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# Acoustic Tagging of Green Sturgeon

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Green sturgeon (*Acipenser medirostris*) are of rising importance to NOAA Fisheries Service, with one distinct population segment (DPS) proposed as a threatened species under the Endangered Species Act (ESA) and the other DPS a species of concern. The lack of basic knowledge on population size, structure, and distribution severely hampers managing green sturgeon. Given their rarity, electronic tagging offers the most practical way to gain some of this information.

In 2002, we recognized that a number of studies of freshwater habitat use by green sturgeon could be leveraged to provide information on stock structure and movement among freshwater and coastal habitats. This was possible because many researchers on the west coast use Vemco (Shad Bay, Nova Scotia) acoustic tags and receivers with default frequencies and code maps. We supplied the existing projects with additional tags and receivers, initiated new tagging projects in estuarine areas where green sturgeon aggregate, and developed collaborations with people studying salmonids and rockfish from Monterey Bay to southeast Alaska (see Figure 1). Green sturgeon are an excellent subject for long-term acoustic tagging because they can carry a large tag that has extended battery life and their migrations are extensive but typically restricted to shallow depths on the shelf. With a shoestring budget and the goodwill of many people and agencies, we have been

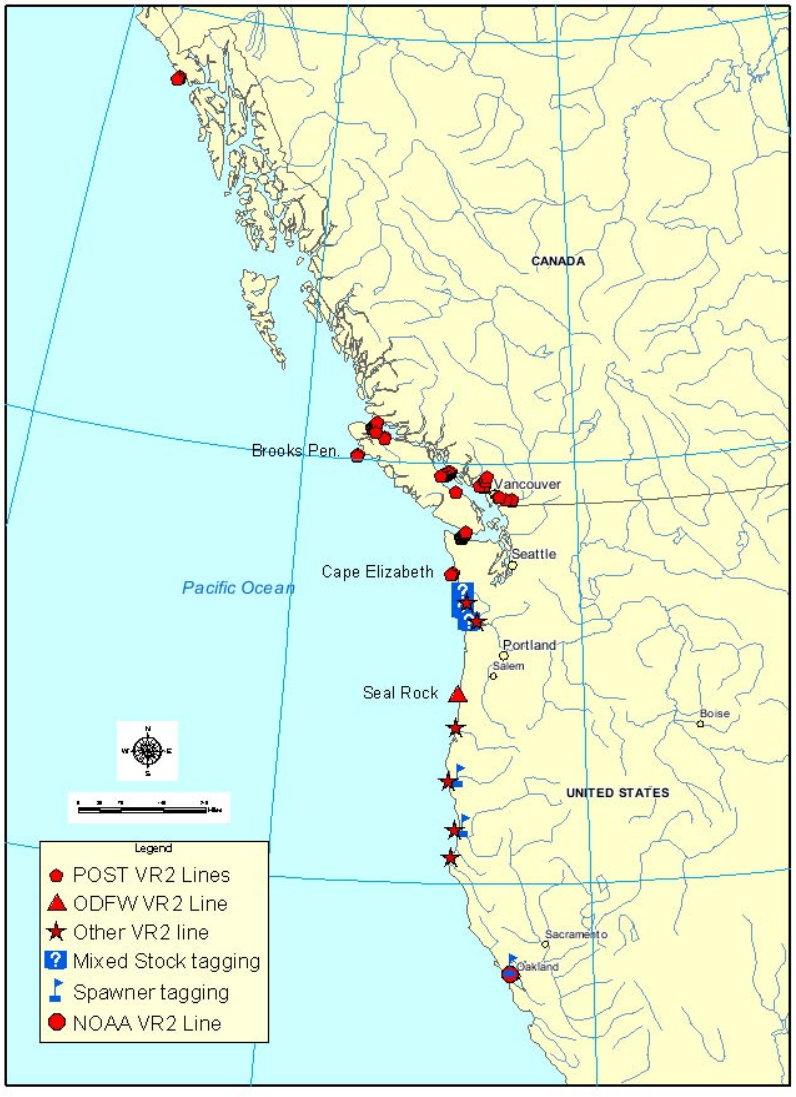


**Figure 1. Map of the west coast of North America showing Vemco receiver locations for various agencies and sites where green sturgeon were tagged.**

**Figure 2. Researchers tagging a green sturgeon with a Vemco acoustic tag.**

remarkably successful in describing movement among systems, patterns of migration along the coast, and the source of mixed stocks (Figure 2).

While we have learned much about green sturgeon from our work thus far, much more could be learned using this technology as the basis for more ambitious studies. Because acoustically tagged green sturgeon are readily "resighted," mark-recapture studies are feasible with modest tagging efforts, compared to traditional approaches that require physical recapture of the fish. For example, the Cormack-Jolly-Seber capture-recapture model could be used to estimate survival rates from the temporal pattern of tag detections. Stage-based models of the tagged animals could be developed that could estimate movement rates among habitat types as a function of animal size or spawning history. Ultimately, a nonacoustic sighting component would be added to allow estimation of the tagging rate. With this kind of information, the complete dynamics of the population could be estimated with a multistage open population model.

The basic approach of using acoustic tagging and mark-recapture designs could be expanded to other species (such as salmon, sharks, other large coastal pelagics, and the more migratory groundfish) as part of the developing Pacific Coast Ocean Observing System (PaCOOS). A major goal of PaCOOS is to provide the information required for fishery resource management. The backbone of the system would be a series of hydrophone arrays along the continental shelf, extending and embracing the Pacific Ocean Shelf Tracking (POST) Project (formerly known as the Pacific Ocean Salmon Tracking Project). Such a system, combined with appropriate tagging, could allow accurate description of the temporal and spatial dynamics of populations at a resolution not achievable with other available technologies.

In addition to substantial funding, the long-term nature of such studies will require coordination of tag codes, receiver settings, and data sharing. Ideally, this coordination would happen through a neutral party. The Pacific States Marine Fisheries Commission (PSMFC) coded-wire tag and PIT tag systems might provide a useful model for managing acoustic tagging on a coast-wide scale. Similarly, managing a coast-wide receiver array is a major endeavor for which NOAA Fisheries Service is well suited, with its long experience with numerous and widespread coastal and open-ocean data buoys.