MPA News
Interview with Russ Babcock on the subject of reserve effects
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MPA News: If we define the reserve effect on fisheries as the ability of marine reserves to benefit adjacent fished populations via larval export and/or spillover of adults, would you say that the reserve effect is now settled science? If so, what is your evidence for that? If not, what do we still need to know? These questions are in light of recent studies like Cudney-Bueno et al. (http://www.plosone.org/article/info:doi%2F10.1371%2Fjournal.pone.0004140) and Robin Pelc's study of mollusks (http://depts.washington.edu/mpanews/MPA108.htm#IMPAC2).

Russ Babcock: To briefly answer your question: no, I don't believe spillover or larval export are "settled science". But of course, things are a bit more complex than that.

I don't think there is any argument from anywhere that, in terms of larval export, there will be increased larval production and export of targeted species from reserves, and certainly no one is predicting a decrease. But there are important caveats. Firstly, the reserve effect is contingent on increases in the biomass of the parent stock in a reserve. This effect is common but not a given (e.g., reviews by Claudet et al, Molloy et al). So the question has to be asked, are the species of interest responding? In my experience this often has to be determined on a case-by-case (reserve-by-reserve, species-by-species) basis. So in an important practical sense, this is not a settled question.

Then there is the question of how large any such larval export effect might be. Is it big enough to have a meaningful ecological effect on the exploited population? How about a meaningful economic effect on the fishery? Is it big enough to compensate for changes in fishing practice, displaced effort, etc.? Is it even big enough to measure using the methods we have at our disposal? Recruitment is highly variable, notoriously so in fact, and variations in larval supply are caused by a wide range of factors, not just stock size. Consequently all these questions need to be answered with reference to time series of data that take into account variability before and after changes in reserve management, link recruitment to spawner biomass, and provide data on the relevant fishery.

I can think of the example of the Georges Banks scallops that has been summarized previously in MPA News Vol. 6 No. 11, by Deborah Hart (see also Hart and Rago 2006). The paper by Cudney-Bueno et al is a good start to try and do this, but does not have a long enough time series either before or after the reserve declaration to make a convincing case and rule out chance increases in recruitment. Other key data are also needed: I couldn't see any data on change in spawner biomass in the source population; the modeled particle release area did not coincide with the San Jorge Reserve; etc. Again, while there is no reason to expect anything but a positive effect, measuring this effect and attributing it to

changes in spawner biomass is not a simple matter. And to be practical, it needs to be addressed on a case-by-case basis.

Spillover of adult fish is usually not well demonstrated. While there must be cross-boundary movements of fish, the question of relevance to commercial fishers may be: what is the direction of net movement of biomass? (For trophy recreational fishers the question might be slightly different: what is the modal size of fish moving out?) I believe it is important to be clear how "spillover" is defined: i.e., whether or not we are talking about density-dependent directional movements since density-dependent behaviors have important implications for the questions above. I think Abesamis and Russ have managed one of the few demonstrations of this. Many of the papers referring to spillover are equivocal due to limitations of sampling design (e.g., before-after-control-impact design, or BACI) and replication, not to mention population-level evidence of density-dependent effects. Then of course there is the question of whether any spillover is actually of importance to the fishery.

There are a lot of open questions here, not least because species-level variation and differences between sites (e.g., sources and sinks) are likely to mean very different responses in different locations. While larval export and spillover are possible and even likely, the devil is in the detail of the question "how much?". We must do the necessary science if reserves are to be used in an informed, practical sense as an active part of a fisheries or conservation management system.

While the use of reserves or other spatial fishing closures for fishery management is probably a good strategy, the tactical implementation of this strategy requires ongoing high levels of science inputs. Without this it will risk becoming yet another example of failed fishery management.

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