

Australian Acoustic Tracking and Monitoring System (AATAMS)

Mid-year Progress Report – Receiver Pool Application

21 September 2015

Examining the spawning aggregation dynamics of coral reef fishes



Setting up remote acoustic receivers to monitor the spawning aggregation dynamics of species belonging to the family Siganidae (*Siganus doliatus* shown here). Photos by R Fox

Project title: Examining the spawning aggregation dynamics of coral reef fishes (rabbitfishes, Siganidae)

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Co-investigator: Prof. William Gladstone (UTS)

Project Summary:

Globally, approximately 500 million people rely on coral reefs for their food or livelihood. Managing reef ecosystems for food security or biodiversity conservation requires an understanding of how and from where reef fish stocks are replenished, including how dependent these reproductive processes are on the availability of particular habitat. Across the tropical Indo-Pacific, species of rabbitfish (family Siganidae) are essential providers of multiple ecosystem services, being a key source of dietary protein, an economically important component of fisheries landings^[1,2,3], and a critical ecological group in terms of their functional role (herbivores that control algal growth on reefs)^[4,5]. Despite their importance as a food source and the existence of fisheries offering the potential for over-exploitation, we know next to nothing of their reproductive ecology in the wild. It appears that adult rabbitfish undertake regular monthly migrations to spawning aggregation sites^[6,7,8] however this has yet to be confirmed for many species^[9,10]. The lack of quantitative data on the migratory connectivity exhibited by rabbitfish populations and whether their natural patterns of spawning and site selection are strongly tied to particular habitat attributes is currently a key obstacle to the development of effective species management plans. A better understanding of both their spawning behaviour, and the dependence that rabbitfish have on particular spawning site habitats is needed in order to equip resource managers with data for appropriate fisheries management plans and effective marine protected area planning. This project will use acoustic telemetry to track the reproductive migrations undertaken by two species of rabbitfish whose mating behaviour is currently unknown and will also monitor the use of particular spawning sites over time to determine the role of habitat fidelity in the life-cycle of these two important foodfish species.

Project aims:

- To document the reproductive ecology (including patterns of mating behaviour, extent of reproductive migratory connectivity, and spawning aggregation dynamics) of two tropical marine fish species (the rabbitfish

Siganus lineatus and *S. doliatus*) which form part of reef and lagoon fishery landings in the Indo-Pacific.

Specifically the project aims to:

1. Determine the location of spawning aggregation sites for unfished populations of these species on the Great Barrier Reef, the length of migrations taken by individuals to their spawning sites and the behaviour of these species at reproductive events.
2. Determine the dynamics of rabbitfish spawning aggregations, specifically
 - (i) the residency times of individuals at monthly spawning events,
 - (ii) the number of monthly spawning events an individual attends within a reproductive season,
 - (iii) the fidelity of individual fish to particular spawning sites within a reproductive season, and
 - (iv) the permanency of spawning sites between reproductive seasons.

Achievements against aims:

Aim 1: Documenting spawning aggregation sites and fish behaviour at aggregations

Data collection for this aim is due to commence on 2 Oct 2015 (in line with the timetable set out in Section 7 of my application). The timetabling was constrained by the need to wait until the reproductive season (Oct-Jan) in order to track fish and locate their aggregation sites.

In October (2nd-26th), populations of the species *Siganus doliatus* and *Siganus lineatus* at Lizard Island, Great Barrier Reef (14°40'S, 145°28'E), will be manually tracked to locate their spawning aggregation sites. This manual tracking will be repeated in December (3rd -23rd) for populations from the opposite side of the island in order to location potential alternate spawning sites for Lizard Island populations of the two study species.

Aim 2: Dynamics of rabbitfish spawning aggregations, including fidelity of individuals to particular aggregations.

Data collection for this aim is due to commence on 2 Oct 2015 (in line with the timetable set out in Section 7 of my application). Again, timetabling was constrained by the need to wait until the reproductive season in order to track fish and locate their aggregation sites.

During October and December AATAMS receivers will be deployed at the aggregation sites of *Siganus doliatus* and *Siganus lineatus* located in Aim 1 of the study. At least 4 receivers will be deployed around the perimeter of each aggregation site so as to be able to detect the arrival and departure of individuals from the spawning aggregation. Ten (10) fish of each species will

be tagged (V9-1L, 69kH, 120s nominal delay, 440d battery life) at each of the aggregations and monitored for a 12 month period to determine whether individuals utilise the same site throughout the reproductive season, and whether they return to the same site at the start of the next reproductive season (inter-season site fidelity). Repeat rate of transmitters has been selected so as to minimise rate of signal clashes since could be potentially 10 fish around same receiver at points in time (Vemco modelling predicts 15-16 fish can be 'heard' on a 120s repeat rate, H Pederson pers. com.). Receivers deployed in Oct will be downloaded during the December deployment

Results:

Data collection is due to commence in Oct 2015 and the project timetable is on track with that set out in Section 7 of the application.

My application also stated that a secondary aim of the project was to begin the process of building telemetry research infrastructure at UTS and to establish a pool of hardware that would be accessible by UTS researchers and students, using the IMOS Receiver Pool loan as leverage. On 2 September I received notification that I had been successful in the award of a Science grant from the Ian Potter Foundation (\$20,000 over 2-years 2015-16), the majority of which will be used to purchase VR2W acoustic receivers. The Faculty of Science at UTS has also agreed to make a cash contribution in the amount of \$3,200 in 2016 for the purchase of equipment (VR2W receivers) to supplement this award. The award letter from AATAMS formed part of my application to the Ian Potter Foundation (IPF) and the loan has therefore enabled me to move a significant way towards the goal of establishing a pool of telemetry hardware for UTS-based research.

Outputs to 21/09/2015:

Publications

Fox RJ, Bellwood DR, Jennions MD (2015) Why pair? Evidence of aggregative mating in a socially monogamous marine fish (*Siganus doliatus*, Siganidae). *Royal Society Open Science* **2**: 150252.

Conference presentations

Fox RJ, Bellwood DR, Jennions MD. 'Monogamy without the sex? Remote acoustic telemetry provides new insights into the basis of pairing in tropical marine fishes'. **34th International Ethological Conference (Behaviour2015)**, Cairns, Australia, August 2015. (Oral presentation)

Funding awards leveraged on back of this AATAMS Loan Pool Award

2015-2016

Ian Potter Foundation Science Award (\$20,000 over 2 years), CI: Rebecca Fox

2016

UTS Science Faculty (\$3,200 cash for equipment purchases, VR2W receivers), CI: Rebecca Fox

Media coverage

<https://www.scimex.org/newsfeed/mates-for-life-or-friends-with-benefits-tracking-the-sex-life-of-pairing-rabbitfish2>

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References

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- [10] Sadovy de Mitcheson Y, Cornish A, Domeier M, Colin PL, Russell M, Lindeman KC. 2008 A global baseline for spawning aggregations of reef fishes. *Conserv. Biol.* **22**, 1233-1244.