Model and Data Based Hydrodynamic Connectivity Study for the Marine Protected Area Network off Western Puerto Rico: Connectivity Matrices

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Introduction

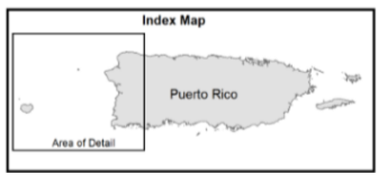
Connectivity Sites

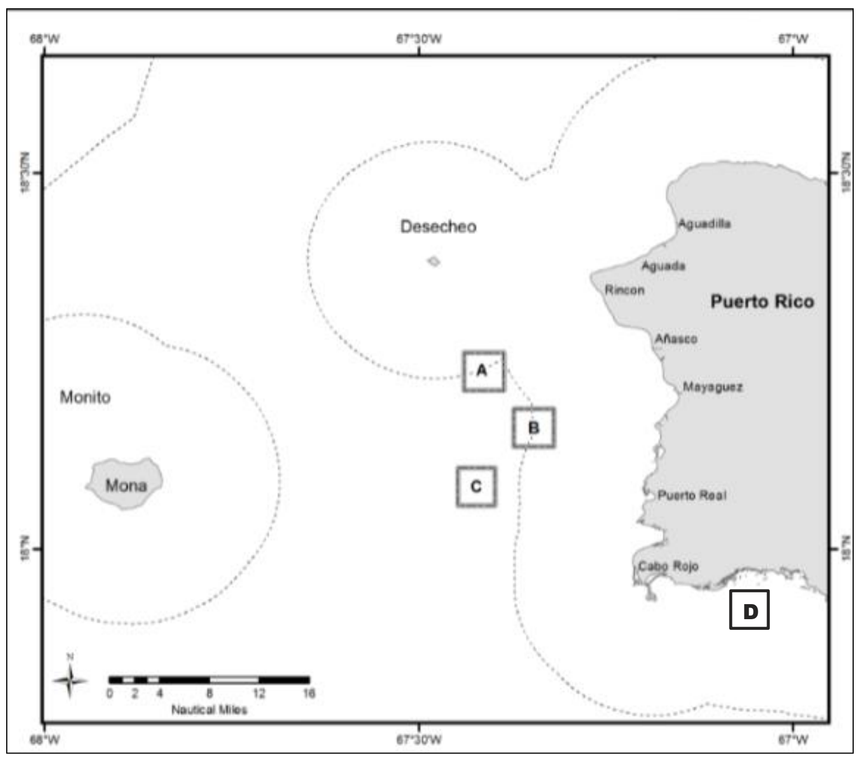
Source - Recruitment

Bajo de Sico [A]	BdS
Tourmaline Bank [B]	TBa
Abrir La Sierra [C]	ALS
La Parguera [D]	LPa

Recruitment

Los Rabos - Aguadilla	LRa
Pichincho	Pin
Desecheo	Des
Mona	LMo
Cabo Rojo	CRo
Guanica	Gca
Guayanilla	Gya

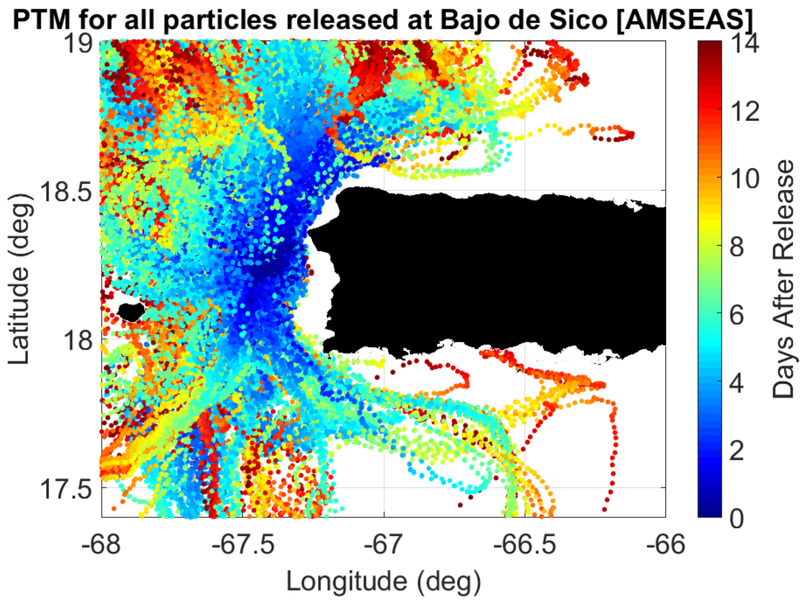




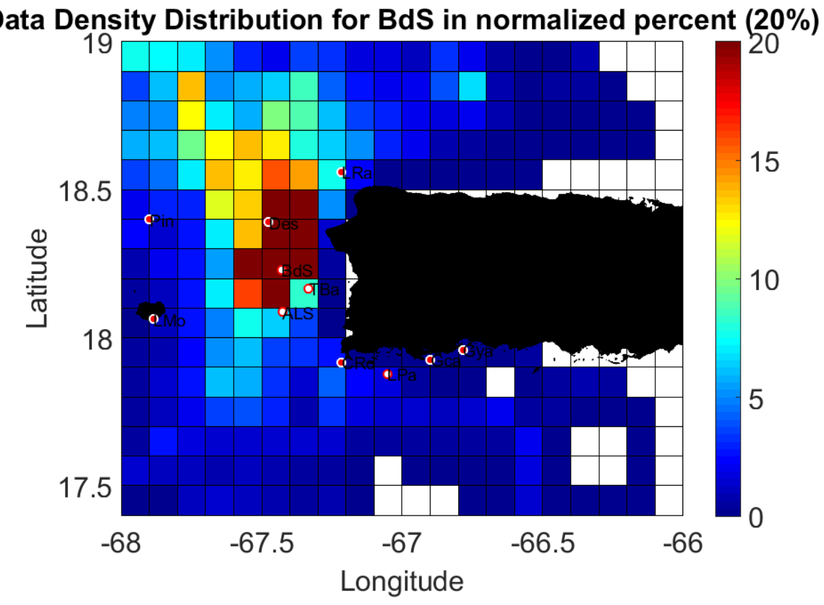
AMSEAS and ROMS model output and HF Radar observations have been used to determine the path of dispersal (or **particle trajectories**) of **large numbers of virtual eggs and early larvae** from the three marine protected areas (MPA) off the west coast of Puerto Rico, and from the spawning aggregation region at La Parguera. Virtual particles were released at the **four source locations** from December 1, 2014 to May 31, 205, which covers the **spawning season** for many commercially important snapper and grouper species including the red hind (*Epinephelus guttatus*) and the mutton snapper (*Lutjanus analis*). Particle trajectories were tracked over a **14-day** period and then used to generate **connectivity matrices** to identify the potential of the four source sites towards larval recruitment at several known fishery sites (herein referred to as **recruitment sites**). This tool will augment the Council's MPA placement and decision-making information suite.

Virtual Particle Trajectories and Connectivity Matrices

PTM for all particles released at Bajo de Sico [AMSEAS]



Data Density Distribution for BdS in normalized percent (20%)

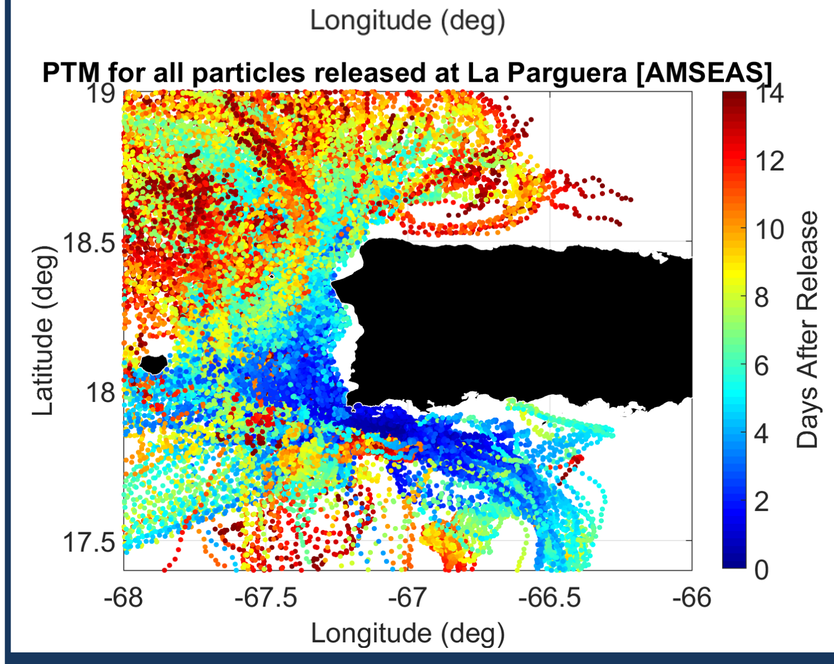


AMSEAS

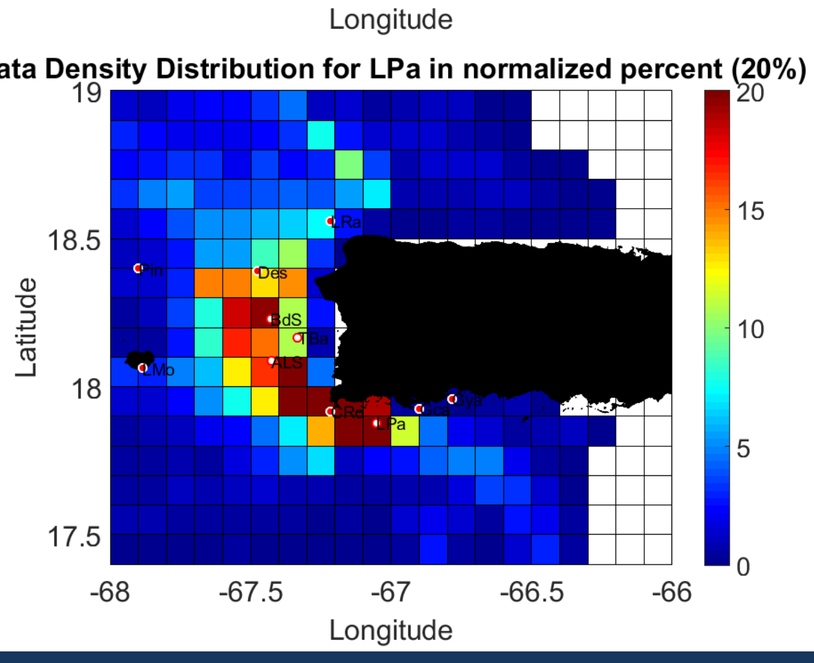
Recruitment Sites \ Source Sites	LPa	ALS	TBa	BdS
LRa	7	10	19	8
Pin	5	15	8	9
Des	13	36	23	31
BdS	19	58	34	100
TBa	11	21	100	8
ALS	16	100	19	6
LMo	7	11	6	3
Gya	0	0	0	0
Gca	1	0	0	0
CRo	44	10	5	3
LPa	100	5	3	2

The connectivity matrices represent an effort towards understanding the dispersal of fish eggs and larvae from the marine protected areas off western Puerto Rico.

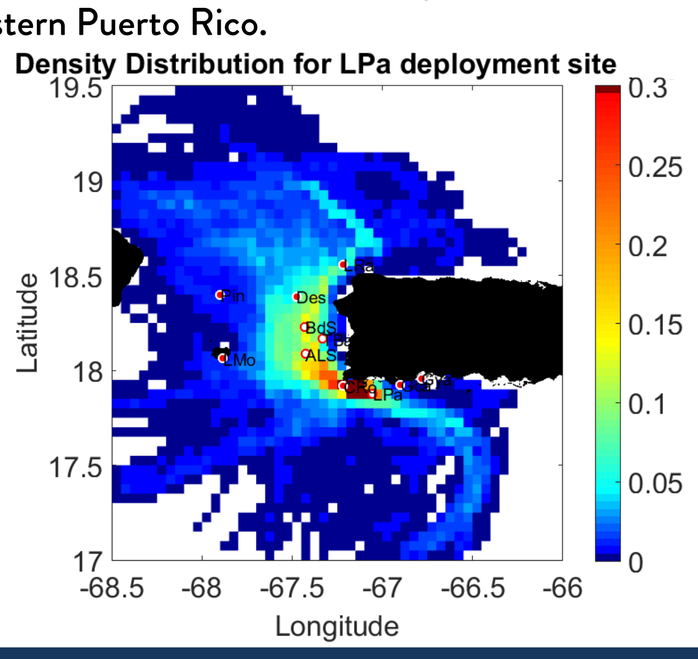
PTM for all particles released at La Parguera [AMSEAS]



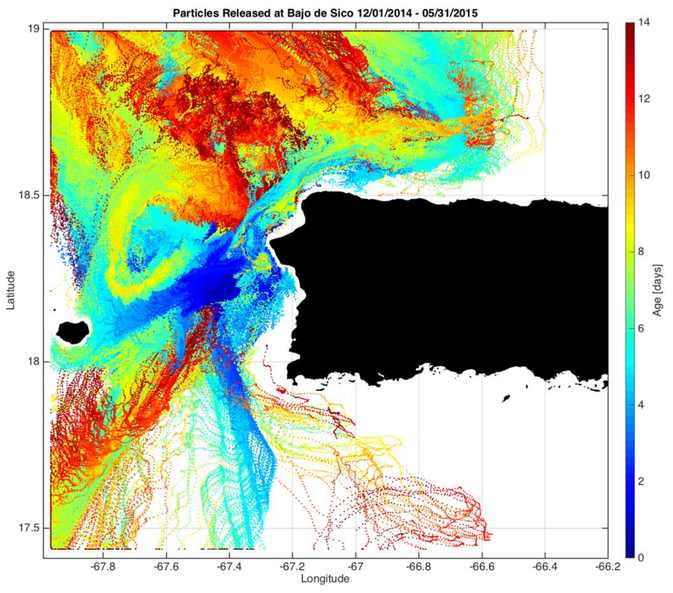
Data Density Distribution for LPa in normalized percent (20%)



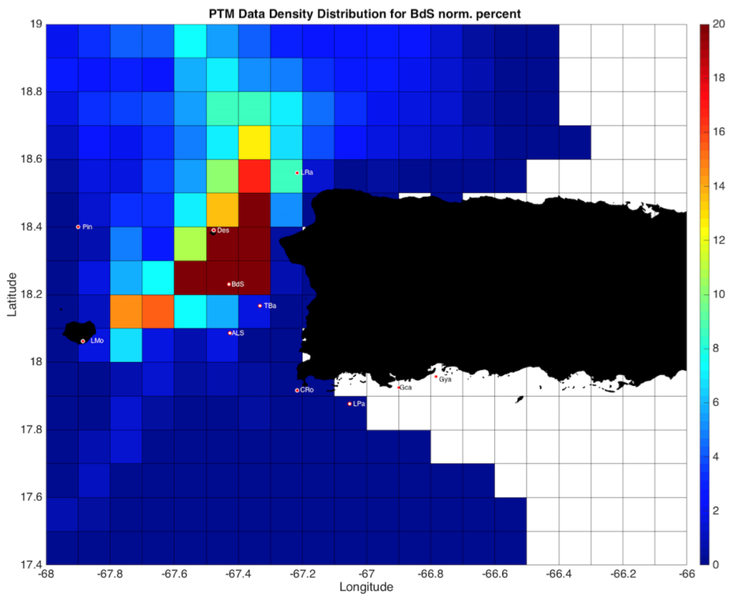
Density Distribution for LPa deployment site



Particles Released at Bajo de Sico 12/01/2014 - 05/31/2015



PTM Data Density Distribution for BdS norm. percent

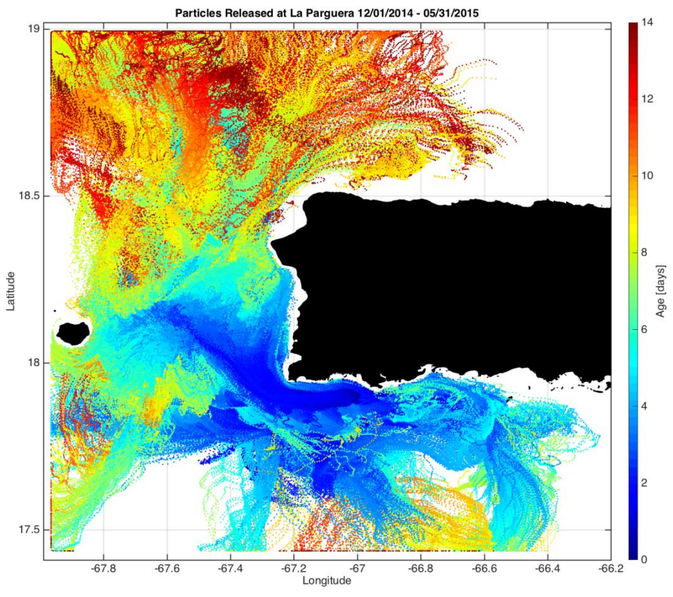


ROMS-LTRANS

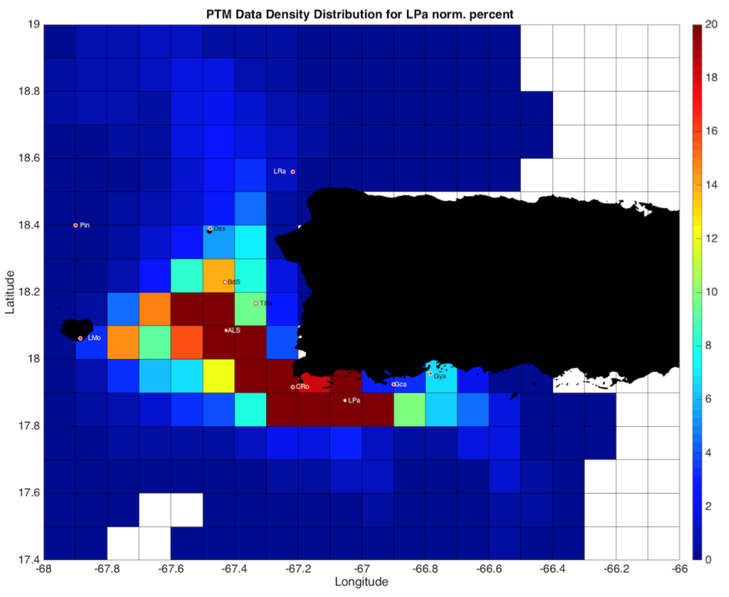
Recruitment Sites \ Source Sites	LPa	ALS	TBa	BdS
LRa	1	8	4	9
Pin	0	2	1	3
Des	5	25	19	41
BdS	14	63	26	100
TBa	9	19	100	2
ALS	29	95	14	2
LMo	4	3	0	3
Gya	7	2	0	0
Gca	3	0	0	0
CRo	33	3	2	0
LPa	100	10	5	0

The connectivity matrices address MPA's management issues such as optimal locations and spatial distributions, as well as the relative contribution of MPA's to local vs. far-field recruitment.

Particles Released at La Parguera 12/01/2014 - 05/31/2015



PTM Data Density Distribution for LPa norm. percent



PTM Data Density Distribution for AIS norm. percent