinole Point (left) from 2012 to 2015

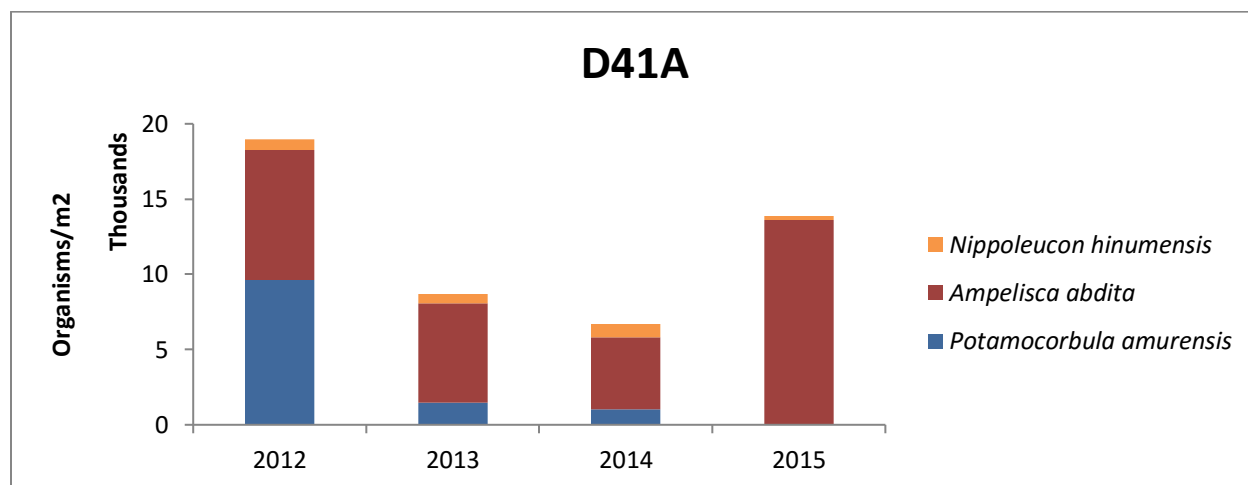


Figure 3. Annual Abundance of Benthic Organisms at site D41A: San Pablo Bay – north central (center) from 2012 to 2015

In Suisun Bay and Grizzly Bay, our mesohaline sites D6 and D7 were both dominated from 2012-2015 by *Potamocorbula amurensis*, which could reach densities tens of thousands per square meter. At D6, *P. amurensis* comprised over 95% of all organisms between 2012-2015 (Figure 4). At D7, over half of the organisms were *P. amurensis*, but the amphipod *Corophium alienense* and the small cumacean crustacean *Nippoleucon hinumensis* also formed a large proportion of the community (Figure 5).

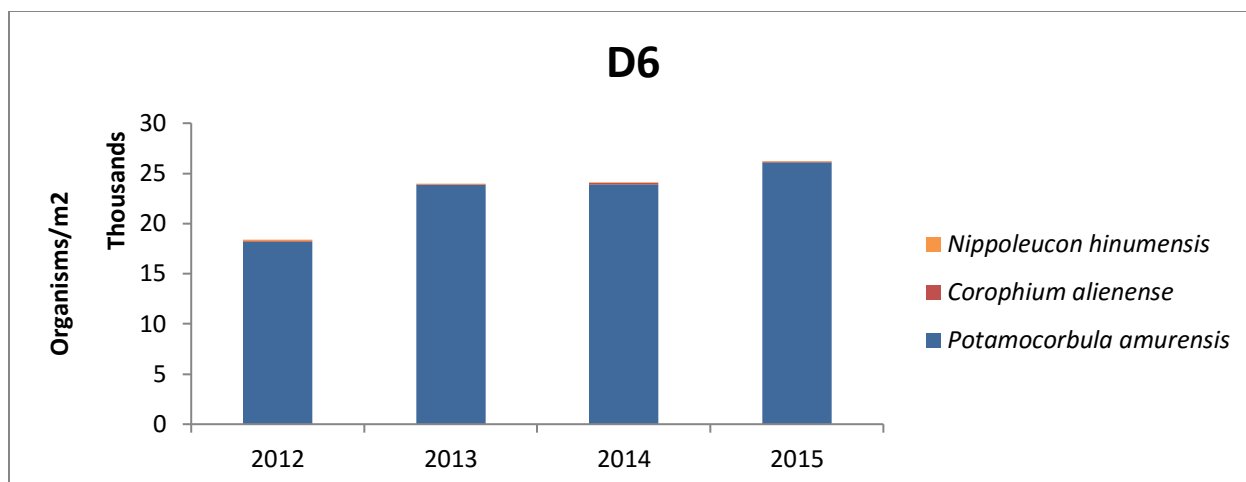


Figure 4. Annual Abundance of Benthic Organisms at site D6: Suisun Bay upstream of I-680 bridge (right) from 2012 to 2015

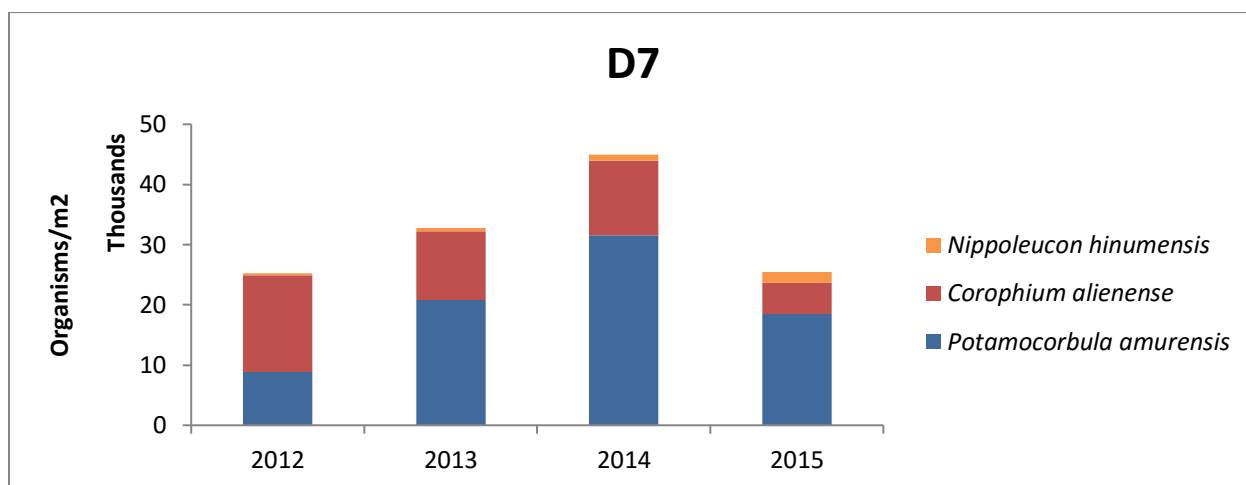


Figure 5. Annual Abundance of Benthic Organisms at site D7: Grizzly Bay at Dolphin near Suisun Slough (center) from 2012 to 2015

At the confluence of the Sacramento and San Joaquin rivers, site D4's oligohaline community was comprised in 2012 largely of the amphipods *Americorophium spinicorne* and *Americorophium stimpsoni*. This gave way in 2013 to a community dominated during 2013-2015 by the sabellid worm *Laonome calida* and the oligochaete worm *Limnodrilus hoffmisteri*, with the oligochaete worm *Varichaetadrilus angustipenis* present at high numbers throughout 2012-2015 (Figure 6).

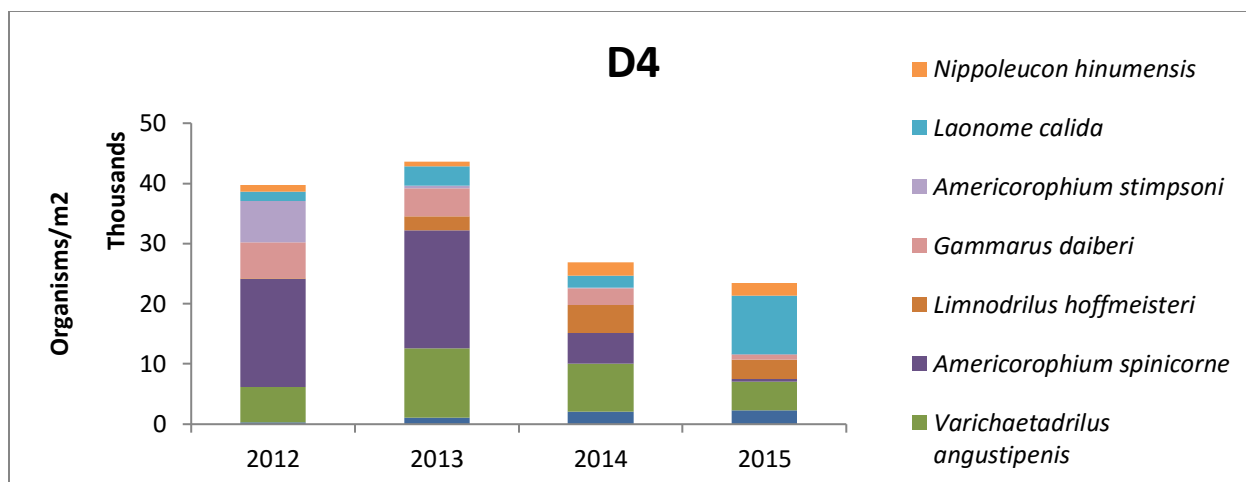


Figure 6. Annual Abundance of Benthic Organisms at site D4: Sacramento River @ Sherman Island upstream of Point Sacramento from 2012 to 2015

In the Sacramento River, freshwater site D24 was dominated by the invasive clam *Corbicula fluminea*, although its numbers (which peaked in 2011) dropped steadily through the 2012-2015 period. There were also significant numbers of the amphipod *Gammarus daiberi* (Figure 7).

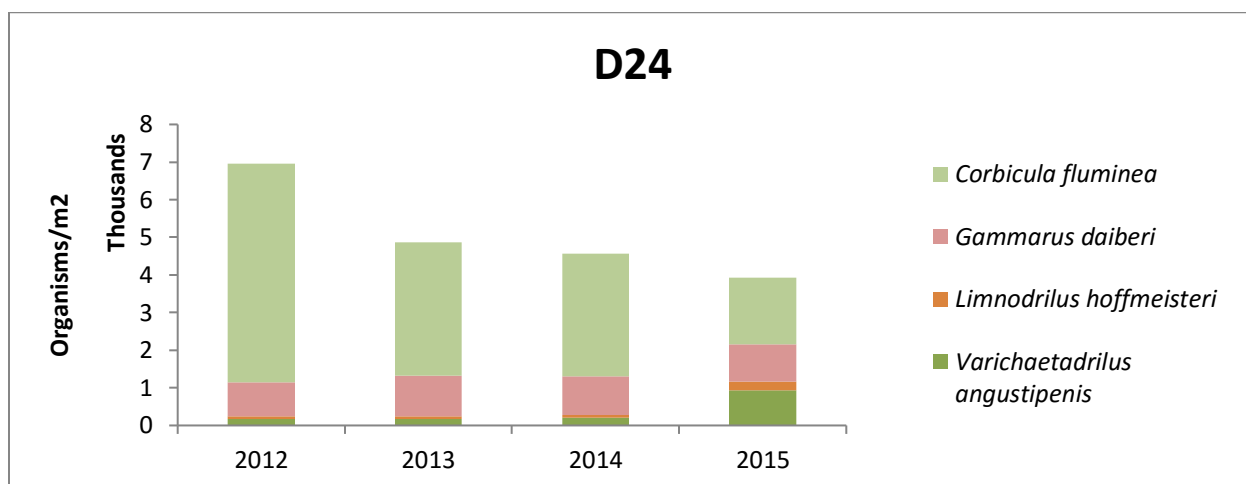


Figure 7. Annual Abundance of Benthic Organisms at site D24: Sacramento River downstream of Rio Vista bridge (left) from 2012 to 2015

In the San Joaquin River, freshwater site D16 (at Twitchell Island) was dominated during 2012-2015 by the clam *Corbicula fluminea* and the amphipods *Americorophium spinicorne* and *Gammarus daiberi* (Figure 8). Further upstream in the San Joaquin River, site P8 at Buckley Cove saw a sharp increase over 2012-2015 (and dating back to 2007) of the sabellid worm *Manayunkia speciosa*, in addition to a diverse community of freshwater oligochaetes and amphipods (Figure 9).

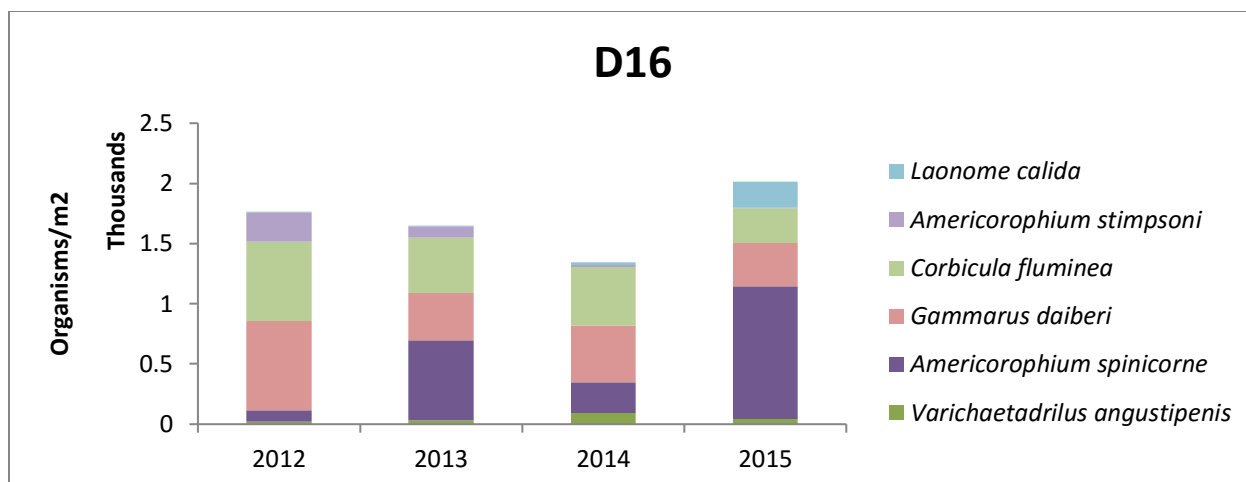


Figure 8. Annual Abundance of Benthic Organisms at site D16: San Joaquin River at Bradford Island (left) from 2012 to 2015

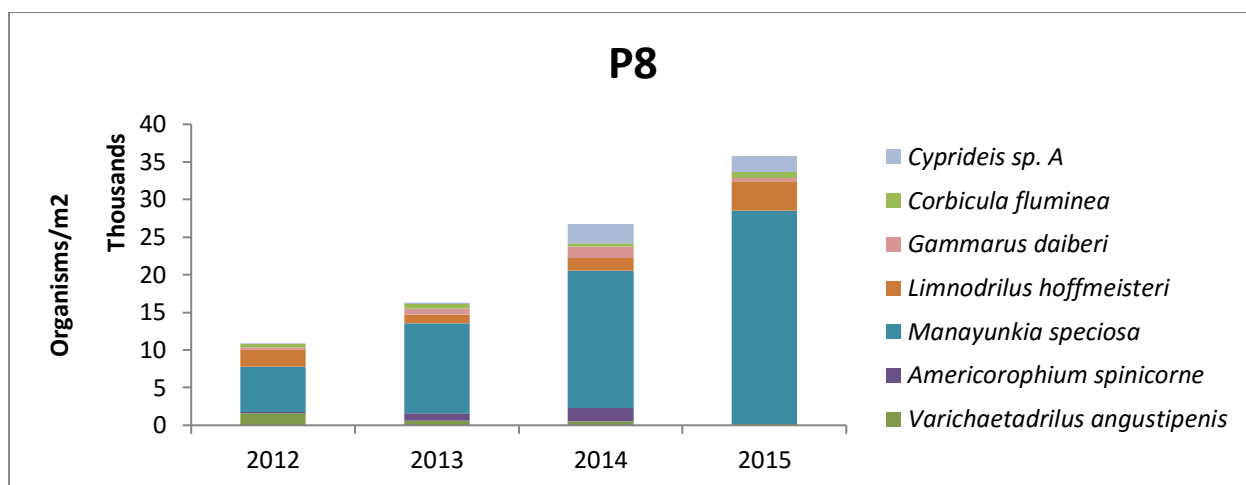


Figure 9. Annual Abundance of Benthic Organisms at site P8: San Joaquin River at Buckley Cove (right) from 2012 to 2015

In Old River, freshwater site D28A had a diverse community in 2012-2015. Similar to site P8, there were large numbers of *Manayunkia speciosa*, as well as the oligochaete *Variachaetadrilus angustipenis*, the ostracod *Cyprideis* sp. A, and the amphipods *Americorophium spinicorne* and *Gammarus daiberi* (Figure 10). Many of these species hit very low numbers following the wet winter of 2011, and saw dramatic increases in 2013.

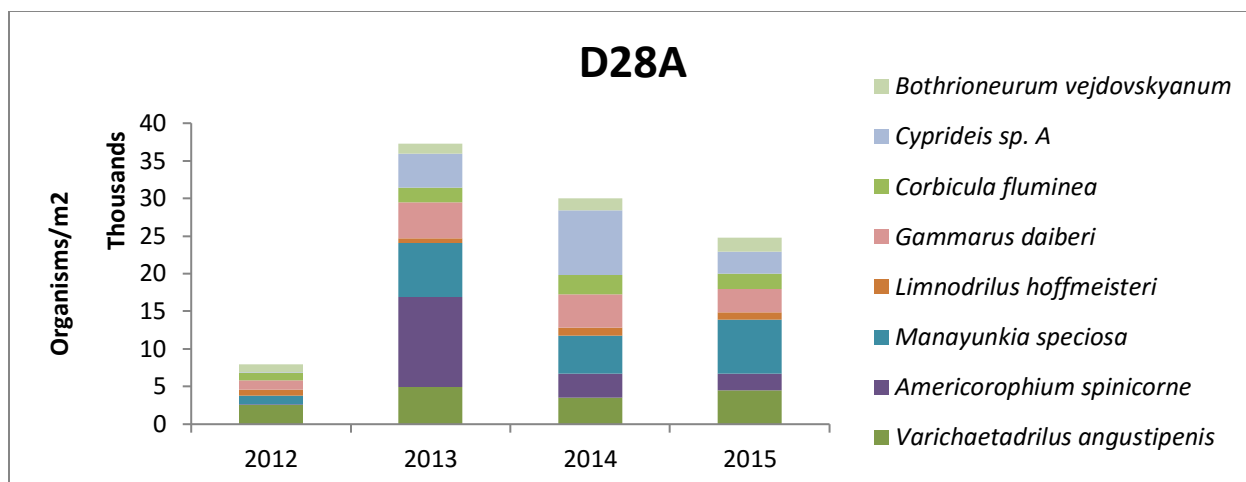


Figure 10. Annual Abundance of Benthic Organisms at site D28A: Old River Upstream of Rock Slough (left) from 2012 to 2015

At Clifton Court Forebay, freshwater site C9 saw decreases beginning in 2012 of several oligochaete worms that peaked in the wet year of 2011 (*Limnodrilus hoffmeisteri*, *Varichaetadrilus angustipenis*, and *Ilodrilus frantzi*), and an increase in the oligochaete *Aulodrilus pigueti* and in the ostracod *Cyprideis* sp. A. in 2014-2015 (Figure 11). While the sabellid worm *Manayunkia speciosa* and the amphipod *Americorophium spinicorne* also saw peaks in 2014, they decreased to much lower levels in 2015.

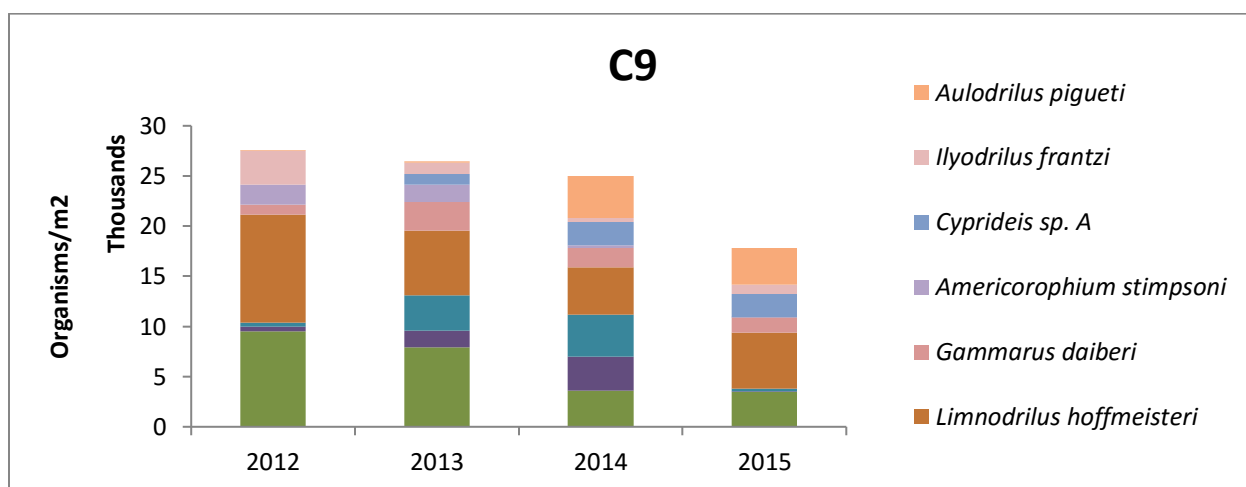


Figure 11. Annual Abundance of Benthic Organisms at site C9: Old River upstream of Clifton court Forebay Intake (left) from 2012 to 2015