

Trip report: Nassau grouper Spawning Migrations (part of: Marine Reserves and the Spillover Effect: Seascape scale movement of grouper and snapper).

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Trip Dates: 10/2-10/11 2006

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Background from previous research

The overall goal of this project is to understand fish movement on multiple spatial and temporal scales as it related to the design of marine protected areas and with respect to establishing fishery management measures for Nassau grouper. In October and November, 2004 a total of 11 Nassau grouper were captured in the Southern 1/3 of the Exuma Cays Land and Sea Park (ECLSP) and acoustic transmitters (Vemco V-8 and V-13 transmitters) were implanted into their body cavity. At the same time, a total of 19 acoustic receivers were deployed across the shelf edge at different distances from the southern boundary of the ECLSP (10, 5 and 1 km inside the park and 0, 2.5 and 5 km outside the park). In June 2005, the acoustic receivers were retrieved, their archived data downloaded and then redeployed. Data from June 2005 indicated that of the 11 fish tagged, the majority of the fish remained within the area in which they were initially captured and released, but 3 of the larger fish (>50 cm) migrated out of the park along the shelf edge on the same day in December, 2004 and returned to the park along the shelf edge within 24 hours of each other 2 weeks later. This movement corresponded with the December full moon, thus it was assumed to be movement associated with annual spawning migrations. Details of these findings can be found in previous reports.

In October, 2005 acoustic telemetry receivers (28 total) were deployed within 300 m of the shelf edge (marked by a sharp drop off to depths >150 m) of the western margin of Exuma Sound, from the area near Sail Rocks in the north of Exuma Sound to the area between Long Island and Little Exuma in the south of Exuma Sound. Receivers were deployed at approximately 10 km intervals. An additional 2 receivers were placed across the shelf at the southern boundary of the ECLSP to improve our ability to detect movement of fish from the ECLSP. This sampling design will allow us to better track the movement of fish migrating to and from spawning aggregations and determine the extent to which fish move in the Exuma Sound system and whether there is spillover from the ECLSP. Table 1 shows the location of receivers deployed on this research trip.

During this trip, we also implanted acoustic transmitters in a total of 15 Nassau grouper and 1 mutton snapper (Table 2) and tagged them with externally visible tags. One Nassau grouper tagged (first listed in Table 2) was captured immediately South of the southern boundary of the ECLSP. Six Nassau grouper and the mutton snapper were captured within the ECLSP (the first 7 fish listed in Table 2), and the remaining Nassau

grouper were caught in the Lee Stocking Island and Great Exuma area. Most fish were captured near receiver deployment sites so that their presence/absence may be noted throughout the year. For fish caught at inshore sites such as the Malobar Cays and Conch Cut in the Exuma Park, an additional receiver was deployed at each site to detect their presence/absence.

Current Research Trip

In October 2006, all receivers deployed in 2005 were recovered, the data downloaded, and the receivers were redeployed with new batteries to continue to detect fish movements through the 2006-2007 spawning season. Data downloaded revealed the detection of 14 tagged fish, including all three fish tagged in 2004 that left the ECLSP to spawn. Of the 14 fish detected by receivers, 6 fish migrated from their home range to spawn during the winter of 2005-2006. Five of these fish migrated in December 2005 and one in January 2006. No fish migrated during both months. Migrations in both December and January bracketed the full moon period by up to 10 days. All fish observed to migrate from their home range were 59 cm total length or more (only 1 fish >59 cm TL was not observed to have moved from its home range; see Table 2 for sizes).

All fish were also observed to make spawning migrations to the south regardless of where they were tagged. This southern migration took them to receiver locations between Little Exuma and Long Island, then most fish disappeared for several days, presumably continuing their spawning migrations to reported spawning aggregation sites at Long Island. Only one fish was tracked continuously through its migration, a fish tagged off Rolleville, Great Exuma, which left its home range on December 8 and reached the Black Rocks area off Little Exuma by December 11, then headed back north on the same day to reach its home range on December 15. Although there is a reported spawning aggregation near Black Rocks, it is unclear whether this fish actually spawned, since it left the reported spawning area to return home prior to the full moon.

All fish observed to migrate from their home range returned to their home range within 10 days after the full moon, except for one fish. The fish that failed to return to its home range was one that left the ECLSP and returned to its home range in the 2004-05 spawning season. During the 2005-06 spawning season, however, it left the ECLSP and was tracked to between Long Island and Little Exuma, and then it disappeared for a few days before being detected on its return migration. It was tracked on its return from the Little Exuma area, all the way to Black Point on Great Guana Cay, where it was last detected on December 20, 2005. Presumably this fish was captured by fishers (during the closed season) between receiver stations off Black Point and Staniel Cay.

Preliminary Conclusions

The preliminary results from this ongoing research project provide several insights into management of Nassau grouper:

1. Long distance migrations of Nassau grouper out of the ECLSP suggest that protected areas are not sufficient to protect Nassau grouper during their spawning migrations. Thus, a closed season is necessary to vital protection during this critical period in the life cycle of Nassau grouper

2. Individual Nassau grouper in the Exuma Cays make 1 spawning migration per year, with most migrating during the December full moon period (this may differ from other parts of the Bahamas).
3. Fish from throughout Exuma Sound migrate to the south towards Long Island to spawn
4. With the exception of the 1-2 week period that they migrate to spawn, Nassau grouper remain in a relatively small home range.
5. Nassau grouper show strong site fidelity, returning to their home range after migrations.
6. While results suggest one potential incident of poaching, the closed season implemented for the winter of 2005-06 appears to have protected the majority of Nassau grouper.

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Table 1. Location of acoustic telemetry receivers deployed in October, 2005.

Date	Receiver	Location	Latitude	Longitude
10/7/2005	5820	Steventon, Exuma	23.659	75.928
10/7/2005	5821	Duck Cay, Exuma	23.595	75.848
10/7/2005	5475	Stocking Island, Exuma	23.549	75.763
10/7/2005	5478	Man O' War Cay, Exuma	23.503	75.679
10/8/2005	5822	Black Rocks, Exuma	23.500	75.577
10/8/2005	5476	Between Exuma & Long Island	23.524	75.486
10/8/2005	5472	Between Exuma & Long Island	23.580	75.407
10/9/2005	5477	Cambridge Cay, ECLSP	24.298	76.520
10/10/2005	5823	Compass Cay Offshore	24.291	76.506
10/10/2005	5824	Compass Cay Middle	24.289	76.510
10/10/2005	5471	Compass Cay Nearshore	24.287	76.514
10/10/2005	5286	O'Brien Cay, ECLSP	24.330	76.539
10/10/2005	5473	South of Compass Cay	24.257	76.477
10/10/2005	5819	Warderick Wells Cay	24.402	76.599
10/12/2005	5287	West of Danger Reef (~1km) ECLSP	24.429	76.684
10/12/2005	5284	Hawksbill Cay, ECLSP	24.300	76.737
10/12/2005	5285	Wax Cay	24.585	76.782
10/12/2005	4575	Long Cay	24.672	76.801
10/12/2005	5286	Allan's Cay	24.760	76.813
10/12/2005	4574	Ship Channel Cay	24.841	76.792
10/12/2005	5474	South Sail Rocks	24.914	76.792
10/12/2005	5825	Sail Rocks	24.952	76.703
10/13/2005	3028	Malobar Cays, ECLSP	24.366	76.635
10/13/2005	3023	Conch Cut Reef, ECLSP	24.286	76.543
10/13/2005	3027	Staniel Cay	24.190	76.433
10/13/2005	3025	Black Point	24.113	76.388
10/13/2005	2307	Great Guana Cay	24.031	76.348
10/13/2005	2301	Farmer's Cay	23.962	76.298
10/13/2005	2304	Rudder Cut Cay	23.881	76.222
10/16/2005	2302	3 Sister's rocks, Rolleville, Exuma	23 43.3	75 59.8
10/19/2005	3024	Bock Wall, Bock Cay	23 49.9	76 09.2
10/19/2005	3026	BA, Lee Stocking Island	23 46.8	76 05.0

NOTE: Coordinates in highlighted yellow are in degrees and minutes. All other coordinates are in degrees only.

Table 2. Fish tagged with acoustic transmitters, October 2005.

Date	Time	Location	Lat	Lon	Species	Size (cm)	Vemco	Floy
10/10/2005	11:24	South of ECLSP southern boundary	24.287	76.514	Nassau grouper	40.5	4549F (V8)	R-0518
10/10/2005	13:45	Conch cut	24.286	76.543	Nassau grouper	35.5	3358C	R-0517
10/11/2005		Jeep reef	24.350	76.589	Mutton snapper	46	5181F	R-0519
10/12/2005	9:16	Danger Reef	24.426	76.676	Nassau grouper	63	5184F	R-0552
10/13/2005	9:27	Malobar	24.366	76.634	Nassau grouper	71	5183F	R-0818
10/13/2005	9:27	Malobar	24.366	76.634	Nassau grouper	53.5	4536F	R-0867
10/13/2005	9:27	Malobar	24.366	76.634	Nassau grouper	63	5182F	R-0858
10/13/2005	12:50	Cambridge Cay	24.298	76.520	Nassau grouper	63	5179F	R-0523
10/16/2005	16:00	Exuma 3 sisters (offshore)	23 43.29	76 59.80	Nassau grouper	59	7283	R-0871
10/16/2005	16:10	Exuma 3 sisters (offshore)	23 43.29	76 59.80	Nassau grouper	39.5	7284	R-0853
10/16/2005	13:00	Exuma 3 sisters (offshore)	23 43.29	76 59.80	Nassau grouper	49.5	7278	R-0572
10/16/2005	13:00	Exuma 3 sisters (offshore)	23 43.29	76 59.80	Nassau grouper	52.5	7287	R-0563
10/17/2005	16:53	Exuma 3 sisters (inshore)	23 43.04	75 59.86	Nassau grouper	51	7275	N/A
10/17/2005	16:53	Exuma 3 sisters (inshore)	23 43.04	75 59.86	Nassau grouper	36	3361	N/A
10/18/2005	9:30	LSI - White Horse	23 48.29	76 07.32	Nassau grouper	43.2	5175	R-0564
10/18/2005	14:10	Exuma 3 sisters (mid shelf)	23 42.21	75 59.86	Nassau grouper	40	4541	R-0506

NOTE: coordinates highlighted in yellow are in degrees and minutes. All other coordinates are in degrees only.