# California Marine Life Protection Act Initiative
# Response to Science Questions Received at the January 13-14, 2009 Meeting of the MLPA South Coast Regional Stakeholder Group

***Revised April 6, 2009***

The science questions in this document were received at the January 13-14, 2009 meeting of the MLPA South Coast Regional Stakeholder Group (SCRSG). MLPA staff and the MLPA Master Plan Science Advisory Team (SAT) co-chairs reviewed the questions to determine which questions are policy or management based, and which questions are science based. MLPA staff was assigned to respond to the policy/management question, while the SAT formed work groups tasked with responding to science questions.

1. **What are important *[marine*] ecological features of San Clemente and San Nicolas Islands and how do these relate to the bioregion?**

   ***Status:*** The SAT presented an analysis of habitats and ecological features of military controlled areas of the SCSR, including San Clemente and San Nicolas, Islands to the MLPA Blue Ribbon Task Force (BRTF) on February 27, 2009. Policy guidance from the BRTF along with relevant information on ecological features of these islands is forthcoming.

2. **What are [*larval*] retention zones? Can you provide the SCRSG with maps and/or location information for retention zones?**

   ***SAT Response – Approved February 24, 2009:*** Larval retention zones are places that exhibit symptoms of retention, either in terms of phytoplankton or meroplankton/larvae. Retention zones are areas where waters spend more time than elsewhere and they are characterized by weaker or recirculating currents. These regions often are stratified. These areas are important as they may exhibit higher phytoplankton concentration or may retain larvae for a significant portion of their time while planktonic. These retention zones can either retain larvae long enough so the larvae can settle near to where they were spawned (local recruitment) or, if retained for shorter periods, retention zones tend to reduce the net distance that larvae travel from their origin. In this latter case, the retention zone can affect larvae that originate from either within or upstream of the retention zone. Relatively short retention times are specifically important if the larvae are retained near favorable habitat just before or during metamorphosis and settlement. Locations where retention has been reported (formally or informally) are indicated on the map*. Typically, larger retention zones will retain larvae for longer periods. In contrast to upwelling zones, retention zones are less well-defined and very challenging to identify through observations.

   ** A map of retention zones is being developed.*

3. **Do the established marine protected areas (MPAs) on the north shore of San Miguel, Santa Rosa, and Santa Cruz Islands network with the coastal MPAs of Santa Barbara and Ventura Counties and count toward the size and spacing criteria?**

   ***SAT Response – Approved April 6, 2009:*** The short answer is no. Larval dispersal is the primary mechanism for population connectivity and the contribution of island larvae to mainland populations is considered to be too weak to sustain mainland MPAs along the mainland coast. Thus, the mainland network of MPAs should be designed in a way that is complete in itself, i.e., size and spacing criteria should be met for the mainland MPAs without taking the islands into consideration.

This answer is based on the best, readily-available science – specifically on results from the ROMS simulation of circulation in this region, but also from ecological data (e.g., micro-chemical signals and plankton surveys). The model scenarios are based on oceanographic data gathered between 1996 and 2003, but include a variety of simplifications relating to larval dispersal (see Chapter 7 in the *Draft Methods Used to Evaluate Marine Protected Area Proposals in the MLPA South Coast Study Region*). Larval dispersal patterns are obtained through assuming that larvae will be transported as passive particles. While the general result may be overcome by specific behavior in some species, it is expected that most populations will reflect the general result that that island-to-mainland connectivity is notably weaker than mainland-to-island connectivity.

Why is island-to-mainland connectivity weak? The weak island-to-mainland connectivity is due to a combination of two phenomena – (1) the tendency for larvae spawned at the islands to be "washed away" to locations where there is no adult habitat (i.e., offshore), and (2) the fact that the Santa Barbara Channel eddy is not permanent nor is it a perfect closed circulation with an equal proportion of island larvae transported to mainland as vice versa.

The complex circulation in the channel has been studied through surface drifters and moored current meters and six circulation states have been identified[1] (see Chapter 3.1.11 on oceanography in the draft regional profile of the study region). There is a tendency for eastward flow through the Santa Barbara Channel during upwelling in spring, a sheared circulation in summer (eastward along the northern shores of the Channel Islands and westward along the mainland), westward flow through the channel during relaxation from upwelling effects in the fall (and during El Nino years), and weak mean circulation in winter." [2] In the western channel a counterclockwise recirculation often is observed, strongest in spring, summer and fall[3] - this is referred to as the Santa Barbara Eddy and may persist for weeks at a time. During these periods, water moves eastward along the northern shores of the Channel Islands and then northeastward towards the mainland where it "bifurcates into westward and eastward flowing currents a few tens of kilometers offshore of the coast between Santa Barbara and Point Hueneme."[4] It is only during these recirculation periods and periods of weak mean flow in winter that there is a significant transport of island-released particles to the mainland, and even then, there is a significant loss of island particles southward through the island passes and east of Santa Cruz. This

[1] Harms, S., and C. D. Winant, 1998: Characteristic patterns of the circulation in the Santa Barbara Channel. *J. Geophys. Res.,* **103,** 3041–3065.
[2] Dever, E. P., M. C. Hendershott, and C. D. Winant (1998), Statistical aspects of surface drifter observations of circulation in the Santa Barbara Channel, *J. Geophys. Res.*, 103(C11), 24,781–24,797.
[3] Hendershott, M.C., and C.D. Winant. 1996. Surface circulation in the Santa Barbara Channel. Oceanography 9(2): 114-121.
[4] Hendershott, M.C., and C.D. Winant. 1996. Surface circulation in the Santa Barbara Channel. Oceanography 9(2): 114-121.

southward larval loss is greater during the spring eastward flow scenario and there is little supply of particles northward to the mainland between Ventura and Point Conception. Likewise, during westward flow through the channel, particles typically do not move north to the mainland but are rather transported offshore and entrained in the southward California Current found offshore.

In summary, model results suggest that larvae from the Channel Islands tend to stay at the islands or to be carried away from the islands into areas where settlement is not possible. For a few species (e.g., kelp bass, lingcod and red sea urchin), the model predicts that some larvae from the northern Channel Islands may settle along the mainland coast, particularly along the coast from Point Conception to Santa Barbara. However, the potential for (passive) transport of larvae from the islands to the mainland is limited compared to the potential for larvae to (1) originate and settle along the mainland coast, (2) originate along the mainland coast and settle at the islands, or (3) originate and settle at the islands. Model circulation may underestimate larval retention on the islands due to inadequate representation of retentive nearshore flow patterns, but there is no reason to expect that future improvements in representing small-scale nearshore circulation would increase the model-predicted delivery of island larvae to the mainland. While island larvae thus are considered unimportant in maintaining mainland populations, it is worth noting that the island larvae exported from the Santa Barbara Channel are widely dispersed throughout the Southern California Bight and healthy island populations may be critical in reviving mainland populations if there were a dramatic population collapse along the mainland.

4. **Can you identify which threats from water quality are most likely to cause harm to species identified as most likely to benefit from MPAs?**

   ***SAT Response – Approved February 24, 2009:*** The SAT has identified three principal water quality concerns, in its guidance document to the SCRSG titled *California MLPA Master Plan Science Advisory Team Recommendations for Considering Water Quality and Marine Protected Areas in the MLPA South Coast Study Region*. These three threats are 1) entrainment, and to a lesser extent impingement, from power plant once-through cooling water intakes, 2) stormwater discharge sites, and 3) municipal wastewater and industrial discharge sites. More details about these threats can be found in the referenced document.

5. **What are the level of pollutants from the first flush rain events to subsequent rain events?**

   ***SAT Response – Approved February 24, 2009:*** The question correctly indicates that there is a first flush effect, with the concentrations of contaminants in stormwater runoff correlated with the period of antecedent rainfall. There is also a first flush effect within individual storms, with the highest concentrations typically associated with the early parts of a storm. The magnitude of the antecedent rainfall effect varies considerably depending on characteristics of the watershed, the amount of rainfall received, and the contaminants of concern[5, 6]. While antecedent rainfall does affect the magnitude of contamination associated with storm events, effluent from most large drain systems in most storms is still toxic and the SAT recommendations regarding stormwater discharge locations remain as one of the factors that should be considered in siting MPAs.

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[5] Stein ED, Tiefenthaler LL, Schiff K. 2006. Watershed-based sources of polycyclic aromatic hydrocarbons in urban stormwater. *Environ Toxicol Chem* 25:373–385.
[6] Tiefenthaler LL., Stein ED, Schiff K. 2008. Watershed and land use-based sources of trace metals in urban storm water. *Environ Toxicol Chem* 27:277–287.