Joint ARC-CWG Workshop

"Connectivity and population resilience -- sustaining coral reefs during the coming century"

Townsville 13-16 October, 2007

Provisional Program 9/7/2007

Saturday 13th October A.M.

Chair  Geoff Jones

(A) Introductory presentations:

(1) “Scope and goals of the workshop”
    Geoff Jones (15 min)…………………………………………..  8.30am

(2) “ARC Centre of Excellence Connectivity Program”
    Garry Russ (10 min)…………………………………………… 8.45am

(3) “Coral Reef Targeted Research and Capacity Building for Management - Connectivity Working group Program”
    Peter Sale (10 min) ……………………………………………. 8.55am

(4) “ Introductions – who am I?” All participants……………………….9.05am

(B) Researching connectivity: latest technologies

(4) “Population genetics of corals and algae”
    Madeleine Van Oppen (15 min)………………………………… 9.15am
(5) “Population genetics of fishes and invertebrates”
   Menchie Ablan (15 min) ......................................................... 9:30am

(6) “Biophysical modelling”
   Claire Paris (15 min) .............................................................. 9:45am

(7) “Larval marking using stable isotopes”
   Simon Thorrold (15 min) ....................................................... 10:00am

   * * Morning Tea 10:15-10:45 * *

(8) “Parentage analysis”
   Serge Planes (15 min) ............................................................. 10:45am

(9) “Larval behaviour”
   Jeff Leis (15 min) ................................................................. 11:00am

(10) Pre-lunch discussion – strengths and weaknesses of different approaches; importance of cross-validation (30 min) ........................................... 11:15am

C. Applying connectivity: the managers perspective

(11) “We need connectivity data now”
   Laurie McCook (15 min) .......................................................... 11:45am

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DISCUSSION TOPICS

The main focus of the workshop will be four discussion topics. It is hoped that each of these will be the genesis of a publication, either on the topic as outlined below, or new contributions arising from the discussions. Papers can be authored by any willing combinations of the participants or other invited authors. To get things going, 4 people have been selected to outline the boundaries of each topic and provide material to stimulate the discussion. The Chair (in consultation with the 3 Rapporteurs) should develop a short presentation prior to the meeting to define the topic and provide opening and provocative comments. Following the opening comments presented by the Chair, the Rapporteurs should deliver short statements to further stimulate discussion. The first half-day discussion on each topic (Sat, Sun, Mon a.m.) will take the form of a general discussion, during which all invitees may contribute. We will subsequently divide into 4 break-out groups lead by the respective Chairs and Rapportuers named for each group (Mon p.m, Tues a.m.). If you have not been named for any particular discussion topic, please join the group(s) of your choice.

Saturday 13th October P.M.

Discussion topic 1: Connectivity and population resilience

Chair and opening comments: Louis Botsford (15 min)

Rapporteurs: Mary-Alice Coffroth, Mark Butler, Simon Thorrold (5 min each)

Scope: It is often stated that populations of marine organisms with pelagic larvae function as meta-populations – a large number of subpopulations with dynamics driven to a substantial degree by larval connectivity. A high degree of connectivity among sub-populations is often argued to confer resilience to local and global extinction. However, recent information on corals, reef fishes and some other organisms has suggested a high level of local retention, often at very small scales. Although there is clearly broad-scale connectivity on evolutionary time-scales, it is not clear at what scales significant demographic connectivity occurs. That is, sufficient larval exchange to make a significant contribution to the overall recruitment to and persistence of subpopulations each generation. Recent information also raises questions about the existence of reefs that are important sources of larvae and others that function primarily as sinks. The purpose of this discussion will be to evaluate current information on larval connectivity and the application of methods that can be used to estimate connectivity on ecological time scales.
Sunday 14th October A.M.

Discussion topic 2: Connectivity and biodiversity conservation

Chair and opening comments: Bob Pressey (15 min)

Rapporteurs: Bette Willis, Dan Heath, Sean Connolly, Glenn Almany (5 min each)

Scope: An understanding of the extent to which coral reef populations are connected by larval dispersal is vital to understand both past impacts and future prospects for sustaining biodiversity. The increasing diversity, intensity and scale of human impacts on coral reefs will likely act to reduce potential connectivity among remnant populations, due to declining numbers and increasing fragmentation. Many, if not most, MPA networks have been established for biodiversity protection, not specifically as fisheries management tools. However, the degree to which they achieve the goal of “protecting” species is uncertain. Given that the majority of marine species are not eaten (at least not yet), closing areas to fishing or collecting does not necessarily address the primary threats to most species. MPAs may be of limited benefit where these threats – habitat loss and fragmentation, pollution and climate change – are having devastating effects on marine biodiversity. Understanding connectivity is critical for both the design of marine reserve networks to protect biodiversity and developing conservation strategies to protect rare or endangered species associated with degrading and fragmenting seascapes. The aim of this discussion will be to highlight recent advances in our understanding of larval retention and connectivity, and explore their implications for evaluating threats to marine biodiversity and different management options for minimising these threats.

Sunday 14th October, P.M.

Discussion topic 3: Managing coral reef ecosystems: does connectivity matter?

Opening Comments and Chair: Bob Steneck (15 min)

Rapporteurs: Peter Sale, Garry Russ, Angel Alcala, Laurie McCook (5 min each)

Scope: While managing coral reef systems is likely to require a large ecosystem approach, management efforts often centre on networks of relatively small marine protected areas (MPAs). The effectiveness of the small footprint of MPAs depends upon the effectiveness of connectivity in sustaining recruitment. While the scientific evidence for localized adult spillover from MPAs is good, evidence of larval spillover (i.e. connectivity effects) is largely lacking. There are several reasons for disconnectivity between broodstock populations and recruitment. Variation in the recruitment potential of the benthos could result in low rates of larval delivery translating to high rates of recruitment, and vice versa. New research from the Caribbean shows that coral recruitment rates decline 75% in small localized (meter-scale) patches of elevated algal biomass. Among the cohort of corals that settle, survival in the first year can drop to zero in these algal patches compared to adjacent algal free habitats. Also, given the potentially large number of species-specific dispersal patterns distributed among reef organisms, can we ever hope to have sufficient connectivity information to manage the ecosystem on this basis? The
intellectual satisfaction of tackling the complex biophysical problem of connectivity must be tempered by the absence of studies that may move science closer to understanding what drives recruitment and resilience in coral reef ecosystems.

**Monday 15th October, A.M.**

**Discussion topic 4: Connectivity and climate change**

**Opening comments and Chair:** Philip Munday (15 min)

**Rapporteurs:** Janice Lough, Michael Kingsford, Claire Paris (5 min each)

**Scope:** Climate change is likely to have important consequences for the connectivity of marine populations by altering the environmental conditions experienced by larvae and by altering the reproductive cycles of adults. Increased ocean temperatures are expected to directly affect larval development and survival. Changes to ocean currents could alter patterns of larval supply and changes to pelagic productivity to could affect how many larvae survive the pelagic stage and their condition at settlement. Increased ocean temperatures are also likely to alter the spawning patterns of adults, probably increasing the breeding season at some locations and curtailing it at others. Connectivity and population replenishment could be seriously impacted if increased ocean temperature lead to a mismatch between the timing of reproduction by reef organisms and periods of high planktonic productivity that are important for larval survival. *This theme will consider the likely consequences of climate change on marine connectivity under a range of climate change scenarios.*

**Monday 15th October, P.M.**

**Small group discussions**

Breakout into the 4 groups. Chairs and Rapporteurs should stay in allotted group during this session. Others may join the group of their choice. The group should elect a spokesperson and note taker (not necessarily the Chair). Discuss the potential for a publication on the topic as outlined or a variant of more interest to the group as a whole. If a paper is warranted, make a provisional plan of the structure, allocate tasks and discuss target journals.

**Tuesday 16th October, A.M.**

Continue small group discussions until tea.

Group spokesperson to present off-the-cuff summary of each discussion and publication plans.

**Tuesday 16th October, P.M.**

Matters arising…. The potential for other useful discussion or publication topics.

Final summary of plans to go forward and be productive.
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