AQUATIC RESOURCE PROGRAM REPORT

1. Aquatic resource survey for the lower Cosumnes and Mokelumne Rivers

This section contains two reports, one on invertebrates (IA) and one on fish (IB).

For fish, most of the information originally proposed for this section is now included in section 3 of this report because the results of our floodplain studies are compared to those of adjoining river and sloughs which make up the lower rivers. However, we do include here a brief summary of three years of electrofishing of the lower Cosumnes River and its sloughs because the sampling focused mostly on adult fishes as residents rather than the juveniles that tended to dominate floodplain habitats.

1A. Aquatic resource survey of the lower Cosumnes and Mokelumne Rivers: invertebrates

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Abstract

We surveyed and compared the zooplankton of the lower reaches of the highly regulated Mokelumne Rivers with the Cosumnes River and adjacent Dry Creek, which experience more natural seasonal variation in flows. In 2000 and 2001, we collected zooplankton samples from two to three sites along each river and compared the patterns of temporal and seasonal variation. We found that the Cosumnes River and Dry Creek showed much stronger seasonal fluctuations in zooplankton biomass than the Mokelumne River. Both the Cosumnes and Dry Creeks showed substantial declines over 1-2 months while the Mokelumne showed nearly constant biomass into June. The zooplankton assemblages of all three rivers were nearly the same with little evidence of invasion by exotic species.

Introduction

River systems in western North America are heavily influenced by natural variation in flows both within and among years (Mount 1995; Poff 1997; Poff et al. 1997; Fausch et al. 2002; Stanley and Doyle 2002). The Cosumnes River, which drains about 1600 km^2 on the western side of the California Sierra Nevada, experiences natural variation in flows, while in the watershed immediately to the south drained by the Mokelumne River, large dams dampen most variation in seasonal flows. Therefore, the Cosumnes River has largely unobstructed seasonal flows created by winter rains and spring snowmelt, while the hydrograph of the Mokelumne remains nearly constant except for summer dam releases in high water years.

In this section, we attempt to compare aquatic invertebrate resources between the two watersheds with the goal of understanding how invertebrates may be influenced by the differences in the hydrographs. Using similar sampling methods, we directly compare the abundances of zooplankton in the Mokelumne River with the Cosumnes River and a tributary of the Mokelumne which also has largely unregulated flows. By making these comparisons among sites within rivers and across time, we aim to describe differences among the basins in terms of the invertebrate species of most importance for maintaining upper trophic levels including healthy fish assemblages.

Methods

We measured the abundance of aquatic invertebrates at different sites along the Mokelumne and Cosumnes Rivers in order to compare the abundance and distribution along both. The lower watersheds of the two rivers experience dramatically different hydrographs during the course of the year. The Camanche Dam and Woodbridge dams regulate the reaches of the lower Mokelumne River and maintain higher flows during the summer when compared with the Cosumnes River, which may run dry in certain lower reaches in some years. Also, because the dams releases water from the lower part of the reservoir, the releases maintain cooler water temperatures as well. However, the dam controls normally high flows typical of the winter and spring flood seasons and there are no high flows in Mokelumne compared with the more normal flood-induced volumes experienced on the Cosumnes river. Also, the Mokelumne also lacks any floodplain that is comparable to the CRP.

The focus of our sampling was on water column invertebrates including crustacean zooplankton and aquatic insects at several sites along the Cosumnes and Mokelumne Rivers as well as sites on Dry Creek, a non-regulated lower tributary of the Mokelumne River (Figure 1-1). The sites include Twin Cities Rd. and Latrobe Rd. along the lower Cosumnes River, Mackville Rd., Elliott Rd. and New Hope Rd. along the lower Mokelumne River and Alta Mesa Rd. and J10 and the Dry Creek tributary of the Mokelumne River (Table 1-1). These sites all well with 10 m elevation above sea level and are below highway 49 and above the Cosumnes Floodplain Preserve (CFP) (see section 3).

These sites generally were accessible after flood events had subsided in spring and were amenable to collections of water column zooplankton either in the main channel or along the banks depending on depth and flow. We used a plankton net (150 um mesh, 0.3 m wide, 5:1 l/w ratio) outfitted with a propeller flow meter (Ocean Dynamics) suspended in the middle of the opening of the net. The net was tossed into the current and maintained just below the surface for a period long enough to allow a standard count of >1000 units on the flow meter (typically about 30 seconds in ~ 1 m/s flow). In sites with no or little flow, the net was pulled through the water column by hand with the net extended to avoid capturing benthos kicked up by the person sampling. We took two replicate tows in adjacent areas per sampling site. We collected zooplankton from the net into labeled 500 ml Nalgene bottles and placed in a cooler until return to the lab. In the lab, zooplankton were fixed with sweet Lugol's iodine and enumerated under a dissecting scope at 25 x on a plankton counting wheel.

At some sites aquatic insects could be sampled along the channel banks using a sweep net. A 0.5 x 0.3 m sweep net was pushed along the stream bank often through vegetation over a distance of 2 meters. We took two replicate sweeps in adjacent areas per sampling site. Insects were then rinsed from the net into labeled plastic Ziploc bag and placed in a cooler until return to the lab. In the lab, invertebrates were rinsed and picked off of vegetation and debris and fixed in 70% EtOH and enumerated under a dissecting scope at 25 x.

Results

Zooplankton Abundance, Diversity and Biomass. We found essentially the same suite of common zooplankton taxa along the Mokelumne and Cosumnes Rivers including Dry Creek (Table 1).

Temporal patterns. We found that taxa were fairly consistent in abundance at the Mokelumne sites (Mackville and Elliott) (Fig. 1-2 to 1-4). Although there were some seasonal changes, the zooplankton abundances and assemblages were consistent between time points. Biomass shows little sign of declining at Elliott or Mackville (Figure 1-2 to 1-4). In contrast, the seasonal flows on Dry Creek and the Cosumnes produced more dramatic changes over time (J10 in Fig. 1-2) and Cosumnes sites (Twin Cities in Fig. 1-6) including changes in taxa over a few weeks at one site (New Hope Fig. 1-7).

Spatial patterns. Patterns of spatial differences in the abundance of zooplankton taxa show that Elliott and Mackville are much more similar to each other than they are to sites on other rivers (Fig. 1-5 and 1-8). Dry Creek sites (J10, Alta Mesa) show more heterogeneity among sites (Figs. 1-8 and 1-9). Sites on the Cosumnes River showed some similarity between sites, but not to the same degree (Fig. 1-10).

Discussion

We found distinct differences between the aquatic invertebrate communities of the Mokelumne Rivers compared with the Cosumnes River and Dry Creek. However, the species lists for both rivers are identical at the taxonomic levels investigated in this study (Table 1). There was a stronger seasonal pattern with more rapid change in the invertebrate communities along the Cosumnes River and Dry Creek compared with the Mokelumne River. Differences between sites were less along the Mokelumne river than across sites along the Cosumnes and Dry Creek sites where there was a much sharper decrease in biomass during the late spring.

We found little evidence for the presence of known non-native species, although we hasten to add that the native status of most species of aquatic insects is rarely documented, and our methods were not designed to effectively sample benthic species over large areas. Nonetheless, we little evidence for high abundances of exotic crayfish and no evidence for the presence of Chinese Mitten Crabs, at least in the two years of our study.

References

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Table 1.

Order	Family	Genus	Life Phase
Acari			
Amphipoda	Hyalellidae	Hyallella	
Amphipoda	Gammarridae	Gammarus	
Oligochaeta			
Coleoptera	Elmidae		Larva
Coleoptera	Dytiscidae		Larva
Coleoptera	Hydrophilidae		Adult
Coleoptera	Chrysomelidae	Disonycha	Adult
Coleoptera	Curculionidae		Adult
Coleoptera	Staphylinidae		
Coleoptera	Carabidae		Larva
Coleoptera	Curculionidae	Listronotus	Adult
Coleoptera	Elmidae		Adult
Collembola	Entomobryidae		Adult
Decapoda	Cambaridae	Procambarus	
Diptera	Ceratopogonidae		Larva
Diptera	Chironomidae		
Diptera	Simuliiae		Larva
Diptera	Ephydridae	Discocerina	Larva
Diptera	Nematocera		Pupa
Diptera	Tipulidae		Adult

Order	Family	Genus	Life Phase
Ephemeroptera	Baetidae		
Ephemeroptera	Caenidae	Cerobrachys	Larva
Hemiptera	Corixidae		Adult
Hemiptera	Corixidae		Nymph
Hemiptera	Saldidae		Nymph
Homoptera			Adult
Lepidoptera	Noctuidae	Bellura	Larva
Mollusca	Physidae		
Mollusca	Planorbidae		
Mollusca	Lymnaeidae		
Mollusca	Gastropoda		
Mollusca	Bivalva		
Odonata	Aeshnidae		Larva
Odonata	Coenagrionidae		Larva
Odonata	Libellulidae		
Plecoptera	Perlodidae	Isoperla	Larva
Podocopida	Ostrocoda		
Tricoptera			Larva

Table 2.

General Taxa	Specific Taxa	Genus
Copepoda	Calanoida	Diaptomus
Copepoda	Calanoida	Osphranticum
Copepoda	Cyclopoida	
Copepoda	Harpacticoida	
Cladocera	Daphnidae	Alona
Cladocera	Daphnidae	Alonella
Cladocera	Daphnidae	Daphnia spp.
Cladocera	Daphnidae	Diaphanosoma
Cladocera	Daphnidae	Bosmina
Cladocera	Daphnidae	Ceriodaphnia
Cladocera	Daphnidae	Daphniopsis
Cladocera	Daphnidae	Eurycercus
Cladocera	Daphnidae	Pseudochydorus
Cladocera	Daphnidae	Sida
Cladocera	Daphnidae	Simocephalus
Cladocera	Daphnidae	Scapholeberis
Cladocera	Macrothricidae	
Diptera	Chironomidae	

Figure 1. Map of lower watershed of Cosumnes and Mokelumne Rivers and the Dry Creek tributary of the Mokelumne showing sampling sites as follows: Mackville Rd (Mokelumne River), Elliott Rd. (Mokelumne River), New Hope Rd. (Mokelumne River), Alta Mesa (Dry Creek), J10 (Dry Creek), Latrobe Rd. (Cosumnes), Twin Cities (Cosumnes).

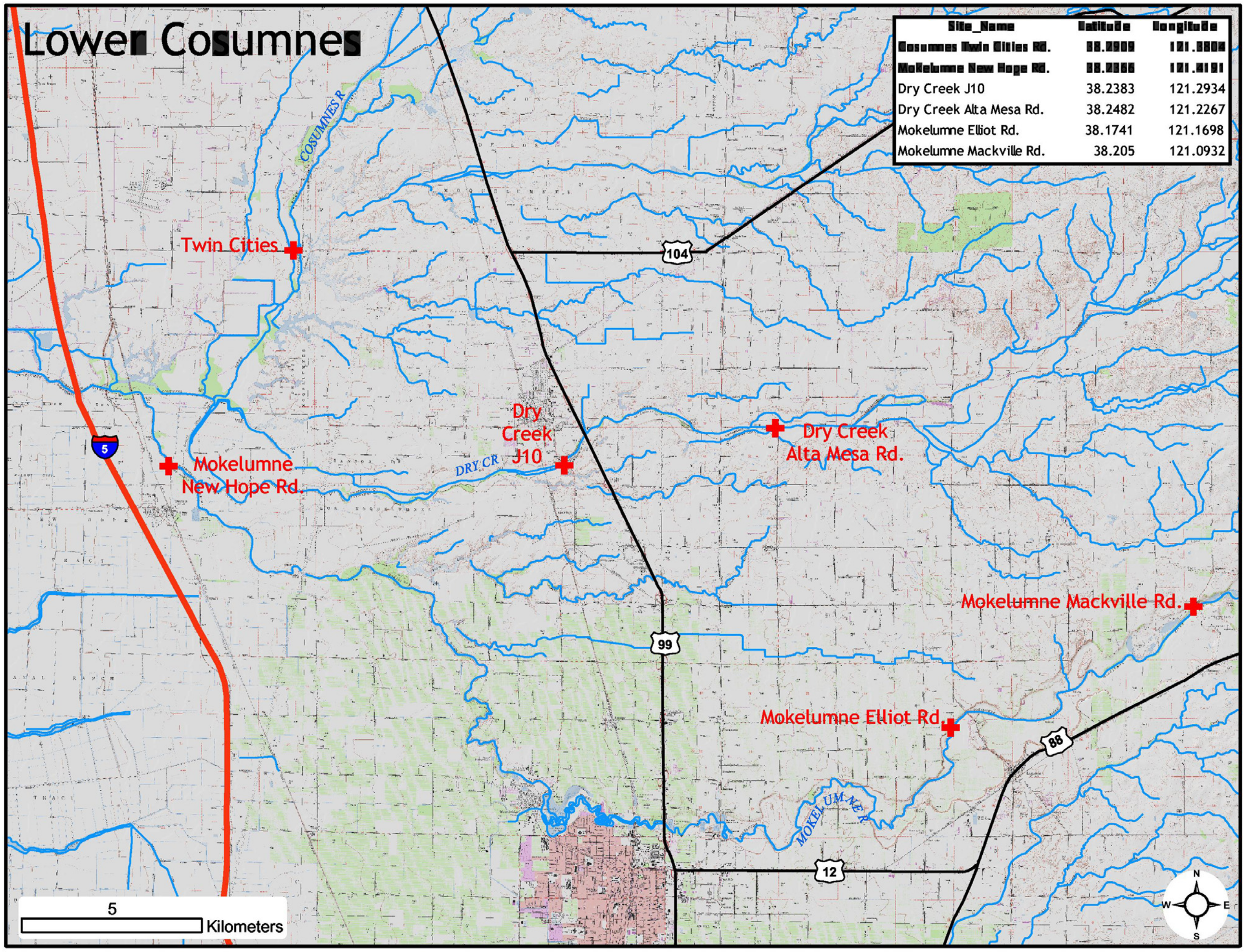

Figure 2. Zooplankton biomass for sampling dates in 2000 for Mokelumne River sites (Elliott Rd., Mackville Rd.), and Dry Creek sites (Route J10, Alta Mesa Rd.). Points represent means of two tows per site.

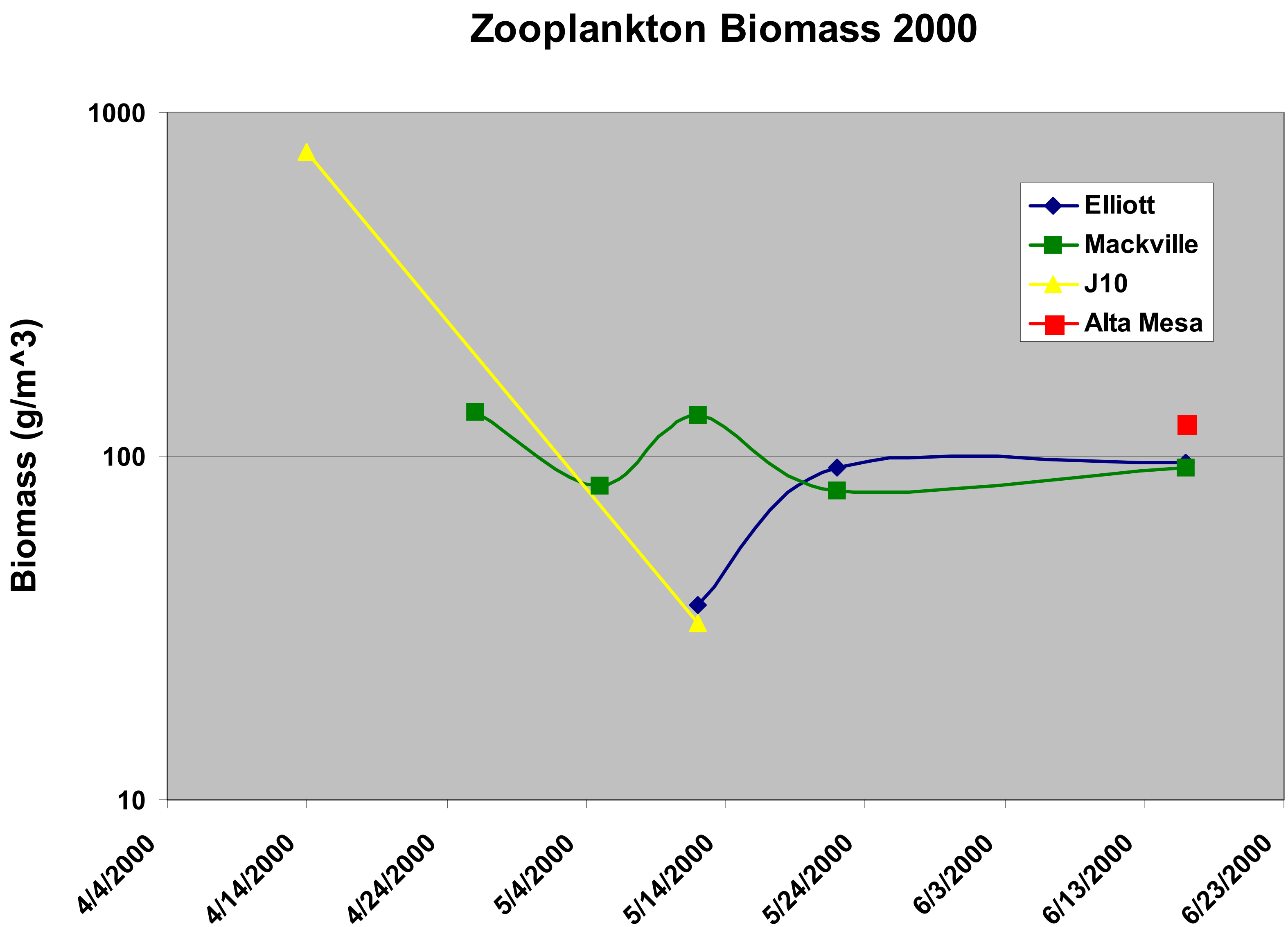

Figure 3. Zooplankton biomass for sampling dates for Elliott Rd. (Mokelumne River) for sampling dates in 2000 showing biomass of individual taxa. Points represent means of two tows per site.

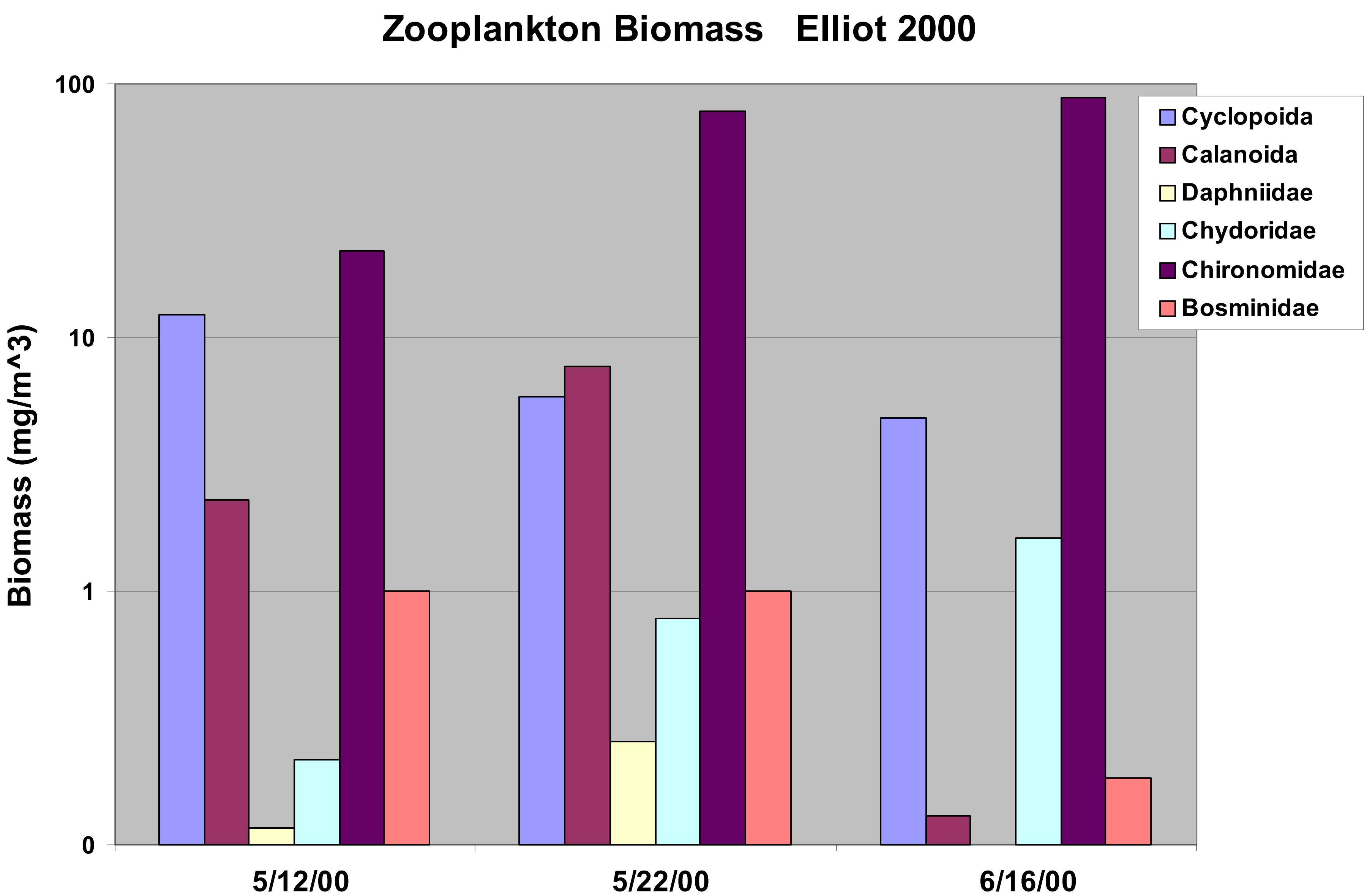

Figure 4. Zooplankton biomass for sampling dates for Mackville Rd. (Mokelumne River) for sampling dates in 2000 showing biomass of individual taxa. Points represent means of two tows per site.

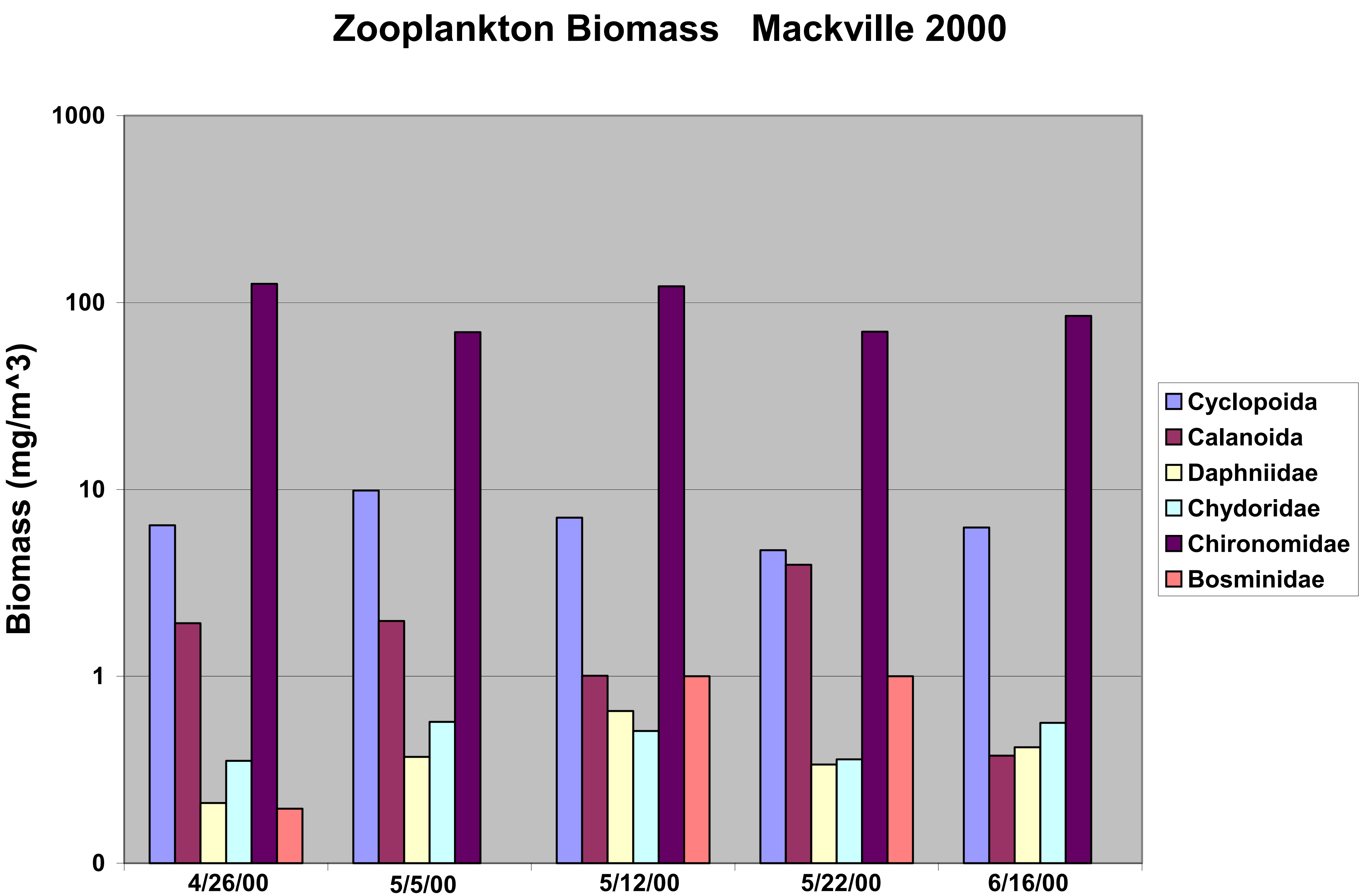

Figure 5. Zooplankton biomass for May sampling date in 2000 at Mackville and Eliott Rds. (Mokelumne River) and Route J10 (Dry Creek) showing biomass of individual taxa. Bar heights represent the mean of two tows per site.

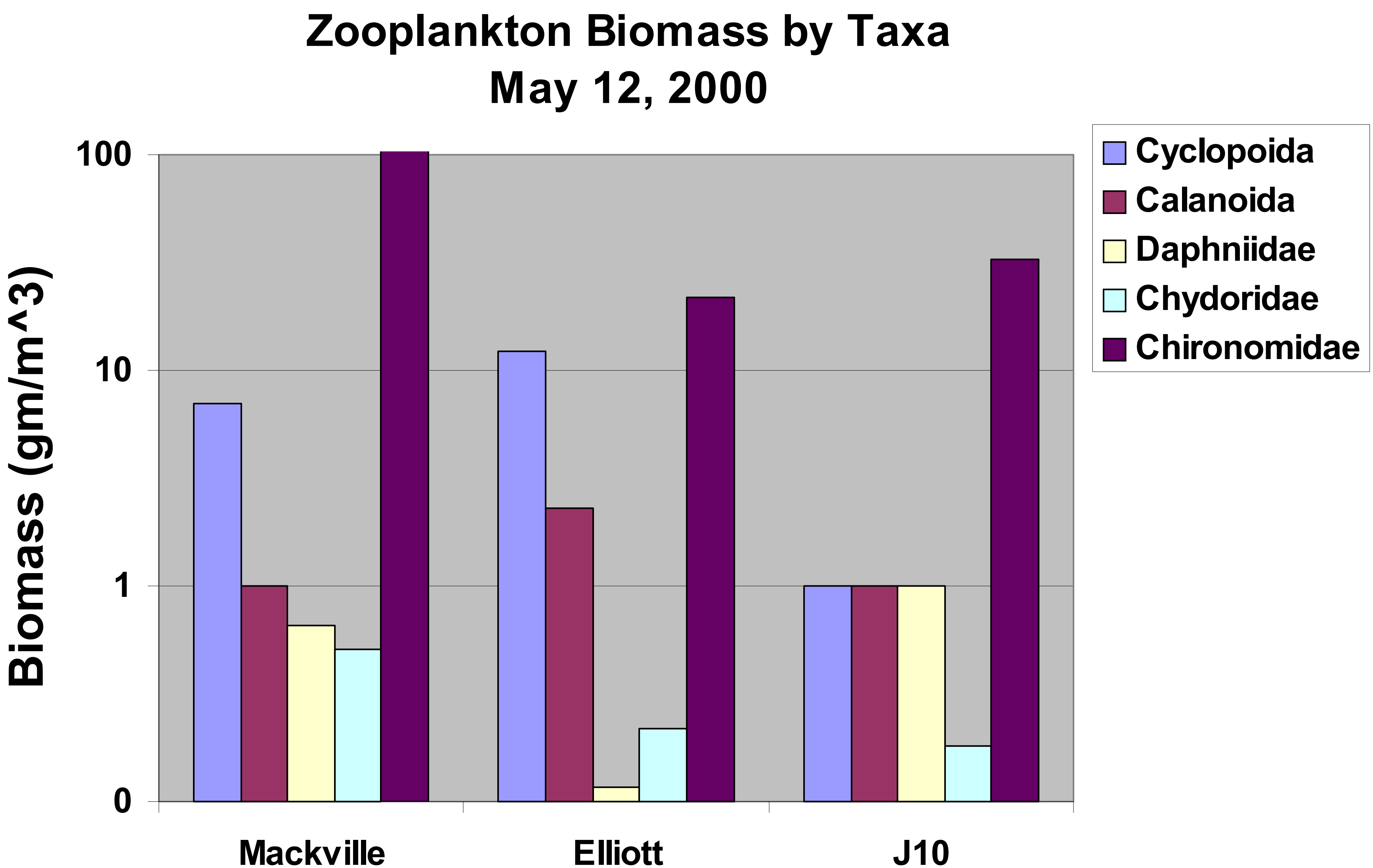

Figure 6. Zooplankton biomass for sampling dates in 2000 for Mokelumne River sites (Elliott Rd., Mackville Rd., New Hope Rd.), Dry Creek sites (Route J10, Alta Mesa Rd.) and Cosumnes River sites (Latrobe Rd., Twin Cities Rd.). Points represent means of two tows per site.

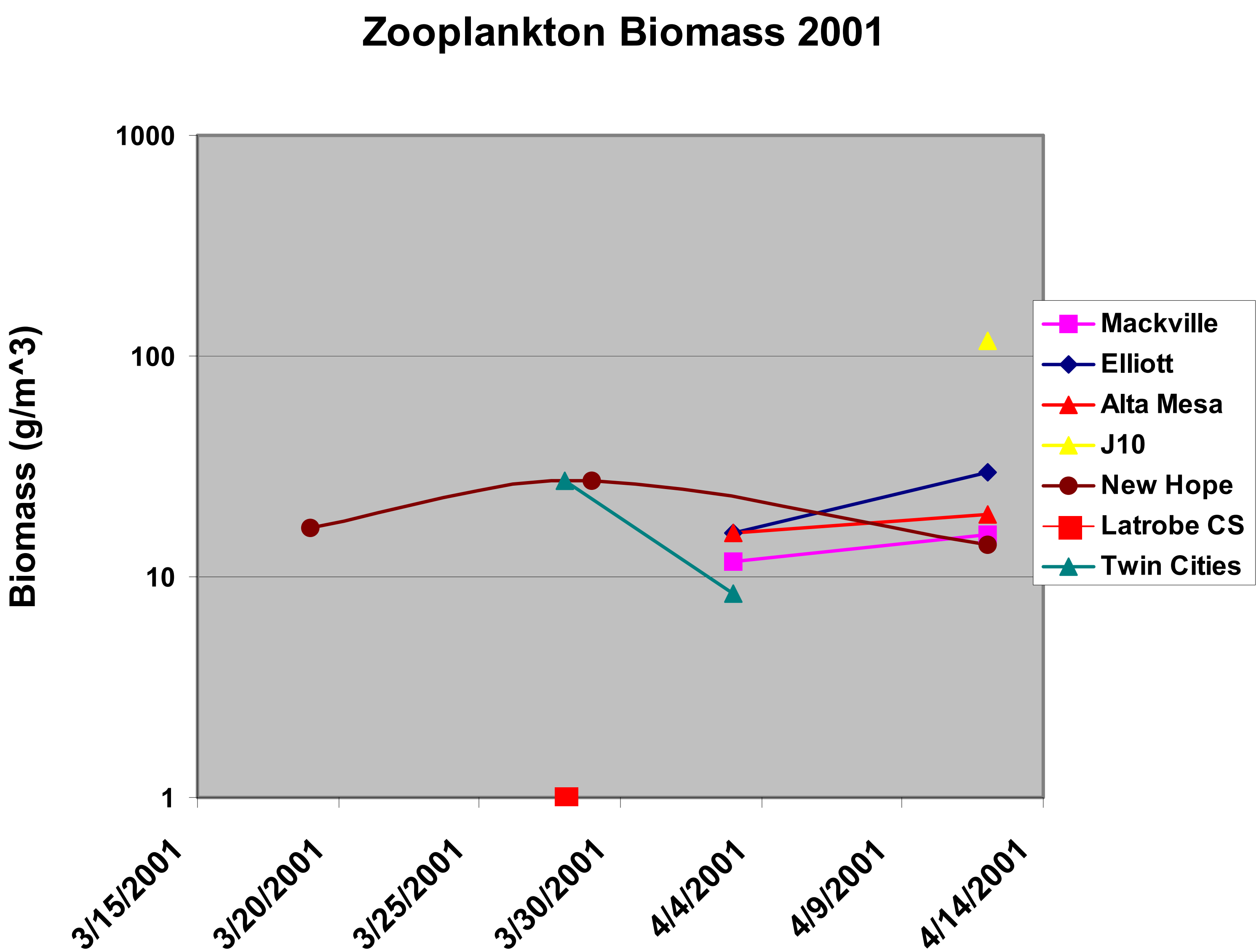

Figure 7. Zooplankton biomass for March sampling dates in 2001 at New Hope Rd. (Mokelumne River) showing biomass of individual taxa. Bar heights represent the mean of two tows per site.

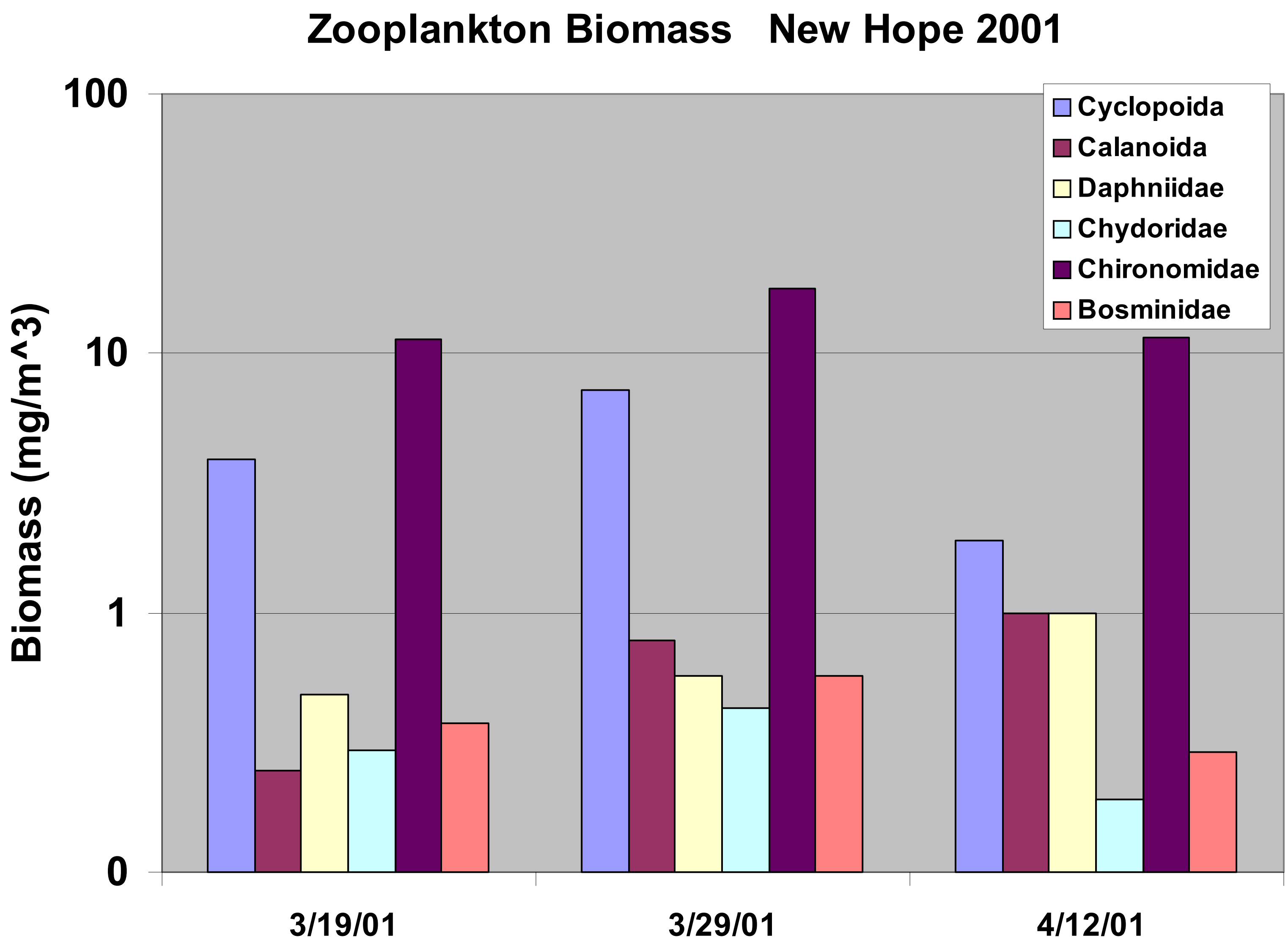

Figure 8. Zooplankton biomass for April sampling date in 2001 at Mackville and Elliott Rds. (Mokelumne River), Alta Mesa Rd. (Dry Creek) and Twin Cities Rd. (Cosumnes) showing biomass of individual taxa. Bar heights represent the mean of two tows per site.

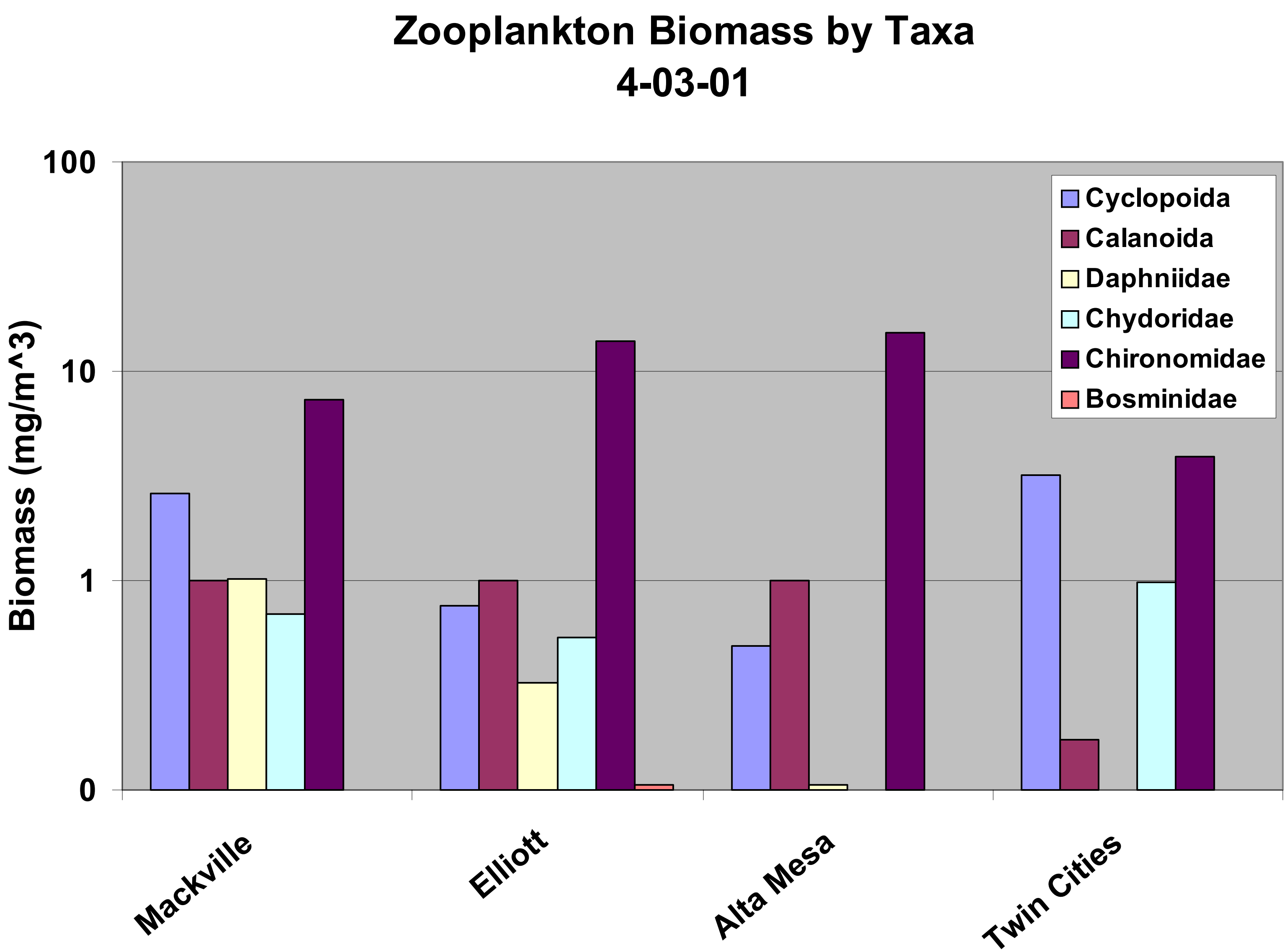

Figure 9. Zooplankton biomass for April sampling date in 2001 at Mackville, Elliott and New Hope Rds. (Mokelumne River), Alta Mesa Rd. and Route J10 (Dry Creek) showing biomass of individual taxa. Bar heights represent the mean of two tows per site.

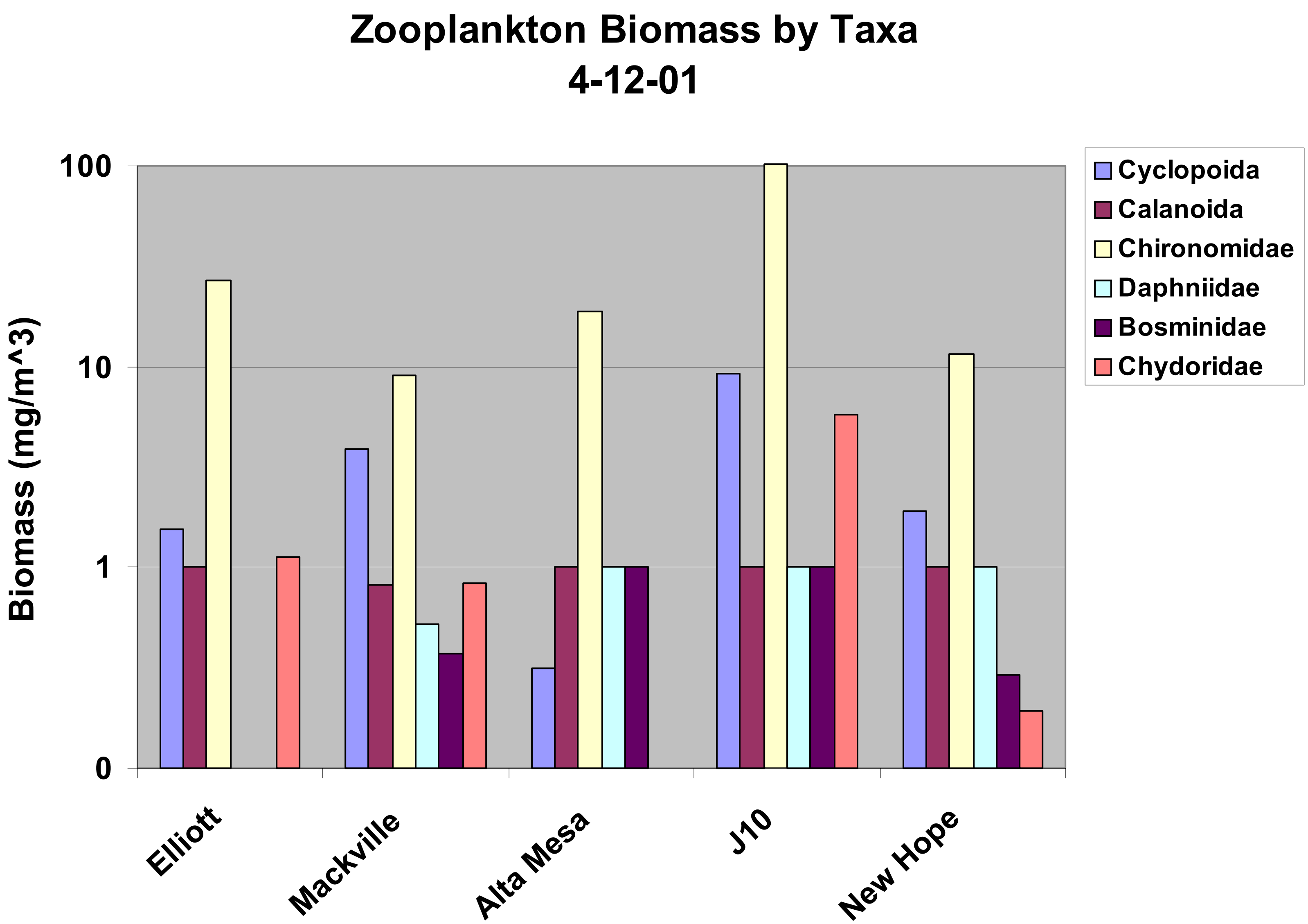

Figure 10. Zooplankton biomass for March sampling date in 2000 at Latrobe and Twin Cities Rd. (Cosumnes River) showing biomass of individual taxa. Bar heights represent the mean of two tows per site.