Larvae, Dispersal, and MPAs

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Why are larvae and their dispersal important?
Larvae replenish marine populations.
Larvae disperse individuals and genes among populations.
Larval dispersal has implications for design of MPAs.

Who produces larvae?
- Most invertebrates and fishes
- Most fished species
- Mature fish of all sizes
- Mobile and non-mobile species

What determines how far and what directions larvae disperse?
1. Timing of release (birth)
2. Time spent drifting in the ocean
3. Direction and magnitude of ocean currents
4. Behavior of larvae

The larval stage of the majority of (reef) fishes is 1-3 months.
The larval stage of invertebrates varies greatly from less than1 day to over 1 month.

Genetics can be used to estimate typical dispersal distances.
Larval dispersal based on genetic distance:
- Invertebrates: 5-100 km
- Fishes: 20-200 km

Implications for the design of MPAs

1. Individual MPAs are likely to protect species with dispersal distances similar to the length of the MPA and those with shorter dispersal distances.
2. Larger MPAs are likely to sustain a greater diversity of species.
3. Larvae of some species will disperse beyond the boundaries of MPAs and enter surrounding areas (to replenish surrounding populations).
4. The magnitude of the contribution of larvae to surrounding areas depends, in part, on the size of the MPA relative to the surrounding area, the time the MPA has been protected, and the intensity of historical fishing in the region.
5. To contribute to an ecological network, MPAs should be placed at distances that allow exchange of larvae between MPAs.
6. Sustainability of populations can be enhanced, even for species whose larval and adult dispersal exceeds the length of individual MPAs, if the populations are protected in multiple MPAs that are close enough to each other to function as an interconnected network.

Glossary

Larvae – The newly hatched, earliest stage of any of various animals that undergo metamorphosis, differing markedly in form and appearance from the adult.

Plankton – Organisms that live in and are carried by the currents of open water, unable to maintain their position or distribution independent of the movement of water or air masses.

Recruitment – The influx of new members into a population by reproduction or immigration.

Retention - Retention areas form in places where coastal headlands create eddies in coastal currents. In retention areas, water from the upwelling centers and nutrients, plants, and animals in that water are carried back toward the shore. These retention areas are biologically rich and support the growth of many marine organisms.

Sessile Organism –An organism that does not move because of its attachment to a surface.

Upwelling - Upwelling centers occur in areas where coastal winds (combined with the rotation of the Earth) move the warm surface water offshore, sometimes as far as 200 km offshore. As the surface water is pushed away from shore, it is replaced by cold, nutrient-rich water coming from the deeper ocean. The nutrients that are brought to the surface support the growth of plankton, which in turn provide a rich food source that supports the broader marine food web.

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