Estuarine and Coastal Nekton

by Dennis M. Allen for CERF-Lit, October 2009

Summary

The term ‘nekton’ refers to free-swimming aquatic organisms, especially fishes, crustaceans, and cephalopods. Some definitions include the marine mammals. Swimming forms less than about 20 mm in size are usually considered members of the zooplankton; however, the term micronekton has been used for small, motile, forms in the water column. Fishes and crustaceans that have strong affinities for the bottom (e.g. rays and crabs) are sometimes referred to as epibenthic or demersal, whereas those in the water column are called pelagic. Nekton comprise taxonomically, morphologically, and functionally diverse assemblages in estuarine and coastal systems.

Research involving nekton has been conducted at the molecular/cellular, organism, population, community, and ecosystem levels. Because many large aquatic animals comprise economically important fisheries, much of the research on nekton has been focused on the ecology, behavior, and genetics of harvested species. With a growing awareness that managed fishery stocks need to be understood in the context of the entire ecosystem, management decisions rely on nekton research that addresses all phases of life cycles and the habitats essential to supporting exploited populations.

Nekton diversity and abundance are especially high in estuaries and shallow ocean areas. The geographic distributions of many key species or congeners are wide. The life cycles of many fishes demonstrate the strong connectivity between estuaries and oceans (Gillanders, et al. 2003). Many familiar estuarine occupants migrate to spawn in rivers (e.g. salmon, shad, striped bass), coastal waters (e.g. menhaden, drums, some flounders) or deep ocean areas (e.g. American eel). Early life stages are often planktonic and studies of larval transport and recruitment processes have been important in understanding the dynamics of fisheries stocks (Epifanio and Garvine 2001). Estuarine nekton assemblages are usually dominated by juveniles of transient species, especially during the warmest seasons. Transient and resident estuarine species have special adaptations that facilitate survival in highly variable and physiologically challenging environments. Estuaries are often called nurseries for nekton. The importance of estuarine systems in the completion of the life cycles of many fishes,

shrimps, and crabs cannot be refuted, but estuaries are not essential for development of many species (Able et al. 2003) and they might not ultimately contribute the largest proportion to adult populations (Beck et al. 2001).

Movements and migrations occur at many spatial and temporal levels, and major changes in nekton composition typically occur over tidal cycles and between seasons. Motility and patchiness combined with rapidly changing environmental conditions that affect collection success create significant difficulties in quantifying nekton. No single type of net, trap, camera, or sound-wave based detector can be relied upon to quantify all of the species in any one area. The selection of appropriate gear (usually multiple gear types) is critical (Rozas and Minello 1997, Boswell et. al. 2007) and the design of the sampling program is equally important in order to generate quantitative assessments of nekton composition and abundance. Ontogenetic changes in size, behavior, and distribution must also be considered in designing quantitative field studies. Determining movements, fidelity, and growth of individuals is often accomplished with mark-recapture techniques. Advancing technology has enabled the continuous tracking of large nekton implanted with acoustic or satellite tags. Otolith analyses provide estimates of growth rates and age structure in populations of fishes (Secor and Rooker 2000, Begg et al. 2005). Molecular genetic techniques have proven valuable in determining population structure and distributions (Nielsen et al. 2009).

Studies of habitat use comprise much of the nekton literature. During their juvenile and adult stages, many species are associated with specific kinds of habitats including marshes (Kneib 1997), mangroves (Nagelkerken et al. 2008), sea grass (Connolly and Hindell 2006), oyster reefs (Coen et al. 1999), surf zones (Jarrin et al. 2009), rocky intertidal (Horn et al. 1999), coral reefs (Sale 1993), and rivers (Lucas and Baras 2001). Within estuaries, nekton rely on the ability to move among adjacent habitats (Able et al. 2007). Reproduction, growth, and production of fishes can vary among habitats and locations (Minello et al. 2003, Heck et al. 2003, Ross 2003, Hosack et al. 2006). Diets, feeding behavior, and the organisms' positions within food webs have been studied for many nekton species, and the use of stable isotopes has been particularly useful in identifying diets and trophic structure (Fry 2006) Relationships between nekton growth and production, bioenergetic constraints, and landscape characteristics are important in developing plans for habitat restoration (Kneib 2003, Simenstad, et al. 2002, Peterson et al. 2003).

A wide range of environmental issues impact nekton. Changes in water quality, freshwater inflow to estuaries (Kimmerer et al. 2009), habitat alteration (Bilkovic and Roggero 2008), hypoxia (Breitberg, et al. 2009), harmful algal blooms (Hall et al. 2008), and watershed development (Holland et al. 2004) are just some of the issues that affect nekton. Increasing concerns have prompted studies concerning effects of contaminants and

incidence of parasites and diseases (Reichmuth et al. 2009). Fishes are often used to indicate environmental and ecological changes within estuaries (Whitfield and Elliott 2002). Climate- related changes in water temperature and ocean currents have been linked to changes in the geographic distributions and phenology of nekton, especially the timing of migrations and reproductive events (Attrill and Power 2002, Collie, et al. 2008).

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Image Gallery

Silver perch (*Bairdiella chrysoura*) is a widely distributed member of the estuarine nekton. It is a member of the drum family (Sciaenidae)

Seines are among the most frequently used collection gear for nekton in shallow estuarine habitats.

Seine collections in salt marshes often produce large numbers of small resident and transient nekton species.

Trawls are used to collect nekton in open waters.

Researchers often construct enclosures and exclosures to experimentally address questions such as nekton growth and impacts on benthic populations.