5.7.2b Analysis of Drift Feeders

As Outlined in Merritt and Cummins (1996)

Downstream drift is a characteristic phenomenon of invertebrates in running waters. Despite the adaptations for maintaining their positions in the current or avoiding it, occasional individuals could be expected to lose attachment or orientation and be transported downstream. However, the large numbers of some taxa that drift indicate that this is more than a passive activity. Waters (1965) divided drift into three categories: (1) ***catastrophic***, resulting from physical disturbance of the bottom fauna, e.g., by floods, high temperatures, and pollutants, (2) ***behavioral***, indicated by characteristic behavior patterns resulting in a consistent diel periodicity (usually at night), and (3) ***constant***, the continual occurrence of low numbers of most species. Mayflies of the genus *Baetis* consistently exhibit high behavioral drift rates with a night active periodicity. Other mayflies, stoneflies, caddisflies, black flies, and the amphipod *Gammarus* sp. are frequently abundant in drift. Drift is important to stream systems in the recolonization of denuded areas, as a dispersal mechanism, and particularly as a food source for visual predators. Many fish, especially salmonids and in particular juvenile steelhead, select and defend territories best suited for the interception of drift (Waters 1972).

Drift propensity is related to behavioral habits, which are reflected by body shape and vary with functional feeding group. For example, many of the active (behavioral) drifters are swimmers, well adapted to their collector-gather lifestyle and swim frequently between food patches. They have a cylindrical, streamlined body shape with a height to width ratio near 1. Almost all of the filtering-collectors and scrapers cling to surfaces. Scrapers and predators that are clingers have a flattened body (low height to width ratio) that avoids the main thrust of the current. These are normally accidental drifters that are dislodged into the current from their high-risk locations on exposed, periphyton-rich surfaces. Burrowers generally have a cylindrical body shape (high ratio), such as many shredders, that live concealed in their plant litter food resource and are accidentally introduced into the drift when the litter accumulations they inhabit are disturbed. Sprawlers may have low height to width ratios, but the adaptation is largely for wide bodies to maintain position on top of flocculant substrates in depositional areas. Their appearance in the drift is normally accidental occurring at times when depositional areas are scoured. Some shredders are sprawlers living and feeding on litter accumulations and woody debris and occasionally drift between food patches. (Wilzbach *et at.* 1988).

A survival advantage for generalists may accrue during unpredictable changes in environmental conditions when resources are unavailable. Predictably, such generalists are often pioneer colonists performing better than specialists in newly available aquatic habitats following disturbance, but are outperformed by obligate specialists in mature systems.

Distribution of an aquatic insect population is ultimately set by the physical-chemical tolerance of the individuals in the population to an array of environmental factors. Within its range of occurrence, population abundance is regulated through interactions between habitat and food suitability and availability (Merritt and Cummins, 1996).

Relationship Between Drift Insects and Steelhead (Fields, 1984)

Studies of the food habits of juvenile steelhead in 1982 documented the relative contribution of food from three sources, including drifting insects, terrestrial insects, and benthic invertebrates (Fields, 1984) (**Figure 5.7.2b-A**). Approximately 96 percent of the food consumed by smolts originated from drift and terrestrial sources. The tendency for young-of-the-year fish to consume drifting insects was more pronounced with drift insects comprising more than 99 percent of the food. While juvenile steelhead feed on drifting insects, much of this food originates from the benthic environment. Consequently, the proportion of food comprising drift species is correlated to the proportion of these species in the benthos (**Figure 5.7.2b-B**). An adequate food supply depends upon maintenance of populations of insects that exhibit drifting behavior. Rader (1997) rated 95 taxa of stream invertebrates on their tendency to drift and developed an index for rating the availability of these taxa as food resources for salmonids. He compared this index with the percentage contribution of taxa in stomach samples and found good correlations. Based on this study, it appears that the availability of drifting insects is a key component of energy transfer from lower trophic levels to juvenile steelhead populations. Predicting that the food supply for juvenile steelhead will be adequate and sufficient is reasonable if the benthic community is dominated by abundant numbers of drifting insects.

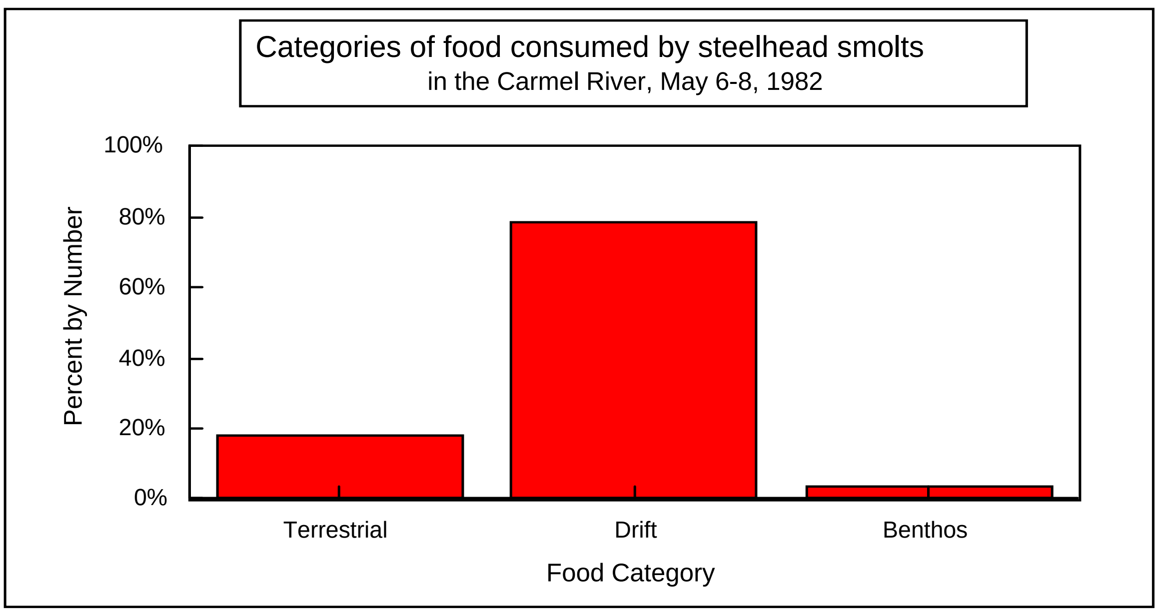
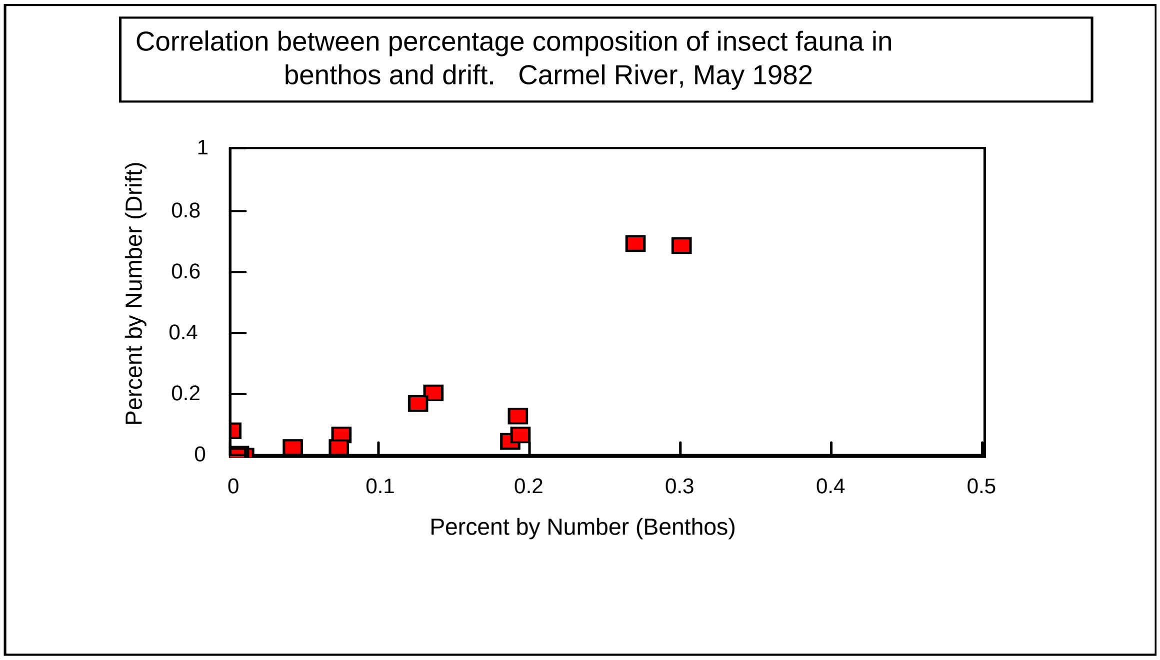


Figure 5.7.2b-A. Categories of food consumed by steelhead smolts.



Note: Data shown for most important food items in stomachs of steelhead smolts
Source of primary data: Fields (1984)

Figure 5.7.2b-B. Correlation between percentage composition of insect fauna in benthos and drift.

As suggested by Wooton, Parker and Power (1996), the dominance by drifting insects may be associated with occurrence of high flows, which mobilize coarse sediment and dislodge the benthic fauna, including mobile and sessile species. The drift propensity for BMI in three reaches on the Carmel River were analyzed using data from Field's 1984 report:

(1) *Cachagua Creek to Los Padres Dam* - Based on 1982 surveys, the aquatic insect biota in this reach is rich (38 species), highly diverse (Shannon-Weaver Diversity Index [SWDI] = 3.58), and moderately abundant (insect density = 4,400 individuals/square meter [No/m^2]). More important, the assemblage of insects is dominated by drifting insects, including Chironomid and Simulid flies and Baetid mayflies, which are readily consumed by juvenile steelhead. Based on the drift rating system proposed by Rader (1997), the drift propensity in this reach is high for 33 of the insect species (87% of the total) (**Figure 5.7.2b-C**). The drift propensity is low or negligible for only two species, representing less than 1 percent of the total number of insects in the benthos.

(2) *Tularcitos Creek to San Clemente Dam* - The aquatic insect biota in this reach is characterized by lower species richness (average 31 species), lower diversity (average SWDI = 3.06), and low abundance (insect density = 2,265 No/m^2). As in the reach above Cachagua Creek, the assemblage is dominated by drifting insects, with high rate drifters comprising 84 percent of the species (average of 24.5 of 29 total species) and about 92 percent of the organisms (**Figure 5.7.2b-D**). Only three species with low or negligible drift propensities were noted, representing less than 1 percent of the number of insects.

(3) *Narrows to Tularcitos Creek* - The aquatic insect biota is characterized by lower species richness (averaging 29 species), variable diversity (SWDI ranging from 1.83 to 3.26), and low to abundance populations (average insect density = 4,115 No/m^2 and ranging from 2,146 - 5,182 No/m^2). As in other reaches, species with low or negligible drift propensities comprised no more than 1 percent of the total number of insects (**Figure 5.7.2b-D**). A summary of the species composition in 1982, including: Order, Family, Genus and Species, and ranking by number are shown in **Appendix 5.7.2b-A**.

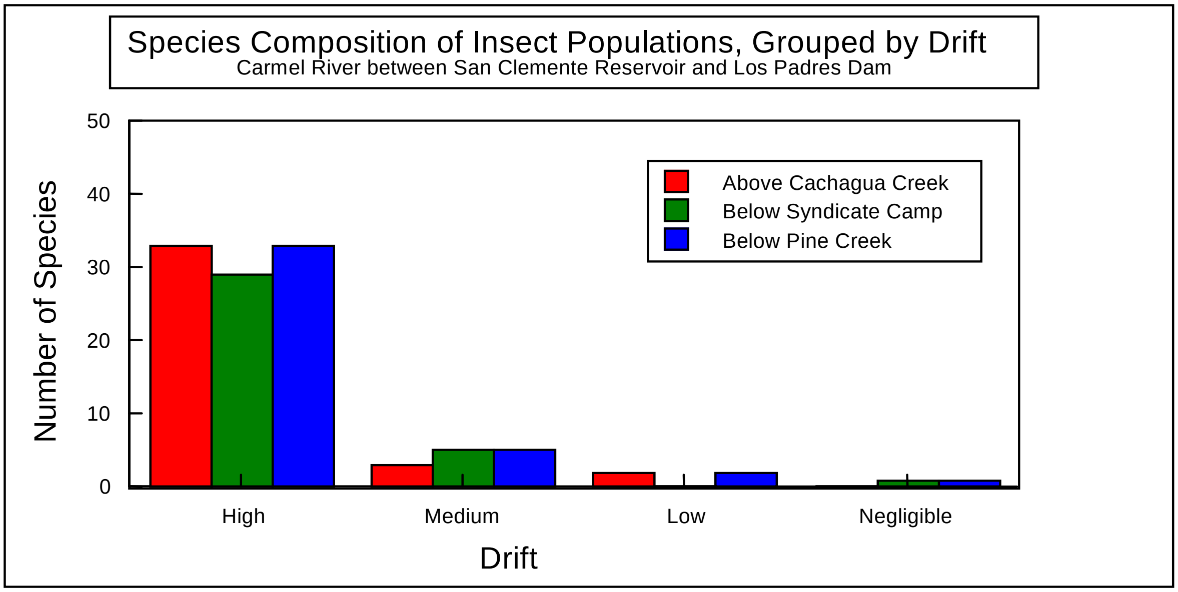


Figure 5.7.2b-C. 1982 species composition and drift propensity in the reaches between Los Padres and San Clemente dams.

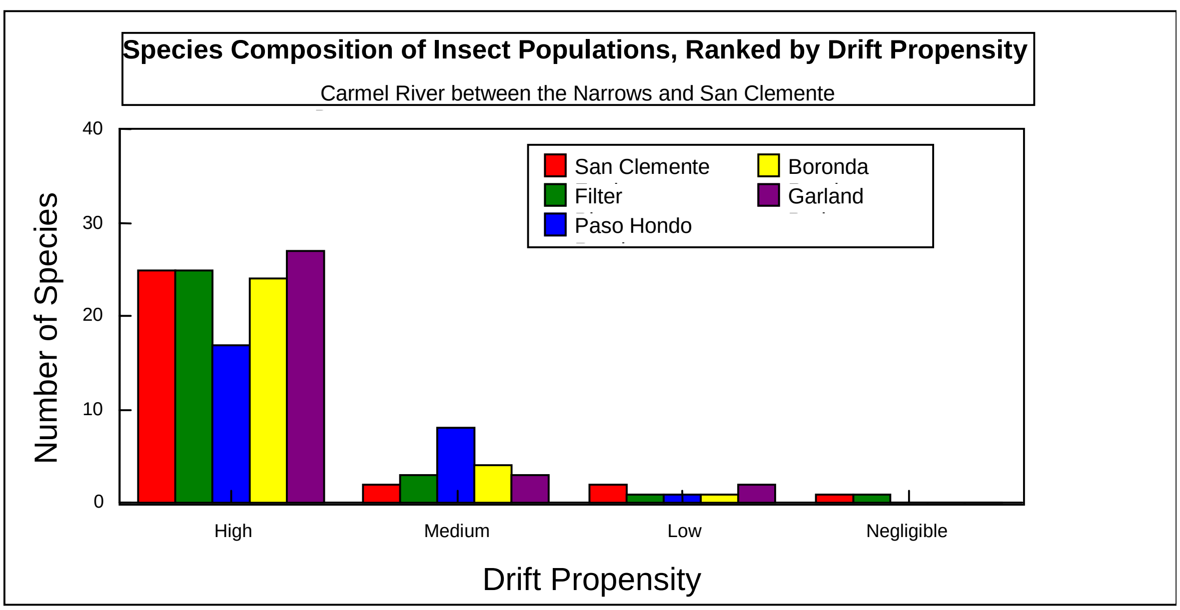


Figure 5.7.2b-D. 1982 species composition and drift propensity between the Narrows and San Clemente Dam.